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AN ECOLOGICAL STUDY OF CARTAGENA LAGOON, PORTO RICO, WITH SPECIAL REFERENCE TO THE BIRDS [1]

FOREWORD

By STUART T. DANFORTH

The ultimate aim of Ornithology, to my mind, is to make use of birds to the limit of their capacity as servants of man. I believe that eventually we will know so well how to encourage and protect birds that they will be practically one hundred per cent efficient in protecting our forests and crops from insect pests, and that poisonous sprays and other protective measures will be unnecessary in the vast majority of cases. But before we can know how to use birds to their best advantage it is necessary to learn almost countless things about them. First of all we must know which birds are injurious and which beneficial, and in what ways they are beneficial. For this we must have a complete knowledge of their food. We must learn in detail what particular habitat each species prefers, and what kind of a situation it requires for nesting. We must know what the enemies of each species are, and how they can be controlled. We must have exact information about the breeding season of each species. We must know the innumerable interrelations of each species with its neighbors and its environment. Indeed, there is almost no end to the facts which must be known about each species before it can be utilized to its fullest extent, and one never knows what seemingly insignificant bit of information may eventually prove to be of the most importance. The investigation upon which this paper is based was undertaken with the desire of discovering as many of these facts about a much-neglected group of Porto Rican birds as possible within the available time, and it is hoped that eventually our information will be so complete that they may be utilized to the fullest extent. But we do not have to wait until that time to begin deriving benefits from them. We already know enough about them to utilize them much more fully than we do at present. Many of the most useful species in Porto Rico are sadly

[1] A thesis presented to the faculty of Cornell University in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

in need of more complete and efficient protection. Better game laws are necessary, and strict enforcement of those already in effect if many species are to be prevented from extermination or from becoming excessively rare. Sixteen species of West Indian birds are already extinct and many others are verging upon extinction. It is to be hoped that the people of Porto Rico will act before it is too late to save some of its most valuable bird inhabitants.

The field work upon which this paper is based was done during twenty months spent in Porto Rico. During the first period of nine months from October, 1921, to the last of June, 1922, bird work was of necessity confined to Saturdays and occasional holidays. During the second period of eleven months, from November, 1923, to October 1924, the whole time was devoted to Ornithology and related field work with the exception of an occasional week in which attacks of fever prevented work. During such a short period it is impractical to work intensively in a large area. Therefore Cartagena Lagoon, which is at present the most important wildfowl resort in Porto Rico, was chosen as the chief field of my labors. Bird work done at other places on the Island was merely incidental.

The author wishes to express his appreciation to Professor A. A. Allen for his helpful advice and guidance throughout his work in Porto Rico and the preparation of this manuscript; to Professor A. H. Wright for his help and encouragement; to Professor O. D. von Engeln for his assistance in interpreting the physiographical aspects of the work and for his encouragement; to Dr. N. L. Britton of the New York Botanical Gardens for identifying most of the plants; to Dr. Karl P. Schmidt of the Field Museum of Natural History for his helpful advice and kindly interest in the herpetological phase of the problem; to Mr. L. L. Buchanan of the Biological Survey, Mr. A. J. Mutchler of the American Museum of Natural History, Mr. James A. G. Rehn of the Academy of Natural Sciences of Philadelphia, Mr. George N. Wolcott, formerly of the Porto Rico insular Experiment Station, Mr. W. L. McAtee of the Biological Survey, and to Mr. H. G. Barber of Roselle, N. J., each of whom has identified one or more insects which are mentioned in this paper; to Dr. Mary J. Rathbum of the U. S. National Museum for identification of the Crustacea; and to Dr. A. Alvarez of Mayagüez, P. R., and Mr. Luis H. Mendoza of Cabo Rojo, P. R., for sending me certain additional specimens for which necessity arose during the writing of this paper. Others too numerous to mention have sided in one way or another, and to them also I wish to express my appreciation for their valued assistance.

PART I

GENERAL ACCOUNT OF PORTO RICO

Porto Rico is the smallest and easternmost of the Greater Antilles. It lies between 17°54′ and 18°33′ North Latitude and between 65°13′ and 67°16′ West Longiture. It is in the same latitude as Jamaica, British Honduras and the northern part of Guatemala. It is about 1,450 miles from New York, and 450 miles from the nearest part of Venezuela. The Island is nearly rectangular, 113 miles long and 40 miles wide. Its area is 3,670 square miles, which is about four-fifths that of Jamaica, seven-tenths that of Conneticut, or three times that of Rhode Island. The coast line measures about 360 miles, the north and south sides being nearly parallel, while the east and west shores are more irregular. The northern coast of Porto Rico rises abruptly from the sea; in fact Brownson's Deep, which is 24,000 feet in depth, and said to be the deepest spot in the Atlantic Ocean, lies less than 100 miles north of Porto Rico. Slightly further to the south of Porto Rico, in the Caribbean Sea, lies Tanner's Deep, extending 15,000 feet downward. Thus Porto Rico may be regarded as a badly eroded summit region of a great mountain mass.

Almost the entire surface of the island is covered with mountains of various heights and shapes without any apparent system of arrangement. Most of them are not very high. The highest peak is El Yunque (in the northeastern part of the Island), which rises to a height of 4,895 feet. The only other peaks which are known to exceed 4,000 feet are a few near Jayuya, in the center of the Island, one of which, unnamed on the maps, reaches a height of 4,440 feet. Notwithstanding this apparently confused arrangement of the mountains there is a distinct watershed which divides the Island into two unequal parts. This divide extends from Mayagüez on the west to Humacao on the east, with a branch extending northeastward to El Yunque. The part of the divide from Mayagüez east to Aibonito is known as the "Cordillera Central"; that from Humacao to Aibonito as the "Sierra de Cayey", and that from El Yunque to Humacao as the "Sierra de Luquillo". About one third of the Island is south of this divide and two-thirds north of it. In places the mountains and sea meet abruptly, but in most places there is a narrow coastal plain, and a few broad valleys extend well inland.

There are no lakes in the mountainous interior of the Island

except the recently completed Guayabal Reservoir near Villalba. In the coastal plain are some salt-water bayous and mangrove swamps, and a few more or less temporary fresh-water lagoons, which will be discussed at length later in this paper.

GEOLOGY OF PORTO RICO

Porto Rico and the other Antilles were, according to geologists, formerly joined to each other and to North America, forming a continent known as Antillea. Then a great subsidence occurred, leaving only the mountain tops above water. After awhile an uplift took place, and the old continent reappeared. The sediments which appeared during the period of submergence were then folded into huge mountain systems. Then came another but lesser subsidence which resulted in breaking up the continent into the island groups as they occur at present. Jamaica was the first to be separated, then Cuba, and afterwards Haiti and Porto Rico .

The central mountains are composed mainly of volcanic materials (tufas and conglomerates), which have been sorted and laid by water, with occasional intrusions of blue limestone. They are mainly of Cretaceous age. All the rock material is weathered at the surface in the humid regions, due to the great amount of precipitation and the high temperature, forming a deep mantle of red clay, which is so tenacious that it can maintain itself in an almost vertical position. The foothills are white limestone of marine origin, and are all of late Tertiary and Pleistocene age. The coastal plain deposits are alluvial formations, usually of a rich, dark-brown sandy loam.

PHYSIOGRAPHIC HISTORY OF PORTO RICO

According to Lobeck (1922) Porto Rico is probably essentially a block or horst bounded by faults. The oldland was a complex mountain mass composed of igneous rocks. Under the influence of subaërial erosion this oldland was reduced to a rather perfect peneplain except for two groups of Monadnocks, which are the Luquillo Mountains at the east of the Island, and the Cordillera Central, which crosses the Island from east to west. This first peneplain was then uplifted, and a new cycle of erosion started. Then a submergence occurred and a coastal plain was deposited on the north and south sides of Porto Rico. Another uplift then occurred, and initiated the dissection of both the coastal plains. After this dissection the entire coast suffered a slight submergence, supposed to have been caused by the melting of the continental glaciers at the

close of the Glacial Period. Recent changes which have taken place since this submergence include the deposition of alluvium along stream courses; the building of extensive alluvial fans along the south coast, and the silting up of bays. Finally there is some evidence of a slight emergence now taking place.

CLIMATE OF PORTO RICO

Although Porto Rico is well within the tropics, its climate, except that of the west end, is not so torrid as might be expected, as it is modified by the North Atlantic trade winds, of which it is in the direct path. These trade winds blow from the northeast with remarkable constancy throughout the year, so they have but little effect on the western end of the Island. Their velocity rarely varies from a yearly average of eleven miles per hour, except in July, when the velocity increases to thirteen miles, and in October and November, when it falls to about nine miles. March is also a month of very light winds.

Thunderstorms are not very frequent, nor are they usually very violent. On very rare occasions they are accompanied by hail.

Many hurricanes pass near Porto Rico, but the centers of few cross over the Island. The most notable of recent years were those of August 8, 1899, and September 13, 1921. In the summer of 1924 three passed close to Porto Rico, but brought only gentle wind and rain there. One of them did considerable damage in St. Thomas, eighty miles east of Porto Rico, but in the latter island the effects were scarcely noticeable.

The U. S. Weather Bureau records for more than forty stations show an annual average temperature of 76.3°. During the coldest winter months the average is 73°, and during the hottest summer it is 79°. The daily range of temperature is much greater than the seasonal. The difference between afternoon and early morning temperatures may be as great as 25°. The maximum temperatures range from 90° to 95° at the more elevated stations, and 95° to 104° along the coast and in the valleys. The minimum temperatures range from 50° to 55° at the higher elevations, while a minimum of 60° is rarely reached on the coast. The lowest recorded mountain temperature is 43°.

Porto Rico, small as it is, has a topography which causes an extreme variation in the amount of precipitation in different places almost if not quite as great as can be found in the whole of the United States. The entire south side is dry enough to make irrigation necessary to grow crops, the annual precipitation varying from

20 to 45 inches, while on the north side it ranges from 55 to 135 inches. The highest average rainfall is in the Luquillo Mountains (135 inches) with a maximum record in 1901 of 169 inches. On the south coast there is a record of thirteen months when not an inch of rain fell at Guayama, and of a period of three years when no rain fell at Cabo Rojo. The average number of days when rain falls for the Island as a whole is 169, with a minimum of 28 at Guánica and a maximum of 341 in the Luquillo Mountains.

The average humidity for the Island is about 78 per cent, varying from a minimum of 75 per cent in the driest month to a maximum of 81 per cent in the most humid month.

In many parts of the Island the rainy and dry seasons are not well defined. Rains may occur at any time of the year, although the minimum rainfall is in February and the maximum during the summer months.[1] In the western part of the Island the rainy and dry seasons are more distinct. In Mayagüez the rainy season is usually from May or June until November, although it is rather variable. In the semiarid southwestern part of the Island the rainy season is shorter, generally occurring from September to November. At Mayagüez occasional rains occur in winter, and there are often summer days without any rainfall.

EFFECT OF DENSE POPULATION ON WILD LIFE

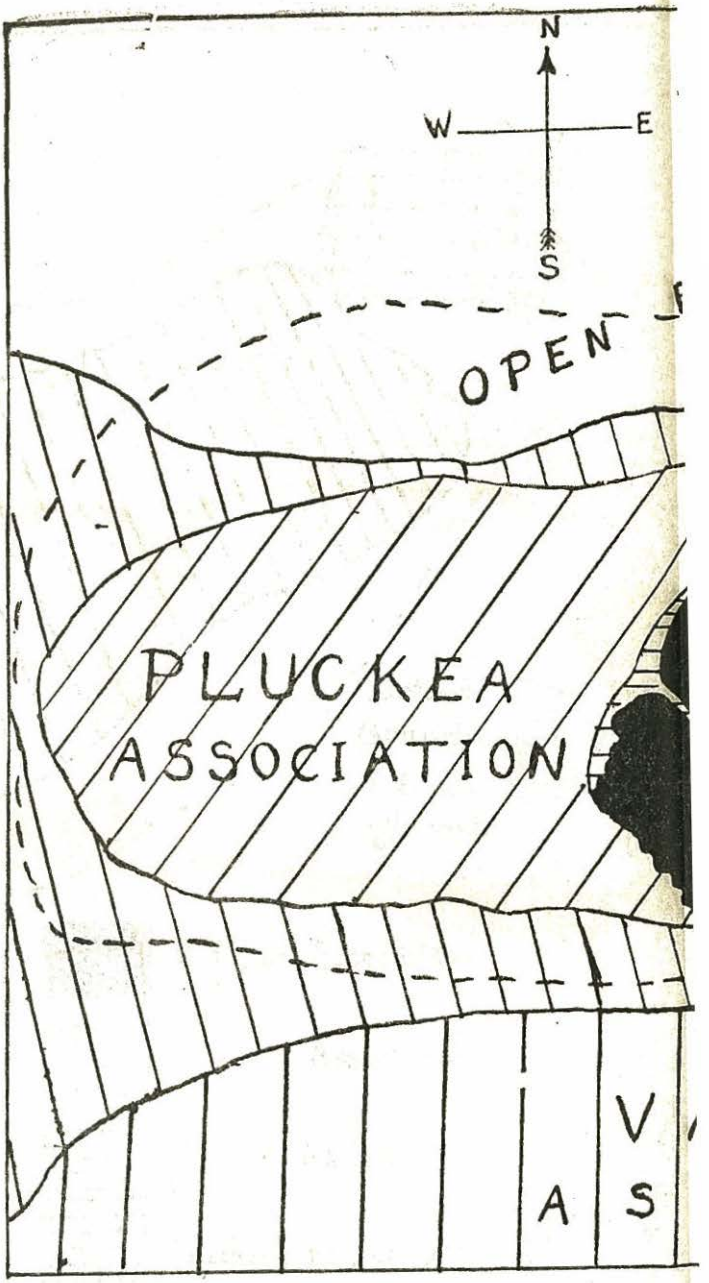
The population of Porto Rico according to the census of 1922 was 1,299,809, or at the rate of 392.14 persons per square mile. This is a denser population than that of any state except Rhode Island, Massachusetts and New Jersey, and is not conducive to very favorable conditions for birds, particularly as 79.9 per cent of the population is rural. That the distribution of the population is remarkably even is shown by the fact that the centers of area and population are less than five miles apart. There are almost no spots on the Island where one can be out of sight of human habitations. Owing to this overpopulation, practically every foot of arable soil is under cultivation, even to the tops of many of the higher mountains, and very little of the original forest remains. Only four

[1] EDITOR'S NOTE.—Dr. Oliver L. Fassig, Chief of the West Indies Climatological Service, in his article "The Climate of Porto Rico" in "The Book of Porto Rico", page 29, says, referring to rainfall: "The maximum generally falls in September along the north coast, while in the mountains of the interior the time of maximum occurs in one of the summer months or as early as May."

small tracts are known to me: One on El Yunque, another in the mountains near Maricao, the third a very small patch of private forest reservation on the north coast at Sardinera, and the fourth a still smaller patch south of Pueblo Viejo.

BIRD LIFE OF PORTO RICO

The avifauna of the West Indies is noted for its paucity of species as compared with places in corresponding latitudes on the mainland. As might be expected, Porto Rico has even fewer species than the other Greater Antilles. This is on account of its smaller size and its comparative remoteness from continental land areas. Only about 150 species of birds are now found on the main Island of Porto Rico, and many of them are very rare or local in their distribution. Nearly 70 of the species are migrants, and 24 species are peculiar to Porto Rico. Although the species of birds are relatively few, the number of individuals is large, a certain few of the species, such as the Honey Creeper, the Gray Kingbird, the Porto Rican Grackle and the Carib Grassquit being exceedingly abundant. On the other hand, many species such as the Porto Rican Short-Eared Owl, Parrot, Crow, Limpkin and the Blue Pigeon are upon the verge of extinction. The owl and pigeon may already be extinct.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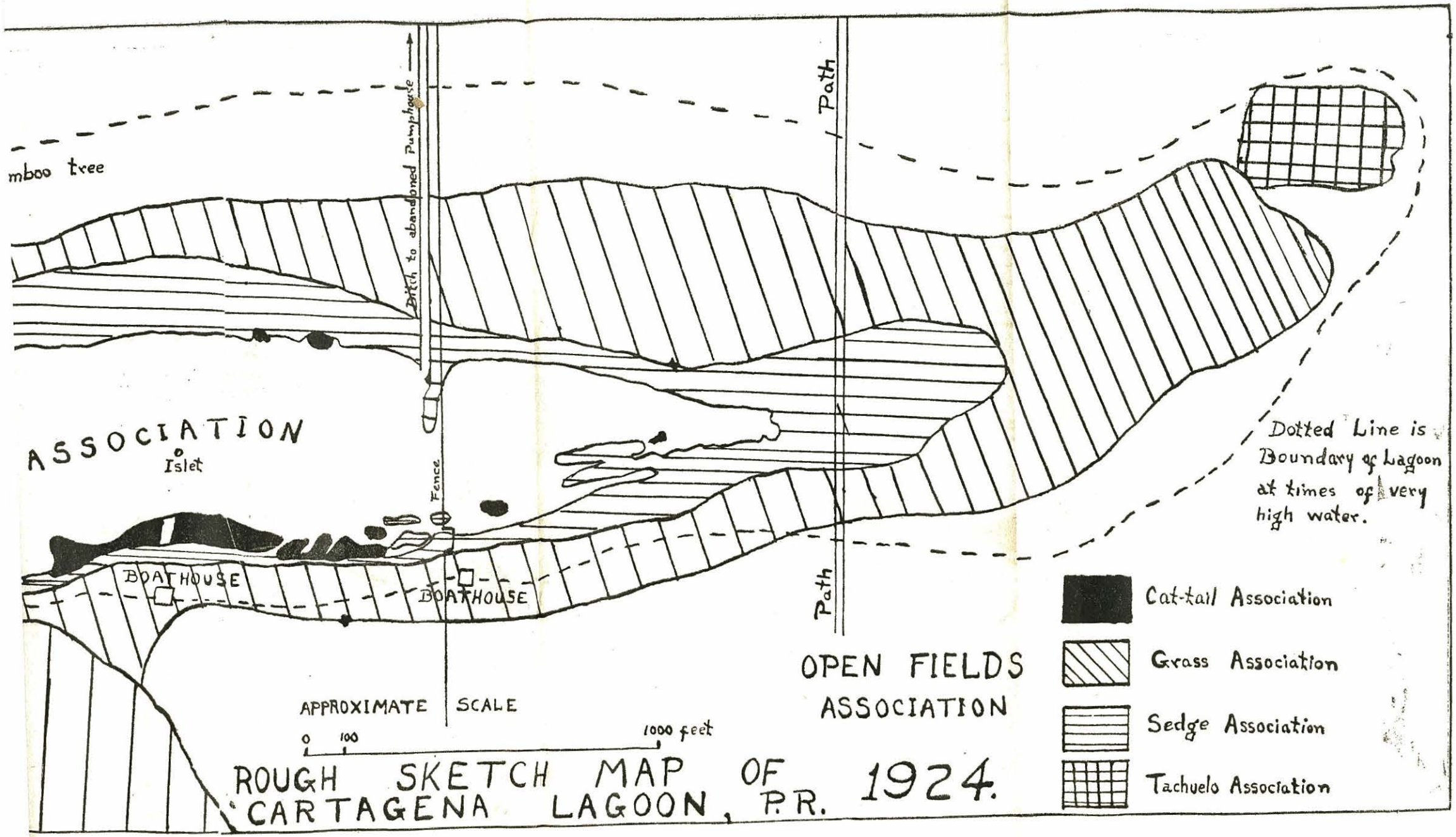

mboo tree
Ditch to abandoned Pumphouse
Path
ASSOCIATION
Islet
Fence
Dotted Line is Boundary of Lagoon at times of very high water.
BOATHOUSE
BOATHOUSE
Path
OPEN FIELDS ASSOCIATION
Cat-tail Association
Grass Association
Sedge Association
Tachuelo Association
APPROXIMATE SCALE
0 100 1000 feet
ROUGH SKETCH MAP OF CARTAGENA LAGOON, P.R. 1924.

PART II

CARTAGENA LAGOON AND ITS FLORA AND FAUNA

CARTAGENA LAGOON

Geographically, Cartagena Lagoon is situated in the southwestern corner of Porto Rico, about two miles west of Lajas, five miles east of Boquerón, and a half a mile south of Desengaño switch on the Cabo Rojo branch of the American Railroad. Its latitude is 18°01′ North, its longitude 67°06′ West. The lagoon is approximately one and a third miles long and a half a mile wide, although at times of especially high water its extent may temporarily be somewhat greater.

Parts of Cartagena Lagoon are included in three different sugar estates. The eastern end (east of a wire fence which crosses the lagoon), belongs to Señor Don Carlos Val; the remainder is owned by Señor Don Jacobo Cabassa, with the exception of a small area in the northwestern corner, which belongs to Señor Don Ernesto Forestier. The owners are at present considering draining the lagoon to convert it into canefields, but for the sake of the wild life of the Island it is to be hoped they will not do so. Unless water were brought from the mountains their venture would doubtless not be very successful, since under present conditions the growth of cane in the nearby field is dependent upon water pumped from the lagoon during a large part of the year.

The lagoon is situated in the broad Yauco-Boquerón anticlinal valley. This is a rather remarkable valley twenty-one miles in length, and approximately three miles wide at its widest point. It runs in an east-west direction, and at present is not occupied by any stream in the greater part of its length, and only by the small and intermittent Boquerón River and its tributaries at its lower end. According to Mitchell (1918) this valley was eroded almost to its present extent before the Tertiary period by the action of a large stream having its sources in the mountains near Yauco. But then the Guanajibo River pushed its headwaters back and captured the streams which were flowing into the Yauco-Boquerón Valley, leaving it dry. Water gaps now mark the spots where this stream piracy took place. The southern side of this valley is a wall formed by San Germán limestone and tuff, but the northern boundary is

less strongly set off from the low hills of the mountainous region. The valley is formed principally on tuff. To the north is a region of low hills, while to the south a single ridge of low hills separates the valley from the Caribbean Sea. Parts of Mariquita (or Tinaja) and Paquita Hills lie directly south of the lagoon. These hills are formed of San Germán limestone and Upper Cretaceous tuff, with streaks of Upper Cretaceous shale. Cartagena Lagoon is merely a low spot in this valley. The valley has a gentle slope from sea level at Boquerón, so that the elevation of the lagoon is about twenty feet above sea level.

Cartagena Lagoon has no inlet, except immediately after a heavy rainfall when several small and temporary streams flow into it, and it has no regular outlets, although at times of very heavy rainfall it occasionally overflows, and its excess waters reach the tributaries of the Boquerón River, and flow thence to the sea.

Two other lagoons exist in this valley to the east of Cartagena Lagoon, namely Anegado and Guánica Lagoons. These are broader and shallower than Cartagena Lagoon, and are more irregular in the seasons at which they contain water. An extra rainy season may fill them up so much that they may contain water for over a year at a stretch, as in 1921 and 1922, or they may be dry for two or three consecutive years, as in 1923 and 1924. Much of the time the beds of these lagoons are so dry that clouds of dust are raised when a horse gallops across them. Cartagena Lagoon at its driest has an oozy mud bottom. In addition to the lagoons of the Yauco-Boquerón Valley I know of but one other fresh-water lagoon on the Island (Laguna Tortuguero, on the north coast). However, the recently constructed Guayabal Reservoir, near Villalba, forms a fresh-water lake of fair size.

The bottom of Cartagena Lagoon consists of alluvial clay which holds the water caught at times of heavy rainfall until it disappears almost solely by the process of evaporation, which is very rapid in this semiarid region. Nevertheless the lagoon catches so much water from each rainfall that it very seldom dries up completely. Until 1923 it had never been known to do so, but it dried up completely in the summer of 1923 and again in July 1924. In addition to the water which disappears by evaporation, much water is pumped from the lagoon during the drier parts of the year for irrigating the nearby canefields. Most of the pumping is done from March to September (in 1924 it was begun on March 11).

The reason for the semi-aridity which the region around Cartagena Lagoon shares with the entire southern coastal plain is that the

prevailing northeast trade winds have to pass over the high Cordillera Central before reaching this part of the Island. The mountains extract the moisture from the winds, causing heavy precipitation on the mountains, and causing the winds to be drying rather than moisture-bearing winds when they reach the valley. Their drying effect is so great that on the coast two miles from the lagoon salt is made by the open-air evaporation of seawater. The extreme southwestern tip of the Island verges on actual aridity. According to the official records, for a period of three years no rain fell at Cabo Rojo Lighthouse.

At Cartagena Lagoon occasional showers occur at any season of the year, but very few of them outside of the rainy season bring sufficient precipitation to cause water to flow in the temporary streams which feed the lagoon. The rainy season, if such it can be called, begins in September and lasts until November. This does not mean that it rains very often in this period, but that it is during this period that the few heavy rainfalls which occur during the year always take place. During this period the lagoon always fills to the brim and sometimes to overflowing, and then the process of evaporation begins. Just before the beginning of the "rainy season" it is often nearly dry.

When the lagoon is full the water is five feet deep at the deepest part, while the average depth is from two to three feet. But underlying all is a layer of oozy mud varying from a few inches to four feet or more in depth. However, there are but few parts where it is unsafe to go on this account, and there are but few records of people having lost their lives. Pigs and goats, however, often become mired, especially when the lagoon is dry or nearly so, and the sun bakes a thin crust over the top of the mud which deceives the animals. In August, when the lagoon is at this stage, myriads of small migratory shorebirds sworm over its surface, and the waterfowl are forced to the extensive mangrove swamps and salt water lagoons of the coast. When the first showers of the rainy season, during the latter part of August or the early part of September, bring enough water for their needs they come trooping back, and it is the turn of the hordes of shorebirds to seek other and more hospitable regions.

PLANTS AND ANIMALS OF CARTAGENA LAGOON

PLANTS

In a study of bird ecology plant societies are one of the most important factors. Before discussing the distribution of the plants

at the lagoon, however, a few general statements about the flora of the southwestern part of Porto Rico are pertinent. As this region is semi-arid, the vegetation is more sparse than in most parts of the Island. Except near the watercourses, which, of course, are only intermittent streams, tall trees are scarce, and most of the vegetation is brushy, much of it having quite a close superficial resemblance to the sage brush of the western states. Cacti abound on the higher land, and in places grow in profusion right to the edge of the sea. Cocoanut palms fringe the beaches, but are scarce farther inland. In places where the brush does not grow there are a number of species of drought-resisting grasses and herbaceous plants. Bamboos and fair-sized trees line many of the water courses, and occasional tall trees are found in other places. Porto Rican Royal Palms (*Roystonea borinqueña*), seem to resist drought fairly well, but are not nearly so common as they are in more humid regions.

At the lagoon the succession of the plant associations is quite distinct, though somewhat complicated by the great seasonal changes in the amount of water together with the fact that it is always the "growing season" for plants in Porto Rico.

Plant Associations of Cartagena Lagoon

I. THE OPEN WATER ASSOCIATION

This association includes the open part of the marsh. It is continuously covered with water except when the lagoon is dry or very nearly so. Plants which cannot grow in deep water do not get a foothold here. Without question the dominating plant of this association is *Naias guadeloupensis*. It is found everywhere in the open water, and almost completely chokes the lagoon by the time it becomes half dried up. After that stage it is impossible to use a boat in the lagoon. From December to May Pistia is exceedingly abundant, mostly floating around near the borders of this association, but when low water comes it seems to disappear. Lemna is also very common at times of high water, and a green alga becomes quite abundant as the lagoon is drying up. A list of the more important plants found in this environment follows:

1. *Naias guadeloupensis* (Spreng) Urban
2. *Pistia stratiotes* L.
3. *Ceratophyllum demersum* L.
4. *Castalia pulchella* (DC) Britton
5. *Castalia ampla* Salisb.
6. *Lemna perpusilla* Torr.

The plants of this zone are important in the ecology of bird life by supplying forage for the grebes, some of the ducks, the Porto Rican Coot and the Porto Rican Gallinule. In fact, almost the entire food of the Coot and Gallinule consists of the stems and leaves of Naias. These plants also supply food indirectly by harboring the larvæ of many aquatic insects which are eaten in considerable numbers by many of the marsh-inhabiting birds.

No birds are restricted to this environment in their nesting, but the species which occasionally nest here are the Pied-billed Grebe and the Black Necked Stilt, the latter species only nesting here when driven from its normal breeding ground.

II. THE CAT-TAIL ASSOCIATION

This association is very distinct, and contains but one species of plant (*Typha angustifolia L.*) There is almost no mingling with other societies. Wherever cat-tails are found in the lagoon, no plants intervene between them and the open water. In fact, cat-tails occupy many of the deepest parts of the lagoon. The probable explanation is that they cannot thrive in other spots at times of low water. They grow much taller than any plants of the same species I have seen in temperate regions, those in the deeper parts of the lagoon attaining a height of from eighteen to twenty feet. The country people cut them in large quantities at times of low water and use them for roofing their huts, where they are said to last four or five years. The native name for plant is *Hinea (enea)*.

Birds which nest in this environment almost exclusively are the Least Grebe, Least Bittern and Purple Gallinule. Others which commonly nest here, but are by no means restricted to this environment are the Porto Rican Coot, Porto Rican Gallinule, Allen's Ruddy Duck, Pied-billed Grebe, Porto Rican Zenaida Dove, Porto Rican Grackle and Porto Rican Golden Warbler.

The cat-tails offer no forage except the insects which they shelter. Their leaves and seeds are much used in nest construction.

III. THE SEDGE ASSOCIATION

This association follows the cat-tail association wherever present, and where absent borders on the open water association. It could more properly be called the Persicaria association, as these plants are more abundant than the sedges, but the dividing line between the Persicarias and the grasses is not so distinct as that between the sedges and the grasses. Persicaria is probably the most abundant

plant at the lagoon. The first three species listed below are the dominating plants in this association:

1. *Persicaria portoricensis* (Bert.) Small
2. *Cyperus giganteus* (Vahl).
3. *Eleocharis interstincta* (Vahl) R and S.
4. *Cyperus articulatus* L.
5. *Sphenoclea zeylanisa* Gaerten. (On the south shore only)

This is the preferred breeding ground of the Pied-billed Grebe, Allen's Ruddy Duck, Porto Rican Gallinule and Porto Rican Coot, and probably of the Yellow-bellied Rail. Black necked Stilts also breed quite commonly here, though reaching their optimum in the grass association.

The seeds of Persicaria are important food items for many species of water and shore birds. Otherwise this association furnishes little forage, except for insects, which abound in its shelter.

IV. GRASS ASSOCIATION

This association is very extensive at the east or shallow end of the lagoon, and there marks the transition from the marsh proper to the marsh border. At the deeper end it is of very small extent, and is soon followed by the Pluckea association. The grass association is characterized by grasses and by *Sesban emerus* (a leguminous herbaceous shrub). The following are the characteristic plants of this zone:

1. *Panicum geminatum* Forsk.
2. *Hymenachne amplexicaulis* (Rudge) Nees
3. *Sesban emerus* (Aubl.)

The seeds of *Hymenachne amplexicaulis* have the annoying faculty of digging their way into the flesh when one comes in contact with them while wet, and producing a strong stinging sensation. When these seeds are ripe, principally in September, wading in the grassy area is anything but a pleasure.

In this society most of the Black-necked Stilts nest. The Porto Rican Coot and Porto Rican Gallinule often nest here, and sometimes the Bahama Duck and Allen's Ruddy Duck.

This association is also much used as a feeding ground, especially by ducks, herons and certain shorebirds. Many seeds and insects are obtained here. A species of weevil, (*Tyloderma sp.*), which attacks Sesban is very frequently eaten by many species of birds.

V. PLUCKEA ASSOCIATION

This society forms the transition zone from the marsh proper to the border at the deeper west end of the lagoon. At times of high water there are about two feet of water in this area, but for about half the year it is high and dry, so that dry land forms which are resistant to a large amount of water form a dense mat of vegetation here. The most characteristic plants are as follows:

1. *Pluckea purpurascens* (Sn) DC.
2. *Jussiaea repans* L.
3. *Asclepias curassavica* L. Red Milweed or Bloodflower; Algodoncillo.
4. *Nymphoides humboldtianus* (HBK) Kuntze. Water Snowflake.
5. *Verbesiva alba* L.
6. *Cuscuta indecora* Choisy. Dodder.

Very few birds nest in this habitat, the only nests I have found here being of an occasional Porto Rican Gallinule and Coot, and one of a Porto Rican Golden Warbler. It is used more as a feeding ground, as a varied assortment of seeds and insects can be found here. During the winter it is the almost exclusive haunt of the Sora Rails.

VI. OPEN FIELDS ASSOCIATION

On the north and west sides of the lagoon the grass and Pluckea associations respectively merge into the open-fields association. This is a region of level fields on the floor of the extinct river valley, mostly planted to sugar cane. The water for irrigating the cane is pumped from the lagoon. Extensive areas immediately bordering the lagoon are left uncultivated, largely because they are overflowed occasionally at times of extremely high water. Here *Lippia repans* and the grass *Chloris paraguaiensis* are the dominating plants. An occasional Porto Rican Royal Palm breaks the monotony of the fields. The principal plants found here are:

1. *Lippia repans* HBK.
2. *Chloris paraguaiensis* Steud.
3. *Panicum barbinode* Trin. Malojillo.
4. *Roystonea borinqueña* Cook.

This is the nesting ground of the Porto Rican Grasshopper Sparrow and the Antillean Killdeer, and where the taller *Panicum* grows, of the Bahama Duck, though most of them nest at a greater distance from the lagoon. It is also used extensively as a feeding ground

for many species of birds, especially when the fields have been newly plowed.

VII. TACHUELO ASSOCIATION

At the shallow east end of the lagoon the grass association ends in a grove of yellow-flowered leguminous Tachuelo trees. This grove is about one acre in extent, and is a practically pure stand of Tachuelo [*Pictetia aculeata* (Vall) Urban]. The branches of many of them are densely covered with the epithyte *Tillandsia polystacyra* L. In these trees Jamaican Mockingbirds, Porto Rican Grackles, Anis, and an occasional West Indian Green Heron nest. It is not used as a foraging ground as much as one might expect, probably because the variety of seeds and insects offered is not great.

VIII. VARRONIA ASSOCIATION

On the south side of the lagoon, where the land rises quite abruptly from the marsh, there is only a narrow strip of the grass association, and this is followed by the Varronia association. This society is formed mainly of drought-resisting shrubs, with here and there a few herbaceous plants or a taller tree. By far the commonest shrub is *Varronia angustifolia.* The dominant plants found here are:

1. *Varronia angustifolia* West.
2. *Ricinella ricinella* (L) Britton.
3. *Lantana camara* L. (Red Sage. Yellow sage).
4. *Guazuma ulmifolia* Lam. (West India Elm).
5. *Spondias mombin* L. (Jobo).
6. *Bucida buceras* L.
7. *Solanum torvum* L. (*Wild Eggplant.* Berenjena Cimarrona).
8. *Bromelia pinguin* L. (Maya).
9. *Momordica zeylanica*
10. *Abrus abrus* (L) W. F. Wight. (Wild Licorice. Crabs' Eyes. Peronillas).
11. *Neptunia plena* L. (?)
12. *Peiranisia polyphylla Britton* and Rose. Retama prieta.

This is the principal breeding ground of the Porto Rican Ground Dove, Ani, Gray Kingbird, Yellow-shouldered Blackbird, Porto Rican Grackle, Carib Grassquit, Byrant's Grassquit, Jamaican Vireo and Jamaican Mockingbird. It is also a rich foraging ground, for seeds and insects are abundant.

FIG. 3.—Bamboo Association (to left) and lower end of Cartagena Lagoon

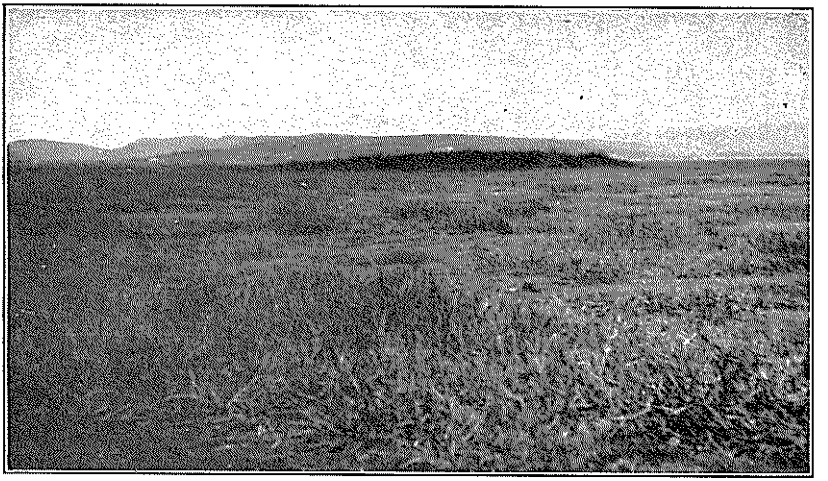


FIG. 4.—Guánica Lagoon, October 3, 1924

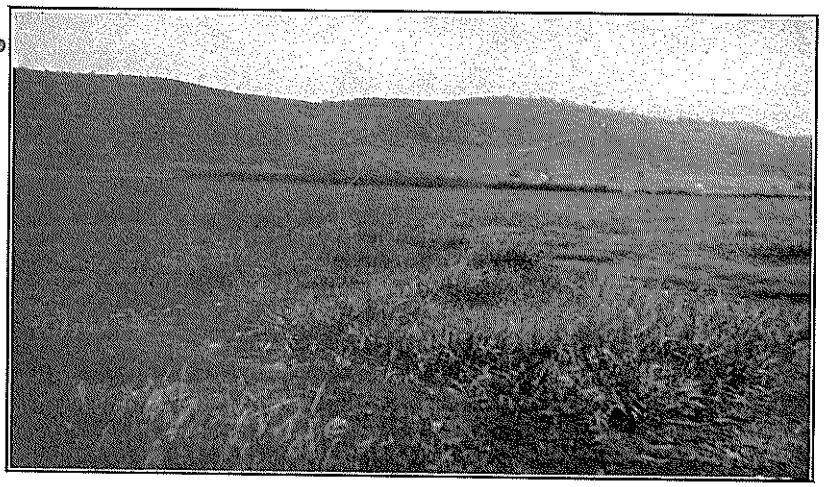


FIG. 5.—Guánica Lagoon, October 3, 1924

IX. BAMBOO ASSOCIATION

Although this association does not strictly speaking belong to the lagoon, it is necessary to consider it in an ecological study of the lagoon. It consists of the vegetation fringing the steep banks of La Quebrada, one of the tributaries of the Boquerón River which passes within a few hundred feet of the lower end of the lagoon, though not connected with it except at times of very high water. At such times it occasionally overflows its banks and some of its waters flow into the lagoon. On the other hand, when the lagoon is exceptionally full some of its surplus water spills into La Quebrada, and is carried through the Boquerón River to the sea. Like most of the streams in this part of the country, La Quebrada is nothing but a dry stream bed most of the time, but after heavy showers its volume is so great that it cuts a deep valley. Bamboos have been planted to help retain the walls of this valley and to prevent the stream from washing away the adjacent cane fields. A few other trees and a few herbaceous plants have sprung up among the bamboos, forming a dense but narrow strip of vegetation on each bank. Some of the principal plants found in this association are:

1. *Bambusa vulgaris* L. Bamboo. Bambú.
2. *Cordia nitida* (Vahl). Cerezo.
3. *Spondias mombin.* L. Jobo.
4. *Mangifera indica* L. Mango.
5. *Andiva ineuris* HBK.
6. *Cissus sicyoides* L.

Many of the lagoon birds come here to breed, and others include this association in their feeding range. It is the principal breeding ground of the West Indian Green Heron and of the Ani. Others which nest here are the Gray Kingbird, Jamaican Mockingbird, Porto Rican Golden Warbler, Jamaican Vireo and Porto Rican Honey Creeper. Little Blue Herons, Water-thrushes, Spotted Sandpipers and Porto Rican Ground Doves feed here extensively. This is the best place in the vicinity of the lagoon for migrant warbles. It is of especial importance to the bird life of the lagoon because it is the nearest dense shelter available.

SUCCESSION

Conditions in the marsh are far from static. When I returned to the marsh in November, 1923, after an absence of nearly a year and a half I was impressed with the fact that the cat-tail area was much smaller than it had been. On more careful scrutiny other

changes could likewise be noted. In most places sedges were replacing cat-tails and grasses were replacing sedges, and at the west end of the marsh the plants of the Pluckea association were encroaching upon the cat-tails. All were tending to fill in the marsh. But the regularity of this succession is not so great as would be expected in a northern cat-tail marsh. This is largely due to the periodical drying up of the lagoon, which gives some of the marsh border plants a chance to obtain a foothold in the marsh at times of low water. For example, some grasses straggle out into the open-water association, and in all the associations there is a greater intermingling of types than one would expect in a marsh where conditions were more uniform. During my absence the very shape of the lagoon had been changed. Very likely at this writing it has changed a good deal since I mapped it in the summer of 1924. Many years of observation are necessary for a detailed understanding of the succession. The accompanying map was made to aid in following these changes from year to year.

ANIMALS OF THE LAGOON

MAMMALS

Mammals are few in species at the lagoon as in the entire Island. There are no indigenous terrestrial mammals living in Porta Rico to-day, the mammalian fauna being limited to marine forms and bats, together with a few introduced terrestrial mammals.

The following mammals have been recorded from Cartagena Lagoon:

1. *Nyctinomus murinus* Gray. Furry-winged Free-tailed Bat. Three specimens of this bat were collected in an old house near the lagoon on September 27, 1924. Only two species of bats have been collected near the lagoon, but probably others occur at times. Both of them are insectivorous.

2. *Molassus fortis* Miller. Smooth-winged Free-tailed Bat. One specimen was collected August 20, 1924, and four on September 27, 1924, in old houses near the lagoon, from whence they issue at night to feed over the lagoon. Among those collected on the latter date was a young one which had attained nearly half adult size, but it had no teeth or fur as yet.

3. *Herpestes birmanicus* Thomas. Mongoose. The Mongoose is an introduced species which has become exceedingly common over the entire Island of Porto Rico. It has practically exterminated

snakes, which used to be very common in Porto Rico, and has also been making great reductions in the number of ground lizards and ground-nesting birds. It is very common at the lagoons, and is one of the worst enemies of the birds. It hunts over any region where the water is not deep enough to necessitate actual swimming, and thus occurs in all the plant associations except the open water association, and very often even there at times of very low water. It makes way with many eggs and young of such birds as the Gallinule and Coot, and probably with the adults of smaller species. I have seen one glide up behind an adult West Indian Green Heron and make a spring at it, but the heron realized its danger just in time to take hasty flight to safety. The Mongoose should be exterminated wherever possible. Although it was introduced to exterminate rats, rats are just as abundant as they ever were, but the same cannot be said of the native ground-nesting birds and lizards. Mongooses can be easily trapped in large wire-cage rat traps baited with fish heads. A boy in Mayagüez trapped twenty in this manner in about a month. They will also come freely if hen's eggs are used as bait, though they seem to prefer fish.

4. *Rattus rattus alexandrini Geoffroy.* Roof Rat. This introduced species is abundant in Porto Rico. It frequently occurs in and near the swamps, in all the plant associations except the Open Water and Cat-tail. It is more abundant in the canefields where it feeds upon the cane, but on coming to the marshes it often varies its diet with a few eggs and young birds.

5. *Rattus norvegicus Erxleben.* House Rat. This is another introduced species, less common than the preceding, and far less frequently seen in the marsh. Otherwise the habits of the two species appear to be quite similar. Most of the trapped animals I have observed in Porto Rico have been Roof Rats.

6. *Mus musculus musculus* Linnaeus. House Mouse. Introduced and abundant in Porto Rico. Often found in the grass and sedge associations in the lagoon at times of low water, where it apparently feeds upon seeds.

I believe it is possible that a second species of mouse may occur, though none such has been listed from Porto Rico. On two occasions near the lagoon I observed a mouse with a very red back, once in a canefield near the lagoon, and once in a growth of Persicarias in the sedge association, but neither time was I able to collect the specimen seen, so that it cannot yet be recorded.

Reptiles

1. *Anolis cristatellus* (Duméril and Bibron). Common in the Varronia and open field associations, and occasionally penetrating into the grass and sedge associations of the lagoon proper, where it feeds upon insects. Numerous specimens were collected.

2. *Anolis stratulus* (Cope). Common in the Varronia and Open Field associations.

3. *Anolis pulchellus* (Duméril and Bibron). Common in the Open Fields association, and frequently enters the grass association of the lagoon proper. On September 27, 1924, many were stranded on isolated plants and hummocks in the newly flooded part, thus falling easy prey to birds, some species of which, notably the Porto Rican Grackle (*Holoquiscalus niger brachypterus*), are very fond of them.

4. *Anolis poncensis* (Stejneger). Lizards of this species were noted at the base of Tinaja Hill, directly south of the lagoon, and probably occur at times in the Varronia Association. All the Anoles are insectivorous. Being small and lacking means of defense they are included in the bill of fare of many birds.

5. *Ameiva exsul* (Cope). Frequently noted and twice collected in the Varronia association. These lizards are too large to be fed upon extensively by most birds except birds of prey, though small specimens are occasionally taken by other birds, such as the Gray Kingbird.

6. *Ameiva wetmorei* (Stejneger). Though I have not found this recently discovered species in the immediate vicinity of the lagoon, it occurs not uncommonly on Tinaja Hill, where I collected three speciments on May 6, 1924. It is conspicuous with its yellow lateral stripes and brilliant green tail, and prefers the arid limestone hills.

Amphibians

1. *Leptodactylus albilabris* (Günther). This is the only amphibian recorded from the lagoon. Its tadpoles abound in the grassy parts of the lagoon during November and December, and later many small frogs occur in the same region. I have never observed an adult at the lagoon, though I have collected a number of them at Mayagüez. The tadpoles and small frogs form an important element in the food of the lagoon birds, particularly of the herons.

Fishes

Fishes are very few in species at the lagoon. I have personally observed only three species, but have been told of a fourth which is very rarely found and of a fifth which was said to occur in the lagoon before it dried up for the first time. The identity of this species I have not been able to ascertain. It was known to the country people as *Pez grande,* and is said to have lived in the mud and to have attained a weight of as much as twenty pounds. When the lagoon dried in 1923 all of them were cleaned out, and none have appeared since then. The following four species exist at present in the lagoon:

1. *Anguilla chrysypa* (Rofinesque). Eel. Anguilla. Eels are very abundant in the lagoon though seldom seen except when it is drying up. During the drying-up period in June and July most of the attentions of the eggers are diverted from egg hunting to eel fishing. The eels are obtained with fish spears of from one to four, usually two, prongs known as *figas,* or more often with *machetes.* The boys and men wade around up to their knees or even to their waists in mud, brandishing their machetes which they let fall on any luckless eel they encounter, usually nearly severing the head with the force of the blow. On July 5, 1924, I counted seventy large eels which twelve boys had secured, and they were still killing others rapidly. Some were over forty inches in length, and most of them were from twenty-five to thirty-five inches long. The eels appear to be of little ecological significance. I have no records of their being eaten by any birds, but having observed a Great Blue Heron eating an eel in the north I would not be surprised if its southern relative occasionally eats an eel.

2. *Centropomus parallelus* (Poey). Robalo. This fish is reported by the country people living near the lagoon, but I have never observed it there, and do not feel very certain of its identity.

3. *Awaous taiasica* (Lichtenstein). Mapiro. This is a rather scarce fish at the lagoon, usually seen swimming among the cat-tails. I have observed it on only a few occasions. It is said by the country people to bury itself in the mud at times of low water.

4. *Poecilia vivipara* (Bloch and Schneider). Cisi. This is by far the most abundant fish at the lagoon, occurring everywhere that the water is deep enough to permit of swimming. They swarm in great numbers in the shallower places. It is the only species which enters into the food of the birds to any great extent. This little fish is mut-eating and viviparous. Nearly half of those captured

Coleoptera occur in great profusion, as in most tropical regions. Fleabeetles are particularly numerous. Among the worst beetle pests found near the lagoon are white grubs (larvæ of *Phyllophaga vandinei*), and the Sugar Cane Stalk Weevil (*Diaprepes spengleri*). Coleoptera form the largest part of the food of the insectivorous birds, and the most injurious species form a goodly proportion.

The insects which are most conspicuous as one approaches the lagoon are the clouds of butterflies which arise as one walks through the fields. About nine per cent of them are of one species, (*Anartia jatrophæ Linnaeus*). Their black, spiny larvæ feed on *Lippia reptans*) (HBK), which forms a large part of the Open Fields association. On September 23, 1924, these larvæ were so excessively abundant as to nearly conceal the plants. Some other species of butterflies which are often found with *Anartia jatrophæ* are *Junonia genoveva* (Cramer); *Didinis biblis* (Fabricius); *Anosia plexippus* (Linnæus); *Euptoieta hegesia* (Cramer); *Callidryas eubule* (Linnæus) and two undetermined species of *Lycæna*.

The most prominent and most feared species of Hymenoptera is the Bembecid *Stictia signata* (Linnæus). They are constantly flying over the lagoon, especially over the Persicarias, often chasing flies. They live in holes in the ground near the edge of the lagoon. When one sits down to eat lunch two or three of them are sure to come buzzing around appearing very formidable and ferocious. Although they have a prominent sting, I have not learned of an authentic case of a person being stung by one. I have no records of this species being eaten by birds.

A small ant (*Prenolepis sp*), is very abundant, and nests in the large tops of the Giant Sedge (*Cyperus giganteus Vahl*), during the time that these are in blossom and seed, or from September to December. During the balance of the year these ants are often found breeding in the nests of Coots, Gallinules and other marsh birds.

White ants (*Isoptera*), of several species are very abundant, but are seldom eaten by birds as they remain in places inaccessible to them except when flights of the winged form take place. On such occasions birds eat many of them.

CRUSTACEA

Three species of land crabs live near the borders of the lagoon. Dr. Mary J. Rathbun, of the U. S. National Museum, kindly identified these for me. The common large blue land crab is *Cardisoma guanhumi* (Latreille). It lives in large tunnels in the ground which

it excavates for itself when the ground is soft after the rains, leaving big heaps of mud near the entrance. They rarely emerge from these holes during prolonged droughts. They are largely carnivorous in their habits, and are an enemy to the birds to some extent. I have observed an especially large crab of this species taking eggs from under a hen which was incubating in a nest in a box near the ground not far from a marsh. It pushed the hen half way off the nest and proceeded to devour the eggs. The hen was powerless to prevent it. Doubtless these crabs often rob the nests of ground-nesting birds. Another crab which is found much more rarely near the lagoon is the smaller blue-bodied, pink-legged *Gecarcinus ruricola* (Linn.), a form which is peculiar in that the eggs hatch directly into crabs with the form of the adult. A male of this species which I sent to the U. S. National Museum is the first specimen they have of this species from Porto Rico. Another crab which is not often found at the lagoon though it is abundant on the nearby limestone hills is *Coenobita clypeatus* (Herbst). They live in large, heavy snail shells, but despite the cumbersome weight of these shells they can travel quite rapidly. They are practically omnivorous. Near Cabo Rojo Lighthouse I have seen them so abundant that in a patch of about ten square feet they were packed so closely that it was impossible to see the ground, and thousands of others were nearby on all sides. When one stopped to eat lunch these crabs gathered by the hundred from all sides to try to get their share of it. They would eat anything that was thrown to them, from meat scraps to orange peels. It was difficult to keep them out of our food supplies when camping, as they would tear through heavy pasteboard boxes to get at the food inside. They were particularly active at night, though by no means inactive in the daytime. Small birds' nests would not be safe where they are abundant, as they are not only found on the ground, but they climb to some extent. I once found a small specimen climbing up a cat-tail stem in the lagoon.

Domestic Animals

Cattle are pastured in the fields surrounding the lagoon, and they often wade in the marsh proper to graze upon the succulent grasses and other plants which grow there. Pigs and goats also run at large through the marsh where it is not too deep, while domestic turkeys, guineafowl and hens feed along the shore.

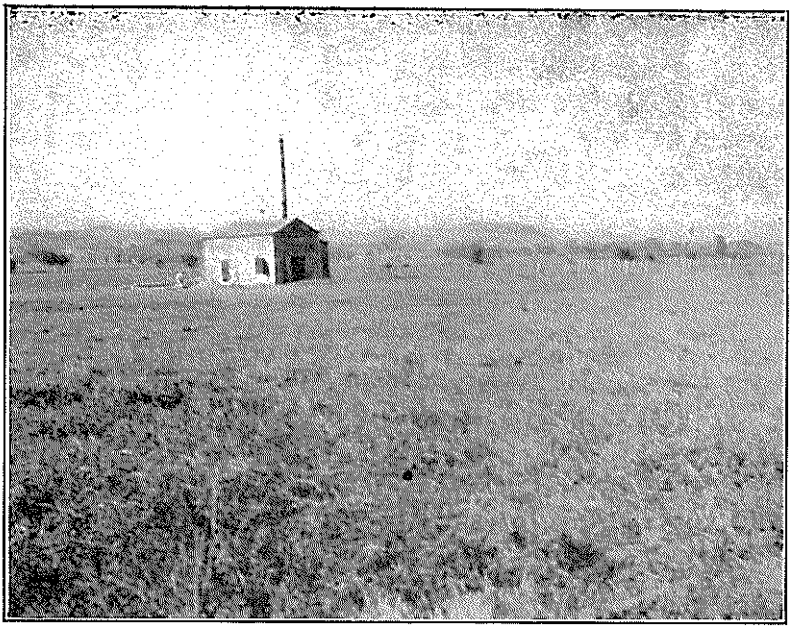


FIG. 6.—Pumphouse, Cartagena Lagoon

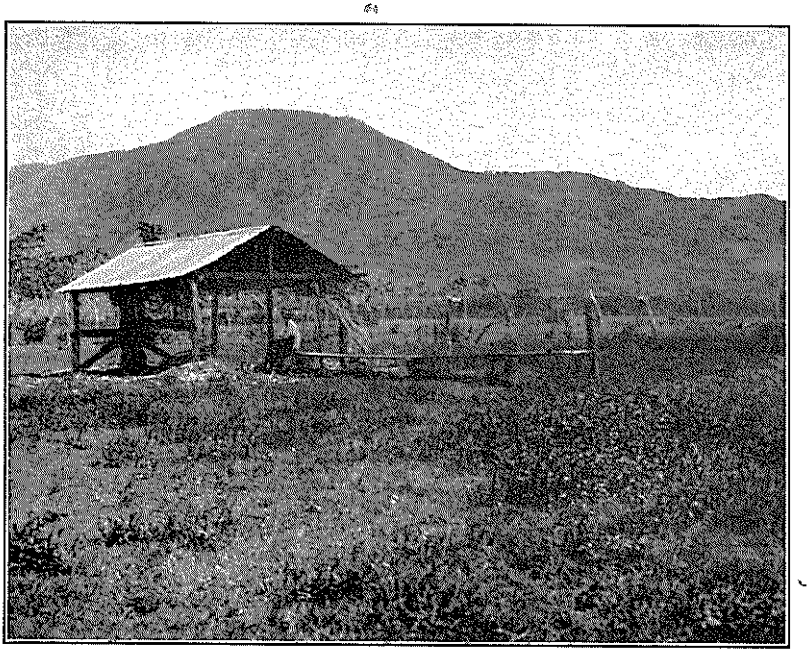


FIG. 7.—Boathouse, Cartagena Lagoon

FIG. 8.—Cartagena Lagoon. Open Water Association with Pond Lilies. April, 1922

FIG. 9.—Cartagena Lagoon. Open Water Association with Pied-billed Grebe Nest in Foreground. May, 1924

WORKING CONDITIONS AT CARTAGENA LAGOON

The difficulties of ornithological work at Cartagena Lagoon were so great that at times it seemed very discouraging. In the first place it was necessary for me to live at Mayagüez, and there was just one train a day from there to the lagoon. It allowed me only six hours a day at the lagoon, and I had to spend four on the train going back and forth over the twenty-six intervening miles of rail. Occasional outbreaks of fever kept me from making as frequent visits to the lagoon as I would have liked.

At the lagoon the eggers interfered greatly with my work. They searched the marshes so systematically that I was able to follow any given nest through to the hatching period in but one or two cases. Unfortunately the eggers did not confine their attention to the edible eggs of the larger species, but with incomprehensible lack of foresight they destroyed all eggs too heavily incubated to be eaten, "so as to save the next man the trouble of examining them". They did not seem to realize that by so doing they were "killing the goose that laid the golden egg". And this is not all. Any small birds' eggs which they found were broken and thrown away. Once I asked an egger why he did it. He answered: "I dont know; I just can't bear the sight of an unbroken egg remaining in a nest, no matter what kind it is". It seems marvellous to me that any birds are left in a region where such destruction is permitted.[1] Of course the actions of the eggers prevented the doing of much intensive work on nesting habits. I actually had to pay the boy who carried some of my photographic and other equipment extra in order to prevent him from taking the eggs in the nests I found and wished to photograph. It was impossible to use a blind for bird photography at the lagoon, for a blind would immediately attract attention to the nest upon which it was set, and by my next visit, the eggs, and like as not, the blind itself would have disappeared. The taking of eggs is a pernicious habit, and should by all means be prohibited by law and sentiment. If the birds and their eggs are not protected during the breeding season they have but small chance of reproducing their kind. The surest way to decrease the number of birds is to permit the taking of breeding birds and their eggs. The present laws prohibit this to some extent, but many revisions are necessary to adequately protect the birds. Cartagena Lagoon is the most important breeding ground for water-

[1] This destruction is not permitted. It is done in violation of the law. An appendix has been prepared containing legislation enacted and in force.—THE EDITOR.

fowl on the Island, and it would well repay the Porto Rican people to have it regularly patrolled by an officer of the law, especially during the breeding season.

At certain times of the year Cartagena Lagoon is a favorite rendezvous for hunters from Mayagüez and Ponce, while the country people hunt at all times of the year, whenever they get money enough to buy ammunition. The hunters add to the difficulties of the ornithologist, not only by the number of birds they take and by the danger from passing shots, but by keeping the birds stirred up. Many a time when I have been concealed in the cat-tails or other vegetation trying to photograph or watch certain birds, a hunter's shot or one of the boys stationed around the marsh to keep the birds in flight has scared my birds away and thereby spoiled an afternoon's work.

That bloodthirsty villain the Mongoose ranks perhaps third as an arch enemy of the ornithologist, though it seldom molests nests placed among vegetation growing in deep water.

Stinging Entomostracans, *Cucarachas de agua* and stinging grass seeds produced much discomfort, but did not interfere seriously with work. Every country person and city hunter I have talked with who was familiar with the lagoon a few years ago tells me of the vast number of large leeches which formerly lived there and caused great discomfort if not actual serious injury to those persons who ventured into the lagoon. It is said that the leeches attained a length of eight inches, and that as many as thirty frequently attached themselves to a man within a few minutes. Somewhat similar conditions still exist in a small marsh near Cabo Rojo. But at Cartagena Lagoon the leeches were said to have all suddenly disappeared immediately after the hurricane of September, 1921, when the lagoon waters rose very high and the high wind whipped it into large waves. Possibly they were washed out to sea. At any rate none are now to be found, much to the relief of any one who has occasion to work in the marsh.

PART III

BIRDS OF CARTAGENA LAGOON

The species of birds discussed in the pages which follow include all those which are known to occur at Cartagena Lagoon. Under each species are given the scientific, English, and Spanish names used by the people who live near the lagoon; a statement of the occurrence of the species at the lagoon; an account of the habits; accounts of the nesting and young, of the enemies, of the food, and of the ecological and economic importance of the species. In many cases the Spanish names will be found to differ from those given in published accounts of Porto Rican birds. Most of these were given by Gundlach, who in many cases gave the names by which he had known the species in Cuba.

1. *COLYMBUS DOMINICUS DOMINICUS* (Linnaeus). Least Grebe. *Tigua.*

Least Grebes are common permanent residents at Cartagena Lagoon, leaving it only when the lagoon is so dry that they cannot swim. In 1924 they stayed until June 21, when there was very little water at the lagoon, and appeared again August 26, very soon after the first shower had begun to replenish the lagoon waters. About twenty-five pairs bred in 1924. Only about six pairs bred in 1922 when there was water at both Anegado and Guánica Lagoons.

The cat-tails are the favorite haunt of this little grebe, and it is seldom seen far from them. Even while feeding it seldom goes far away from their protection. Often after one has been standing still among the cat-tails for some time the gray form of a Tigua will pop up beside him, usually to disappear again as quickly as it had at first appeared. They are usually found in loose flocks at all times of the year, probably not so much from any gregarious instinct as from a community of interest which brings large numbers together where conditions are favorable. Flocks of as many as seventy-five are often seen at Cartagena Lagoon during the breeding season. Their favorite feeding ground is in patches of open water immediately adjacent to growths of cat-tails. The water in such places is usually so choked with Naias, and at other times so shallow that the Tiguas are seldom able to swim under water. At these times they take wing at the slightest alarm, and head directly for the cat-tails,

so it is very difficult to observe them closely unless one hides behind a screen of cat-tails. When frightened they fly with a weak wing-stroke which enables them to keep their bodies barely above the surface of the water. They gain increased speed by pushing downwards and backwards against the water with their feet, though their body is supported entirely in the air. When deep water free of Naias is available (just after the lagoon has filled up) these little grebes have a chance to show off their far-famed powers of diving and swimming under water. They are then observed much less frequently as they dive at the slightest suggestion of danger, to reappear again only among the cat-tails. When they have been frightened away from their feeding ground they do not return to it for half an hour or over, even when the cause of their alarm does not remain in the vicinity.

The note of the Least Grebe is a loud, reed-like "week", but it is seldom uttered.

The Least Grebe is commoner than the Pied-billed Grebe. When on the water they are easily confused unless a close view is obtained, when the smaller size of the Least Grebe, and particularly its grayish coloration and light-colored iris can be noted. There is no danger of confusing the species when in flight, as the white in the wing of the Least Grebe is very conspicuous, making the wing appear almost white from a distance.

The Least Grebe, as I have already indicated, nests exclusively among the cat-tails, and usually in the deepest parts of the swamp, as that is where the rankest cat-tails grow and where the nests are freest from molestation. All the nests I have found were anchored to cat-tails in water from one to three feet deep, and were made of partially decayed cat-tail leaves, with occasionally a few rootlets in addition. These are heaped to-gether to form a bulky rounded mass mostly below the surface of the water. Those in shallow water were built up from the bottom, but those in deeper water were strictly floating affairs. They are slightly hollowed at the top to receive the eggs. Although this species is said to lay from three to six eggs in other parts of its range (Bent, 1919, p. 37), three eggs is the largest set I have found in Porto Rico, and often only one or two eggs are laid. However, Struthers (1923, p. 469), records nests with as many as seven eggs. The eggs are pure white when laid, but they soon become so stained with dirt that they become deep brown in color. A freshly laid set of two eggs observed on September 6, 1924, became quite dark in a week. Eggs nearly ready to hatch

are very dark. I found that I could guess the stage of incubation rather closely by observing the color of the egg. In almost every case the adults covered the eggs with decayed vegetation before leaving the nest. The only time this was not done was in the case of very much stained eggs nearly ready to hatch.

The months in which these grebes nest most frequently are April and May, and September to November. Apparently they raise two broods a year.

On May 16, 1924, I obtained a young bird from pipped egg. The markings as noted on this were: The color is brownish black above. There is a large triangular rufous patch on the crown, and a narrow stripe of the same color extends forward from this patch to the base of the bill. On each side of this rufous patch is a short white stripes, and another white stripe extends from each eye backward onto the neck. The under side of the head is white, with two broad black stripes converging at the base of the bill. The back is brownish-black with two narrow white lines extending from the neck to the tail. The breast and belly are a dirty white. The bill is mostly creamy white, more or less dusky at the tip and on the upper surface of the upper mandible. On the lower mandible there is a narrow black V. The egg tooth is pure white.

The worst enemies of the Least Grebe are the native eggers and the so-called sportsmen who shoot any birds that come in sight whether they are fit to eat or not. However, this species suffers less than most of the aquatic birds from the former cause, as their nests are placed in some of the most inaccessible places that can be found at the lagoon. Unfortunately the birds are quite easy to shoot if the hunter hides in the cat-tails near their feeding grounds. This species is infested with tapeworms to a remarkable degree. Several tapeworms, often as long as 100 millimeters, were taken from each of the five adult specimens I collected.

Very little has been recorded about the food of the Least Grebe. Apparently the sole account in literature is an unsatisfactory note by Gosse (1847, p. 443): "The gizzards of all that I obtained were filled with a finely comminuted substance, rather dry, of an unctuous appearance, and mingled with short silky filaments. A close examination with a lens failed to determine its nature; but I believe it to have been principally vegetable."

Five stomachs from Cartagena Lagoon, taken in September and October, were obtained. The material in these was much comminuted and rather difficult to determine, but upon careful examination the

greater part of the material was identified. Animal food comprised 99.8 per cent of the total. The only vegetable matter found was a few seeds of *Sesban emerus* in one stomach. Feathers comprised 35.4 per cent of the stomach contents, showing that this species has the feather-eating propensities so characteristic of the grebe family. The animal food was composed entirely of insects, mostly aquatic forms. Some of those found were dragonfly naiads, 6 per cent (eaten by two birds); adult dragonflies 1 per cent (eaten by one bird); adult damselflies 4 per cent (eaten by three birds); Naucoridae, *Pelocoris femoratus*, 8 per cent (eaten by two birds); adult Hydrophilids 1 per cent (eaten by two birds); Hydrophilid larvæ 3 per cent (eaten by two birds); aquatic Dipterous larvæ 1 per cent (eaten by one bird); two Maybeetles, *Phyllophaga vandinei*, and one Carabid beetle, comprising 1.5 per cent, were eaten by one bird, and are the only terrestrial forms found. Very likely they were specimens which had fallen in the water.

The Least Grebe is a strictly aquatic species, entirely dependent upon the marsh for food and shelter. It is incapable of long migratory flights on accounts of its short wings, so they wander little or not at all from their native marsh unless forced to by the drying up of the waters of the marsh. It is so thoroughly adapted to an aquatic existence that it is doubtful if it could exist long elsewhere. It is primarily a bird of the cat-tail association, and seldom ventures far from its protection.

2. *PODILYMBUS PODICEPS ANTILLARUM* (Bangs). Antillean Pied-billed Grebe. *Zaramago. Zaramagullón.*

The Pied-billed Grebe is a rather common permanent resident at Cartagena Lagoon, though slightly less common than the Least Grebe. It leaves only when the lagoon dries up so much that swimming is impossible. In 1924 it left June 21, and returned August 26, thus going and returning on identically the same days as the Least Grebes.

This grebe is more a bird of the open-water association than the Least Grebe, and seldom seeks the protection of the cat-tails, either for feeding or nesting. It escapes danger by diving if the water is deep enough or by swimming if it is not. It takes flight much more rarely than the Least Grebe. They are never seen in flocks; usually they occur singly, occasionally in pairs. They are less easy to observe from a cat-tail blind than the Least Grebe because they feed mostly far out in the center of the lagoon, and also because if once frightened from one part of the lagoon they seldom return to it in

less than three or four hours. Four or five pairs breed at Cartagena Lagoon. The species is fully as common in summer as in winter, and I doubt very much if any migrants from North America occur, despite the prevalent belief that they do.

The call of the Antillean Pied-billed Grebe consists of a long series of cuckoo-like notes followed by some gulping sounds, thus: *cow, cow, cow, cow, cow, cow, cow, cow-wullup, cow-wullup.* The female also has a soft *cuk, cuk* note which she uses when calling to her young.

The larger size, browner coloration and black throat easily distinguish this bird from the Least Grebe. Birds in breeding plumage (with the black throat), may be seen at all times of the year. Immature birds lack the black throat. I do not have sufficient specimens to ascertain whether the adults ever acquire a winter plumage similar to that of North American birds or not.

On April 4, 1924, during a rather heavy shower, I observed the courtship and mating of this species. The male chased the object of his devotions at high speed for about two minutes, making a great splash in the water, and occasionally diving and coming up near the female. I did not observe any vocal sounds accompanying this performance, but the noise of the rain might have prevented that. Finally the male capture the female and mating took place.

The nests of the Pied-billed Grebe are found in the open-water association where the water is from two to three feet deep, either built up from the bottom in the open-water, or floating and anchored to a few cat-tails or grasses which straggle farther out towards the center of the lagoon than most of their kind. All the nests I have found were constructed of Naias. Sometimes this was quite fresh, in other cases it was largely decayed. The nest is a bulky structure built up about two inches above the surface of the water. The top is slightly hollowed to receive the eggs. In every case these numbered three at Cartagena Lagoon, though Struthers (1923, p. 469) records a nest with six at Anegado Lagoon. The eggs are white when laid, but soon become stained brown.

The breeding season is not so well marked as that of the Least Grebe. I have found young about one-third grown on December 7, 1923, and newly hatched young on December 11, 1923. Struthers (1923, p. 469) records a nest with eggs on February 18, 1922. On March 17, 1924, I found newly hatched young, but by far the greater part of the nests with eggs and young are found in April and May.

On April 30, 1924, I had the opportunity of observing a nest the

day the young were hatching. One egg had just hatched, one was pipped and the third, as I learned later, was infertile. Before leaving the nest the parent covered the two eggs, leaving the new hatched young on the edge of the nest. When I approached the nest it dived into the water, but I caught it easily and replaced it in the nest, but it would not stay there long enough to be photographed. When I visited the nest on May 2 the mother grebe was seen swimming nearby with a bunch of pondweed and the two young on her back. The infertile egg remained uncovered in the nest. When the old bird wanted to get the young off her back she simply took a dive and apparently dumped them off.

The downy young is strikingly marked with black, white and rufous. The upper parts are mainly black. Two white superciliary stripes and two white stripes above them converge at the forehead. There is a small triangular-shaped rufous patch on the crown, and a rufous stripes runs from one eye around the back of the neck to the other eye, the rufous color becoming brighter in color on the back of the neck than it is near the eyes. Behind this, on the neck, is a short rufous bar. The back is black, with six narrow white stripes running its entire length. The underparts are dull white, with a little black mottling on the under sides of the head and neck. The bill is mainly black, with a brownish-red fleshy area at the base. The egg tooth is large and is pure white in color.

The worst enemies of the Pied-billed Grebe are the eggers. Hunters account for some losses in the rank of this species, but they are much harder to shoot than Least Grebes and so are obtained much less frequently.

The stomachs of two Pied-bills from the lagoon were available for examination. That of an adult collected April 18, 1924, contained 4 dragonfly naiads (8 per cent) and fragments of many Naucoridæ, *Pelocoris femoratus* (8 per cent), in addition to the customary feathers found in all grebes' stomachs, which in this case formed 80 per cent of the stomach contents. The stomach of a downy young, not over three days old, collected March 17, 1924, contained but one feather, but that was large and formed 10 per cent of the stomach contents. In addition to this the stomach contained 1 Mole Cricket, (*Scapteriscus didactylus*), forming 86 per cent. Vegetable matter constituted 4 per cent, and consisted of two small pieces of Naias, 1 seed of *Hymenachne amplexicaulis* and a little rubbish. A stomach from Aguadilla examined by Bowdish and one from Manatí by Wetmore contained crawfish.

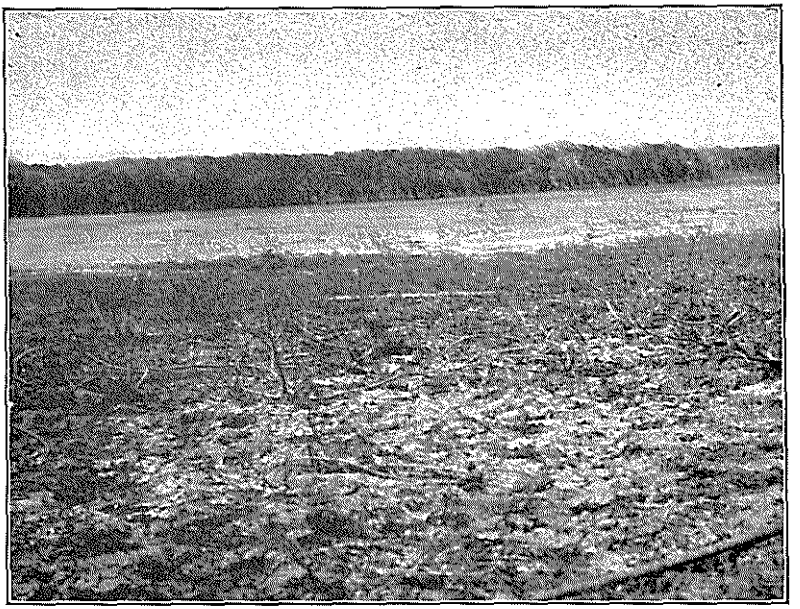


FIG. 9 *a*.—Cartagena Lagoon. Cat-tail Association in Background. June, 1924

FIG. 10.—Cartagena Lagoon. Grass Association. May. 1924

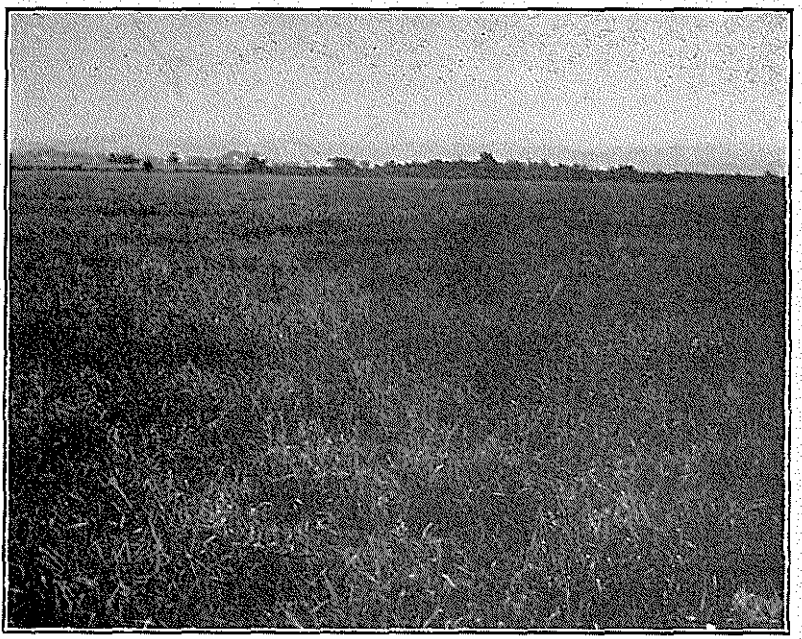


FIG. 11.—Cartagena Lagoon. Grass Association, Tachuelos in Background

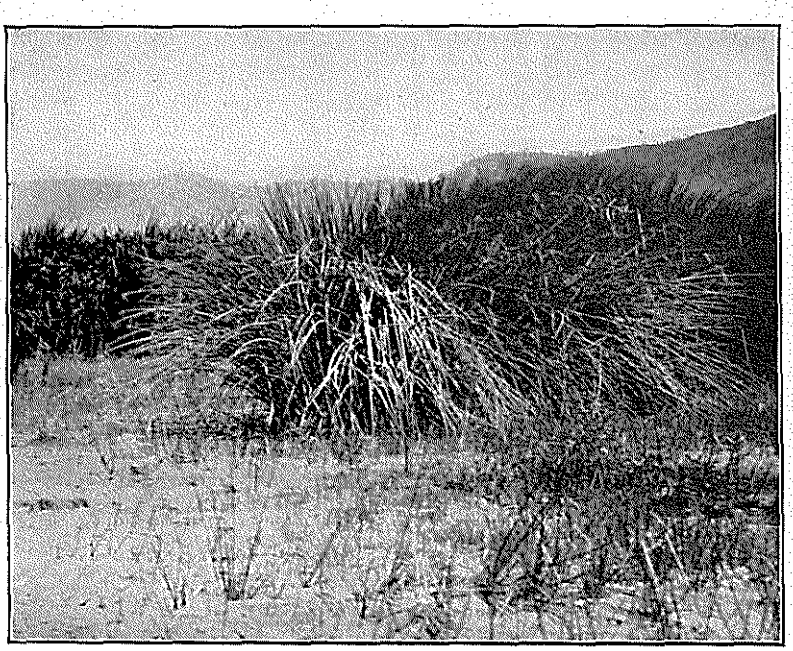


FIG. 12—Cartagena Lagoon. Sedge Clump (Eleocharis) in Foreground, Cat-Tails in Background

The Pied-billed Grebe is a strictly aquatic species, and dependent entirely upon the marsh for food and shelter. The scanty data available on its food habits indicate that it is a useful bird and worthy of protection. It is a bird of the open-water association and is seldom found in the cat-tails. In this respect it differs materially from the Least Grebe in its habits.

3. *LARUS ATRICILLA ATRICILLA* (Linnaeus). West Indian Laughing Gull. *Gaviota.*

Laughing Gulls occur commonly on the coasts of Porto Rico, but are very rarely seen at the fresh water lagoons. I have observed this species on two occasions at Cartagena Lagoon, two birds seen on May 27, 1924, and one on September 3, 1924. Apparently Laughing Gulls do not nest on the main island, and it is doubtful if they nest on Desecheo Island, but nevertheless they are seen on both islands in spring and summer months only. In 1922 my first record for the arrival of this species at Mayagüez was March 10; in 1924 it was March 6. They are not seen after September.

4. *GELOCHELIDON NILOTICA* (Gmelin). Gull-billed Tern. *Gaviota.*

The Gull-billed Tern is a summer resident at Cartagena Lagoon, though it does not breed. Its occurrence in Porto Rico was previously unknown. In 1924 they arrived on May 20, and stayed until September 3, staying right through the period when the lagoon was dry, as they could obtain a plentiful supply of insects from the mudflats. They were almost constantly on the wing, and obtained their food by swooping down to the mudflats and scooping in the insects without stopping their flight. Occasionally they could be seen in small groups resting on the mudflats. Even while there were still little pools of water these terns picked their food from the partly caked mudflats rather than from the water.

On July 9, 1924, I collected a female from a flock of nine resting on the mudflats. The ovary was somewhat enlarged, the largest ovules being three millimeters in diameter. The stomach of this bird contained 58 aquatic Hemiptera (*Pelocoris femoratus*), constituting 94 per cent of the contents. One dragonfly naiad formed 4 per cent, and 1 *Corixa reticulata* 2 per cent.

The Gull-billed Tern evidently finds conditions quite favorable for its existence in the mudflats of a drying lagoon, else it would not remain there all summer so far from its normal breeding range.

5. *THALASSEUS SANDVICENSIS ACUFLAVIDA* (Cabot). Cabot's Tern. *Gaviota.*

Cabot's Tern is an irregular winter visitor to Cartagena Lagoon. An individual in winter plumage was observed skimming over the lagoon on each of my trips between December 4 and December 22, 1923. Nothing has been recorded of the food habits of this species in Porto Rico, where it is by no means common, even on the coast.

6. *HYDROCHELIDON NIGRA SURINAMENSIS* (Gmelin). Black Tern. *Gaviota prieta. Gaviota ceniza. Pitirre de agua.*

The Black Tern is a common fall migrant at Cartagena Lagoon. It is never found there in the spring, but it is said by the country people to occur every year in large numbers in September. In 1924 the first birds arrived on August 20, and none were noted after October 7. From 150 to 175 could be noted almost any day in September. In 1921 Struthers (1923, p. 474) noted twenty on August 18.

The flight of the Black Tern is very erratic and swallow-like, making them difficult marks for the hunter. When one is shot and injured its comrades gather around above it and make a great din of sharp cries. Occasionally large numbers of terns could be seen perched on the wire fence which crosses the lagoon or on the mudflats, but when resting they are very wary and it is impossible to approach within gunshot of them. They often hover low over the surface of the water while feeding. They obtain most of their food from the open-water regions, but scattering groups forage over the dry grassy fields at some distance from the lagoon. On one occasion I observed a Black Tern catching dragon flies on the wing over the water. During the latter part of their stay at the lagoon these birds began to act peculiarly. On September 27, 1924, a closely packed flock of sixty were flying back and forth over the lagoon, wheeling around, dipping to the water and rising again, always in perfect unison, each bird maintaning its respective position in the flock. This occurrence was noted again on September 30, 1924, only this time the flock numbered seventy-six. After this date only about twenty-five scattering birds were observed. The only call note observed from any of the birds was a sharp metallic *peek*. It is from this note that the native name of *Pitirre de agua* is probably derived, as it is somewhat suggestive of the call note of the Pitirre (*Tyrannus dominicensis*).

When the Black Terns arrive most of them are either in the light winter plumage, though quite a number in the dark summer plumage or in a pied intermediate plumage can be observed. As the season progresses the number of black and pied individuals decreases until in October all the birds are in the light plumage. On September 3 approximately one hundred and fifty Black Terns were observed. Of these 130 were in light plumage, 10 were dark and 10 were pied. On September 20, two out of 125 were dark, and five were pied. After September 27 no dark birds were observed.

While in Porto Rico the worst enemy of the Black Tern is the sportsman. It is a favorite mark of his, as it tests his skill in shooting more than most common birds. Some of the better marksmen bag large numbers of terns.

The stomachs of three birds collected on September 3, 1924, contained 99.7 per cent of animal matter and 0.3 per cent of vegetable matter. Hydrophilid larvæ composed 55.3 per cent of the total. One bird had eaten 119 of them and another 36. Noctuid moths comprised 33.3 per cent. One bird had eaten nothing but five large moths. Other insects found were an ambush bug (2.3 per cent); a damselfly (2 per cent); a dragonfly (3.8 per cent) and a Lamellicorn beetle (1 per cent). The only vegetable matter found consisted of one *Hymenachne* seed and a little rubbish, in one stomach.

Although the Black Tern does not obtain all of its food in the marsh, it is primarily a bird of the marsh and more particularly of the open water association. It show a preference for aquatic insects, though not spurning terrestrial forms. It is less strictly aquatic than most of its allies, and it is my belief that it may represent a branch of the family gradually diverging towards a more terrestrial existence.

7. *PHALOCROCORAX VIGUA MEXICANUS* (Brandt). Mexican Cormorant.

On October 17, 1924, I observed a small cormorant flying over the cat-tails at Cartagena Lagoon. It continued its flight over the lagoon and far away over the mountains to the north without once stopping. Unfortunately I was unable to collect it, but I feel very confident that it was of this species. No cormorants had previously been recorded from the Island. A native boy who was assisting me and who knew the local birds very well gasped in amazement when he saw this bird and said he had never seen one like it before.

8. *FREGATA AQUILA* (Linnaeus). Man-o-war Bird. *Rabijunco.*

The Man-o-war Bird is a salt-water species which rather frequently but irregularly visits Cartagena Lagoon in search of food. I have recorded them at the lagoon in every month except February. Usually they come singly, but on two occasions (December 11, 1923, and July 5, 1924) I saw three soaring together. Generally they soar overhead at a considerable height, but occasionally they dip down to the surface of the water, making a splash when they hit it, but only their bills go under water. Probably they are catching small fish, as Dr. Wetmore found the food of this species to consist entirely of fish. Any Coots that chanced to be near when the Man-o-war Birds made these dives flew away in terror.

There is a nesting colony of Man-o-war Birds on a small coastal island near Parguera, about five miles from Cratagena Lagoon, and probably most of the birds that visit the lagoon are occasional visitors from this colony.

9. *MARECA AMERICANA* (Gmelin). Baldpate. *Pato Lablanco.*

The Baldpate is a rare winter visitor to Cartagena Lagoon. I observed a flock of ten on February 27, 1924, and again on March 1, and on March 11 a male and famale at close range. They were feeding in the open-water at the eastern end of the lagoon where the grasses straggle some distance out into it. No specimens were collected, so I can make no definite statements concerning their food, though I believe it does not differ greatly from that of the Blue-winged Teal which prefers the same part of the lagoon.

10. *QUERQUEDULA DISCORS* (Linnaeus). Blue-winged Teal. *Pato celecal.*

The Blue-winged Teal is a common winter visitor at Cartagena Lagoon. In 1924 the last birds in the spring were seen on May 2, and the first fall migrants appeared on September 6. They do not become common until November or December, and in the spring they are not common after about the tenth of April. They prefer the shallower parts of the lagoon, and are about as often found paddling about in the sedge and grass associations as in the open water. They are even found quite frequently among the cat-tails. A moderate estimate of the number of Teal wintering at the lagoon in 1922 and in 1924 would be 500 each year. This species is also very

common at the other lagoons when they contain water. On March 4, 1922, I counted over 1,000 at Anegado Lagoon. They are very wild and difficult to shoot, so a comparatively small toll of their numbers is taken by hunters. If the existing game laws were strictly enforced this species would be adequately protected.

Only one stomach, that of a female collected April 11, 1924, was available for examination. This contained 99 per cent of vegetable matter and 1 per cent of mineral matter. 90 per cent of the vegetable matter consisted of 83 seeds of *Persicaria portoricensis*. The rest was rubbish. The mineral matter consisted of three small pebbles.

11. *SPATULA CLYPEATA* (Linnaeus). Shoveler. *Pato cuchareta.*

The Shoveler is a very scarce winter visitor. The only certain record I have is that of a crippled female observed at Cartagena Lagoon on May 30, 1924. She was in a dense growth of sedges. She could fly only a few feet before dropping clumsily into the sedges. On two other occasions I made rather unsatisfactory identifications of this species. On February 27, 1924, I saw a few ducks that I took to be this species at Cartagena Lagoon, and on April 1, 1922, at Anegado Lagoon I observed two ducks that appeared to be Shovelers, but in neither case could I approach closely enough to be positive of the identification.

12. *DAFILA ACUTA TZITIHOA* (Vieillot). Pintail. *Pato pescuezilargo.*

The Pintail is an uncommon winter visitor at Cartagena Lagoon. The first certain record of the occurrence of this species in Porto Rico was a male bird which I observed at close range at the lagoon on April 8, 1922. This record is included by Bent in his Life Histories of North American Wildfowl (1923, p. 155). In 1924 I observed a flock of six on February 15; a flock of seven and another of three on February 27, and a pair on March 11. They were feeding in the grass association at the east end of the lagoon. At that time the water was so deep that they could easily swim among the grasses. The flock of six observed on February 15 was accompanied by a seventh duck which was probably an albinistis bird of some stockier species. The wings, breast and under side of the throat of this bird were pure white, while the top of the head was dark brown and the back black.

13. *POECILONETTA BAHAMENSIS BAHAMENSIS* (Linnaeus). Bahama Duck. *Pato Inglés.*

The Bahama Duck is a common permanent resident at Cartagena Lagoon, leaving only when it becomes so dry that swimming becomes impossible. In 1924 they disappeared on June 18, to reappear on August 20. About 125 was the largest number observed in one day at the lagoon.

The grassy region is the favorite feeding ground of the Bahama Duck at times of high water, though it is not at all averse to feeding in the sedges, and is often seen feeding in the open-water association. On a few occasions I have flushed Bahama Ducks in the Pluckea association. The shallow grassy region at the east end of the lagoon is the region where one is surest of finding them. They usually feed in pairs or small flocks of from three to ten individuals, though occasionally flocks of as many as eighty are seen. They do not associate closely with other species. Often they are forced to scatter out while feeding among the Coots, Gallinules and other ducks, especially among the Blue-winged Teal, but upon taking flight they always form flocks of their own. The Bahama Ducks are very silent birds. On only two occasions have I heard them under utter any notes. Both times when I was near young birds hidden in the sedges. The first time was December 11, 1923. The female then made a circle around me, making a continuous low quacking sound as it flew, scarcely audible at a greater distance than 100 feet. The second occasion was October 11, 1924. This time the female flew in eleven clockwise circles around me, and then two counter clockwise circles. After that her flight became quite erratic, but she made occasional lunges toward me. All this time she was absolutely silent except for a single low quack which she emitted when quite close to me.

The Bahama Duck very seldom nests at Cartagena Lagoon. I have never had the opportunity of examining a nest, but reliable natives have often described them to me. They say that these ducks always nest in dry grassy fields at some distance from the water, and that they then lead their young to water. Certain it is that though the nests are never found at the lagoon, parents with young unable to fly are frequently encountered. A native of the lagoon region by the name of Eladio Sanoguel, whom I found to be a very accurate observer, described to me on May 20 a nest that he had found the day before. He said it was on the ground in a field of Guinea Grass at a distance of one kilometer from the lagoon. It contained twelve eggs the color of which he described as a light hen's egg brown. A

city hunter claimed the eggs and took them home to try to hatch them under a hen. Apparently the breeding season is quite extensive, as I have encountered young unable to fly on October 7, 11 and 17, 1924, and on December 11, 1923, and Struthers (1923, p. 471) records a nest with twelve eggs at Anegado Lagoon on February 18, 1922, and young unable to fly on December 8, 1921. On August 30, 1924, I observed several Bahama Ducks flying low over grassy fields at some distance from the lagoon. The country people said they were then building nests. From this evidence it would seem that the breeding season extends more or less continuously from February to November. The young scatter and hide or dive at the slightest warning, so it is seldom possible to obtain a good view of them.

Among the enemies of the Bahama Duck the Mongoose probably ranks high, as with other ground nesting birds. Then there are the egg hunters who take the eggs to eat, and last but not least are the hunters who consider the Bahama Duck an especial prize.

The stomach of a male Bahama Duck collected April 11, 1924, contained 6 per cent of animal matter and 94 per cent of vegetable matter. The animal matter consisted of 2 Dytiscid larvæ. Ninety per cent of the vegetable matter was pondweed (*Naias guadeloupensis*) and the other 10 per cent consisted of 20 seeds of *Persicaria portoricensis*. In addition mineral matter to the extent of 52 per cent of the stomach contents was found. This consisted of coarse gravel, 85 per cent of which was red rock and 15 per cent white quartz. Dr. Wetmore examined the stomachs of eight adults, which contained green algae (83.75 per cent) and seeds of ditch grass (*Ruppia maritima*) (16.25 per cent), while two downy young had eaten various grass seeds varied with a few aquatic Hemiptera.

The Bahama Duck is dependent upon the marsh for food but not for shelter. It breeds away from the marsh, but is found there at all other times. Apparently it has found that its nests are safer in other places. If it nested in the marshes at present it is doubtful if many nests would escape the ravages of the eggers. It appeared to be less common in 1924 than in 1922. It needs absolute protection from February 1 to December 1 to keep it from becoming a *rara avis* in the Porto Rican avifauna.

14. *MARILA AFFINIS* (Eyton). Lesser Scaup Duck. *Pato turco.*

The Lesser Scaup Duck is a winter visitor to Cartagena Lagoon. In 1924 the last birds seen in the spring were two on May 16, and

the first fall arrivals noted were a flock of twelve (six males and six females), on September 23. On May 5, 1924, I observed a flock of between fifteen and twenty in migration, at Mayagüez. It was just before sunset. They were flying due north over the ridge of hills which separates Mayagüez and Añasco valleys. They kept in Λ-formation, and flew at a height of about 200 feet above the hills. At Cartagena Lagoon the Lesser Scaup is common in February and March, but occurs rather sparingly earlier and later. As many as 200 may be observed in one day in February. I noted them as common at Anegado Lagoon on March 4, 1922. On January 5, 1924, there were about 50 at Guayabal Reservoir in the mountains near Villalba.

At Cartagena Lagoon the Lesser Scaup inhabits the open-water association exclusively. It is almost always found in small flocks of from two to twelve. On two occasions I have observed flocks of greater size, a flock of forty on March 11, 1924, and one of sixty on March 17, 1924.

While in Porto Rico man is the worst enemy of the Lesser Scaup, as they keep well out towards the center of the lagoon, out of reach of the marauding Mongoose. They also succeed fairly well as a general rule in keeping out of reach of hunters, most of whom try for game that is more easily obtained, and the flesh of which is more palatable.

In the three stomachs examined, animal matter constituted 50.5 per cent and vegetable matter 49.5 per cent. All the animal matter was contained in one stomach, and consisted of 13 Planorbis snails (80 per cent of animal matter), and 6 Belostomidæ (20 per cent of animal matter). 73 per cent of the vegetable matter consisted of pondweed (*Naias guadeloupensis*); 6.7 per cent of seeds of Compositæ; 20 per cent of *Persicaria portoricensis* seeds; and 0.3 per cent of seeds of *Hymenachne amplexicaulis*. In addition, gravel to the extent of 39.7 per cent of the stomach contents was sound. A bird collected by Dr. Wetmore (1916, p. 29) at Guánica Lagoon had eaten mostly insects, including aquatic Hemiptera, Coleoptera and dragonfly naiads.

While at Cartagena Lagoon the Lesser Scaup is strictly a bird of the open-water association; it is harmless in its food habits, and quite well able to take care of itself under existing game laws. Its flesh is not particularly palatable, though it is better in the fall than in the spring.

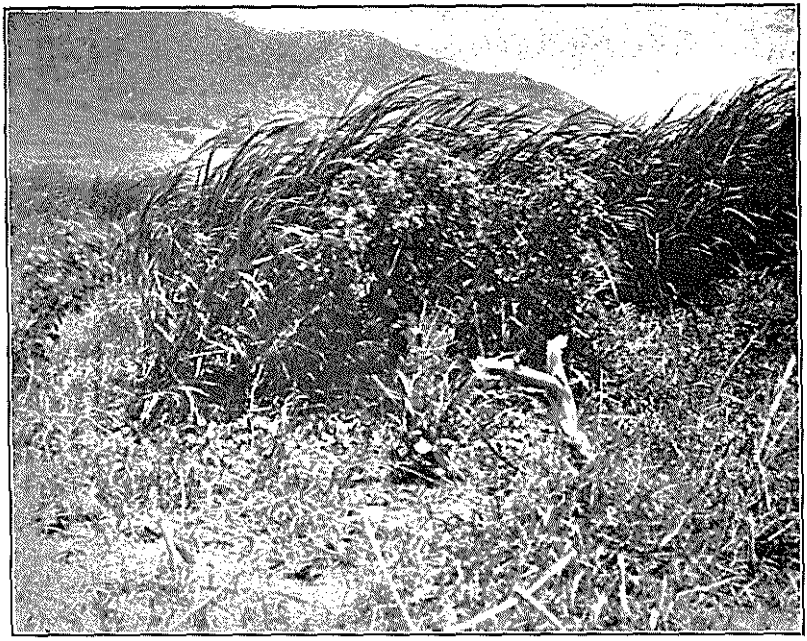


FIG. 13.—Cartagena Lagoon. Pluckea Association. Cat-tails in Background

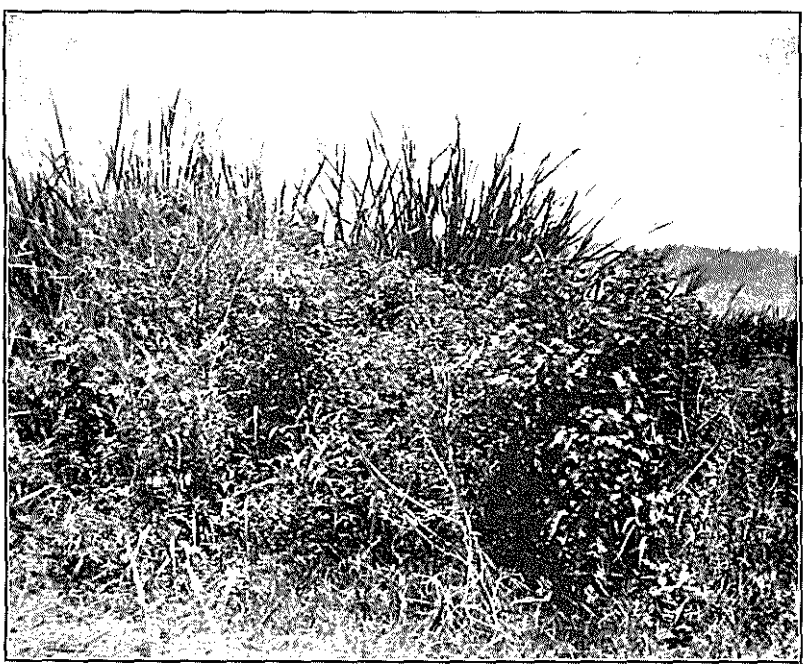


FIG. 14.—Cartagena Lagoon. Pluckea Association. Cat-tails in Background

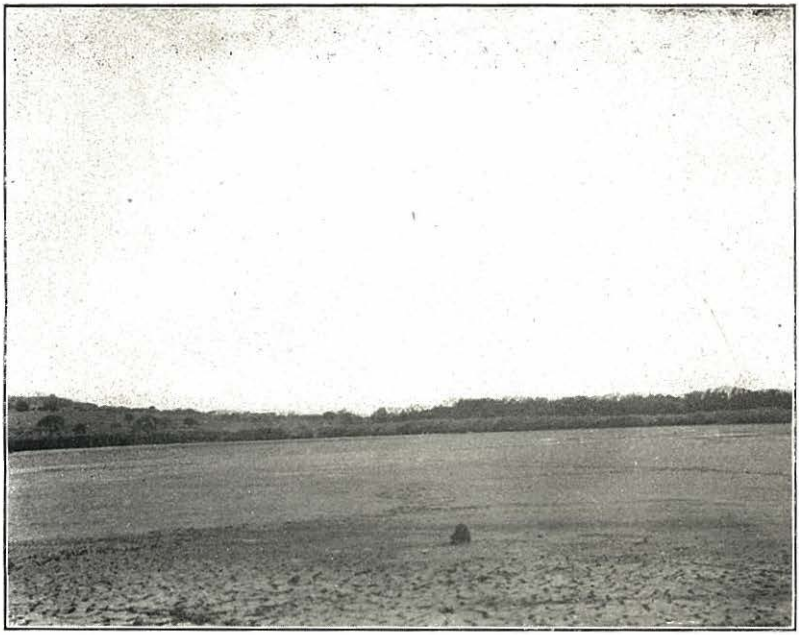


FIG. 15.—Cartagena Lagoon. Mudflats in July

FIG. 16.—Porto Rican Royal Palms

15. *ERISMATURA ALLENI* (Danforth). Allen's Ruddy Duck. *Chorizo. Pato chorizo.*

Allen's Ruddy Duck is a common permanent resident at Cartagena Lagoon, and is one of the commonest breeding birds there. However, as in the case of other aquatic birds, it is forced to leave when the lagoon becomes dry. In 1924 the last one seen as the lagoon was drying up was on June 14, with the exception of some molting birds unable to fly observed on June 28. They began to return on August 20, but it was September 3 before they were back in their usual numbers. Most of them apparently go to the mangrove swamps of the coast when forced away from the lagoon. As nearly as I can estimate somewhat over 100 pairs nested at Cartagena Lagoon in 1924. When Anegado and Guánica Lagoons are dry as many as 300 birds at a time may be observed feeding at Cartagena. A few were noted at Guayabal Reservoir on January 5, 1924.

Allen's Ruddy Duck feeds primarily in the open water and cat-tail associations, and nests in the cat-tail and sedge associations, and to some extent in the grass association.

One of the most characteristic and attractive sights at the lagoon is a raft of these dapper little ducks in the more open parts with a dense growth of tall cat-tails rising like a wall behind them. On the appearance of danger they often swim into the cat-tails for protection, but they more often take wing and fly to some distant part of the lagoon. On first appearance it would seem that their almost absurdly short wings would be unsuited for flight, but such is decidedly not the case, for they are often seen flying over the lagoon, especilly on days when they are much disturbed by hunters. When a gun is fired near them they almost invariably try to escape by taking wing instead of by swimming or diving. But unless one comes upon them suddenly or startles them by firing a gun they usually swim slowly away from one, keeping a little over a gunshot ahead until they meet some obstruction, when they invariably fly. Their flight is rapid and almost bullet-like, usually for but short distances, and is maintained by very rapid wingbeats.

Allen's Ruddy Ducks usually live in flocks of from ten to a hundred, occasionally as many as two hundred. While feeding the individuals scatter somewhat and are usually associated with Coots or with Lesser Scaup Ducks, and when flushed they likewise fly with the Coots and Scaups, though remaining somewhat segregated. On extra windy days the ducks stay out in water that is rough enough to drive the Coots to shelter.

Although primarily birds of the open-water association Allen's Ruddy Ducks frequently feed among the cat-tails, and are very often found in the parts of the open water near them. This is probably because most of the deepest parts of the lagoon are near the cat-tails. This fact is well known to the hunters, who conceal themselves in the cat-tails and obtain large numbers. It is one of the first species to approach a blind after the hunter conceals himself.

These little ducks obtain most of their food by diving when the water is deep enough to make this necessary, but they do not stay under water long.

This species has been previously considered identical with *E. jamaicensis* of North America, but upon examination of the specimens collected the wing and tail proved much shorter, the tarsus longer and the coloration darker than *E. jamaicensis*. These characteristics, together with the fact that the male undergoes no eclipse plumage, as such, influenced me in describing the Ruddy Duck found in Porto Rico as a new species.* Male birds of this species may be observed in the red plumage every month in the year, and molting birds in March were molting from red into red. This constitutes a deep and fundamental difference between *E. alleni* and *E. jamaicensis*, the males of which spend at least half the year in the brown eclipse plumage, in which they closely resemble the female.

The Ruddy Ducks are extraordinarily silent birds. I cannot recall hearing them utter call notes of any kind. Shortly before the nesting season they may be observed swimming around in pairs among the cat-tails and sedges, apparently investigating suitable nesting spots, but I have never observed the actual mating.

The nesting season apparently extends from November to May. Gundlach (1878, p. 407) found them hatching at Guánica Lagoon in November 1873. Struthers (1923, p. 471) records twenty-two nests found at Anegado Lagoon from December 1, 1921, to March 1, 1922. At Cartagena Lagoon I have found nests from December to May, and the birds were apparently getting ready to breed in October 1924. The eggs were just hatching in a nest found on December 27, 1923. The latest nest I have found was one in which the complement of six eggs was completed on May 23, 1924. This nest was broken up before the eggs hatched. Another nest that had one egg on this date was also broken up. By far the greater number of nests I

* Described in the October 1925 *Auk* as *Erismatura alleni*, named in honor of Dr. Arthur A. Allen, Professor of Ornithology at Cornell University.

found were from the latter part of February to the early part of May, but March is the month in which nests are found most abundantly and in which the eggers live highest.

Several types of nests are used, but perhaps the commonest is made of sedge and grass stems and placed in clumps of sedges where the water is a foot or less in depth. It is a rather bulky affair, built up so that the bottom of the nests is about at water level, yet it is well concealed in the sedge clumps. The top is hollowed to receive the eggs, but it is not much more than deep enough to contain them. On Las Casitas many nests are built among the tall grasses where there is little or no water. These nests are constructed almost exclusively of grasses. I have found four floating nests of this species anchored among the cat-tails. They were built of dead cat-tail leaves, built up to such a height that the bottoms of the eggs rested about four inches above the surface of the water. They were all in the edges of the cat-tail areas, and anchored in water from eight inches to four feet deep. One of these was found on December 27, 1923; one on February 19, 1924, and two on May 9, 1924. Another nest was found May 23, 1924, in the cat-tails where the water was only four inches deep, so that it rested upon the bottom.

The nests which appeared to contain full complements of eggs contained from four to eight eggs. The average is six or seven. However, Struthers (1923, p. 471) records finding nests with from one to twelve eggs at Anegado Lagoon, and Mr. Luis H. Mendoza, a university graduate and an experienced hunter, informs me that at a small marsh at Cabo Rojo he once found a nest with twenty-two eggs. It is possible however that in the case of some of the larger sets more than one female deposited eggs in the same nest. The eggs are very large for the size of the bird. They are white in color. The smallest egg measured was 62×48 millimeters, the largest 65×50 millimeters. It was impossible to make long-continued observations of any of the nests found, due to the activities of eggers and the marauding Mongoose. In one case, however, a nest remained undisturbed long enough for me to ascertain the rate of deposition of eggs. On May 16, 1924, I found a new nest of grass, placed among the cat-tails on what was then dry land, as the lagoon had already receded to a considerable extent. On that date it contained one egg. On the 20th it contained four eggs, and on the 23rd, six eggs. On the 27th all the eggs had disappeared. Thus the female laid an egg nearly every day until the set was completed.

The young on hatching are covered with a rather stiff, bristly down. It is blackish brown above, with a whitish spot on each side of the back. A brownish-white stripe runs from the bill below the eye to the occiput. Beneath this is a much broader brownish-white stripe, extending onto the chin. The rate of the underparts are grayish white, shading into dark brown on the throat.

Very few of the eggs laid are destined to ever become adult ducks, for their enemies are many. First and foremost among these are eggers. The eggs are large and of good flavor, and are consequently most eagerly sought after. On March 1, 1924, five eggers collected nearly 200 eggs of this species. The eggers comb the marshes with great regularity, and the wonder is that any eggs are left to hatch. The adult birds constitute one of the largest items in the hunters' bags, as they are easily obtained by shooting from the cat-tails. The Mongoose likewise looks upon Allen's Ruddy Duck eggs with particular favor, and many a broken up nest gives telltale evidence of this culprit. But this species is confronted with a peculiar danger in addition to those already enumerated. In common with all other ducks this species has the habit of molting all its primaries at once, rendering it flightless for a period. Many of them are at this flightless stage when the lagoon dries up. They flounder around on the mudflats and fall an easy prey to hunters, who use dogs to aid in their capture. On June 28, 1924, many were being caught in this manner.

The stomach contents of five birds collected on March 1, 1924, were examined. Four other specimens were collected for me later, but unfortunately their stomachs were not saved. Animal matter comprised 9.8 per cent of the stomach contents, and vegetable matter 90.2 per cent. Of the animal matter, 47 per cent was dragonfly naiads; 20 per cent Dytiscid larvæ, and 33 per cent Belostomidæ. Of the vegetable matter, 68 per cent was seeds of *Persicaria portoricensis;* 28.7 per cent pondweed, (*Naias guadeloupensis*); 2.5 per cent seeds of Compositæ; 0.4 per cent seeds *Sesban emerus* and 0.4 per cent rubbish. Mineral matter, which formed 59.2 per cent of the stomach contents, consisted of coarse gravel. Eighty per cent of this was red shale, and 20 per cent white quartz.

To sum up, Allen's Ruddy Duck feeds primarily in the open water society, where it associates with the Porto Rican Coot and Lesser Scaup Duck. It breeds in the cat-tail and sedge associations, and, on the island, in the grass association. It is entirely dependent on the marsh for its food, and is harmless in its food habits. It is

a very important game bird in a land where game birds are few, and to preserve it much better protection from its principal enemies (eggers, hunters and the Mongoose) is imperative. The taking of eggs should be absolutely forbidden. The game laws at present permit the hunting of this bird from January 1 to May 1, which is entirely within its breeding season, during which it should receive absolute protection. An open season during the fall months would be much more satisfactory.

16. *DENDROCYGNA AUTUMNALIS* (Linnaeus) Black-bellied Tree Duck. *Chiriría.*

The Black-billied Tree Duck is not uncommon at Cartagena Lagoon, especially during the autumm months. Often while walking through the tall sedges a seemingly enormous bird is flushed and with a few shrill whistles sails over the marsh to take refuge in some distant part of it. If a native son of Porto Rico be present the word *Chiriría* will instantly be upon his lips and a longing look will come in his eyes as he watches a dinner fit for kings speedily departing from him. The Chiriría is sometimes found in the grasses and cat-tails as well as in the sedges. It is seminocturnal, and feeds mostly by night. According to the country people, most of the Chiriría spend the day in the hills and descend to the swamp at dusk to feed. Hunters lie in wait along their lines of flight and obtain them at that time, and a royal good meal they are said to make. The birds seen in the day time are always flushed singly or in pairs; at night they are said to come in flocks of as many as twenty-five. Eladio Sanoguel reported 100 feeding at Cartagena Lagoon by night on October 10, 1924, and I have frequently been told by various hunters of the occurrence of from 50 to 75 individuals. Unfortunately I was unable to visit the lagoon by night to observe their feeding habits at first hand, but they are said to feed not only in the marsh, but in cultivated fields as well, especially those in which grain is grown.

The Black-bellied Three Ducks nests rarely, if at all, at Cartagena Lagoon. The only evidence I have of its ever nesting there was the discovery of a very large rotten white egg, at least twice as large as that of a Ruddy Duck, found floating among some cat-tails on May 30, 1924. People who live near the lagoon say that the Chiriría nests on Tinaja Hill, building nests of grass on the ground in bushy places, and that they lay from eight to fourteen eggs. Eladio

Sanoguel reported finding such a nest with one egg on September 6, 1924, but the press of other work prevented me from investigating it. He says that soon after hatching the parents lead the young to the swamps. Struthers (1923 p. 471) records finding a nest with two eggs and two nestlings in a hollow tree at Anegado Lagoon on February 18, 1922. Gundlach (1878 p. 400) says they nest on growths of Bromeliaceæ, on large horizontal limbs of trees, in hollow trunks, and in the dense vegetation of the lagoons, that the nest is made of dry leaves and twigs, and that twelve to fourteen or more eggs are laid.

Probably hunters and the Mongoose are the worst enemies of this species. It is apparently much scarcer than it used to be in Gundlach's time. I know nothing definitely about its food habits, but I have heard no reports of damage done in recent years to crops. Its rank as the largest and most palatable Porto Rican game bird certainly entitles it to protection, at least from March to November.

17. *DENDROCYGNA ARBOREA ?* (Linnaeus). Tree Duck. *Chiriría pinta.*

A second species of tree duck occurs in Porto Rico, and is found rarely at Cartagena Lagoon. The native hunters are familiar with it, but they say it is very rare. Mr. Luis H. Mendoza saw a flock of eight on February 24, 1924, and described them as being a little larger than the ordinary *D. autumnalis,* and as lacking the white color in the wing. He said the general coloration as seen from above was reddish brown. His description agrees substantially with that commonly given by the hunters. On October 17, 1924, I saw a tree duck in the distance which lacked white in the wing, and which I was told was this second species. I did not see it well enough to positively identify it as *Dendrocygna arborea,* but I believe it was this species.

18. *BOTAURUS LENTIGINOSUS* (Montagu). Bittern. *Yaboa.*

The Bittern is a casual migrant to Porto Rico and to Cartagena Lagoon. I flushed one from a dense growth of sedges on November 30, 1923. There are only three other published records for the Island. One was observed by Gundlach (1878, p. 361) at Guánica Lagoon in November 1873, and he records (1874, p. 313) one in the collection of Blanco at San Juan. Struthers (1923, p. 471) took a specimen September 23, 1921, in a swamp near Boquerón.

19. *IXOBRYCHUS EXILIS EXILIS* (Gmelin). Least Bittern. *Martinete chico.*

The Least Bittern is a fairly common permanent resident and breeder at Cartagena Lagoon, though much commoner in the winter and spring than in the summer and fall. It is primarily a bird of the cat-tail association, though it feeds quite extensively in the sedge association, and to same extent in the grass association. When disturbed while feeding away from the cat-tails it invariably flies with dangling feet and alights in them for protection. When one alights on a dead cat-tail it is difficult to distinguish the bird from the leaf, as the bird is so long and slim and protectively colored.

The Least Bittern places its nest in the cat-tails four or five feet above the water. The nests are almost flat platforms, but quite substantially built of cat-tail leaves, sometimes with the addition of pieces of Persicaria plants. I have found nests from April 11, 1924, to May 9, 1924. From two to three pale bluish-white eggs are laid; two fresh eggs were collected from a nest on May 9, 1924. They measured 1.30 × 0.95 inches. On May 2, 1924, I observed two adults accompanied by three young scarcely able to fly. Struthers (1923 p. 471) records a nest with eggs at Guánica Lagoon on April 2, 1921, and Gundlach (1878, p. 360) found a nest on the branch of a shrub with three eggs on May 7, on the bank of the Arecibo River.

The Least Bittern is a very retiring bird, and apparently is not much disturbed by the Mongoose or by hunters. Eggers take their eggs whenever found, and are probably the worst enemy of the species.

No stomachs were obtained for examination, but Wetmore (1916, p. 27) reports that small fish formed 84.34 per cent of the contents of three stomachs collected at Guánica Lagoon on may 26. Crustacean remains formed 13.33 per cent; amphibian remains 0.33 per cent and aquatic Hemiptera 2 per cent. Many feathers were also eaten by these birds.

The Least Bittern is thus shown to be strictly a bird of the marsh, nesting and seeking shelter in the cat-tails, but feeding largely in the grass and sedge associations. It is a harmless or even slightly beneficial species. The taking of its eggs should be prohibited.

20. *ARDEA HERODIAS ADOXA* (Oberholser). West Indian Great Blue Heron. *Garzón cenizo. Yaguasa.*

The West Indian Great Blue Heron is a tolerably common permanent resident. It ocurs at Cartagena Lagoon at all times of the year,

but does not nest there. Its case is probably analagous with that of most of the other herons, which feed at the lagoon but resort to the mangroves of the coastal islands for nesting. Apparently this is a species which has been increasing slightly recently. In 1911 and 1912 Wetmore (1916, p. 26) noted but two; apparently Struthers (1923 p. 471) observed but seven in 1921 and 1922 (five at Anegado Lagoon and two at Boquerón). This agrees well with my own experience, for in 1921 and 1922 I found but thirteen birds (six at Cartagena Lagoon, six at Anegado Lagoon and one at Mayagüez). In 1923 and 1924 the increase in their numbers was very noticeable. At Cartagena Lagoon as many as twelve were sometimes in sight at one time, and on January 14, 1924, I noted fifteen. I also observed them more frequently on other parts of the Island, notably at San Juan on November 23, and January 3, 1924; Toa Baja on November 24, 1923; Mayagüez on November 30, 1923; Guayanilla on January 2, 1924; Boquerón on March 8, 1924; Cape Rojo Lighthouse on April 26 and 27, 1924, and Anegado Lagoon on December 14, 1923.

On February 27, 1924, I collected a female of this species at Cartagena Lagoon. The ovary was rather enlarged, indicating the approach of the breeding season. Unfortunately the stomach was empty so I can say nothing about the food habits. Probably they will not be found to differ materially from those of the North American variety. They are said by the country people to catch unwary birds that come too close. On October 20, 1924, I observed one pursue a Gray Kingbird for some distance. For a long time neither seemed to gain on the other, but finally the Kingbird gave a spurt and eluded its ungainly pursuer. Whether the heron was trying to make a meal of the Kingbird or not I cannot say.

While at Cartagena Lagoon the West Indian Great Blue Heron shows a decided preference for the grass association. Here its great height permits it to observe any approaching danger at a considerable distance, and it is a lucky hunter who gets a shot at one. Very few of the hunters I interviewed had ever been able to obtain one.

21. *HERODIAS EGRETTA* (Gmelin). American Egret. *Garzón blanco.*

The American Egret is a rather uncommon permanent resident at Cartagena Lagoon, although, as in the case of the Great Blue Heron, it probably nests only in the mangroves of the coastal islands. From one to four were observed on practically every visit I made to

FIG. 17.—Pseudemys palustris

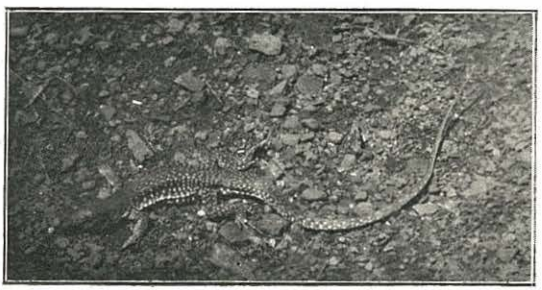


FIG. 18.—Ameiva exul

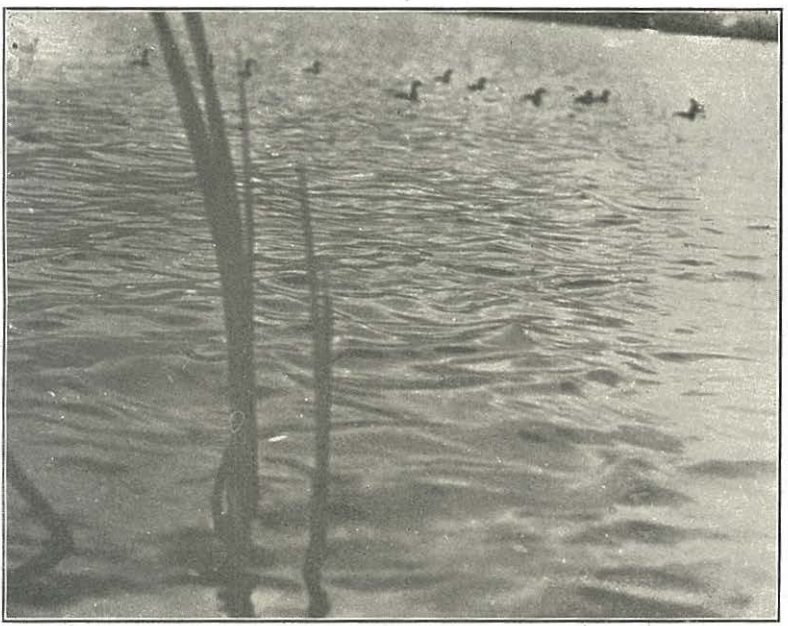


FIG. 19.—Flock of 13 Least Grebes

the lagoon, even while it was dry. The habits of this species and of the Great Blue Heron, with they sometimes associate, are almost identical, though the Egret is even warier, and I have never met a hunter who had been able to obtain one. Like the Great Blue Heron its habitat is the grassy part of the lagoon, though both on rare occasions are found in the sedges. No stomachs were available for examination. One obtained by Dr. Wetmore (1916), p. 26) contained a small goby and seven entire frogs (*Leptodactylus albilabris*), 69 per cent; a mole cricket and some grasshoppers, 15 per cent; and some vegetable matter, 4 per cent.

The only places in Porto Rico other than Cartagena Lagoon at which I have observed this species are Añasco (November 24, 1923); in the mangroves at Boquerón (March 8, 1924); and fishing in salt water near Cape Rojo Lighthouse (April 26 and 27, 1924). Wetmore (1916, p. 25) records a nest in the mangroves near Mameyes on February 14, 1912, and a breeding colony of 15 or 20 on Piñero Island, near Fajardo. They are said to nest on small islands off the south coast, but they are certainly far from common. They should be prevented from becoming exterminated, both on account of their destruction of injurious insects and on account of their beauty.

22. *EGRETTA CANDIDISSIMA CANDIDISSIMA* (Gmelin). Snowy Egret.
Garza blanca.

The Snowy Egret is another heron which feeds at the lagoon, but apparently nests only on the mangrove islands near the coast. They may be distinguished from the white immature specimens of the Little Blue Heron as the tarsus is black and the toes yellow, while in the latter the tarsus is greenish.

The Snowy Egret is found at Cartagena Lagoon at all times of the year, but is most common during the summer months when the lagoon is dry, or nearly so, and there are extensive mudflats which it uses as a feeding ground. When the lagoon is full it feeds in the grassy areas, and occasionally in the canefields.

It is usually found in small flocks, and in the summer often in larger flocks. On June 21, 1924, I observed a flock of 120, and on July 2, 1924, a flock of 90. Sometimes it occurs in mixed flocks with *Florida c. caerulescens*, but usually each species flocks by itself.

I have noted birds with nuptial plumes as early as March 22, 1922, and as late as May 20, 1924.

On June 3, 1924, I collected a male. It measured 23.5 inches in the flesh. Its stomach contained only animal matter. Twenty-seven entire *Killifish* (*Pœcilia vivipara*) and the fragment of others constituted 78 per cent; 14 damselflies and 4 damselfly naiads formed 19 per cent. The remaining 3 per cent consisted of aquatic Hemiptera (2 *Pelocoris femoratus*), 2 per cent; and 1 *Corixa reticulata*, 1 per cent. A bird taken by Dr. Wetmore (1916, p. 25) near Río Piedras had eaten two dragonfly naiads, a small crab, a lizard and a small frog. Another from Mameyes contained gobies, Dolichopodid flies and grasshopper fragments.

Formerly these Egrets were much persecuted by plume hunters, and occasionally they are molested even yet on this account. Usually they are hunted but little, as they are wary and their flesh is not very palatable. The Mongoose cannot often molest them, so conditions seem favorable for their increase. This increase is apparently slowly taking place, and is very gratifying, as this is a beautiful species, and if abundant would probably help materially in combating the mole cricket.

23. *HYDRANASSA TRICOLOR RUFICOLLIS* (Gosse). Louisiana Heron.
Garza de vientre blanco.

The Louisiana Heron is not very common, but it occurs quite regularly at Cartagena Lagoon during most of the year. However, there was a period from July 5 to September 23, 1924, when I did not see any. Whether they were breeding in the mangroves at this time or not would be difficult to say without further investigation. They certainly breed on the island, as on October 7, 1924, I observed two young birds about three-quarters grown. They were almost foolishly tame, though they could fly fairly well when they finally decided to do so.

While at Cartagena Lagoon, Louisiana Herons were found either singly or in small groups of two or three. They were often observed fishing in the open-water near cat-tails, and perhaps were even more often flushed from the sedges and from the Pluckea association, and they are sometimes found in the grassy regions where most of the Heron life of the lagoon congregates. They have a very harsh, raucous cry, but it is seldom uttered.

A male collected June 3, 1924, measured 26.8 inches in the flesh. Its testes were much enlarged. Its stomach contained only animal matter. Killifish fragments (*Poecilia vivipara*) constituted 27 per cent; Dytiscid fragments, 20 per cent; a dragonfly naiad, 5 per

cent, and other much-comminuted insect remains, 47 per cent. A bird taken by Wetmore (1916, p. 25) had eaten a goby and killifishes.

Louisiana Herons are not much hunted, and it is doubtful if the Mongoose is very injurious to them, yet they are not so common as most of the other herons. The only localities in Porto Rico other than Cartagena Lagoon at which I have observed this species are at Anegado Lagoon, and in mangrove swamps at the Caño Corazón, near Mayagüez, and at Boquerón.

24. *FLORIDA CAERULEA CAERULESCENS* (Latham). Little Blue Heron. *Garza azul. Garza blanca. Garza pinta.*

The Little Blue is the most abundant heron at Cartagena Lagoon at all times of the year, but it does not breed there. It feeds in all the associations of the marsh proper except the cat-tail, but most commonly in the grass and sedge associations. It also feeds extensively in the canefields, not only near the lagoons, but practically everywhere in the coastal region of the Island. It is particularly abundant in the canefields near Hormigueros. Other places on the Island at which I have observed it include San Juan, Mayagüez, Añasco, Filial Amor, Cabo Rojo, Yabucoa, Boquerón, Parguera, San Germán, La Plata, Lajas, Cape Rojo Lighthouse, and Anegado and Guánica Lagoons. It probably nests almost exclusively in the mangroves of the coast. Birds are often observed flying over the hills from the lagoon towards Parguera, where they are said to nest.

Little Blue Herons occur at the lagoon in particular abundance in the fall. On September 30, 1924, I attempted to make a count of a big aggregation of these herons in the grassy region east of the lagoon. It was impossible to count them exactly, but there were certainly at least 1,000 of them. They are quite shy, and it is impossible to approach them very closely.

In Porto Rico, at least, Little Blue Herons apparently retain their white juvenile plumage for only one year. During the latter part of June and most of July only birds in the blue adult plumage were observed. In August a few white birds began to appear. On September 17, 1924, I noted that about one quarter of all the birds seen were white, and on September 30 about 500 out of the 1,000 birds seen were in white plumage. Approximately half the birds seen in the winter months are in this plumage. In February a few white birds begin to show a little blue in the plumage. By the middle of April all the immature birds show a little. By May most of them have attained the odd-appearing half blue and half

white or *pied* plumage. At this stage they are known to the country people as *garza pinta*. The amount of blue in the plumage gradually increases until by the first of July virtually one hundred per cent are in full blue plumage. The white birds apparently begin coming to the lagoon to feed very soon after the breeding season. Gundlach (1878, p. 357) says that the breeding season extends from May to July. Wetmore (1916, p. 23) records eggs the first of May at Yabucoa, and Struthers (1923, p. 470) found four nests with young in the mangroves west of Boquerón June 15, 1921.

The Little Bue Heron apparently has but few enemies. The Mongoose cannot easily obtain its young unless they fall on the ground, and hunters molest them but little.

The food of the Little Bue Herons collected at Cartagena Lagoon was almost exclusively animal matter. The 0.5 per cent of vegetable matter found consisted of seeds and was probably taken in accidentally with other food. A bird taken April 18, 1924, had eaten insects exclusively. Among these were a large Dytiscid larva (25 per cent); a large smooth green caterpillar (20 per cent); a water bug, *Belostoma,* (25 per cent); a grasshopper (5 per cent), and a Naucorid (*Pelocoris femoratus*). A bird collected December 27, 1924, had obtained a more varied diet. Its stomach contained 15 entire frogs (*Leptodactylus albilabris*) constituting 25 per cent; 4 centipedes, 20 per cent; an adult mole cricket (*Scapteriscus didactylus*), 18 per cent; 1 large ground cricket, 6 per cent; 2 grasshoppers, 4 per cent; 2 Belostomidæ, 8 per cent; 1 *Pelocoris femoratus,* 1 per cent; 7 Notonectidæ (*Plea* sp), 4 per cent; 1 spider, 2 per cent. Mole crickets also formed 7.23 per cent of the food in 15 stomachs examined by Dr. Wetmore (1916, p. 24), and other insects formed 31.51 per cent.

This species is very useful in the destruction of mole crikets and other Orthoptera, despite the fact that it obtains most of its food in the swamps. Doubtless specimens obtained in the canefields would show an even higher percentage of mole crickets and other injurious insects.

25. *BUTORIDES VIRESCENS MACULATUS* (Boddaert). West Indian Green Heron. *Martinete. Martín pescador.*

The differences between the eight forms of West Indian Green Herons described by Oberholser (1912, pp. 529, 577) are so slight that I prefer to follow Barbour (1923, p. 30) in grouping them all under one name.

This is a common species at Cartagena Lagoon, and is the only member of the Heron tribe except the Least Bittern which nests in the immediate vicinity of the lagoon. It does not nest in the marsh proper, but principally in the Bamboo association, and to some extent in the larger trees which are interspersed in the Varronia association and in the Tachuelo association. Its principal feeding ground is the sedge association, although it is sometimes found in all of the associations. It is also frequently found in the canefields, and even at considerable heights in the hills near small mountain streams. It is the most generally distributed heron on the Island, but it is a rather poor second to the Little Blue Heron in abundance at Cartagena Lagoon. It prefers regions with denser vegetation where it can better conceal itself while seeking its prey. When alarmed it flies up with a scream-like *skeow* and alights on an elevated perch, if such be handy, to watch the intruder. It is the least suspicious of the herons and can often be approached closely.

Most of the nests I have observed were bulky affairs built of sticks, placed in quite inaccessible position near the tops of slender bamboos. In April, 1924, many martinetes were building nests. Apparently the main breeding season is in April and May, though I observed a nest in use on November 30, 1923. Young birds unable to fly are most frequently found in May. They are then easily captured, and are often kept as pets. In the coastal regions the nests are usually placed in the tops of cocoanuts palms, where they are quite secure against most enemies except the rats which frequent such places. It is likely that the Mongoose secures an occasional martinete in the act of feeding. Once I observed a martinete alight on along projecting into the water. Immediately a large Mongoose glided silently out on the log. The heron realized its danger in the nick of time and flew squaking away. The Mongoose sniffed the air and returned to shore, disappointed at losing a good dinner. Doubtless many less wary individuals fall victim to the bloodthirsty Mongoose.

The contents of three stomachs collected at Cartagena Lagoon were examined. One collected on December 27, 1923, was nearly empty. All that was identifiable were some cockroach fragments. Two collected on September 30, 1924, contained nothing but insects and spiders. In these two, dragonfly naiads constituted 32 per cent; Locustid grasshoppers, 11.25 per cent; 9 *Pelocoris femoratus*, 6.5 per cent; spiders (*Aranea sp*), 7 per cent; 7 blue damselflies (all in 1 stomach), 10 per cent; *Notonecta sp.* 0.25 per cent;

1 *Belostoma* sp., 2 per cent; Hydrophilid larvæ, 0.5 per cent; adult midge 0.25 per cent. Wetmore (1916, p. 24) found that mole crickets formed 54.33 per cent of the food of 51 stomachs. Probably these form a large part of the food when feeding in the canefields. It is one of the most valuable especies on the Island from the standpoint of the sugar grower, and should be protected at all times. It can be encouraged by planting bamboos along the streams and irrigation ditches for shelter. It is very adaptable to changing conditions, and is common at almost all localities in the coastal plain, though it is particularly common at the lagoons, probably because insects and other small animal life are more abundant there.

26. *NYCTICORAX NYCTICORAX NAEVIUS* (Boddaert). Black-crowned Night Heron. *Yaboa.*

The Black-crowned Night Heron is a rather uncommon permanent resident at Cartagena Lagoon, though apparently slightly on the increase. Wetmore (1916, p. 21) did not find this species, and Struthers regarded it as rare. In 1921 and 1922 I observed it there only once (April 8, 1922), while in 1923 and 1924 it was frequently observed, though never more than six in one day, and usually only one or two. During the winter only adults were noted, but in June immature birds appeared, and were observed regularly until October. An immature specimen was obtained on June 28, 1924, but the stomach contents were too much decomposed for identification. At Cartagena Lagoon *Yaboas* are usually observed only when flushed from the dense cat-tails or tall sedges in which they spend the day. Doubtless they could be observed feeding after dusk. They are regularly hunted by the country people who say that the fiesh is very good. It does not nest at the lagoon.

27. *NYCTANASSA VIOLACEA* (Linnaeus). Yellow-crowned Night Heron. *Yaboa.*

The Yellow-crowned Night Heron is a more generally distributed bird in Porto Rico than the Black-crowned, but it is observed far less frequently at Cartagena Lagoon. Like the Black-crowned species it is much hunted for its flesh. That is said to be the reason for the present scarcity of these two species. Bowdish (1902, p. 359) found it common at the localities he visited. He found fiddler crabs, eels and crawfish in the stomachs which he examined.

28. *PORZANA CAROLINA* (Linnaeus). *Sora Gallareta chiquita.*

The Sora is a tolerably common winter visitant at Cartagena Lagoon. It arrives in October (October 14, 1924), and leaves in April (April 8, 1922; April 18, 1924). While at the lagoon it is found most commonly in the Pluckea and sedge associations, though it often ventures into the cat-tails. Occasionally they can be observed walking on the pond-lily leaves, and even on the floating Pisiias. When flushed they fly with dangling legs to the nearest shelter, which more often than not is a clumb of cat-tails. During the winter they are as a rule quite silent, but as spring approaches their characteristic whinny is heard with greater frequency. While in Porto Rico the Sora has but few enemies, as there are not many hunters who waste their ammunition on so small and elusive a bird, and I doubt if even the Mongoose is quick enough to get very many of them. No stomachs were available for examination.

29. *PORZANA FLAVIVENTRIS* (Boddaert). Yellow-bellied Rail. *Gallareta chiquita.*

The Yellow-bellied Rail is a permanent resident at Cartagena Lagoon. While it cannot be said to be very common, it is commoner than it is usually supposed to be, since on account of its retiring habits it easily escapes notice. It occurs almost exclusively in the sedge and grass associations. On being flushed it flies quite swiftly for a short way and then suddenly drops into the vegetation, from which it is usually impossible to flush it a second time. On one occasion (May 23, 1924) one stalked ahead of me through the cat-tails for a considerable distance as though trying to lead me away from its nest, but search as I would I could not find it. So far as I can ascertain the nesting habits of this species remain undiscovered. I collected two birds for examination of the stomach contents. One collected on February 19, 1924, contained animal matter, 99 per cent (entirely insects); and vegetable matter, 1 per cent (1 small unidentified seed). The insect matter consisted mainly of four Syrphid pupæ and the fragments of a Lamellicorn beetle. The stomach contents of a male collected April 4, 1924, consisted of 96 per cent of animal matter and 4 per cent of vegetable matter. The vegetable matter was green algæ with a little rubbish. The identified animal matter consisted of 1 Dytiscid larva (20 per cent); 1 Syrphid fly (13 per cent); 2 Notonectidæ (10 per cent). This bird had also eaten six down feathers, totalling 16 per cent of the stomach contents.

This meager data indicates that the Yellow-bellied Rail is a useful species. It is too small to be considered a game bird. It is a useful and interesting member of the Porto Rican avifauna.

30. *IONORNIS MARTINICUS* (Linnaeus). Purple Gallinule. *Gallareta inglés.*

The Purple Gallinule is not uncommon at Cartagena Lagoon, where it is a permanent resident. It is a bird of the cat-tail, sedge, grass and Pluckea associations, and shows but little partiality towards any one of these, except that for nesting it prefers the cat-tails. One seldom seems more than ten Purple Gallinules in a day at the lagoon. If alarmed while feeding it runs very fast, occasionally using its wings to gain increased speed in propelling itself through the vegetation, until it reaches the protection of the nearest clump of cat-tails. If the distance to be covered is too great it takes wing. In one case a bird flew into the top of the cat-tails and gave vent to its displeasure in a series of rail-like cackles before disappearing into the hidden recesses of the cat-tails. I have never observed this species swimming. They are usually flushed singly or in pairs. One seldom catches more than a fleeting glimpse of them as they disappear into the cat-tails, so they are very hard to shoot. An experienced hunter with whom I talked said he had been trying for ten years to obtain some Purple Gallinules, and in that time he had succeeded in shooting just one, and he is no mean marksman, as I can testify after seeing him bag five ducks out of six shots, each of them single birds.

The Purple Gallinule has two nesting seasons at Cartagena Lagoon. The principal one is in April and May, but there is another extending from the last of August through October.

In 1924 the first evidence I had of the breeding season was on April 8 when I observed a Purple Gallinule fly into the cat-tails with a large leaf in its mouth. During 1924 I discovered eight nests of this species. Six were in May, one in September and one in October. All but one were placed in cat-tails at heights ranging from six inches to six feet above the water, most of them being from two to three feet above it. This constitutes an important difference between the nesting of this species and that of *Gallinula chloropus portoricensis*. All of these cat-tail nests were more or less substantial bulky platforms of cat-tails leaves. In two of them the leaves used in construction were still green. The eggs are light buff with larger rufous brown spots and blotches than those of *G. c. portoricensis*. Another important difference is that all the eggs of Ionornis have more or less distinct spots and blotches of pale lavender, especially at the

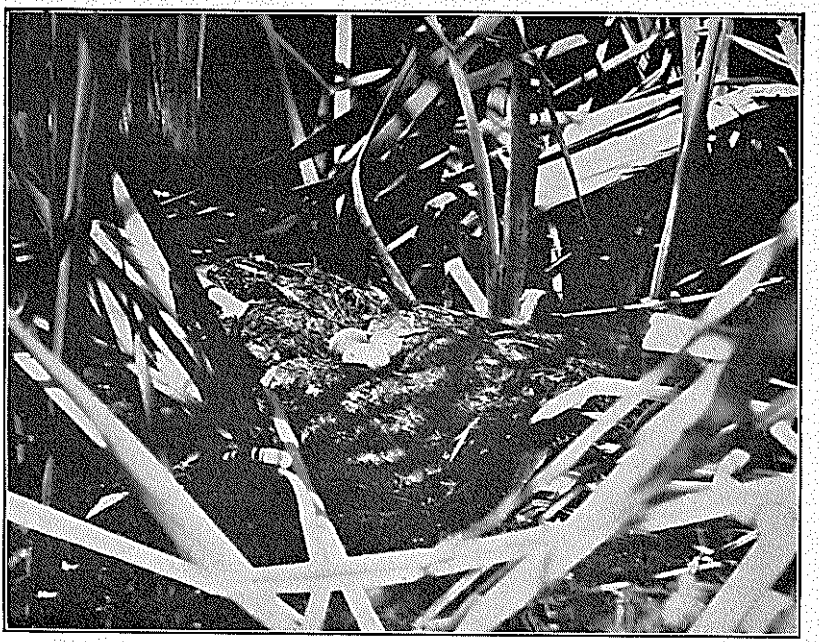


FIG. 20.—Nest and Eggs of Least Grebe. Cat-tail Association, September 20, 1924

FIG. 21.—Closer View of Same Nest

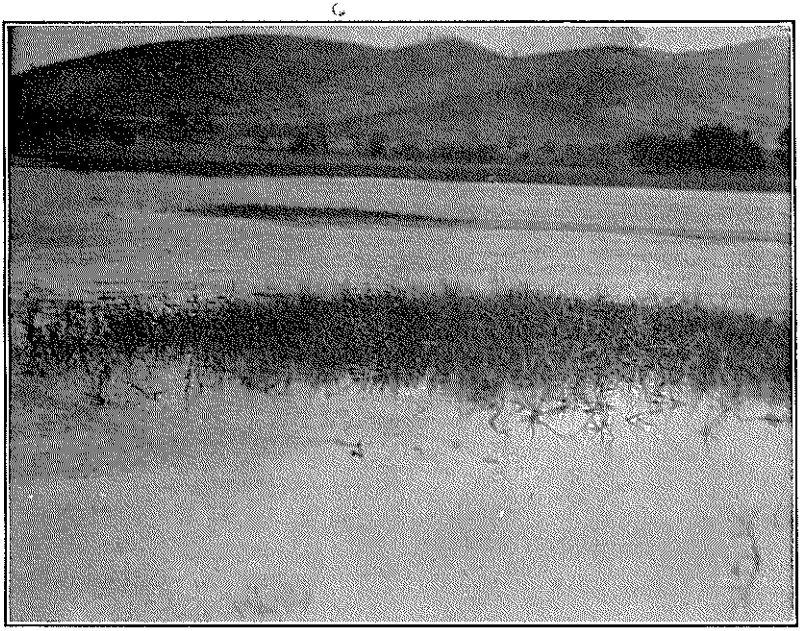


FIG. 22.—Nesting Site of West Indian Pied-billed Grebe

FIG. 23.—Newly Hatched West Indian Pied-billed Grebe

larger end. The measurements of three eggs from different sets were 1.60 × 1.15 inches; 1.62 × 1.15 inches and 1.7 × 1.2 inches. The number of eggs varied from two to six.

The one nest which was not in the cat-tails was found on August 30, 1924, when it was partly completed. It was constructed of the stems of sedges, and was placed in a clump of sedges at a height of one foot above the water. The nest was deserted before any eggs were laid in it. The other fall nest was found on October 14, 1924. It was placed four feet up in some cat-tails, and at that time contained one egg. On October 17 the eggs had increased to three.

The first spring nest that I located contained two eggs, one of them pipped, on May 9, 1924. In the second nest the young hatched May 16. The third nest had five slightly incubated eggs on May 16, but this was the lowest nest found and was later broken up, presumably by a Mongoose. The fourth nest was also a low one. It contained three eggs on May 16, which had increased to four some time before May 20, but this nest was likewise broken up. The fifth nest contained two eggs which hatched on May 23. The sixth nest deserves most mention. I first discovered it on May 16. It was built of green cat-tail leaves and placed in some fifteen-foot cat-tails at a height of six feet above the water. At that time it contained six eggs, at least one of which was only slightly incubated, as I learned by accidentally breaking one. While I was examining the nest one of the adult birds slighted on some nearby cat-tails, but on seeing me it gave some startled clucks and cackles and did not return again within the hour and a half which I waited in concealment. When I visited the nest on the morning of May 27 one egg had hatched and another was pipped, and had hatched when I visited the nest a second time about an hour later. I took the two young birds back to Mayagüez with me, leaving the three unhatched eggs in the nest. The next time I visited the nest (May 30) it contained two eggs and the shell from which a young bird had hatched, which I removed. On my next visit (June 3) the nest contained the empty shell from which the fourth young had hatched, and one rotten egg. The long intervals between the hatching of the young indicates that incubation is begun before all the eggs are laid, and that they may not all be laid on successive days. The young on hatching were covered with a rather stiff black down, except for a few white hair-like feathers on the head and throat. The bill was red at the base and black in front. The egg tooth and a region around it were pure white. The iris was was such a very dark brown that it

appeared black unless examined closely, in which case it could be distinguished from the jet plack pupil and feathers surrounding the eye. The feet and legs were pinkish flesh color. They made a peeping sound resembling that made by the young of domestic fowl, but rather more discordant. I kept them in a small coop, at night placing them in a brooder improvised from a couple of tin cracker boxes and a kerosene lamp. They fed voraciously upon cracker crumbs moistened with water, cooked oatmeal and hard-boiled egg. They would take food only when it was offered to them in one's fingers; any that dropped on the floor would not be touched. They liked to be in the sunshine, and when in it they would doze quietly unless they heard me coming. Then there would be a clamor for food, and when it was offered they would vie with each other for the lrst morsel, picking at the white spots on each other's bill, and trying to push each other out of the way. The more aggressive one sometimes grabbed its weaker brother's wing in its bill. The sounds they made when they heard me approaching were loud discordant twitterings, not unlike those of young swallows in the nest. Whenever they were not dozing their wings were constantly in motion, wiggling back and forth alternately, beating the air until it seemed as though they would wear themselves out.

By June 1 I noticed that the red on the bills was getting less bright. The weaker bird died at the age of 8 days as the result of a chilling in a hard rain. It measured 4.25 inches at that time. After the surviving bird was about 10 days old I let it out to run in the grass occasionally. It had an annoying habit of running about for a few minutes and then squatting and hiding. Even though I knew almost exactly where it was, so perfectly did it conceal itself even where the grass was comparatively short that I had great difficulty in finding it. Once it got off a little farther than usual, and it took me nearly an hour to find it, and even then I probably would not have found it if it had not uttered a couple of peeps which led me nearly to it. When I once found it I had no difficulty in capturing it, as it was not afraid of me, but its natural instinct seemed to tell it to keep concealed. This accounts for the very few downy young that one sees in their native haunts. When not concealed this bird kept up an almost incessant peeping. It had a sharp hook on the pollex which it used to aid it in getting through dense vegetation rapidly. This lived to the age of 30 days, but in that time it appeared to have increased scarcely at all in size, nor did it have a single feather other than down feathers. It had been fed finely

cracked shells for lime, and grift, in addition to its regular diet, but it probably lacked some essential article of food, though this hardly seems possible, as it had quite a variety. It was very fond of mangos and bananas. The direct cause of its death was a chilling. Natives claimed to have raised them by feeding them nothing but polished rice.

I can say but little about the food of this species, as I obtained no stomachs for examination. In Gundlach's time the Purple Gallinule was very common, and did much damage by eating rice and breaking down the stalks. At present practically no rice is grown on the Island. Field observations show that it eats tender blades of grass, especially of *Hymenachne amplexicaulis,* and it is said by the country people that its food consists almost exclusively of this.

The Mongoose is an enemy of this species when it nests near the ground, as it is of all ground-nesting birds, and probably it obtains many a tidbit of young gallinules. This species is now so shy that hunters do not materially lessen their ranks. They are perhaps the most beautiful of the Porto Rican game birds, and the pity is that they are not more abundant.

31. *GALLINULA CHLOROPUS PORTORICENSIS* (Danforth). Porto Rican Gallinule. *Gallareta.*

The Porto Rican Gallinule is an abundant permanent resident at Cartagena Lagoon. It is preeminenty a bird of the grass, sedge and Pluckea associations, though it is very frequently observed in the open water and cat-tail associations. It reaches the pinnacle of its abundance in the grass association, and nests in all except the open-water association.

The principal characters which distinguish this form, which I am describing in the October 1925 *Auk,* from its allies are: The tarsus averages slightly longer than the North American *G. c. cachinnans* and shorter than *G. c. cerceris* of St. Lucia and Grenada. The frontal shield is conspicuously larger than in the North American bird. The coloration is much darker, and the brown on the back is confined mostly to the middle back.

The cackling of the Gallinules is the most characteristic sound of the marsh, and can often be heard from a considerable distance as one approaches it. They are not as aquatic as the Coot, and keep more to the regions of dense vegetation, though they swim readily and sometimes associate with the Coots in the open-water areas. Flocks of scores may be noted resting and feeding in the grassy region at the east end of the lagoon. They can be distinguished at

a great distance by means of their broad scarlet frontal plates. When the lagoon was drying up in June large aggregations of Gallinules were noted on the mudflats near Las Casitas. On the slightest alarm they would make for the cat-tails, swimming if the water were deep enough to permit it, otherwise they would splatter over the shallow water and mudflats, beating their wings to hasten their progress. Once in their cat-tail retreat they would not emerge until the coast had been clear for some time, for they are suspicious birds.

The country people hunt Gallinules with dogs which drive the birds, ever reluctant to take flight, towards their masters, who then kill them with sticks. Many adults as well as immature birds not yet able to fly are caught in this manner. On May 9, 1924, I was presented with a live and apparently uninjured young bird captured in his manner. It was about half grown, but its wing quills were still just budding sprouts, so, of course, it was unable to fly. Its frontal shield was not yet red. Unfortunately it escaped before I had had it very long.

The nesting season of the Porto Rican Gallinule is practically continuous throughout the year, except for periods when the lagoon is dry. Eggs and young in all stages can be observed in almost every month, but the main breeding season appears to be from February to May, and I have found many more nests in March than in any other one month.

The nests vary greatly in their construction and location. Some are floating nests built of cat-tails leaves and anchored to cat-tail plants. Others are built of sedge stems and placed on the ground among the sedges or built up from the bottom in shallow water. Some are built of grass stems and roots and placed among the grasses, either on the ground or floating and anchored to a tuft of grass. Most of the nests are not much more than open platforms, but occasional nests are arched over and resemble a giant Meadowlark's nest. They are always built of the same kind of plant as that which forms the surroundings. Usually they are placed where the surrounding vegetation conceals the nest to some extent, but I have found some nests in very exposed positions, such as in patches of grass no taller than a new-mown lawn. One nest was even anchored to a wire fence in the open water. But they are never placed more than two or three inches above the ground, while those of *Ionornis martinicus* are always placed higher than this. The eggs of *G. c. portoricensis* are buffy, spotted and speckled with rufous brown, but these spots are not as large as in the case of *Iornornis,*

and they lack the pale lavender markings. They are also slightly larger, though the difference in size is not very apparent. Their measurements average about 1.8 × 1.2 inches. The number of eggs varies from three to eight, though nests with over six are very rare, and the usual number is four or five. As many dozens of nests were found during each season, I feel that I can speak quite positively about this. I have been unable to ascertain the incubation period, as eggers made way with the eggs before they hatched in every nest I was trying to keep under observation.

The black downy young with red bills are frequently observed, both before they have left their nests, and afterwards as they patter around over the floating Pistias or scramble around among the dense vegetation, usually with an anxious parent swimming around near nervously clucking. Apparently the youngsters cannot swimm well, for they are never observed in this act. On one occasion I observed an adult transport a downy young bird across a stretch of open water on its back, clucking loudly as it did so.

The Porto Rican Gallinule is so beset with enemies that it is a wonder that any survive. Eggers search the marshes so systematically that only a small proportion escape their eagle eyes, and many of those that do escape them fall prey to the Mongoose. Hunters obtain hundreds of gallinules a year at the lagoon, and birds of prey, notably the Duck Hawk and Red tailed Hawk, obtain their share. But the Gallinule is so adaptable that it persists in large, though constantly diminishing, numbers.

Vegetable matter formed 100 per cent of the food in three adult stomachs examined. Of this, pondweed (*Naias guadeloupensis*) formed 95.3 per cent. Seeds of *Persicaria portoricensis* formed 2 per cent, and the other 2.7 per cent consisted of rubbish, which included several pieces of bark. Coarse sand was present in considerable quantities, forming 9.3 per cent of the stomach contents.

Field observations show that these Gallinules also eat considerable quantities of tender grass stems (*Hymenachne amplexicaulis*).

This species is thus harmless in its food habits. It is strictly a marsh bird, common in all the plant associations of the marsh proper, where it associates to some extent with the Coot, though less strictly aquatic in its habits. The marsh is not essential to its existence however, as is shown by the fact that the country people often raise them with their domestic fowl. But in the wild state they are never found far from the marshes, as here it finds the vegetation which provides the dense shelter so much to its liking, and here it

finds the tender green stuff which forms its favorite article of diet. It is one of the most valuable native game birds, and its abundance for future generations should be insured by absolutely preventing the taking of eggs, and by prohibiting hunting at least during its main breeding season, which extends from February to May, and a much longer closed season would be preferable.

32. *FULICA CARIBAEA MAJOR* (Danforth). Porto Rican Coot. *Gallinazo.*

The Porto Rican Coot is the most abundant permanent resident at Cartagena Lagoon. Approximately 3,000 birds are present at all times of the year when the water is deep enough to permit them to swim. It is for the most part a bird of the open-water association, though it feeds quite extensively in the sedge and grass associations, and nests mostly in the cat-tail, sedge and grass associations.

While feeding the Coots usually congregate large rafts. These rafts are composed for the most part of the one species, but it is not unusual for a few Porto Rican Gallinules and Allen's Ruddy Ducks to associate with them. While swimming the Coots jerk their heads back and forth and frequently emit little croaking sounds. When alarmed they patter over the water for a considerable distance before getting into the air, using both feet and wings and producing a peculiar swishing, splattering sound. Occasionally they take to the cat-tails for refuge, but ordinarily they fly to some distant part of the lagoon. Unless frightened again they do not return for hours. Hunters are well aware of this fact, and station boys at many points around the lagoon to scare up the birds wherever they attempt to alight, and force them to fly near the cat-tails where the hunter is concealed.

At times many Coots may be observed resting on the grassy flats. They also feed to quite an extent upon the tender grass shoots, which in certain favored areas they keep plucked as fast as they appear, producing the effect of a closely mowed lawn. When the receding waters of the lagoon cause the coots to congregate more closely they become rather quarrelsome. When a bird approaches too closely to another in a flock it receives a (savage) jab and is driven away. Usually it does not retaliate. On one occasion (September 9, 1924) I observed three Coots engaged in a free-for-all fight. The birds would swim towards each other, using their wings to gain greater impetus. They made savage jabs at each other's heads until each was satisfied, when they swam off in different directions.

They are noisy birds, and at times the marsh resounds with their high cackling notes, which can be heard from a great distance. They are quite similar to some of the notes of the Porto Rican Gallinule, but louder. Another note which is frequently heard is similar to the sound produced by pouring water out of a glass decanter.

Until recently the breeding Coots of Porto Rico were supposed to be *F. americana*. Since publishing his "Birds of Porto Rico" in 1916 Dr. Wetmore began to suspect that it might be *F. caribæa* instead. All my specimens and all the birds observed closely in the field proved to be a heretofore undescribed race of *F. caribaea* which differs from *F. c. caribaea* (Ridgway) chiefly in its much larger size. I am describing as *F. c. major* in the October 1925 *Auk*.

As the lagoon is drying up many immature birds not yet able to fly are caught on the mudflats and in the cat-tails with the aid of dogs. The young keep their down for a long time, and are more than half grown before their wing quills are sufficiently grown to enable them to fly. In the oozy mudflats the birds could neither run nor fly, and there the country people picked them right up in their hands.

These birds stand in shallow water to bathe. They dip their head in water, throw water over their backs and then shake themselves.

I have sometimes observed what I believe to be the courtship of this species. The male swims around the female with wings half raised and tail elevated so as to display the white under tail coverts to full advantage. All the feathers are fluffed out and it appears very large. Then it pursues the female for a distance, but I have not observed actual mating to follow this performance.

Nests and eggs of the Porto Rican Coot may be found at any time of the year except when the lagoon is dry. However, more birds nest in April, May, and October than in any other months.

The nests are very similar to those of the Porto Rican Gallinule, but a larger proportion of them are floating affairs, and a slightly larger proportion of them are built among the sedges. Out of the three hundred odd nests found at Cartagena Lagoon about forty per cent were placed in the sedges. Most of these were built of sedge stems, particularly those of *Eleocharis*. Stems and leaves of *Persicaria portoricensis* are also frequently used in nest construction. About forty per cent of the nests were placed in the grass association, but most of these were anchored to the herbaceous shrub *Sesban*

emerus which grows commonly in this association. These were mostly constructed of sedges or cat-tail leaves. A few nests were placed right in the grass, in which case they were made of grasses. About fifteen per cent were anchored among the cat-tails and made of dead cat-tail leaves. Five per cent or less were in the Pluckea association, but only at times of very high water.

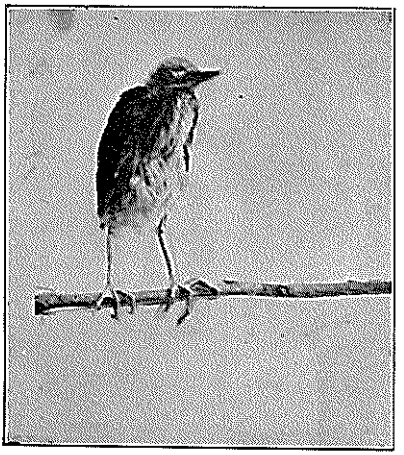
The number of eggs in a set varies from one to eight. Five or six is the most common number, while sets of seven and eight are very rare. The eggs are immediately distinguishable from those of the Porto Rican Gallinule by their much larger size and the fine and uniform speckling. They are very pale buffy white, sometimes grayish-white, finely and uniformly speckled white black, occasionally with chocolate. They measure 1.95×1.3 inches.

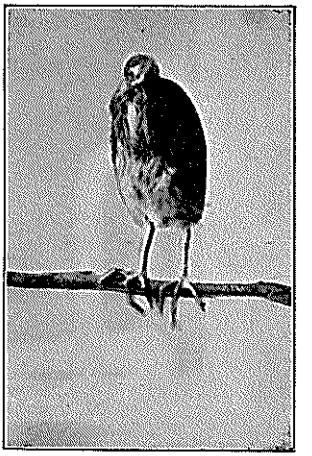
The downy young appear to be quite similar to those of *F. americana*. I have never had them in my hand, but in the field they appear to be black with a red bill. They are expert divers. When the mother gives the alarm note they dive so quickly that one is lucky to catch a glimpse of them. After they have dived the mother swims anxiously about making little croaking notes. If one stands motionless in the cat-tails or other dense vegetation he will often be rewarded by seeing a female Coot followed by one or more downy young swimming around among the stems of the plants. The young apparently accompany the parents until they are about half grown. After leaving the parental care the immature birds show a tendency to flock together.

The Porto Rican Coot is so thickly beset with enemies that it seems marvellous that any are left. It is at present the best game bird on the Island that is at all plentiful, and its flesh is the most palatable of any of the lagoon birds I have tasted. The Black-bellied Tree Duck is the only species the flesh of which is more sought after. Therefore most hunters would rather make a large bag of Coots than of almost any other species, and hundreds are obtained every year at Cartagena Lagoon. Their eggs are large and of good flavor and easily found. Several thousand eggs a year are taken by eggers. They search the marshes so systematically that about 98 per cent of the nests I found were robbed within three days of the time I found them. This made it impossible to carry on any intensive study of the nests. As an example of the large number of eggs which are taken I might mention a statement made by a hunter friend of mine that he and one other man collected ninety Coot eggs at Cartagena Lagoon on December 16, 1923, which is not during the

FIG. 24.—Nest and Eggs of Allen's Ruddy Duck

FIG. 25.—Nest and Eggs of Allen's Ruddy Duck





FIGS. 26 AND 27.—Captive Young West Indian Green Heron

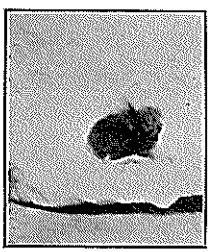


FIG. 28. — Downy Young Purple Gallinule

FIG. 29.—Nest and Eggs of Porto Rican Gallinule

main breeding season. In March I have seen the regular eggers coming out of the marsh with a burlap grain sack half full of eggs, and they do this repeatedly. The Mongoose is also very fond of Coot eggs and young Coots. Many a nest shows evidence of having been ravaged by this destructive animal. In the winter of 1921–22 and in the beginning at least of 1924–25, a Duck Hawk resided at the lagoon and fed principally upon Coots. The Red-tailed Hawks from Tinaja Hill likewise show interest in the Coots, though I have never actually observed one catch one. Another hazard which the Coot encounters is that of the sudden increase in volume of the lagoon. Many Coots had nests early in September, 1924. Then on September 27 a heavy rain increased the depth of the lagoon by over a foot and submerged many of their nests.

The contents of four stomachs, three taken in September and one in January, were examined. The food found was entirely vegetable matter, and 79.2 per cent of it was pondweed (*Naias guadeloupensis*). The other 20.8 per cent consisted of seeds of *Persicaria portoricensis*. Besides this food the stomachs contained a lot of fine sand, forming 35 per cent of the total stomach contents. Field observations show that this species also eats many tender grass shoots (*Hymenachne amplexicaulis*), and a bird taken at Guánica by Dr. Wetmore (1916, p. 35) "had eaten a large quantity of grass or sedge, with a few small roots". This species is not entirely herbivorous, as is indicated by the stomach contents of a bird collected by Wetmore on Culebra Island, which included a water scavenger beetle, some small crustaceans and some eggs believed to be of crustaceans.

The Porto Rican Coot is thus shown to be either neutral or slightly beneficial in its food habits, and it is of great value as a game bird. I think I may even say unhesitatingly that it is the most valuable game bird in Porto Rico. One of the surest ways to diminish the numbers of any bird is to persistently rob its nests. Unless this pernicious practice is stopped the Porto Rican Coot will undoubtedly become a rare bird. Stringent measures should be taken to stop this practice if future generations are to continue to have the privilege of hunting Coots. The Coots should also be protected from March 1st to December 1st.

33. *HIMANTOPUS MEXICANUS* (Müller). Black-necked Stilt.
Viuda. Zancudo.

The Black-necked Stilt is a common summer resident at Cartagena Lagoon. It is never found there in the winter months, nor have I

found it at any other place on the Island during these months. Other ornithologists record it as a resident species, so it may be found in some of the more remote mangrove swamps at the time. At Cartagena Lagoon the first birds were noted on April 8, 1922, though I had observed a few at Anegado Lagoon on March 4. In 1924 the first Stilts appeared on March 11, and none were seen after October 7.

This is primarily a bird of the grass association. As the lagoon is drying up they feed farther and farther out towards the center of the lagoon in the open-water association. Birds are sometimes seen in any of the associations of the marsh proper except the cattail. Except while nesting they are usually found in small flocks. They are very noisy birds, particularly during the breeding season. Their sharp *kek, kek* is one of the characteristic sounds of the marsh in summer. They often wade in water up to their bellies, which, as their legs are so long, means that they can feed in pretty deep water. They fly with neck and feet extended. They are quite shy, and except when they are defending a nest or young it is difficult to approach very close to them. With a few sharp call notes they are off for a distant part of the marsh as soon as they regard themselves in danger. At times of low water they may often be observed lying and basking in the sun on the hard-caked mudflats which then occur. Their legs are so long that they have difficulty in keeping their balance in a strong wind. In order to keep it they spread their wings and quiver them, either directly facing the wind or with their back directly towards it. A curious feature about this species is the upper mandible, which is quite flexible, especially near the base.

When the Stilts first appear in the spring they are in flocks of from 15 to 25. By March 25 they had begun to separate into pairs, each pair picking a certain portion of the marsh. But for some time the birds did not defend their portion of the marsh with great zeal, and a central flock remained. Gradually this flock became smaller and smaller until by April 18 it contained only eight birds. All the rest were in pairs, each in its own area of the marsh. When two pairs chanced to come together fighting ensued, for by that date the birds were very zealous in the defense of their territory. Courtship was also taking place. The male (distinguished from the female by his jet black upperparts, while those of the female are dark brown) would spread his wings and walk around near the female in semicircles or sometimes in zigzag lines resembling the line of march of a drunken man, but the female appeared to pay no

attention to him. By April 22 all the birds were paired. On April 30 there was another small influx of migrants, perhaps from nearby regions. The new arrivals consisted of a small flock of unpaired males and another of unpaired females. By this time the paired birds were more pugnacious than ever in defending their territories. One pair even chased off a Turkey Vulture which ventured too near. By May 2 all the new arrivals were paired and in possession of territories except a small flock of excess females. A male collected at this time had greatly enlarged testes. On May 9 many pairs had nests under construction, but I found none with eggs then. On May 20 most of the birds had complete sets of eggs, but all of these nests that I discovered were robbed by eggers soon after the sets were completed. These first nests were all in little hummocks of grass and *Persicaria* surrounded by shallow water at the east end of the lagoon. The nests were made of grasses and concealed in the centers of the little hummocks. This is evidently the favorite nesting site of these birds, but later nests varied greatly from this type of nesting site, as will be shown later. The number of eggs in these first layings varied from five to seven. They were extremely variable in color and markings, even within the set. The commonest type were buffy-clay color thickly spotted with rufous-brown, especially at the larger end, but with great variation in the size and color of the spots. Some eggs also had a few pale lavender spots. Some were olive green spotted with chocolate. The background of some was almost copper-colored. Some measurements taken were 1.72 $\times$ 1.25 inches; 1.75 $\times$ 1.30 inches; 1.87 $\times$ 1.08 inches. This shows that they vary greatly in shape as well as color. The last one mentioned was from a set in which all the eggs were long and pointed, this was the extreme one. The birds become much excited when their nests are approached and make aerial dashes at the intruder, almost hitting him in their downward swoops, and all the time keeping up a racket of sharp *kek, kek* notes.

After the first nests were destroyed the Stilts immediately began to build again. This time they showed great ingenuity in concealing their nests. The colony then spread over the marsh and the number of ways devised and variety of places in which nests were found was astounding. Space permits me to mention only a few of them. One was built of sedges in a small pile of dead Sesban brush in the grass association. One was built on a little hill of fairly firm bare mud surrounded by soft oozy mud. The top of this little mud-hill was hollowed out and a few roots placed in it, on which the

eggs were laid. Several nests were built on a low mudflat island which was practically unapproachable on account of the deep morasses on each side of it. One of these was composed only of a little earth scraped together with the addition of a very few broken twigs. It was scarcely distinguishable from the rest of the island. Other nests were built of Sesban stems and hidden in the Persicarias. One nest was even built right in the open water where it was six inches deep. It was constructed of Naias, and was built up from the bottom. All these nests were built in late May and June. None contained over five eggs. Most had four, while a few had only three. But despite the precautions of the birds practically every egg fell victim to the eggers, largely due to the extra dry season which permitted the eggers to obtain the eggs more easily. In 1922 quite a large number of young were raised, but in 1924 so far as I know only two pairs succeeded in even hatching any eggs, and I believe something happened to their young before they were very old, so it is very doubtful if a single bird was raised in 1924.

By the latter part of June the adults had begun to flock again, and by the middle of September all the Stilts at the lagoon (155 by actual count) had formed one compact flock. This count was made on September 17. By September 20 only about 50 were left; on September 23 there were 20; on September 27 and September 30; sixteen; on October 7, five. After that none were seen.

The three stomachs examined contained nothing but insect matter. A bird collected April 4, 1924, had eaten two Dytiscid larvae (6 per cent), and adult Dytiscids (94 per cent). The stomach of one collected May 2, 1924, contained Syrphid larvae (93 per cent); an adult Syrphid (1 per cent); a Dipterous pupa (1 per cent); and fragments of a Dytiscid beetle (1 per cent). One collected October 7, 1924, had eaten exclusively the larvae and pupae of Anopheles mosquitoes. Sixty entire pupæ, 5 entire larvæ and the fragments of many others were found. Two birds collected by Wetmore (1916, p 45) had eaten aquatic Hemiptera and small fish scales.

The large number of Anopheles mosquito larvæ and pupæ eaten alone entitles this bird to protection, for Anopheles is the carrier of the much dreaded tropical malaria. The taking of eggs should be forbidden, and the Stilt should be placed on the protected list, as its flesh is of little value as food. It is strictly a bird of the marsh, but it is very adaptable and can live in any part of the marsh except the cat-tails and very deep open water. It obtains its food from the marsh and is well adapted to feed in quite deep water by

reason of its very long legs. It occurs in salt as well as fresh-water marshes, but in Porto Rico it appears to prefer the fresh.

34. *CAPELLA GALLINAGO DELICATA* (Ord). Wilson's Snipe. *Becacina.*

The Wilson's Snipe is a winter visitant of somewhat irregular occurrence and abundance at Cartagena Lagoon. In the winter of 1921–22 they arrived early and were very abundant. In 1923–24 they did not arrive until December 27, and after that not over eight were seen on any one day, and usually not over four. In the fall of 1924 one was noted on October 7, and no others before I left (on the 22nd). The dates of spring departure were March 22, 1922, and April 15, 1924. In the winter of 1921–22 it was also seen abundantly at Anegado Lagoon. My only Porto Rican records for this species from other localities are a bird seen December 26, 1923, in a canefield at Añasco and one February 13, 1924, in a small fresh-water swamp at Mayagüez.

At Cartagena Lagoon the Wilson's Snipe shows a decided preference for the sedge and grass associations, and is found in particular abundance among the Persicarias. It is occasionally found in the Pluckea association, and once I flushed one in the Varronias.

A stomach from Río piedras examined by Wetmore (1916, p. 45) contained aquatic Hemiptera and Coleoptera, Mole Cricket remains, grass and sedge seeds. Probably the diet of the Cartagena Lagoon birds would be somewhat similar.

This is a game bird, but it is little known and is practically never obtained by local hunters. Its flight is so swift and tortuous, and it springs from the vegetation so suddenly that it startles any but the experienced hunter. This makes it a very difficult bird to shoot, and in Porto Rico, where it is not a common species, very few gain the needed experience, so I consider it fairly safe while there, and do not believe it needs any special protection.

35. *MICROPALAMA HIMANTOPUS* (Bonaparte). Stilt Sandpiper. *Putillá.*

The Stilt Sandpiper is a tolerably common migrant at Cartagena Lagoon, occurring only during August and September. In 1924 the first arrivals were noted August 20, and the species was present until September 27. On August 20 I observed at least thirty-five (collecting some for positive identification), and on September 17 there were at least fifty. Lesser numbers were seen on other days. They were feeding on the mudflats and shallow water areas of the open-water association. They associated freely with Semipalmated

Sandpipers and Lesser Yellowlegs. Such careful scrutiny is necessary to distinguish them in the field from the latter species that doubtless many are overlooked.

Seven stomachs (five collected on August 20 and two on September 17) were available for examination. Animal matter composed 70.1 per cent of the food, and vegetable matter 29.9 per cent. Bloodworms (Chironomid larvæ) were the largest food item, forming 72.8 per cent of the animal food. From 150 to 600 bloodworms were found in all but two of the stomachs. Dytiscid larvæ formed 15.5 per cent, small Planorbis snails 7.1 per cent, and mosquito larvæ 0.8 per cent of the animal matter. The vegetable matter was composed of seeds. Seeds of *Persicaria* formed 80 per cent of the vegetable matter; seeds of *Sesban emerus* 7 per cent; seeds of Compositæ 10.2 per cent, and rubbish 2.8 per cent. This is a useful species, obtaining what food it can on the mudflats. Like most of the sandpipers, it is too small to be considered a game bird, though often shot as such.

36. *PISOBIA MACULATA* (Vieillot). Pectoral Sandpiper. *Putilla.*

The Pectoral Sandpiper is a common fall migrant at Cartagena Lagoon, and is even abundant at times. Occasional birds are seen in the winter. They are common from August through October. In 1924 the first arrivals were noted on August 13. In 1922 a few were observed at Anegado Lagoon as late as April 1, and on April 27, 1924, I shot four from a flock of twenty feeding on the salt water mudflats near Cape Rojo Lighthouse, but I have no spring records from Cartagena Lagoon. There it feeds in the grass association, occasionally venturing into the dry open fields near the lagoon. It is particularly abundant in September. On September 17, 1924, there were at least 1,000 at the lagoon. All the birds collected were extremely fat.

The stomach contents of seven Pectoral Sandpipers collected at Cartagena Lagoon in August, September and October were examined. Animal matter comprised 67.6 per cent and vegetable matter 32.4 per cent. Noctuid larvæ constituted 51 per cent; noctuid adults 10 per cent; Sesban weevils (*Tyloderma sp.*), 16.1 per cent, Sphingid caterpillar 8.5 per cent; and Naucoridæ (*Pelocoris femoratus*), 2.9 per cent of the animal matter. Of the vegetable matter, 42.9 per cent was grass; 36 per cent was seeds of *Hymenachne amplexicaulis;* 5.6 per cent was seeds of Compositæ; 1.4 per cent *Naias guadeloupensis;* 1.4 per cent charcoal, and the remainder was rubbish.

The Pectoral Sandpiper lives exclusively in grassy land, and feeds largely on the Noctuid moths and their larvæ which abound in such places. Their food habits are entirely beneficial. They seldom associate with other species.

37. *PISOBIA FUSCICOLLIS* (Vieillot). White-rumped Sandpiper. *Putilla.*

The White-rumped Sandpiper is a rather uncommon fall migrant at Cartagena Lagoon. In 1924 it was noted from August 26 to October 20, and at times as many as thirty were noted in a day. The only previous record for the main Island of Porto Rico is a female collected by Bowdish (1902, p. 360) at the west end of the Island October 2, 1900. Wetmore (1916, p. 44) saw two on Culebrita Island April 15, 1912. At Cartagena Lagoon the White-rumped Sandpipers did not flock together, but scattered among large flocks of Semipalmated Sandpipers, Yellowlegs, and other Sandpipers. In flight their form bore a strong resemblance to that of the Spotted Sandpiper. Their call notes were very distinctive, and I could recognize them by sound at a greater distance than by sight The call note is a sharp, metallic *prink, prink.* They feed mostly in the open-water association, where the water is very shallow. Occasionally they are flushed in the grass association.

Four White-rumped Sandpipers collected August 26 and September 17 had eaten 77.7 per cent of animal food and 22.3 per cent of vegetable matter. Fifty per cent of the animal matter consisted of Bloodworms; 25 per cent of Planorbis snails, and 5 per cent of *Corixa reticulata.* The vegetable matter consisted entirely of seeds, of which those of Compositæ formed 33.3 per cent; *Sesban emerus,* 30 per cent; and *Persicaria portoricensis,* 36.7 per cent. In addition to food the stomachs contained mineral matter (coarse red sand) forming 32.5 per cent of the stomach contents. This is a species of the mudflats and shallow-water areas and eats only such food as may be obtained there.

38. *PISOBIA MINUTILLA* (Vieillot). Least Sandpiper. *Putilla. Putilla chiquita.*

The Least Sandpiper is found at Cartagena Lagoon during the greater part of the time when the water is low enough to give it suitable feeding ground. It is a migrant from North America, but it is not long after the last spring migrants disappear before the first fall ones appear. In 1924 they were seen up to May 30, and appeared again July 5. It is very rare at the lagoon during the

high-water period from November to March. During the rest of the year it is never very common. Usually only three or four are seen in a day, occasionally as many as fifty. I have observed them much more commonly on the tidal mudflats near Cape Rojo Lighthouse in April. At the lagoon they are almost exclusively a bird of the mudflats, alighting in the grass and sedge associations only when driven away from the mudflats. They usually occur in small flocks composed exclusively of their own species, although occasionally mingling to some extent with Semipalmated Sandpipers.

Ten stomachs collected in March, April, May, August and October were examined. These birds had eaten 80.9 per cent of animal matter and 19.1 per cent of vegetable matter. The animal matter consisted entirely of insects and their larvæ. All of them were either aquatic forms or terrestrial forms occurring commonly on the mudflats. The items which were not too much comminuted to be recognizable were: Dytiscid larvæ, 22 per cent of the animal matter; Carabid beetles (*Stenous* sp., a species inhabiting the mudflats), 20 per cent; very small aquatic Dipteroud larvæ, 25 per cent; aquatic Syrphid larvæ, 11.9 per cent; Carabid, probably *Stenous*, larvæ, 1.5 per cent. The vegetable matter consisted entirely of seeds. Those of *Sesban emerus* composed 50 per cent; those of an unidentified legume, 25 per cent, and of *Persicaria portoricensis*, 25 per cent of the total. In addition to the food considerable gravel was found in the stomachs, forming 26.8 per cent of the total stomach contents.

39. *EREUNETES PUSILLUS* (Linnaeus). Semipalmated Sandpiper.
Putilla.

The Semipalmated Sand piper is by far the most abundant shore bird at Cartagena Lagoon, though it occurs only as a fall migrant. I have records from August 13 to October 20, 1924. During the latter part of August they are present in almost unbelievable numbers. I hardly dare estimate their numbers, but on August 26, when they were at the height of their abundance, I am sure that 100,000 would have been a low estimate of their numbers. They simply swarmed over the mudflats. On this date, although I was trying to avoid shooting them, I got sixteen while shooting other birds. They were so abundant that stray shots could not help killing numbers of them. On other days many were also unintentionally shot in the same manner. In fact, all but four of the 36 that I collected were shot in this way. This species prefers the mudflats, but when they were so excessively abundant some were forced to feed in the sedge and

FIG. 30.—Nest and Eggs of Porto Rican Coot. Cat-tail Association, September 20, 1924

FIG. 31.—Nest and Eggs of Porto Rican

FIG 32.—Nest and Eggs of Black-necked Stilt. Sedge Association. June 7, 1924

FIG. 33.—Nest (eggs robbed) of Black necked Stilt. Open Water Association. June 14, 1924

grass associations, and when the fall rains came a little later practically all of them were forced to the sedges and grasses and even to the canefields. But within a few days after this most of them left for parts unknown. I have occasionally observed this species in wet cane fields in other parts of the Island (Hormigueros and Boquerón) but its chosen habitat is the mudflats. Yellowlegs, Least, Stilt, and White-rumped Sandpipers frequently associate with them while feeding, but they were so much more abundant than any of the other species that they always formed the bulk of the flock. The mudflats are alive with bloodworms, and these form the principal food of the hordes of sandpipers that frequent them in August before the waters cover them too deeply. After that but few are eaten.

An examination of the contents of 36 stomachs taken in August and September shows that these birds had eaten 63.5 per cent of animal matter and 36.5 per cent of vegetable matter. Bloodworms formed 83.4 per cent of the animal matter, and over 90 per cent in the August stomachs. The remainder was composed of mudflat-inhabiting Carabid beetles (*Stenous sp*), 4.7 per cent; Hydrophilid larvæ 3.2 per cent; Dytiscid larvæ 1.9 per cent; *Coptocycla sp.* 1.8 per cent; aquatic Syrphid larvæ 0.45 per cent; Sesban weevils (*Tylo-derma sp*), 0.27 per cent; Dytiscid adults, 0.23 per cent, and a little unidentifiable debris. The vegetable matter consisted of seeds, of which the following were recognizable: Compositæ, (probably blown to lagoon from a distance), 54.6 per cent; Sesban emerus 10.5 per cent; *Persicaria portoricensis,* 3.8 per cent; *Hymenachne amplexi-caulis,* 2.2 per cent; Crotalaria retusa, 0.3 per cent. In addition to the food these stomachs contained mineral matter (coarse sand) to the extent of 35.6 per cent of the stomach contents.

The Semipalmated Sand piper is so small and so tame that it can scarcely be regarded as a game bird, and its insectivorous habits should give it a place on the protected list. When it occurs in cane-fields it doubtless eats many injurious insects.

40. *EREUNETES MAURI* (Cabanis). Western Sandpiper. *Putilla.*

A female Western Sandpiper which I collected at Cartagena Lagoon on August 26, 1924, constitutes the first Porto Rican record for the species, and I have duly recorded it in the October, 1925, *Auk.* It was in a flock of Semipalmated Sandpipers feeding in shallow water. It was in almost full summer plumage. Its stomach contained 150 Bloodworms (90 per cent) and a Hydrophilid larvæ

(10 per cent). It had eaten some coarse sand, which formed 47 per cent of the stomach contents.

41. *TOTANUS MELANOLEUCUS* (Gmelin). Greater Yellowlegs. *Playante.*

The Greater Yellowlegs is a migrant from North America, but a few individuals apparently spend the summer at Cartagena Lagoon, as they were observed on every trip to the lagoon from May to September, and, in fact, on practically every visit throughout the year. It is not very abundant, and I have never observed over 20 in one day. It occurs in small flocks, mostly in the shallow parts of the open-water association, sometimes in the sedge and grass associations, with other sandpipers, especially the Stilt and Semipalmated Sandpipers and Lesser Yellowlegs, from which its larger size and characteristic notes distinguish it, especially when the two species occur near together.

Three birds, one collected in April and two in June, had eaten exclusively animal matter. The recognizable fragments were: Dragonfly naiads, 65.33 per cent; aquatic Hemiptera (*Belostoma* sp), 22 per cent; fish scales (*Poecilia vivipara*), 6.0 per cent; Dytiscid larvæ, 0.66 per cent. The food of these specimens was thus mostly such as would be obtained in the shallow open water, with the exception of a fleabeetle (*Haltica jamaicensis*), forming 1.3 per cent. This species is found abundantly in the sedge association. The Greater Yellowlegs is of neutral economic importance, as the fish are too small to be utilized as food. It is a game bird, and should receive protection from March to October. It is the only one of the sandpipers which is large enough to be of much value as a game bird.

42. *TOTANUS FLAVIPES* (Gmelin). Lesser Yellowlegs. *Playante.*

The Lesser Yellowlegs is a common visitant from the north. As in the case of the Greater Yellow legs, some stay right through the summer, and there is never a day in the spring, summer and fall that it is not possible to observe some at Cartagena Lagoon. They become rather scarce at times of very high water in the winter, but they may then be observed abundantly at the saltponds on the nearby coast. At the lagoon they occur in flocks of from 2 to 100. They reach their greatest abundance early in October. On October 7 and 11, 1924, I observed over 1,000, and on other days shortly before and after these dates, from 500 to 800. Usually there are not over 100 present at once. They feed in the shallow open water, on the mudflats, and among the flooded grasses and sedges. They often

associate with other sandpipers, especially the Greater Yellowlegs, Stilt, and Semipalmated Sandpipers. They are surprisingly tame while in Porto Rico, and it is slaughter, not sport, to shoot them. Sometimes the flocks are so densely packed that hunters kill as many as 20 at a single shot.

The stomach contents of nine Lesser Yellowlegs collected at Cartagena Lagoon in February, March, April, August, September and October were examined. Animal matter formed 99.22 per cent, and vegetable matter 0.78 per cent. Dytiscid larvæ formed 26.6 per cent of the animal matter, and Hydrophilid larvæ, 1.8 per cent; Bloodworms, 5.1 per cent; Planorbis snails, 5 per cent; Fleabeetles, 1.1 per cent; Hydrophilid adults, 3.1 per cent; Dytiscid adult, 0.7 per cent; grasshoppers, 0.22 per cent; Bupestrid beetle, 0.55 per cent; Lycosid spider, 0.55 per cent; Notonectidæ, 1 per cent; fish scales, 0.33 per cent; Carabid beetle (*Stenous* sp), 0.55 per cent, and other beetles 3.2 per cent. Many insects were too finely comminuted for identification. The vegetable matter was rubbish, and was probably taken in accidentally with the insects. Only one stomach contained any mineral matter. It consisted of a little red sand and formed only 1 per cent of the contents of that stomach. However, the stomachs of five birds collected at the saltponds at Boquerón on February 22, 1924, were entirely empty except for a few pieces of shell and a little sand, though they were collected in the afternoon. Incidentally, these birds, collected at a single shot, were all males. It is possible that birds of a sex flock together in the winter.

This is a neutral species as far as the agriculturist is concerned, as its food is obtained entirely in the marsh, but as it is classed as a game bird, and has some value as such, small as it is, it should receive at least as much protection as the Greater Yellowlegs.

43. *HELODROMAS SOLITARIUS SOLITARIUS* (Wilson). Solitary Sandpiper. *Putilla.*

The Solitary Sandpiper is an uncommon migrant at Cartagena Lagoon. I saw it on numerous occasions between August 30 and October 7, 1924, but never more than one at a time. It was seen on the mudflats, in the grass association, and in the damp canefields near the lagoon. I have also observed it in damp, newly plowed fields at Filial Amor, Cabo Rojo, and Boquerón in September and October. On September 20, 1924, ten were noted in a single field at Filial Amor. My only spring record for the Island is a single

bird observed at Anegado Lagoon, March 4, 1922. They are not shy birds. When flushed they fly rapidly and utter their *tweet, tweet* call note.

The stomach of a female collected at Cartagena Lagoon September 9, 1924, contained nothing but one Hydrophilid beetle. It is probable that when feeding in canefields, as they frequently do, they eat many injurious insects. Two stomachs examined by Wetmore (1916, p. 42) contained only insects. The indications are that this is a useful species deserving protection. It is too small to be considered a game bird.

44. *CATOPTROPHORUS SEMIPALMATUS* subsp. Willet. *Playante.*

The Willet is an accidental visitant to Cartagena Lagoon. One was observed September 23, 1924, in the grassy area at the east end of the lagoon. On being alarmed it flew far away from the marsh towards the coast, where I have observed between 25 and 30 on two occasions in the mangrove swamps near Boquerón (February 22 and March 8, 1924). I also observed two on the tidal flats near Cape Rojo Lighthouse on April 27, 1924. Gundlach (1878, p. 639) found them at Boquerón and said he believed they nested on the Island. I collected two females at Boquerón on February 22, 1924. Their measurements do not check with those given by Ridgway for either *C. s. semipalmatus* or *C. s. inornatus.* The wing, bill and tarsus are as short or shorter than the extremes given for *C. s. semipalmatus,* while the tail is well within the limits given for *C. s. inornatus.* The measurements are given in the following table:

	C. s. longicaudis	C. s. semipalmatus		C. s. inornatus		
	2 females, Boquerón, P. R.	Female extremes Ridgway	Female ** Bahamas May	Female extremes, Ridgway	Female * N. Y., August	Female N. Mex.
Wing	172-191	175-191	199	209.5-220	212	215
Tail	81-81	66.5-74	74	74-88	82	85
Exposed culmen	49-54	53.5-59	55.5	63.6-65.0	61.5	65
Tarsus	47-55	51.5-58	54	66.5-70	69	68

* Female in winter plumage, collected at Ithaca, N. Y., on August 8, 1921.

** Female in summer plumage, collected May 5, 1902, on Andros Island, Bahamas. Coll. L. A. Fuertes, No. 862.

It is possible that the Porto Rican birds represent a resident subspecies differing from mainland birds. If such proves to be the case I suggest the subspecific name *longicaudis* for the Porto Rican bird, with a female collected at Boquerón, February 22, 1924 (Cornell University Collection No. 2326), as the type.

The stomach contents of the two birds collected at Boquerón were examined. One contained nothing but a crab (*Hippa* sp), and the other only a fiddler crab (*Uca pugnax rapax*).

45. *ACTITIS MACULARIA* (Linnaeus). Spotted Sandpiper. *Putilla.*

The Spotted Sandpiper is a tolerably common winter visitant to Cartagena Lagoon. In 1924 the last spring birds were noted May 23, and the first fall arrivals August 13. This is a bird frequenting firmer ground than the other sandpipers. It is seldom observed feeding in the shallow water or on the mudflats, but prefers the firmer south shore at the edge of the Varronia association, and is also found at the edge of the open-fields association, and frequently right in the canefields. The other sandpipers seldom alight on elevated perches, but this one often perches on fence posts, keeping up its characteristic teetering all the while. It is also frequently found on the sea beach and along the smaller inland streams. It is the most universally distributed sandpiper on the Island.

Two birds collected February 15 and September 9 at Cartagena Lagoon had eaten entirely animal matter. Carabid beetles (*Stenous* sp) formed 58.5 per cent; engraver beetles (*Xyleborus* sp), 20 per cent; down feathers (probably its own), 7.5 per cent, and miscellaneous insects, mostly Coleoptera, 15 per cent. Wetmore (1916, p. 41) found mole crickets forming 10.78 per cent of the food in 9 stomachs, and undoubtedly those individuals that feed in canefields consume many of them. Many crustaceans were also found in these stomachs.

The Spotted Sandpiper feeds in the fields more than any of the other sandpipers, and it is present during the greater part of the year, so its beneficial possibilities are great and should win protection for it.

46. *CHARADRIUS DOMINICUS DOMINICUS* (Müller). Golden Plover. *Playero.*

The Golden Plover is probably a rare migrant at Cartagena Lagoon. I have no positive records for it, but on February 15, 1924, a flock of five Plovers flew over the lagoon which I believed to be of this species. Struthers (1923 p. 473) collected one from a flock of six at Anegado Lagoon on November 4, 1921, and Wetmore (1916, p. 40) saw one near the mouth of the Río Mameyes on February 16, 1912. These are the only recent records for the Island.

47. *OXYECHUS VOCIFERUS RUBIDUS* (Riley). West Indian Killdeer.
Putilla.

The West Indian Killdeer, which is similar to *O. v. vociferus*, but smaller and darker colored, is a permanent resident at Cartagena Lagoon. It is common during most of the year, but decidedly uncommon during the high-water period from November to February. In fact I have never seen them at the lagoon in December, and only once in January. During these months they are feeding in the drier parts of the Island, and wander a good deal. They may then be found farther inland than usual. In December 1923 they were quite common on the then dry bottom of Anegado Lagoon.

While at the lagoon the West Indian Killdeer prefers the grass association, but is not uncommonly found in the sedge association and on the mudflats, and is common in the nearby canefields, and is particularly fond of newly plowed fields. It is an extremely noisy bird, particularly in the breeding season. Many a time when I have been stalking some rare or shy bird have I felt a keen desire to wring the necks of the loud-mouthed killdeers that stalked just ahead of me screeming as loudly as they could and scaring away every bird in the region. They have a habit of running very rapidly for a short distance, then stopping abruptly and looking around, and then speeding on for a few more feet. They are apparently seminocturnal, as their cries may be heard for an hour or two after sunset and for about an hour before sunrise.

On one occasion (June 18, 1924) I had a rather unusual experience with a West Indian Killdeer. While I was walking through a rather thick growth of sedges one ran out from almost underfoot and squatted, or it might be said "froze" on the ground a few feet away. I slowly approached it until I actually touched it with my gun barrel, but yet it did not fly. Then I moved my hand slowly towards it, grabbed it, and picked it up to examine it. Its tail feathers were worn, a possible indication of incubation, but a careful search revealed no nest or young nearby. On being released the bird flew away in perfectly normal fashion.

The West Indian Killdeer breeds in the fields near Cartagena Lagoon, but I have not been fortunate enough to discover any nests. It apparently nests in the grassy regions, particularly in the open-fields association. Country people living nearby report having found nests on the ground with three to five eggs, usually four. The nesting season apparently extends from February to June. A female collected February 6, 1924, contained well-developed ovules. On

May 27, 1924, one practised deception to a remarkable degree, evidently in trying to lead me away from its nest. Three times it flew a short distance ahead of me and then settled down on the ground and went through the motions of a hen settling down on her nest and turning the eggs under her.

The stomach contents of four birds collected at Cartagena Lagoon in February, March, and September were examined. Animal matter formed 98 per cent of the contents, and vegetable matter 2 per cent. In addition, mineral matter (sand and gravel) to the extent of 7.73 per cent of the stomach contents was found. Of the animal matter, Hydrophilid larvæ formed 23 per cent; Dytiscid larvæ, 6.77 per cent; Maybeetle (*Phyllophaga vandinei*), 20.5 per cent; Carabid beetles (*Stenous* sp), 18.8 per cent; Noctuid caterpillars (35, forming 97 per cent of the contents of 1 stomach), 24.27 per cent; Sesban weevils (*Tyloderma* sp.), 1.75 per cent; and miscellaneous insect matter, 4.91 per cent. The vegetable matter consisted of two seeds (one of them a Composite) and a little rubbish.

The West Indian Killdeer is an exceptionally useful bird, as it regularly inhabits canefields, especially when newly plowed, and its food habits are almost entirely benefical. Wetmore (1916, p. 39) found that mole crickets formed 14.42 per cent of the food in 20 stomachs, and beetles, many of them noxious, formed over 30 per cent. At the lagoon this species inhabits the drier, firmer parts, especially the grass association. Although small, it is often considered a game bird, but should receive full protection on account of its great value to the agriculturist.

48. *PAGOLLA WILSONIA WILSONIA* (Ord.) Wilson's Plover.
Putilla. Playero.

Wilson's Plover is only a straggler to Cartagena Lagoon, though it is found on tidal mudflats at all times of the year and almost undoubtedly breeds on the Island. The only record I have for this species at the lagoon is that of a female with very small ovary which I collected on June 3, 1924. It was feeding on mudflats which were then covered with very shallow water. Its stomach contained 93 per cent of animal matter and 7 per cent of vegetable matter, in addition to some white sand, which formed three per cent of the total contents. All the identifiable animal matter consisted of Dytiscid adults (5 per cent) and six Dytiscid larvæ (92 per cent). The vegetable matter was rubbish.

Near Cape Rojo Lighthouse I observed 64 of these birds on April

27, 1924. Most of them were on the tidal mudflats, but a few were on the sandy beach. Two males, with much enlarged testes indicating breeding, were collected on that date. Their stomachs contained 90 per cent animal matter and 10 per cent vegetable matter. Fragments of a small fish formed 47.5 per cent, a small hermit crab 50 per cent, and fragments of a beetle 2.5 per cent of the animal matter. The vegetable matter was entirely composed of pieces of a fine grass-like alga.

This species is of little economic importance, as it is quite uncommon and is a maritime species, only occasionally straggling to regions away from the coast.

49. *ZENAIDA ZENAIDA LUCIDA* (Noble). Porto Rican Zenaida Dove. *Tórtola.*

The Zenaida Dove is common in the vicinity of Cartagena Lagoon, and frequently comes to the marsh, though not very often in the winter months. Although most of these birds breed elsewhere, a few nest in the marsh, and others go there for food and water. The few that visit the immediate vicinity of the lagoon in winter are found almost exclusively in the Varronia association, where they appear to be feeding.

The Zenaida Dove is very wary and difficult to approach. It flushes with a loud clapping of the wings and flies a long distance before alighting. It quite closely resembles the Mourning Dove while walking on the ground, and its notes are even more similar. It feeds upon the ground, but upon being flushed alights in trees, and at other times it can often be found resting in trees. It is a bird of the cultivated lowlands, mangrove swamps, and the lower foothills, never being found in the higher hills. It feeds singly or in small flocks. On one occasion (February 25, 1922) near Mayagüez I flushed a flock of twenty, but that is very unusual.

At Cartagena Lagoon these birds feed chiefly in the Varronias in winter, but in the summer many feed in the grass and sedge associations left dry by the receding waters of the lagoon. The usual nesting place of the Zenaida Dove is in trees. I found such a nest on Tinaja Hill, near the lagoon, on May 6, 1924. It was a loosely constructed platform built on horizontal branch of a scrubby tree at about five feet from the ground, on a wild precipitous slope. At the lagoon a few of these doves forsake their usual nesting sites and nest in the cat-tails. I found two such nests in 1924. The first was a crude platform of twigs on some bent cat-tail leaves in a dense

FIG. 34.—Nest and Eggs of Black-necked Stilt. Sedge Association. June 14, 1924

FIG. 35.—Nest and Eggs of Black-necked Stilt. Mudflat Island, Open Water Association. June 14, 1924

FIG. 36.—Nest and Eggs of Black-necked Stilt. Mudflats. June 14, 1924

FIG. 37.—Semipalmated Sandpipers. August 26, 1924

clump on Las Casitas. It was three feet above the water, which was two feet deep at that place. On May 13 it contained two white eggs, but the nest was so frail it fell to pieces before the eggs had time to hatch. The second nest was built of dry cat-tail leaves and placed in the cat-tails at a height of four feet from the water, which was two inches deep at that time. When I found it on May 27 it contained two egg shells from which the young had hatched but the young birds were nowhere to be seen.

This species is probably preyed upon to some extent by the Mongoose, although its nesting habits make it more immune to attack than the Ground Dove. The Zenaida Dove is one of the most sought-for game birds on the Island, and justly so, as its meat is of good flavor and it is so wary that one has to be an expert marksman to obtain many. But it has a disadvantage in that it frequently flies long distance after being shot before it falls, making the recovery of the birds shot very difficult. Often but a small per centage of the birds killed are recovered, especially when one is hunting in rough country. The few that I have shot were lost in this manner, so I can say nothing at first hand about the stomach contents of this species. Field observations, however, indicate that *Persicaria* seeds are freely eaten. Wetmore (1916, p. 52) found that this species is almost entirely vegetarian in its diet. He found that a great variety of fruits and seeds were eaten, among which were Moral (*Cordia* sp.), several species of grass, and *Polygonum*.

This is a species which visits the lagoon for food, water and shelter, yet it is not preeminently a bird of the lagoon. It is an adaptable species, and apparently some individuals, becoming crowded out of their more natural habitat, and finding a plentiful supply of food and nesting sites of a fashion at the lagoon, decide to stay there to breed. It is an admirable game bird, and should be protected at least from February 15 to October 15 to give the birds a chance to rear their young in safety.

50. *CHAEMEPELIA PASSERINA TROCHILA* (Bonaparte). Porto Rican Ground Dove. *Rolita. Rola.*

The Porto Rican Ground Dove is an abundant species in the immediate vicinity of Cartagena Lagoon, and frequently enters the marsh proper, particularly at periods of low water, to feed. It never nests in the marsh. When the water is low, it feeds in all the marsh association except the open-water and cat-tail associations, and at times of high water it forages in all parts of the marsh where wading

or swimming is not necessary. This little dove is generally abundant throughout the lowland open country in Porto Rico, and is also very common in the lower foothills, particularly those that are covered with brush. It occurs very commonly in canefields, even after the cane is full grown. It feeds exclusively upon the ground, but sometimes alights in trees. At many times of the year, but especially in December, a chorus of mournful *coos* may be heard from the males, which perch in trees to utter these notes. When feeding on the ground they often try to flee from an intruder by walking rapidly away, but if approached too closely they suddenly take flight. When in flight the red under surfaces of the wings are conspicuously exhibited.

These little doves are found in small flocks during the greater part of the year, but during the period from March to June, which covers the greater part of the breeding season, they are usually observed singly or in pairs. The usual nesting site in Porto Rico is in trees or shrubs. This has been believed by Wetmore (1916, p. 50) and Bowdish (1902, p. 361) to be in order to escape the Mongoose, but I doubt if this is the reason, as Gundlach, writing in 1878 (p. 349), before the Mongoose was introduced, says that they nest in coffee, lime and plantain trees, among shoots of trees, among parasitic plants, and above the doorways of country houses, and does not even mention finding any nests on the ground. Nevertheless this species does at least occasionally nest on the ground, and I am inclined to believe that they do so quite commonly in the vicinity of Cartagena Lagoon, though I have actually found only one such nest. This was on Tinaja Hill, about two-thirds of the way to the summit. The nest was built of fine grasses and placed upon the ground under the shelter of a small rock. It was found by flushing the female. On May 28, 1922, it contained two fresh white eggs.

The Mongoose is an important enemy of this species as it feeds and sometimes nests upon the ground. Men sometimes hunt them, as their flesh is said to be excellent, but they are small and usually larger game is sought.

Three birds collected at Cartagena Lagoon in May and September were entirely vegetarian in their diet; in fact their food consisted entirely of seeds. Among these were those of *Persicaria portoricensis* (33 per cent); Cyperaceæ, 26 per cent; *Hymenachne amplexicaulis*, 2 per cent, and of *Sesban emerus*, 7 per cent. The stomach contents of two birds collected near the then dry Guánica Lagoon on October 3, 1924, were also examined. In these the only identi-

fiable seeds were *Crotalaria* sp. (1.5 per cent), *Panicum* sp. (15 per cent) and *Polygonum* sp. (10 per cent). These birds also eat considerable gravel, but this formed only 4 per cent of the contents of the five stomachs examined.

To sum up, the Porto Rican Ground Dove is an abundant species, found everywhere in the open lowlands of Porto Rico. It frequents the drier parts of the marsh to gain its share of the abundance of food which is found there, but it chooses other places to nest. It is sometimes considered a game bird, but it is so small and so useful that it should be placed upon the protected list.

51. *CATHARTES AURA AURA* (Linnaeus). Southern Turkey Vulture. *Aura. Aura tiñosa.*

The Southern Turkey Vulture is said to have been introduced in Porto Rico from Cuba by the Spanish government. It is restricted in its distribution there to the southwestern corner of the Island, having been observed from Ponce to Añasco, but it is commonly observed only in the region from Boquerón to Yauco, which includes Cartagena Lagoon. Seventeen is the most that I have been able to count circling around any one dead animal, and as their range is so restricted this probably represents the greater part of the individuals on the Island. Their number are said (Wetmore, 1916, p. 30) not to have increased or decreased materially nor to have increased their range in many years. None nest in the immediate vicinity of the lagoon, but they often visit the marsh to pick the bones of dead animals, prticularly of Coots, ducks, gallinules, etc., that have been shot but not recovered by the hunters. They are not particularly shy, and may often be approached quite closely while feeding or resting upon the ground.

The Turkey Vulture apparently has no enemies but the Mongoose. The country people realize that they are useful, and that their flesh is not edible, so they are seldom molested.

52. *CIRCUS HUDSONIUS* (Linnaeus). Marsh Hawk. *Gavilán.*

The Marsh Hawk is a rare winter visitor to Cartagena Lagoon. An immature bird was observed there on frequent occasions between November 30 and December 27, 1923. This constitutes the first record for the Island, which I am publishing in the October, 1925, *Auk*. It was hawking over the grassy regions in typical Marsh-Hawk style. On December 22 two were noted.

53. *BUTEO BOREALIS* subsp. Red-tailed Hawk. *Guaraguao. Lechuza.*

The Red-tailed Hawk, though not properly speaking a resident of Cartagena Lagoon, is often seen flying over it, and sometimes visits it in quest of food. One pair breeds on Tinaja Hill, and sometimes descends to the marsh to obtain some of the abundant animal life which is to be found there.

This is not a rare species in most parts of the Island, and is seen most frequently in the foothill region. I have observed it in the hills between Arecibo and Utuado, at Mayagüez, Guánica and La Plata. I have never observed more than two together. Its wild scream is a signal for the country people to call their chickens home, for it is said to eat many chickens. I have no doubt that some are taken, as the custom of allowing all poultry to run loose exposes them to attack. On April 26, 1924, near Guánica I observed a *guaraguao* swoop down and strike a small hen in the field, but we gave it a scare and it dropped the hen, which half limped and half flew towards shelter. A bird observed at Cartagena Lagoon on February 6, 1924, had a rat in its claws. Stomachs examined by Bowdish (1902, p. 361) and Wetmore (1916, p. 33) contained nothing but rat remains. An immature bird obtained at Mayagüez September 18, 1924, was apparently a sick bird. It was wounded by throwing a rock at it. Its stomach contained one brown feather which appeared to be one of its own, and a lot of grass, in addition to some coarse gravel, which formed 6 per cent of the contents. The evidence shows that this bird is often if not usually beneficial, so only those birds which form the habit of eating poultry should be destroyed.

The adults of this species are known to the country people as *guaraguao,* and immature birds as *lechuza.* The subspecific status of the Porto Rican form is uncertain.

54. *FALCO PEREGRINUS ANATUM* (Bonaparte). Duck Hawk. *Falcón grande.*

The Duck Hawk is an irregular winter visitant at Cartagena Lagoon. A bird in the plumage indicated as first year in the plates of the Birds of New York spent the winter of 1921–22 at the lagoon. My latest record was March 22, 1922, though I observed one at Anegado Lagoon on April 1, 1922. During the winter of 1923–24 none were seen, but one arrived September 30, 1924, and was observed regularly until I left the latter part of October.

When in pursuit of its prey this species is fearless of man. At the lagoon it seldom attacks any swimming waterfowl, but waits until they have been flushed and then pursues them at tremendous speed, often whizzing past the man who has flushed them like a catapult in its haste to obtain its prey. It is particularly fond of Allen's Ruddy Ducks and Porto Rican Coots, but they show remarkable ability in dropping to the water and diving when pursued. I have also observed this Hawk pursue some of the larger shore birds, especially the Black Necked Stilt and Lesser Yellowlegs. I once witnessed an exciting race for life on the part of a Black Necked Stilt. The Stilt kept ahead for quite awhile, but the Hawk was steadily gaining on it. Just as it seemed as though its talons would sink into the unfortunate Stilt, a dash into some thick brush saved its life, and the Hawk flew away disappointed. When a Duck Hawk flies near a flock of Little Blue Herons they scatter in a hurry. Despite their large size they fear the "Noble Peregrine". In Porto Rico the Duck Hawk has no enemy but man. It is a destructive species, but fortunately it is not abundant enough to do serious damage. However, it should not be protected.

55. *FALCO COLUMBARIUS COLUMBARIUS* (Linnaeus). Pigeon Hawk.
Gavilán. Lechuza.

The Pigeon Hawk is a regular winter visitant to Cartagena Lagoon. Two birds wintered there in 1921–22, two in 1923–24, and two appeared in the fall of 1924. I have also observed this species at various other localities on the Island. In my notes I find records for Quebradillas, April 12, 1922; Sabana Grande, April 25, 1924; and La Plata December 14, 1923, and March 29, 1924. At Cartagena Lagoon my latest spring record is April 18, 1924, and my earliest fall record October 20, 1924.

At the lagoon it was usually a rather shy species, seldom permitting of close approach. It hunted mostly over the grassy areas, occasionally making tours over the open water and other parts of the marsh. Its favorite perching place was on some posts which supported a barbed-wire fence at the north edge of the lagoon. On one occasion (October 20, 1924) a Pigeon Hawk went through a rather surprising performance. Two birds were apparently fighting for feeding rights, pursuing each other on the wing. Then one of the birds alighted in a Jobo tree south of the lagoon, and the other flew off. As I approached the bird in the tree, much to my surprise it flew towards me, and alighted *on the ground* eight feet in front

of me, and flapped its wings as though feigning injury. A boy who was near then hit it with a pebble and it flew off.

A male collected April 8, 1924, had eaten exclusively animal matter. Two bright red and yellow dragonflies and six other dragonflies formed 73 per cent, a damselfly naiad 12 per cent, and the feathers of a small bird, apparently *Petrochelidon fulva poeciloma*, 15 per cent. In the field I observed one chasing a Porto Rican Grackle, but it escaped. The Pigeon Hawk is another injurious species by reason of its destruction of small birds and dragonflies, and does not deserve protection, though it is not abundant enough to do very great damage.

56. *CERCHNEIS SPARVERIA LOQUACULA* (Riley). Porto Rican Sparrow Hawk. *Falcón.*

The Porto Rican Sparrow Hawk, although a common resident in most of the coastal lowlands of Porto Rico, is a rare visitor to Cartagena Lagoon. In 1923–24 I observed it on just six occasions, mostly in the winter months. When at the lagoon it more often occurs in the open-fields and Varronia associations than in the marsh proper. These Hawks occupy commanding perches from which they scan the nearby country for prey. Field observations indicate that this consists largely of grasshoppers and lizards. I once observed one devouring an *Ameiva exul* so large that it could be swallowed only with great difficulty. It was being scolded the while by a *Chlorostilbon maugaei*. These diminutive hummers, smaller than the North American Ruby Throat, often scold and pursue Sparrow Hawks, either alone or accompanied by other birds, notably the Gray Kingbird and the Yellow-shouldered Black-bird. On March 9, 1924, at Mayagüez, I observed the mating of the Porto Rico Sparrow Hawk. The male pursued the female for a short distance, and upon capturing her mating took place.

Only one stomach, that of a female collected near Cartagena Lagoon on October 10, 1924, was examined. It was nearly empty, containing only a small wad of mouse fur and some fragments of what was probably a centipede. Wetmore (1916, p. 31) found that many mole crickets and other Orthoptera were eaten, and these, together with House Mice, offset the damage done by eating many lizards and a few small birds, so that on the whole they are of somewhat neutral value. Individuals living near canefields where mice and mole crickets abound are of more value, and they should

be encouraged to take up their bode there by providing conspicuous high perches from which they can scan the fields for prey.

57. *PANDION HALIAETUS CAROLINENSIS* (Gmelin). Osprey. *Águila.*

The Osprey is a rare visitor to Cartagena Lagoon. I have observed one flying over the lagoon on two occasions, March 11, and September 27, 1924. On the latter occasion it uttered its familiar whistling cry. The only other record for Porto Rico I have is of two birds observed over Boquerón Bay on March 22, 1922.

58. *GYMNASIO NUDIPES* (Daudin). Bare-legged Owl. *Múcaro.*

Although I have not personally recorded the Bare-legged Owl from Cartagena Lagoon, probably largely because I have not been able to be there at night, I am including it in my list because the country people tell me they sometimes hear it at night. It is a common resident over most of Porto Rico, and might even be classed as abundant in certain regions, particularly in the mountain coffee *fincas.* It is very common around Mayagüez, and when camping on Montuoso Mountain in April, 1922, dozens could be heard calling in all directions among the mountain coffee *fincas.* Its call is a tremulous trill, more tremulous and more rapidly trilled than that of the Screech Owl. It also has a merry, chattering sound which is uttered more frequently during the winter months than the trill. These owls are more vocal on moonlight nights than on dark ones, and they may be then be heard thoroughout the night, whilst on dark nights they are usually only heard for a short time after dusk and for a short time before dawn. On one occasion (May 18, 1924) at Mayagüez (to which locality most of my notes on this species refer) I kept track of the calls heard towards morning to ascertain at what minute the last calls would be uttered. The last one was heard at 5 :57, just before the sun rose with charasteristic tropical suddenness. On moonlight nights these little owls may sometimes be observed very clearly by placing one's self so that the owl is between himself and the moon. One of my most vivid memories of Porto Rican nights is of watching a *múcaro* perched on the branch of a eucalyptus tree, with the moon directly behind it, preening its fink feathers. Its long, bare legs were very conspicuous. Once it flew down to the ground with swift, noiseless flight, and apparently picked up some insect. They also perch at times upon the rolled-up new leaves of banana trees. There normally stand up vertically, but when the owl alights on them they bend to a horizontal position.

In the latter part of the winter of 1922 my brother was presented with a full-sized but still downy young *múcaro* which was captured on the University campus at Mayagüez. It was blind in one eye. He kept it as a pet for several months, feeding it meat and insects. It would eat cooked beef ravenously, pulling it to pieces with beak and claws before swallowing it. But its favorite food was cockroaches, which could be obtained in great numbers without difficulty. He tried to give it its liberty several times, but probably on account of its blind eye it could fly only in circles, and always returned. When we left the Island it was given to some neighbors, but they could not get it to eat anything, so it did not live long.

The country people believe that *múcaros* are injurious by reason of consuming many coffee berries, but there is no evidence to support this theory, and there is much evidence that it is not so. No one has ever seen one actually eating coffee berries, nor have any been found in the contents of stomachs examined. Dr. Wetmore (1916, p. 67) tried to starve some captive birds into eating coffee berries. They could not be induced to eat them, but on being offered animal food they promptly ate it. This experiment was repeated by Miss Rosario Brito of Mayagüez, with similar results.

Two birds were collected at Mayagüez, one in December and one October 3, 1924. The stomach of the December bird was unfortunately lost. That of the October bird contained exclusively insects. Those identified were a huge rat-tailed maggot forming 15 per cent; a large Katydid, 25 per cent; two sugar cane root borers (*Diaprepes spengleri*), 8 per cent; 2 large green caterpillars, 5 per cent; 4 Noctuid moths, 1 per cent; and 1 small Locustid, 1 per cent.

The Bare-legged Owl is a useful species due to its fondness for insects, and is of exceptional value because it is adapted to obtain those insects that are nocturnal in habit. On this account it should receive full protection.

59. *CROTOPHAGA ANI* (Linnaeus). Ani. *Judío.*

The Ani is a common resident species at Cartagena Lagoon, and, in fact, throughout most of the Island. It feeds regularly in all the plant associations of the lagoon except the open-water association, and nests in the Bamboos and the higher trees of the Varronia association. It is always found in flocks, usually of from 6 to 15, and always feeds on or near the ground. When alarmed it flies to a shrub or low tree and examines the intruder, uttering its querulous notes. The flight is low, and seldom of continued duration. The

FIG. 38.—Semipalmated Sandpipers. August 26, 1924

FIG. 39.—Nest and Eggs of Porto Rican Ground Dove. Tinaja Hill. May 28, 1922

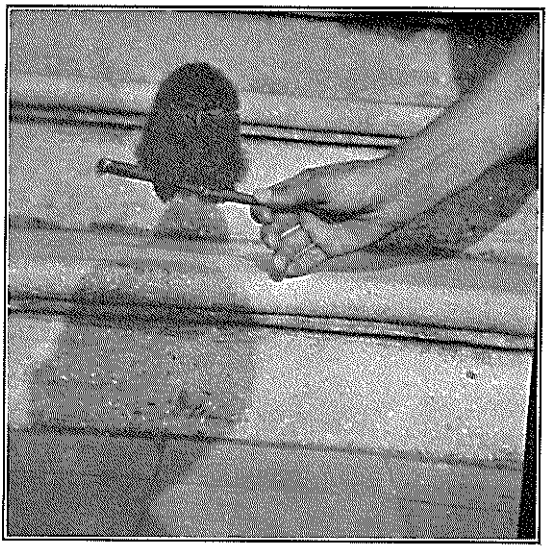


FIG. 40.—Downy Young Bare-legged Owl. May 1922

FIG. 41.—Nest of Porto Rican Grackle in Cat-tails

Ani is quite helpless in a strong wind. Anis usually seem quite peaceful, but once (May 23, 1924) I observed two birds fighting on the ground. With ruffled feathers they would advance to meet each other, emitting guttural *kr-rick* sounds. This kept up until one gave the other a sound jab and caused it to fly away.

The Ani apparently has no well-defined breeding season, as birds may be found breeding at all times of the year. Near the lagoon most of the nests are built in bamboos. They are bulky affairs constructed of sticks and bamboo leaves. From December 4 to 11, 1923, I watched a nest in construction about 12 feet from the ground in an isolated bamboo clump in the open-fields association about 100 yards north of the lagoon waters. A flock of thirteen Anis were interested in it. The bamboo leaves used for construction were still green. Many individuals apparently assisted in the work, yet it proceeded slowly, as they were not very diligent workers. Unfortunately the birds deserted after the first time that I casually climbed up to the nest, so I did not have the opportunity of observing the eggs and young. When the nest was approached the whole flock would gather around and utter complaining calls. I am told by reliable observers that as many as twenty eggs are found in a nest.

On September 30, 1924, I found a young Ani on the ground under some bamboos. It was unable to fly. The wing and tail quills were about half grown. The rest of its plumage consisted of black and white natal down, giving the bird a somewhat ludicrous resemblance to an immature Barred Rock fowl. A large area in the middle of the breast was bare. A flock of seven or eight adults in the bamboos overhead showed great solicitude for its welfare, flying around anxiously and "yelping" until I was some distance away. Many juvenile birds were noted in the Varronias during the summer and fall months. A juvenile male 9.25 inches long collected there October 7, 1924, had not quite finished acquiring its first plumage; a tittle natal down was left. The wing quills were barely long enough to permit it to fly. Despite the small size of the bird, its oil gland was fully as large as that of adult birds.

The Ani feeds so extensively upon the ground that undoubtedly some are eaten by the Mongoose, but they are very quick to observe danger, and if one bird in the flock gives the alarm note the rest all fly immediately, so they seem to be able to maintain their own pretty well against the Mongoose. Their flesh has a peculiar odor, so they

are not sought by hunters as food. Altogether, their enemies are few, so they flourish and are abundant.

The Ani eats almost anything living that comes its way, although it is particularly fond of Orthoptera. In addition, it does not refuse fleshy fruits it they are conveniently obtained. In the field Anis may often be observed eating insects of many kinds and occasionally fruits. I have even observed one swallowing a large mouse entire. It alighted on a wire fence to do it, and had to strain and gulp considerably before the mouse slipped down.

Seven Anis were collected at Cartagena Lagoon and their stomach contents examined. Animal matter formed 99.57 per cent of the food, and the remaining 0.43 per cent consisted of the seeds of fleshy fruits. Twenty-five Mole Cricket nymphs were found in two stomachs, and formed 19.1 per cent of the animal matter. Grasshoppers formed 19.3 per cent and cockroaches 17.9 per cent. Other items found in smaller quantity were:

Naucoridae *(Pelocoris femoratus)*	0.57 per cent
Corixidae *(Corixa reticulata)*	0.14 per cent
Beetle *(Ceratoma ruficornis)*	0.14 per cent
Earwig	0.14 per cent
White flower spider	0.28 per cent
Cave Crickets *(Rhadiphorinae)*	0.71 per cent
Fleabeetles *(Disonycha laevigata)*	0.14 per cent
Fleabeetles *(Cryptocephalus tristiculis)*	0.28 per cent
Fleabeetles *(Oedionychus cyanipennis)*	0.14 per cent
Smooth green caterpillars	8.85 per cent
Lepidopterous pupae	0.71 per cent
Dytiscid larva	1.4 per cent
Blue damselflies	1.4 per cent
Metamasius hemipterus	0.28 per cent
Wasp	0.28 per cent
Sesban weevils (*Tyloderma* sp.)	0.14 per cent
Calosoma beetle	0.28 per cent
Other Carabidae	1.4 per cent
Sugar cane root borers *(Diaprepes spengleri)*	0.71 per cent
Dragonfly naiads	2.57 per cent
Noctuid moths	4.7 per cent
Black feathers (probably its own)	0.71 per cent
Hydrophilid larvae	0.47 per cent
Spider (*Aranea* sp.)	0.47 per cent
Noctuid caterpillars	1.4 per cent
Ambush bug	0.71 per cent
Spider	0.71 per cent

The Ani is thus shown to be a rather omnivorous eater as far as animal matter is concerned, and it is attracted to the lagoon by an

abundance of food rather than by any special love of marsh conditions. It is only slightly more abundant at the lagoon than in the Island in general. It is highly beneficial in its food habits. It is a valuable species, and it is fortunate indeed for the agriculturist that it is as abundant as it is. Would that it were even more abundant.

60. *COCCYZUS MINOR NESIOTES* (Cabanis). Mangrove Cuckoo. *Pájaro Bobo.*

The Mangrove Cuckoo is a rare bird at Cartagena Lagoon, where I have observed it only in the Varronia association. It is a resident species, not very common on any part of the Island. I have observed it most frequently in the vicinity of Mayagüez, where it is not unusual to see and hear it in the coffee *fincas*. The call notes are similar to those of the Yellow-billed Cuckoo. I collected a male with much enlarged testes in a coffee *finca* near Mayagüez on June 24, 1924. Its stomach contained two sugar-cane root-borers, (*Diaprepes spengleri*) and a little debris. One observed in the field was catching moths in an orange grove. Dr. Wetmore (1916, p. 57) found this to be one of the most beneficial birds on the island on account of its propensities for devouring Coleoptera and injurious caterpillars. It is unfortunate that it is not more abundant.

61. *TODUS MEXICANUS* (Lesson). Porto Rican Tody. *San Pedrito. Medio Peso.*

The Tody is never found in the marsh proper, but one pair lives in the Bamboo association, and I have observed a number on Tinaja Hill. It is common over most of the Island, particularly so in the coffee *fincas*. Todies are very tame birds, and I believe it would be possible to catch them in an insect net. They are usually found in the undergrowth at a height of from four to ten feet above the ground. Their usual call note is a loud, grating, rather nasal *pcent*. Sometimes they break out into a series of harsh squeaky sounds. They perch motionless on some bare twig or other exposed position, and dart out after insects on the wing in flycatcher fashion.

Todies nest in holes in banks. Their nest holes are often observed, but I have never dug out one. They are generally dug in the faces of steep banks of the red clay which is characteristic of the humid regions of Porto Rico. The holes are said to go in straight for a short distance, and then turn at right angles to the right or left. From three to four white eggs, very large for the size of the bird, are said to be laid (cf. Gundlach, 1878, p. 219; Wetmore,

1916, p. 64). Apparently the nesting season begins in March and extends to June or July.

The food of the Tody consists mostly of insects, though some vegetable matter is eaten. The stomachs of three birds collected at Mayagüez in December were examined. Animal matter formed 97.66 per cent, and vegetable matter 2.34 per cent. Two large flies (*Volucella obesa*) formed 17 per cent of the animal matter; a cockroach ootheca, 13.3 per cent; weevils, 5 per cent; earwigs, 10 per cent; fleabeetles (*Phyllotreta guatamalensis*), 6 per cent; Membracidae, 5.3 per cent; large insect egg, probably of a moth, 1.6 per cent. The rest of the animal matter consisted of insects too finely comminuted for identification. The vegetable matter consisted of seeds, among which those of the fresa (*Rubus sp.*) were identified. The Tody is a very useful species to the coffee grower, and deserves absolute protection.

62. *STREPTOCERYLE ALCYON* (Linnaeus). Belted Kingfisher.
Pájaro del rey.

The Belted Kingfisher is a common winter visitant to Porto Rico from September to April, but it is decidedly uncommon at Cartagena Lagoon. It is much more frequenly seen along the seacoast and in the mangrove swamps. All my Cartagena Lagoon records are between September 23 and October 14, 1924. At least two individuals were present during that time. At Anegado Lagoon I observed this species on March 4 and April 1, 1922. My latest spring record for the Island is April 11, 1922, at Quebradillas. It is my belief that the scarcity of the Kingfisher at Cartagena Lagoon can be accounted for by the scarcity of suitable perching places over the water, nothing higher that a fence post being available. Those that do frequent the lagoon hover with rapidly beating wings, but without changing their position, at a height of about 25 feet over the water in Sparrow-Hawk fashion before diving. Apparently they feed on Killifish (*Pœilia vivipara*), as when they dive they come up with small fish and this is the only common species of small fish at the lagoon. The Kingfisher is greatly sought by hunters on account of its striking appearance rather than the delicacy of its flesh. The fish taken are not of value as food for man, so it is not directly injurious.

63. *MELANERPES PORTORICENSIS* (Daudin). Porto Rican Woodpecker.
Carpintero.

The Porto Rican Woodpecker is very rare at Cartagena Lagoon

if it occurs there at all. I have never seen any there, but I have seen one on some dead stubs at Anegado Lagoon, and have no doubt that the species at least occasionally visits the larger trees in the Varronia association.

The Woodpecker is common wherever there are many trees, particularly in the coffee *fincas,* where it inhabits the large trees which are grown to shade the coffee. It has a great variety of call notes, the commonest of which is a slightly metallic, but not sharp, series of *works.* It suggest to some the sound of a large muffled sleighbell in the distance. In the spring some call notes suggesting the syllables *wit, wit wit-er-r-r-r-* are heard. Other notes heard at times are a series of *kuks* somewhat like the clucks of a hen, and a sound somewhat resembling the mews of Catbird, but having also a resemblance to the cry of the Sparrow Hawk.

For nesting purposes the Woodpecker excavates a hole in a dead tree. One that I observed in use at Quebradillas was in a dead cocoanut palm, while one at Mayagüez was in dead almendro (*Terminalia catappa*). Both were at heights of about 20 feet above the ground. The hole in the almendro was already occupied in February, but no young birds on the wing were noted until June.

The stomach contents of a male collected at Mayagüez September 25, 1924, were examined. It had eaten entirely animal matter, of which wood-boring Longicorn larvæ formed 90 per cent; a Tenebrionid beetle, 5 per cent; and an adult Longicorn, 5 per cent. Woodpeckers are peculiarly useful birds, obtaining insects which bore in the wood or live under the bark, which few other birds are adapted to obtain. This is the only woodpecker found in Porto Rico, so it should by all means receive all protection. It is possible that in some cases they might do damage by boring in cocoanut palms or other trees, in which case those individual birds should be destroyed.

34. *CHORDEILES VIRGINIANS MINOR* (Cabanis). Cuban Nighthawk.
Capacho.

The Cuban Nighthawk is an uncommon summer visitant, and may nest in the vicinity, though I have no direct evidence of this. On three occasions on cloudy afternoons I have observed a single bird flying over the lagoon. These days were May 27, June 7 and 28, 1924, and moreover, these are my only records for the Island. Stahl (1887, p. 451) states that it is a rare summer visitant, found from April to October, and that it nests on the Island. It is certainly rare.

65. *NEPHOECETES NIGER NIGER* (Gmelin). West Indian Black Swift. *Golondrina.*

The Black Swift is a rare resident in Porto Rico,. and Struthers (1923, p. 475) observed it at Cartagena Lagoon on August 29, 1921, and February 4, 1922. It has never been my good fortune to observe it there, though I observed a flock of forty over the then dry Anegado Lagoon on March 29, 1924. That is a greater number than I have seen on the rest of the Island during nearly two years' residence. This species is never observed except in the early morning and just before dusk. It is most commonly observed from May to July. In addition to Anegado Lagoon I have records from Mayagüez (various dates from March 31 to July 28); Filial Amor (May 16); Guaniquilla (June 28). It is usually observed either singly or in flocks of three. Dr. Wetmore (1916, p. 74) reports that two Black Swif stomachs contained only injurious insects. Swifts are among our most useful birds, and as this is the only swift found in Porto Rico it is regrettable that it is not more common.

66. *CHLOROSTILBON MAUGAEI* (Audebert and Vieillot). Porto Rican Emerald. *Zumbador. Zumbadorcito.*

The Porto Rico Emerald, the smallest Hummer found in Porto Rico, is occasionally observed at Cartagena Lagoon, though more abundant in more wooded regions. It is about half an inch shorter than the familiar Ruby-throat of the North. At the lagoon it is most often seen in the Varronia association or in the bamboos, or else flying across the marsh enroute to one or the other. At Mayagüez it is much commoner. Among its favorite flowers are those of the Rangoon Creeper. It is sometimes observed at sugar cane flowers. It is frequently seen gathering something, presumably insects, from the under sides of banana leaves. On January 25, 1924, I observed one hovering at a tree fern trunk for as long as three minutes. Whether it was obtaining some minute insects for food or some of the fluffy, scaly material on the trunk for nest material I cannot say, but I believe insects were more likely the object of its quest as it did not appear to have anything in its bill when it flew away. They are very quarrelsome birds, and bold despite their small size. A pair which apparently had a nest on the Experiment Station Grounds at Mayagüez in May, 1924, often scolded and pursued a Sparrow Hawk which fed in the vicinity, but the hawk never appeared to notice the angry little Hummer.

The stomach of a bird which I obtained at Mayagüez December 20, 1923, contained only a microscopic chalcid fly, and that of one

collected June 30, 1924, contained a mass of microscopic fragments of what appeared to be very small Diptera.

67. *ANTHRACOTHORAX VIRIDIS* (Audebert and Vieillot). Green Mango. *Zumbador. Zumbador Verde.*

The Green Mango is the Hummer most regularly seen at Cartagena Lagoon, though at most places in the coastal lowlands the Porto Rican Mango is by far the commonest species. A pair of Green Mangos apparently nested in or near the bamboos lining the stream just west of the lagoon, and they were sometimes seen flying over the marsh, though they did not appear to obtain any food there. In the humid part of the Island this is largely a species of the coffee *fincas*. A male which I frequently observed in the hills between Mayagüez and Añasco could almost always be found perched on a certain dead twig of one of the orange trees which occur frequently scattered among the coffee bushes and shade trees of the coffee *fincas*. In the early mornings while the woods were still dripping from the drenching rains of the previous afternoon he could be observed occupying a higher perch in the top of the same tree, sunning himself and preening his feathers. During the day he would occasionally make feeding tours, always returning to the same perch. Rangoon Creepers are perhaps the favorite flowers of this species, as of the other Hummers. It also obtains food from the under sides of banana leaves. When the Rangoon Creepers are in full blossom I have seen as many as four males feeding at once at one small patch, but when too many fed near together there was always fighting, accompanied by sharp squeaks.

68. *ANTHRACOTHORAX AURULENTUS* (Audebert and Vieillot). Porto Rican Mango. *Zumbador.*

The Porto Rican Mango, although the commonest Hummer in most of the coastal lowlands of Porto Rico, is the rarest at Cartagena Lagoon, where I have only one record, that of three birds seen flying over the lagoon on October 14, 1924. At Anegado and Guánica Lagoons this species is really abundant, and it is very common in the brushy growth back of the beach at Boquerón and at Mayagüez and other places near the coast, though less common in the hills than *A. viridis*. Among its favorite flowers are those of the Rangoon Creeper; the Guango or Rain Tree (*Pithecolobium saman*); the orange-flowered *Leonotis nepetaefolia*, and sugar cane. I have also observed them probing cotton bolls. They are very pugnacious birds, and squeak loudly when quarreling.

FIG. 42.—Nest of Porto Rican Grasshopper Sparrow. Open Fields Association

FIG. 43.—Guinea Grass, Favorite Food of Weaver Finches

FIG. 44.—Female Porto Rican Golden Warbler on Nest in Cat-tails

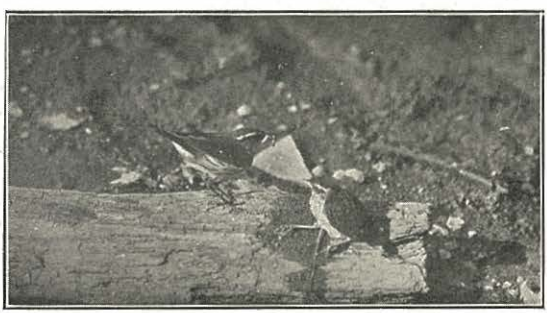


FIG. 45.—Louisiana Water-thrush Feeding Young, at Ithaca, N. Y. This species occurs as a winter visitor in Porto Rico

On April 1, 1922, I found a freshly completed nest ready for eggs at Anegado Lagoon. It was placed in the fork of a small branch of a thorny tree, at a height of five feet from the ground. It was constructed of fresh green lichens and cat-tail down, and was about twice as large as any Ruby-throat nests I have seen in the United States. The owners were buzzing angrily around while I investigated the nest.

I collected four Porto Rican Mangos (a female at Mayagüez, December 21, 1923; a male at Boquerón, March 8, 1924; and two males at Guánica Lagoon, October 3, 1924). Animal matter formed 97.5 per cent of their food, and vegetable matter 2.5 per cent. The vegetable matter was all rubbish. Of the animal matter, the following were identified: Small brown ants, 6.2 per cent; flower spiders (*Misumena* sp.) 8.9 per cent; Dolichopodid flies (*Psilopus* sp.), 12.5 per cent; Cecidomyid flies, 6.1 per cent; other Diptera, 10 per cent; small Dipterous larvæ, 1.2 per cent; Chalcids, 10 per cent; small bees, 7.5 per cent; small Coleopterous fragments, 16.2 per cent. The insects eaten appear to be injurious with the exception of some of the small Hymenoptera.

69. *TYRANNUS DOMINICENSIS DOMINICENSIS* (Gmelin). Gray Kingbird. *Pitirre.*

The Gray Kingbird is an abundant permanent resident at Cartagena Lagoon. It feeds in all parts of the marsh, but is most abundant in the Varronia association. It nests in the Varronia, Tachuelo and Bamboo associations; in fact, wherever there are any trees. It is a noisy bird, and is heard constantly from morning to night until one becomes almost tired of hearing them. The native name "pitirre" is an imitation of the call note. It is the earliest bird to awaken in the morning with the exception of the Antillean Killdeer, though the Jamaican Mockingbird and the Porto Rican Petchary follow soon afterwards. They are very pugnacious, and are continually pursuing Hawks, Blackbirds, Vultures, Killdeers, Sandpipers and other birds. They are expert at catching insects in the air, and are one of the few birds which can catch dragonflies on the wing. I have even seen one catch one of the large green and black species, the swiftest of all the dragonflies at the lagoon. Although catching a large part of their food on the wing, the Pitirre often descends to the ground to pick up insects. Once a Pitirre was observed catching flies that swarmed around a rotten fish. They often swoop down to the surface of the water either to drink or to pick up aquatic insects or both, making a little ripple as they do so.

This species is found in practically all parts of the Island, from the mountain tops to the sea, but is most abundant along the semiarid south shore, and is very scarce in well-wooded areas.

The nesting season apparently extends from April through June or into July. The nests are placed in trees at a height of from ten to twenty feet from the ground. They are cup-shaped affairs, made of twigs and lined with coarse grasses. Three eggs are the usual number. A vari-colored species of cockroach (*Aglaopteryx diaphana* Fabricius) abounds in the Pitirre nests, living among the twigs, also a cricket and a black and yellow ant.

The stomachs of two Gray Kingbirds from Cartagena Lagoon and of one from Mayagüez were examined. The lagoon birds had eaten exclusively animal matter. Inclúded in this were two large wasps (*Odynerus* sp.), 45 per cent; one small wasp, (*Megacanthopus* sp.), 5 per cent; one Sesban weevil (*Tyloderma* sp.), 3 per cent; 1 jumping spider, 5 per cent, and the rest was insect matter too finely comminuted for identification. The Mayagüez bird had eaten a large blue wasp and the fruit of a Cucurbitaceous vine. The Gray Kingbird has a great fondness for Hymenoptera, but as Dr. Wetmore shows (1916, p. 76) it also eats many injurious insects, and is an extremely useful bird.

The Gray Kingbird is no more abundant at Cartagena Lagoon than it is in the surrounding country. Open country is the chosen habitat of this species, and wherever there is open country it abounds.

70. *TOLMARCHUS TAYLORI* (Sclater). Porto Rican Petchary. *Clérigo.*

The Porto Rican Petchary is a very rare bird in the region of Cartagena Lagoon. My only two records are of birds seen in the Bamboo Association April 11 and August 23, 1924. At Mayagüez it is a common species, and I have also observed it at Anegado Lagoon, Guayabal, Peñuelas, near Aibonito, near Santa Isabel and near Utuado. It is most abundant in well-wooded regions, including the coffee *fincas.* In general appearance this bird is quite similar to a Gray Kingbird with a dark brown substituted for the gray of the upper parts, appearing almost black on the head. It is a less aggressive species than the Gray Kingbird, and is seldom observed pursuing other birds. The notes are louder and harsher, but are not uttered as constantly throughout the day, although they are very noisy for awhile at daybreak. They are slightly more noisy in the breeding season than at other times. A bird was observed

carrying nesting material at Mayagüez on February 9, 1924, but I have never actually observed the nest of this species. I did not examine any stomachs of the Petchary, but Wetmore (1916, p. 80) found it to be an extremely beneficial species. Its scarcity at the lagoon is accounted for by the lack of woods.

71. *MYIARCHUS ANTILLARUM* (Bryant). Antillean Flycatcher. *Jüi.*

The Antillean Flycatcher is another species which is very rare at Cartagena Lagoon, though rather common in other parts of the Island. My only record at Cartagena is that of a bird heard in the Varronia association April 22, 1924. At Mayagüez it is a rather common species, and it is much commoner at Anegado than at Cartagena Lagoon. I have also observed it at Juana Diaz. Its native name *jüi* (pronounced *whee* in English) is an imitation of its unmistakable note. It is most common in coffee *fincas* or other places where there is dense cover. It is a quiet and somewhat secretive species and is easy to overlook unless heard. It catches insects on the wing. It is said to nest in holes in trees. The stomach of one bird collected at Anegado Lagoon March 29, 1924, contained a brilliant red and green Scarabeid beetle, 60 per cent; miscellaneous insect fragments, 32 per cent; and a few small berries, 6 per cent.

72. *BLACICUS BLANCOI* (Cabanis). Porto Rican Pewee. *Bobito.*

Although I have no actual Cartagena Lagoon record for the Porto Rican Pewee, it would be surprising if it does not occur occasionally in the Varronias, as it is found in similar situations in other parts of the Island. It is principally a bird of the coffee *fincas* and other regions with dense cover. It perches on dead twigs and makes short flight after insects in true Pewee style. Its call note has been well described by Wetmore (1916, p. 83) as "a low tremulous *pree-e-e-e.*" The birds are very easily overlooked unless calling, and the call note is so inconspicuous that one is apt not to notice it until his ears are trained to hear it. The stomach of a bird taken at Mayagüez June 24, 1924, contained 60 per cent of animal matter and 40 per cent of vegetable matter. The animal matter consisted of two Membracids (80 per cent); fleabeetles, 4 per cent; and a small Lepidopterous larvæ, 16 per cent. The vegetable matter consisted of 30 seeds, apparently of some fleshy fruit or berry.

73. *AGELAIUS XANTHOMUS* (Sclater). Yellow-shouldered Blackbird. *Mariquita.*

The Yellow-shouldered Blackbird is a common resident at Cartagena Lagoon. It comes to the marsh to feed, but nests in trees away from the marsh proper. It lives in flocks at all times of the year. The flocks are of small size during the greater part of the year, but after the breeding season in June flocks containing as many as 250 individuals are observed feeding in the canefields. Flocks of *Holoquiscalus n. brachypterus* often contain a few of this species They feed in all the plant associations of the marsh except the open water, and they also feed in places far from the marsh, though not so commonly. None are found in the higher mountains.

When a bird is shot and injured its comrades gather around with sharp cries. The ordinary call note is a rather sharp metallic *chink,* and they also have a typical blackbird *chuck.* The song is a rather wheezy affair and is seldom heard. Near the lighthouse at Cape Rojo many of these birds congregate in the mangroves at dusk to roost.

The nesting season is in May and June. Where Cocoanut and Royal Palms are found the nests are placed in the axils of the large leaves. Near Cartagena Lagoon where palms are scarce these birds nest in colonies in the larger trees of the Varronia association, often in the same trees with the Grackles, at a height of about thirty feet from the ground. The birds are very noisy when their nests are approached, uttering sharp, high-pitched scold notes. Some young were on the wing by May 28, but others were still in the nest the middle of June. A female collected October 14, 1924, was molting badly.

The Yellow-shouldered Blackbird apparently has but few enemies, as it places its nests in quite inaccessible positions, and it is seldom shot at. The Mongoose undoubtedly obtains a few while feeding on the ground.

A flock of these birds lived near a poultry yard at the edge of a small swamp at Mayagüez, and fed on what grain they could pick up, supplemented by a little food obtained in the swamp. These birds also probe the blossoms of Guamá (*Inga laurina*) and Bucare (*Erythrina* sp.) and other trees for insects and apparently for nectar.

Animal matter formed 92.2 per cent of the food in the stomachs of five birds collected at Cartagena Lagoon in April and October, and vegetable matter 7.8 per cent. The vegetable matter consisted

of finely ground seeds, among which were those of Malojillo Grass (*Panicum barbinade*) and Foxtail Grass (*Chaetochloa*) were identified. The animal matter eaten was quite varied. Items identified were: Aphids, 11.6 per cent; weevils (*Tyloderma* sp.), 4.6 per cent; Fleabeetles (*Systena basalis*Q, 6.0 per cent; Longicorn beetles, 8 per cent; other Coleopterous fragments, 18.4 per cent; Naucoridæ (Pelocoris femoratus), 1.6 per cent; Notonectidæ (*Notonecta undulata*), 1 per cent; aquatic Stratiomyid larvæ, 9 per cent; Syrphid adults, 5 per cent; two leaf-rolling caterpillars (*Dichomeris* sp.), 1 per cent; other Lepidopterous larvæ, 17.6 per cent; fish scales, 1 per cent. The moth *Dichomeris* belongs to the same family (Gelechiidæ) to which the Pink Bollworm belongs. In addition to the food, gravel was found in four out of the five stomachs, but formed only 2.2 per cent of the total contents.

The Yellow-shouldered Blackbird, though closely related to the Red-winged Blackbird, exhibits striking differences in its choice of nesting sites. Although it feeds more commonly in the marshes than elsewhere, it resorts to tall trees, usually at some distance from the marsh, to nest. It is quite an omnivorous feeder, and apparently frequents the marsh more because food is more abundant there than from any special liking for aquatic food or adaptation for life in the marshes. In other words, it has not acquired the "marsh habit" strongly enough to nest there or to restrict its feeding to the marsh, and in this respect it is probably more like the ancestral stock from which both the Yellow-shouldered and the Red-winged Blackbirds have descended.

74. *ICTERUS PORTORICENSIS* (Bryant). Porto Rican Oriole. *Calandra. Mariquita.*

The Porto Rican Oriole is an uncommon resident at Cartagena Lagoon, where it is found only in the Varronia and bamboo associations. It is a common species at Mayagüez, and at most places in the humid regions of the Island, from the high mountains to the sea, and it is not at all uncommon in the semiarid south coastal region where there is sufficient brushy growth to provide suitable shelter.

This species is easily confused with the Yellow-shouldered Blackbird by the beginner, but it is easily distinguished by having a yellow crissum in addition to the yellow shoulders. The sexes are alike, but immature birds are plain greenish brown. Specimens in interesting pied plumage are sometimes observed. I obtained a male in such a plumage at Cartagena Lagoon on March 21, 1924. While feeding

these Orioles often swing with their heads down. They often visit blossoming trees, apparently to obtain nectar and flower-frequenting insects.

The Porto Rican Oriole is perhaps the best singer among the Porto Rican birds, in fact it is almost the only one which can be said to have a musical song, but unfortunately it seldom sings. The lack of bird song is one of the most noticeable features of Porto Rico. The Oriole has two very distinct songs. The commoner one is a clear, highpitched whistle of several notes delivered in a somewhat rambling fashion. The other is a quickly uttered series of four notes strongly accenting the third, thus: *Whip, whip, WHEE-ah.* I am inclined to believe that the second song is the song of the female. Christy (1897, p. 325) records the singing of the young female in transitional plumage of *Icterus dominicensis*, a very closely allied species found in Santo Domingo, and states that its song differs from that of the male, so it would not be unreasonable to suspect that the Porto Rican species does likewise. The season in which this species sings is from February to May. On very rare occasions songs are heard at other times of the year. The breeding season is apparently quite extensive. I have observed young able to fly being fed by the parents at Mayagüez on December 8, 1924. They made a great fuss when the young were approached too closely. On December 18, another pair was observed feeding young.

The stomach contents of four Porto Rican Orioles were examined. Two collected at Cartagena Lagoon in March and September contained 99 per cent of animal matter and 1 per cent of vegetable, the latter consisting of a little rubbish. The insect matter identified included a Tortoise Beetle, (*Chelymorpha*), 6 per cent; a Lamellicorn beetle, 6 per cent; a green Chrysomelid, 4 per cent; a weevil, 8 per cent; other Coleopterous fragments, 5 per cent; cockroach fragments, 1.5 per cent; parts of a butterfly, 1.5 per cent; and a small fly, 0.5 per cent, but most of the contents were too finely comminuted for identification. One grain of white sand was found in one of these stomachs. A specimen collected at Guánica Lagoon October 3, 1924, had eaten two Carabid beetles, 40 per cent; 1 weevil, 20 per cent; 1 Bupestrid, 20 per cent; and other beetle fragments formed 20 per cent. A bird collected at Mayagüez December 25, 1923, had eaten 1 sugar-cane root-borer (*Diaprepes spengleri*), 12 per cent, and 12 small fleshy fruits, 88 per cent.

75. *HOLOQUISCALUS NIGER BRACHYPTERUS* (Cassin). Porto Rican Grackle. *Mozambique. Chango. Pichón prieto.*

The Porto Rican Crackle is one of the most abundant residents at Cartagena Lagoon. It feeds in all the plant associations except the open-water, and nests in the cat-tail and Varronia associations.

This is the commonest bird of the coastal lowlands of Porto Rico. It is found less commonly in the foothills, and I have never seen it in the mountainous interior of the Island. It is particularly abundant around cultivated fields, where it is generally regarded as the most beneficial species on the Island on account of the injurious insects which it destroys. When the canefields are plowed flocks of these birds may almost always be seen following the plow to pick up white grubs, mole crickets and other insects that are turned up by the plow.

The tail of this species has a peculiar form, the lateral tail feathers being elevated above the level of the intermediate ones, forming a letter V. This is particularly noticeable when the birds are in flight, making them appear almost deformed. Their notes include a grackle-like *chuck* and a great variety of squeaky notes.

These grackles are almost always found in flocks. In fact, they are of so social a nature that several pairs usually place their nests near together, many nests being found in the same tree. The ordinary nesting place is in large trees, usually palms when these are available. Near Cartagena Lagoon where there are but few palms they nest in Jobo trees (*Spondias nombin* L), West Indian Elms (*Guazuma ulmifolia* Lam.), Ceibas, (*Ceiba pentandra* L.), and other trees, often placing their nests among the parasitic plants which grow commonly on the branches. One ceiba tree near the lagoon contained a colony of 25 nests. Having become accustomed to seeing mozambiques nesting in tall trees, I was much surprised when I discovered them nesting quite commonly in the cat-tails at the lagoon, at heights of about four feet above the water. The nests are built of grass and roots and mud is often used in their construction. The largest number of eggs I have found in a set is five, and four appears to be the common number. The eggs are very variable in color and markings, but most of them have a putty-colored background marked with brownish-red scrawls and blotches. I have found nests from April to August, and I believe that some may nest even later. All of the many cat-tail nests found were broken up before the young hatched, mostly by boys who wantonly destroyed the eggs. They could not resist the temptation of seeing an egg of any kind and

taking it, even though too small to eat. Small eggs and eggs with large embryos were simply broken and destroyed. It is a very pernicious habit, and everything possible should be done to combat it. Possibly more nature work in the schools would teach the children to have more respect for wild animals.

I noted young birds being fed by an adult at Mayagüez as late as January 8, 1924.

For several years there has been a Mozambique roost in some cocoanut palms on the shore at Peña Cortada, a short distance north of Mayagüez. Towards dusk many long straggling flocks of these birds can be seen flying north just back of but parallel to the beach, sometimes just above the tops of the cocoanut palms which line the beach, sometimes just below them. At least 3,000 birds were using this roost in October, 1924, and probably many more than this. Ccuntry people who live near the roost say it is used at all times of the year.

Although the Mozambiques are useful in destroying insects they also have a less desirable habit of feeding on the lizards (*Anolis*) which so abound in Porto Rico. They have a very clever method of catching these. In describing this habit I cannot do better than to quote from notes made by my father, Prof. Ralph E. Danforth, of the Agricultural College at Mayagüez. "The Mozambiques pursue the lizards on the trees, surrounding the trunk so that the lizards are caught unless they get into the grass in time. Sometimes they try to hunt singly, but seem more successful when several work together. Sometimes hens profit by the work of the Mozambiques, and follow them from tree to tree to seize the lizard the moment the Mozambique drives it down. But even so, many of the lizards escape into hiding. When a Mozambique catches a lizard it flies to a branch and holds the lizard in its feet against the branch while it squeezes the life out of it with its bill, pinching it rapidly from end to end by a series of quick pinches. Then it takes it in its bill and passes it back and forth through the bill, from end to end, by a series of rapid motions like those made by a duck's bill in the water, and finally swallows it whole when it is sufficiently soft and limp." On the grounds of the Federal Experiment Station at Mayagüez there is a grove of closely planted Dwarf Bucare trees (*Erythrina corallodendron* L.), used as supports for vanilla vines. The Mozambiques spend a great deal of time in this grove hunting lizards, but they also hunt them on larger shade trees, such as the Mango.

At the lagoon the flocks of Porto Rican Grakles often contain a few Yellow-shouldered Blackbirds, and the two species place their nest in the same colonies in the large trees. In September and October many tailless molting birds are observed.

In a newly plowed canefield near the lagoon I observed a Porto Rican Grackle swallow a five inch centipede entire. These are very poisonous to humans. I have also seen one eating the seeds of the Cundeamor (*Momordica charantia*), though but little vegetable matter is eaten. Six stomchs of birds taken at Cartagena Lagoon in March, April and October were examined. These contained 94.5 per cent of animal matter and 5.5 per cent vegetable matter. The animal matter identified included the following: Cockroaches, 13.3 per cent; grasshoppers, 1.7 per cent; katydid (*Neoconocephalus*), 5 per cent; dragonfly, 1.3 per cent; adult Neuroptera (*Sialidæ*), 1.3 per cent; butterfly caterpillar, 1 per cent; moth pupa, 0.3 per cent; weevils, 8.3 per cent; Dytiscid larvæ, 5 per cent; Bupestrid (*Chrysobothrys* sp.), 1.7 per cent; tortoise beetles, 1.3 per cent; fleabeetles, 2 per cent; other Coleoptera, 26.3 per cent; bloodworms, 0.3 per cent; spiders (*Aranea* sp.), 1.3 per cent; slugs, 4.3 per cent; snails, 3.9 per cent; black down feathers (probably their own), 0.7 per cent; pieces of eggshell, 1.3 per cent; fish scales (*Poecilia vivipara*), 1.3 per cent (probably of dead fish picked up along the shore). The vegetable matter, in addition to rubbish, consisted of grass, 33 per cent; and seeds of *Panicum* sp., 33 per cent. One stomach contained a little coarse gravel, amounting to 1 per cent of the contents of that stomach. The stomach of a bird collected at Mayagüez in December contained no food but the pulp of some fruit, but it also contained some very large pieces of white gravel forming 20 per cent of the contents.

Thus it will be seen that the Porto Rican Grackle is quite an omnivorous bird, adapted to obtain food in swamps or on dry land, in humid or in semi-arid regions. It nests either in high trees or in the cat-tails of the marsh. It is a very adaptable bird, thriving under many varied conditions, though showing no special adaptations to any one of them. It is scarcely more abundant at the lagoon than elsewhere. Although apparently varying its diet occasionally with bird's eggs, and consuming many lizards at times, most of its food consists of injurious insects, making it a highly benefical species worthy of full protection.

76. *AMMODRAMUS SAVANNARUM BORINQUENSIS* (Peters). Porto Rican Grasshopper Sparrow. *Gorrión.*

This Grasshopper Sparrow is an uncommon resident in the fields just north of the marsh proper. The only other place on the Island at which I have found this species is in the dry fields near Guánica Lagoon. In 1924 there were apparently three pairs breeding in the open-field association at Cartagena Lagoon, although there was only one pair in 1922. The males usually sing on the ground, only on rare occasions mounting on weedstalks of slight elevation for this purpose. The song does not differ noticeably from that of the North American form. The birds appear to nest more or less throughout the year. Young on the wing were noted May 13; the young in a nest under observation hatched May 27, while specimens which appeared to be breeding birds were collected at Cartagena Lagoon August 13, 1924, and at Guánica Lagoon October 3, 1924.

The one nest which I found was built entirely of fine grasses, and was arched over like the nest of a Meadowlark. It was on the ground, largely concealed by a tuft of dry grass. It contained three eggs, similar to those of *A. S. australis,* on May 23, 1924. When the nest was approached the incubating bird scooted away from it like a rat running along the ground. The young hatched on May 27. On May 30 the young had small wing quills and some puffs of down and their eyes were open. On June 3 the nest had been crushed and robbed, apparently by that villain the Mongoose. Such is doubtless the fate of many a young Grasshopper Sparrow. The wonder it that any ground nesting birds are left in a region where the Mongoose is so abundant.

The stomach of the bird collected at Cartagena Lagoon in August contained about 50 small beetles amounting to 95 per cent of the contents. Ten grass seeds (*Chloris paraguaiensis*) formed the rest. Animal matter formed 98 per cent of the food of the Guánica bird, and consisted of 2 slugs (94 per cent); 1 weevil (2 per cent); 1 small Locustid Grasshopper (1 per cent) and finely comminuted insects (3 per cent). The vegetable matter (2 per cent) consisted of 3 seeds of *Panicum* sp. In addition, one large grain of sand was found in this stomach.

The Porto Rican Grasshopper Sparrow does not have a chance to become very common, as it prefers old fields, and the land is so intensively cultivated in Porto Rico that but few such fields are left for it.

77. *TIARIS BICOLOR OMISSA* (Jardine). Carib Grassquit. *Gorrión.*

The Crib Grassquit is a common resident at Cartagena Lagoon, where it inhabits the Varronia, Bamboo and open-fields associations, and nests in the first two mentioned. It is primarily a bird of the open country, but it needs a certain amount of cover for nesting purposes. A few are even found in dense woods. In most parts of the Island it is a very abundant species, being perhaps the most abundant species on the Island with the exception of *Coereba portoricensis* and *Holoquiscalus niger brachypterus.* It is found very abundantly in the canefields whenever there is cover nearby. The birds are not shy. The song is a harsh vibrating *zee-e-e-e.* They sing from exposed perches. The males sometimes spread their wings while singing. The call note is a low *tsip.* Small flocks of young may be noted at all times of the year, and the adults breed throughout the year. Apparently several broods a year are raised. The nests are globular affairs, made of grasses, sometimes with the addition of a little paper, and lined with finer grasses. They are quite similar to the nests of *Coereba portoricensis,* but the opening is always at the side instead of at the bottom as in those of the latter species.

The nests are placed in maya plants or shrub or trees at heights varying from a few inches to twelve feet from the ground. Usually they are well concealed, but occasional nests are found in very exposed positions. One such nest was placed at a height of one and a half feet in an orange seedling not over six inches from a much-used cement walk in Mayagüez. The birds paid for their folly by having their nest broken up when only two eggs had been laid (June 26, 1924). At Cartagena Lagoon the nests are placed in the mayas which grow in the Varronia association, or in the trees and shrubs which grow in that and the Bamboo association. The two highest nests I found there were one six and a half feet in a *Ricinella ricinella* tree, with three eggs on July 2, 1924; and one five feet in a bamboo with three eggs on October 11, 1924. The usual number of eggs laid is three. They are white, heavily spotted with red, especially at the larger end.

Only one stomach of this species was examined, that of a breeding male taken at Cartagena Lagoon. Its legs were badly infected with mites. The food consisted entirely of small seeds. In addition a feather, probably one of the bird's own feathers, and a little sand (5 per cent of contents) were found. In the field they have been observed to eat green leaves, especially those of *Hibiscus.* Field

observations indicate that grass seeds are the main food of this little finch. Large flocks appear when the Guinea Grass and Malojillo Grass seeds are ripe.

78. *TIARIS OLIVACEA BRYANTI* (Ridgway). Bryant's Grassquit.
Gorrión.

Bryant's Grassquit is a common species, though not nearly as common and less generally distributed than *Tiaris b. omissa.* At Cartagena Lagoon it is found rather uncommonly in the Varronia, Tachuelo and open-fields associations. It is more strictly a bird of the open country than the Carib Grassquit. It is commoner in the eastern than in the western half of the Island. It is found singly or in small flocks of three or four individuals. It is a little shyer than the other Grassquit, and can seldom be approached as closely. The males sing their weak trilling song, somewhat suggestive of a grasshopper, from some conspicuous perch. The call note is a faint *tseep.* I have never found their nests at Cartagena Lagoon, but believe that a few nest in the Varronia association. A male collected while singing there on September 17, 1924, had extremely large testes indicating breeding.

These little Grassquits appear to eat seeds almost exclusively. The one stomach examined from Cartagena Lagoon contained only seeds of some grass, possibly *Paspalum.* In the field they are observed to eat the seeds of Guinea Grass and other grasses.

79. *LOXIGILLA PORTORICENSIS* (Daudin). Porto Rican Grosbeak.
Come gandul.

The Porto Rican Grosbeak probably occurs occasionally in the Varronia association, though I have no actual records for the vicinity of the lagoon except upon Tinaja Hill just south of the lagoon. It is very common or even abundant in most places in the humid part of the Island where there are many trees, but it is so secretive in its habits that one seldom realizes how abundant it really is except when singing freely. Unlike most birds, it keeps well hidden while singing. It has two distinct whistled songs. That most frequently heard is a *whip, whip, whip, whip, whee-e,* becoming faint at the last syllable, which sometimes takes the form of a faint trill. This song has somewhat of a resemblance to the song of the Cardinal.

The other song is a very emphatic *coóchi, coóchi, coóchi, coóchi,* and is pitched a little higher than the other song. Birds singing this

song are sometimes answered by nearby birds with the other song. The scold note is a low metallic *wheent*.

I have never observed an occupied nest of this species, but on April 10, 1924, near Mayagüez, I found a deserted nest which could scarcely belong to any other species. It was a bulky affair built mostly of leaves, lined with grass, and placed about ten feet above the ground in a tangle of vines in a small patch of second-growth woods.

80. *SPINDALIS PORTORICENSIS* (Bryant). Porto Rican Spindalis. *Reina Mora. Llorosa.*

The Spindalis is a rare bird at Cartagena Lagoon, where I have found it only in the Varronia association. It is a common species in the hills and mountains of Porto Rico, but is rather inconspicuous and lives in secludes places so that it is rather infrequently observed closely, although not shy like the Grosbeak. Once I saw a male in a mangrove swamp near Boquerón. This species is usually seen either in pairs or in small family flocks. The call note is a weak but sharp *tsheep*. The Spindalis has a song, but it is so seldom uttered that Dr. Wetmore (1916, p. 122) supposed it had no song. I have heard it but once in two years. That was very soon after arriving on the Island, so I neglected to make notes on the song, thinking that I would surely hear it often and be better able to record it after becoming better acquainted with it, but the chance never came, so I cannot record it accurately. My impression is that it was a sprightly song of rather weak notes.

In the field I have observed a Spindalis picking aphids from the under side of the leaf of a Calabash tree (*Crescentia cujeta*). When fresas (*Rubus* sp.) were ripe many of these birds came to feed upon them. They also eat many wild fruits and seeds. They may occasionally do enough damage to fruit to warrant their destruction, but apparently they seldom do much damage to cultivated fruit.

81. *SPERMESTES CUCULLATUS CUCULLATUS* (Swainson). Hooded Weaver Finch. *Diablito. Gorrión.*

The Hooded Weaver Finch is a West African species which was introduced in Porto Rico many years ago. It is now very generally distributed over the lowlands of Porto Rico, though much less common in the semiarid southern coastal region. It is quite uncommon at Cartagena Lagoon, and all my records are for the Bamboo association. At Mayagüez it is a very common species. Large flocks congregate

where Guinea Grass (*Panicum maximum*) and Malojillo (*Panicum barbinade*) and other grasses are going to seed, often in association with Carib and Bryant's Grassquits and Scarlet-cheeked Waxbills. It apparently has no song, but a metallic call note with a burring quality is often uttered. While feeding these birds keep up an incessant chatter, though occasionally the whole flock will become quiet as though at a given signal. During the greater part of the year they are never seen except in flocks, which may be of considerable size, but in May and again in October many pairs are seen. On May 18, 1924, I observed the beginning of the construction of a nest in the top of a Royal Palm at Mayagüez. The female was bringing the grass stems and putting them in place while the male looked on. The next time I observed this nest (exactly a month later) the young were making so much noise in the nest that I should judge they were about ready to leave. On July 8 adults were noted feeding young not far away. Apparently a second brood is raised in the fall, for paired birds are again seen. On October 12, 1924, I observed one carrying grass into a Royal Palm, but on October 19, shortly before I left for the States, the nest was not yet half finished. No birds were collected, but field observations indicate that grass seeds are the principal food.

82. *ESTRILDA MELPODA MELPODA* (Vieillot). Scarlet-cheeked Waxbill. *Veterano. Gorrión.*

The Scarlet-cheeked Waxbill is another weaver finch which was introduced from West Africa many years ago. It has never become as widely distributed as the Hooded Weaver Finch, being confined to the region from Yauco to Añasco, but it is very abundant in the part of this region from Yauco to Cabo Rojo, which includes Cartagena Lagoon. At the lagoon it is most frequently seen in the Bamboo, Varronia and open-fields associations, though it is not infrequently found feeding in the marsh proper, especially in the cattail and sedge associations. They are very frequently flushed in the canefields. They are quick and nervous in their actions. When alarmed they have a habit of bunching together and calling continually, though keeping well concealed in the foliage. When flushed they fly but a short ways before dropping into cover, calling loudly while in flight. Their call is a rather metallic chatter, instantly distinguishable from that of any other species on the Island. The males have a rather attractive song, but it is seldom heard. It is a

rollicking twitter, which might be set down as follows: *swee-sweet-sweét-er-er,* repeated several times in rapid succession.

Nothing has been recorded of the breeding of this species in Porto Rico, and I can find but scant reference to its breeding habits in its native home in Africa. Alexander (1902, p. 300) records finding nests attached to Elephant Grass in the Gold Coast Colony. Bates (1909, p. 52) writing on the birds of Cameroons says he has not certainly found the nest, but in speaking of E. atricapilla he says he believes that species and some others in the same subfamily are communistic, several females laying in the same nest. I had previously come to suspect that such was the case with *E. melpoda* in Porto Rico. The birds remain in flocks throughout the year, and apparently nest in the Varronia association. Once I thought I had a nest spotted there, but time prevented a thorough search to locate it exactly. When the spot was approached a flock of about eight birds, about five of them females, showed much concern. That, together with the fact that the bird are never seen except in flocks, started me thinking. Soon afterwards Mr. Antonio Ramírez, a student in the Agricultural College at Mayagüez, and a very accurate observer, told me that he has observed the nesting of this species many times near his home in Cabo Rojo. He says that they build nests in the bases of clumps of Yerba de Guinea (*Panicum Maximum*) and Yerba de Burro (*Elephantropus spicatus*), the nests appearing like a wad of grass, and that all the females in a flock lay in the same nest. He says that he has found as many as twenty eggs in one nest, and that they are plain white and quite round. I am now quite firmly convinced of the communistic habits of this species.

These little Waxbills are often observed feeding on the seeds of Guinea Grass and other grasses, sometimes in company with *Spermestes cucullata,* but when flushed each species flies off in a flock by itself. But this species apparently does not confine its diet to grass seeds as *S. cucullata* does, for it is more often seen feeding on other weed seeds. However, the seeds of Malojillo (*Panicum barbinode*) formed 98.3 per cent of the food in the stomachs of three birds taken at Cartagena Lagoon in March, September and October, and the rest were some small red unidentified seeds. In addition to the seeds the stomachs contained sand to the extent of 25 per cent of the total contents. Thus it is seen that it is a species of little economic importance, though flocks feeding in cultivated fields doubtless devour many noxious weed seeds.

83. *PROGNE DOMINICENSIS* (Gmelin). Caribbean Martin. *Golondrina de Iglesias.*

The Caribbean Martin is one of the two species which are definitely known to breed in Porto Rico but winter farther to the South. It is a regular and tolerably common summer resident in the vicinity of Cartagena Lagoon, the first spring records being January 6, 1922 (an exceptionally early date) and February 19, 1924. My latest fall record is September 3, 1924, at the lagoon (September 9 at Mayagüez). The Martins feed to a large extent over all parts of the marsh, but especially over the open water, and nest in some houses at some distance from the lagoon. During heavy showers I have observed these birds perched upon a leafless tree near the edge of the lagoon. At Mayagüez a small colony nests in the ruins of the old courthouse, abandoned after the earthquake of 1918. A few nest in the ventilator holes over the door of a small store on Santiago Veve Street, and a few apparently nest in the belfry of the Catholic Padres' House. Near Quebradillas I found a pair occupying a hole in a partially decayed cocoanut palm in April 1922. There is no apparent reason why this species should not become more abundant if it were supplied with nest boxes and martin houses similar to those used for *P. subis* in the States.

84. *PETROCHELIDON FULVA POECILOMA* (Gosse). Jamaican Cliff Swallow. *Golondrina de cuevas.*

The Jamaican Cliff Swallow is a common resident in the vicinity of Cartagena Lagoon, much scarcer in winter than at other times of the year. It feeds extensively over all the marsh associations. It is particularly fond of skimming low over the Persicarias, apparently feeding upon some of the thousand of moths and other insects which fly up when disturbed by a cow or other animal passing through them. In September tremendous flocks, consisting largely of young birds, appear. They alight on the telephone wires near the railroads, and small detachments at a time take feeding trips over the marsh. None of these swallows nest very near the lagoon, as there are no suitable nesting sites for them. They usually nest on overhung cliffs or in caves. On April 15, 1922, I had the opportunity of observing a nesting colony of about 500 pairs on the face of an inaccessible limestone cliff near Quebradillas. It was impossible to examine the nests closely, but by the actions of the birds I judged that some at least already had young. In August and September large flocks, often containing from 1,000 to 2,000

birds, mainly immature, may be observed on the wires in many localities in the western end of the Island. They feed over canefields much of the time.

These birds have a twittering song in addition to their ordinary soft call notes.

The stomachs of three birds collected at Cartagena Lagoon August 13, 1924, were examined. Animal matter formed 100 per cent of the contents. Engraver beetles (*Xyleborus* sp.), formed 2.6 per cent; fleabeetles (*Phyllotreta guatemalensis*), 1.6 per cent; other Coleopterous fragments, 44.2 per cent; wasps (*Polistes crinitus*) 13.3 per cent; ants (small, red-legged species), 3.3 per cent; mosquitoes (*Culex* sp.), 1.6 per cent. The rest of the insects were insects comminuted beyond identification.

85. *HIRUNDO RUSTICA ERYTHROGASTER* (Boddaert). Barn Swallow. *Golondrina.*

The Barn Swallow is a spring and fall migrant at Cartagena Lagoon, commoner in the fall than in the spring. Migration dates obtained are: May 4 to 14, 1922; March 1 to May 23, 1924; and August 26 to September 30, 1924. Cartagena and Anegado Lagoons are the only places in Porto Rico at which I have observed this swallow. On August 26, 1924, about 100 of them suddenly appeared. Their numbers kept steadily diminishing until on September 30 but three were seen, and after that none. They spend most of their time skimming over all the marsh associations, especially the open water. Occasionally they alight on the wire fence which crosses the lagoon. More than half of those seen in the fall are in immature plumage. Three were collected on August 26, 1924. Their stomachs contained exclusively animal matter. Engraver beetles (*Xyleborus* sp.) were found in all three stomachs and constituted 60 per cent of the contents. Other items identified were damselflies (5.3 per cent); deerfly (Chrysops vittatus), 0.66 per cent; Syrphid fly, 1 per cent; Fulgoridæ, 1 per cent; Pentatomid, 1.6 per cent. The indications are that this is a very useful species, as would be expected of a member of this highly insectivorous family. While passing through Porto Rico it appears to be restricted to the marshes.

86. *RIPARIA RIPARIA RIPARIA* (Linnaeus). Bank Swallow. *Golondrina.*

The Bank Swallow is a tolerably common spring migrant at Cartagena Lagoon, and I have also seen it at Anegado Lagoon. Migration dates obtained are March 4 (Anegado Lagoon) to April 8,

1922 (Cartagena Lagoon); and February 19 to April 30, 1924, at Cartagena Lagoon. It feeds exclusively over the marsh, and almost exclusively over the open water, either alone or associated with other swallows. Occasionally these birds light on the wire fence which crosses the lagoon. They occasionally utter a rather harsh, gurgling rattling sound, like pebbles rolling together. No stomachs were examined, but the food probably does not differ materially from that of the other swallows.

87. *VIREOSYLVA CALIDRIS CALIDRIS* (Linnaeus). Jamaican Vireo. *Julián chivi.*

The Jamaican Vireo is one of the two species known to breed in Porto Rico and winter further South. It is a tolerably common summer resident at Cartagena Lagoon, being found in the Varronia and Bamboo associations. It arrives later at Cartagena Lagoon than in the more humid regions. In 1924 I noted the first birds at the lagoon on March 17, while they had been common at Mayagüez since February 14. They are such constant singers that it is not easy to overlook them. My latest fall record is August 23, 1924, at the lagoon, and September 8 at Mayagüez. In appearance they are very similar to the Red-eyed Vireo. The song is also quite similar but more hesitating, louder and more emphatic. It seems as though the birds say *John to whit; sweet John to whit; John to whit; sweet John; John to whit.* The birds repeat this with such unvarying monotony from morning to night that where they are common one becomes tired of hearing about "John to whit" all day long, and after the day is over finds himself still doing things to the tune of "John to whit", uttered silently to himself. To one continental American living at Mayagüez this Vireo seems to say "Think you're pretty?" It is almost the only species that sings through the noonday heat of the tropical day. In addition to its song, it has a nasal *whee*, a complaining call note.

The only nest I have observed was found in the Bamboo association at Cartagena Lagoon. It was pensile, compactly constructed of Bamboo leaves and lined with fine grasses. It was placed in a horizontal crotch of a small *Andira inermis* tree at a height of seven feet above the then dry bed of the quebrada. When found on July 2, 1924, it contained three eggs. They were white with a few red spots and blotches at the larger end, and measured 21 × 15 millimeters (.81 × 55 inches). The incubating bird did not leave the nest until almost touched, and then stayed near uttering occasional complaining

notes. Circumstances prevented me from continuing observations of this nest.

Two birds were collected at the lagoon in April, 1924. The feet of one were very much deformed by a severe attack of mites. The stomachs of these birds contained 12.5 per cent of animal matter and 87.5 per cent of vegetable matter. Fifty-one per cent of the animal matter consisted of beetle fragments, and a smooth Lepidopterous caterpillar formed the other 49 per cent. The vegetable matter consisted of fruits and seeds probably of *Varronia angustifolia.*

88. *VIREO LATIMERI* (Baird). Latimer's Vireo. *Bien te veo.*

Latimer's Vireo is a resident species peculiar to Porto Rico. It is an extremely rare bird in the vicinity of Cartagena Lagoon, my only records being from Tinaja Hill, though I have but little doubt that it is occasionally found in the Varronias. It is quite common in the brushy growth at Anegado Lagoon, and also in the brushy growth on the limestone hills at Ensenada and near Cape Rojo Lighthouse, and I have also observed it near the road between Arecibo and Utuado. It has a sharply accented Vireo-like song which gives it its local name of Bien-te-veo (not *Julian chivi,* as given in other published accounts, in which the local names of this species and of *V. c. calidris* are twisted), but this song is heard less frequently than another song which is quite unlike that of any other Vireo I have heard. It is a rather feeble warbler-like trill, one might almost say insect-like. A third song which is also very suggestive of a warbler is sometimes heard. It is a *wert, wert, weét, wit* uttered in tones not very different from those of Adelaide's Warbler, but more vigorous and louder. A bird which I collected singing this song proved to be a female.

A nest which could hardly have belonged to any other species was found April 25, 1924, on a limestone hill at Ensenada. It was a typical pensile Vireo nest, but it was made of dead leaves mixed with plant fibers and lined with fine plant fibers. It did not yet contain any eggs. It was placed in vines climbing on a brushy tree at a height of five feet from the ground.

The contents of two stomachs were examined. A female collected at Anegado Lagoon March 29, 1924, had eaten 60 per cent of animal matter (a cockroach ootheca and a logicorn beetle) and 40 per cent of vegetable matter (a wild berry with a large flat seed). A male collected at Ensenada April 25, 1924, had eaten 78 per

cent of animal matter (a weevil, some other beetles and a little comminuted insect matter) and 22 per cent of vegetable matter (seeds of a pulpy fruit).

This is a species of regions of brushy growth in the semiarid south coastal region, and is found locally to some extent in other places.

89. *COEREBA PORTORICENSIS* (Bryant). Porto Rican Honey Creeper or Bananaquit. *Reinita.*

The Porto Rican Honey Creeper is the most abundant and universally distributed bird in Porto Rico, being found everywhere that trees or brush grow, from the mangroves of the sea to the tops of the highest mountains. However, it is about as scarce at Cartagena Lagoon as at any place I have been; in fact it can hardly be said to be common at all there, though I have quite often seen it in the Varronia and Bamboo associations, and it undoubtedly breeds there in small numbers. It flits among the trees in a very quick and active fashion. It is very tame and often enters houses in search of sweets and other food. It is the latest bird to awaken and become active in the morning. The song is a rather harsh insect-like trill suggesting the syllables *zee-e-e-e-swees-stee,* the first part being pitched higher.

These birds nest during every month of the year. At Mayagüez I found more nests of this species than of all other species put together. They are globular structures placed at the tips of the twigs of trees from 6 to 35 feet above the ground, and are built of leaves and grasses, lined with fine grasses. They may always be distinguished from nests of the Carib Grassquit by the fact that materials other than grasses are used in their construction, and the opening is always at the bottom. Their high position in the tree usually serves to distinguish them also. Both sexes assist in nest building. From two to three eggs are laid. Empty nests are used as sleeping quarters. Apparently this species has the same habit of building dummy nests as the Marsh Wren, and the nests of these two birds are also quite similar in appearance. About one out of twenty Honey Creeper nests found are occupied. On several occasions I have watched Honey Creepers build nests and then start tearing them to pieces when hardly completed, using the materials for new nests. Several broods a year are raised, and the young begin breeding while still in the juvenile plumage (less than a year old).

Field observations show that the Honey Creeper is very fond of nectar. It frequents blossoming trees of almost any kind, and is particularly fond of the blossoms of the Rangoon Creeper and of the Bucares (*Erythrina* spp.). I have several times watched these birds sucking the juice of unripe oranges, but in at least one case the hole through the skin was originally made by a Porto Rican Grackle (*Holoquiscalus niger brachypterus*). Honey Creepers are very fond of sweets, and will enter houses to obtain sugar or honey. One pair visited a small store in Mayagüez many times a day to feed on the partly refined yellow sugar which was exposed for sale in an open bin. The stomach is very small, appearing nothing more than a slight swelling at the junction of the esophagus and intestine. It would thus appear that nectar might form a large proportion of the food, as it probably does, but many insects are also eaten. One of three birds collected at Mayagüez in December, 1923, had eaten eight Curculio larvæ, which formed 100 per cent of its stomach contents. The second stomach contained nothing but a fragment of white egg shell, while the third contained 1 Blue-bottle fly, 45 per cent; 4 beetles (*Platypus* sp.), 45 per cent; and a little miscellaneous insect matter, 10 per cent.

Boys who wantonly destroy any eggs they can get hold of are perhaps the worst enemy of this species.

90. *MNIOTILTA VARIA* (Linnaeus). Black and White Warbler. *Reinita.*

The Black and White Warbler is a winter visitant, common in the wooded regions of Porto Rico, but rather scarce at Cartagena Lagoon, where it is found only in the Bamboo association. I have found it there only in December. At Mayagüez it is a rather common species. My first fall record is October 12, 1924, and my latest spring records April 29, 1922, and April 21, 1924. It is frequently found in the coffee *fincas*. It often sings for awhile after its arrival in the fall. On October 13, 1924, a bird was singing all day in a small patch of coffee, and I have heard one sing as late as December 19, 1923. One observed in February was continually making sharp *with* scold notes as it gleaned among the twigs of a large tree.

91. *COMPSOTHLYPIS AMERICANA USNEAE* (Brewster) Northern Parula Warbler. *Reinita.*

The Northern Parula Warbler is the most abundant of the migrant warblers in Porto Rico. It is common at Cartagena Lagoon, occurring in the Varronia, Tachuelo and Bamboo associations ex-

clusively. At Mayagüez it is an abundant species. At Cartagena Lagoon my latest spring record is May 2, 1924; corresponding records for Mayagüez are April 15, 1922, and April 22, 1924, and the earliest arrival date I have is September 29, 1924. After March 22, 1924, it was singing regularly until its departure for the north. Birds collected in the spring were extremely fat, and their sexual organs had become quite enlarged. It is common in the Varronias. Frequently around twenty could be counted in a short time there.

Three birds collected at Cartagena Lagoon in April and May had eaten 93.3 per cent of animal matter and 6.7 per cent of vegetable matter. The following items were included in the animal matter: Dragonfly naiad, 2.6 per cent; Fleabeetle (*Systena basalis*), 1.7 per cent; other fleabeetles, 2 per cent; Sesbas weevils (*Tyloderma* sp.), 1.7 per cent; spiders, 1.6 per cent. The vegetable matter consisted of berries of *Varronia angustifolia* and an unidentified seed. Two birds collected at Mayagüez in December had eaten exclusively animal matter. Large moth eggs were eaten by both birds, and formed 25 per cent of the contents. Fleabetles (*Epitrix parvula*) constituted 5 per cent, and other Coleoptera 30 per cent.

92. *DENDROICA TIGRINA* (Gmelin). Cape May Warbler. *Reinita.*

The Cape May Warbler is a very rare winter visitant in Porto Rico and at Cartagena Lagoon, where I saw one in the Bamboo association April 8, 1922. My only other Porto Rican records for this species are one at Mayagüez on February 19, 1922 and one on March 17, 1922.

93. *DENDROICA PETECHIA BARTHOLOMICA* (Sundevall). Porto Rican Golden Warbler. *Canario. Canario de los manglares. Reinita.*

The Porto Rican Golden Warbler is a rather common permanent resident at Cartagena Lagoon, where it inhabits all the plant associations except the grass, open fields and open water habitats, but particularly the cat-tails and Varronias. It also nests in all these associations at least occasionally. In other parts of the Island I have found it chiefly in the mangrove swamps, of which it is a characteristic bird. On January 4, 1924, I observed one beside a small stream at Patillas, and it is said by the country people to appear at other inland points points of low elevation, and in such cases to nest in the Guánica (*Guazuma ulmifolia*).

The males sing from February to September to some extent, and almost constantly during the spring months. In 1922 I heard

the first song on February 25, and in 1924 on February 6. The song is quite similar to that of *D. aestiva*. The call note is a sharp *chip*. A faint *tsheep* is also heard at times.

The nesting season at Cartagena Lagoon is from April to July or possibly August. The nests are compact cup-shaped affairs, rather similar in appearance to those of *D. æstiva*. The materials used in their construction vary considerably. Usually they are built of grasses with the addition of cat-tail down, and sometimes of roots and other plant fibers. In other nests shredded cat-tail leaves are used instead of grass. Every nest found in the marsh proper had many silky spider-egg coverings worked into the outside of the nest. The nests are lined with cat-tail down, and in two cases after the eggs were laid a few Coot feathers were added. The dimensions of a typical nest are: outside diameter, 2.60 inches; inside diameter, 1.65 inches; inside depth, 1.4 inches; outside depth, 2.55 inches. Nests were found placed in the Cat-tails, Pluckeas, Persicarias and Bamboos at heights varying from 4 inches to 6 feet above the ground, and I am told that in large trees they often nest at considerably greater heights. The number of eggs was invariably three in all the nests found. They are greenish-white, thickly speckled with rufous.

A nest in the 18-foot high cat-tails at the west end of the lagoon was observed with particular care. It was placed at a height of 4 feet above the water, which was 1 foot deep at that point, and a person walking there would sink an additional foot into the mud. The nest was placed where two bent cat-tail leaves gave it support beneath in addition to the support of the upright stems at the sides. It was made of fine fibers shredded from cat-tail leaves mixed with cat-tail down and the customary silky spider egg coverings. When I first discovered the nest on May 16, 1924, it was still in the process of construction, though nearly completed. The female was doing all the work while the male sang about 100 feet away. She was very tame and proceeded with her work while I stood but six feet away. After bringing a billful of material she would place it in the nest and then jump in and turn around to keep the shape right. She was very silent while at her work. When I went right to the nest to examine it closely she hopped around nervously within from two to four feet of me, but made no sound nor other attempt to drive me away. On May 20 the nest was completely finished and lined with cat-tail down, and contained one egg. While I was examining the nest the female was right beside me, with her mouth open,

"panting" from the noonday heat, which was very intense among the tall cat-tails, there being no breeze to moderate it. On May 23 the nest contained three eggs, and some Coot feathers had been added to the lining. The female had also begun incubating. On successive dates after that she became even tamer. I photographed her on the nest under great difficulty, due to the depth of the mud and the difficulty of obtaining sufficient light among such very tall cat-tails. June 3 was the last day on which I saw the female at the nest. June 7 she was nowhere to be seen and the eggs were cold. I fear that some accident befell her. I never saw the male nearer than 100 feet to the nest at any time. On June 14 something had broken two of the three eggs which I had left in the nest in the vain hope that the female might return or that the male might take charge of them. They contained rotten embryos. Something also happened to all the other nests discovered, so I had no opportunity of observing the young.

The worst enemies of this species appear to be eggers, who, while searching the marsh for larger eggs, destroy any small birds' eggs they come across.

The stomachs of two birds collected at Cartagena Lagoon in March and April and of one collected near Cape Rojo Lighthouse in April were examined. All of them contained exclusively animal matter. Items identified in the food of the Cartagena birds were: 5 ladybirds (*Hyperaspis apicalis*), 37.5 per cent; 1 large fleabeetle (*Haltica jamaicensis*), 2.5 per cent; 1 green Chrysomelid, 2.5 per cent; other Coleopterous fragments, 30 per cent; 6 ant pupæ, 1.5 per cent; 5 ants (*Prenolepsis* sp), 7.5 per cent; 1 Muscid fly, 2.5 per cent; 2 small Dipterous pupæ, 2.5 per cent. The Cape Rojo bird had eaten a large Notonectid, 90 per cent; and a small weevil, 1 per cent. The balance of the food in all the birds consisted of insects comminuted beyond identification.

Like most of the members of its family, this species appears to be in the main useful. It is a bird of both salt and fresh water swamps, though found to some extent at other places in the coastal lowlands. It is not specialized for marsh life, but seems to prefer the shelter offered by the marshes for breeding purposes, and the abundance of food there is also an attraction.

94. *DENDROICA ADELAIDAE* (Baird). Adelaide's Warbler. *Reinita.*

Adelaide's Warbler is the other warbler indigenous to Porto Rico. It is a characteristic species of the dry, brushy regions on the south

side of the Island and of the limestone hills. At Cartagena Lagoon it is found only in the Varronia association, where it is quite common, though I have not located any nests there. I have observed it all along the south coast from Ponce to Boquerón, and in the limestone hills near Quebradillas on the north side. It is very active and feeds where the vegetation is dense. For that reason it is quite hard to observe, although it is not shy. The song of the male is a sudden trill or series of trills, increasing in rapidity, and with a rising inflection at the end. It might be likened to the syllables *Chip-prr-rr-rr-rr-chip-chí*. The males are very persistent singers, frequently being heard even in the middle of the day.

Apparently the birds nest in May. The only nest I found was on the very summit of Tinaja Hill. It was completed but did not yet contain eggs on May 6, 1924. It was built entirely of fine grass, and was placed about three feet above the ground in the croth of an organ-pipe cactus.

Two birds were collected at Cartagena Lagoon in May and September, and one at Guánica Lagoon in October. All three had eaten nothing but insects. Smooth Lepidopterous larvæ, ant pupæ, and a Pentatomid bug were noted in the Cartagena birds; and 6 Cicadellidæ; 1 Scarabeid beetle (*Ataenius stercorator*), and 1 Chrysomelid (*Lema* sp.) in the Guánica bird.

95. *DENDROICA CORONATA* (Linnaeus). Myrtle Warbler. *Reinita.*

The Myrtle Warbler is an uncommon migrant and a rare winter visitant at Cartagena Lagoon. It is very rare during the winter, and only slightly more common from February to April. It is a late arrival, none being noted before December 14, 1923, and my latest spring records are April 8, 1922, and April 1, 1924. While at Cartagena Lagoon it is found only in the Varronia Association. All my records for this species from other parts of the Island are from dry brushy regions, with the exception of one bird noted in a canefield near Mayagüez on March 17, 1924. The partiality of this species for dry brushy areas while on the Island is noteworthy.

96. *DENDROICA MAGNOLIA* (Wilson). Magnolia Warbler. *Reinita.*

The Magnolia Warbler is a rare winter visitant in Porto Rico. The only Cartagena Lagoon record I have is of a bird seen in the Bamboo Association on November 30, 1923. At Mayagüez I have records of a bird seen March 25, 26, 27, 28 and April 3, 1922, and of one on December 3, 1923.

97. *DENDROICA DISCOLOR* (Vieillot). Prairie Warbler. *Reinita.*

The Prairie Warbler is a rather common migrant at Cartagena Lagoon, occurring only in the Varronia association. Spring dates are February 6 to April 4, 1924, although in 1922 birds were seen as late as April 22. In 1924 the first fall birds arrived September 20. A few birds stay all winter in parts of Porto Rico, as I have noted them at Mayagüez right through the winter, and also one near Utuado on January 1, 1924. Near Mayagüez they are found mostly in the brushy growth just back of the beach, although they are found to some extent in the coffee *fincas.*

Two males collected at Cartagena Lagoon March 21 and April 4, 1924, were extremely fat. They had eaten 98 per cent of animal matter, among which were 1 Fulgorid, 2 deerflies (*Chrysops vittatus*), 1 Pentatomid bug, 1 small moth, and some beetle fragments (the latter forming 45 per cent of the stomachs' contents) were noted. A little white pithy matter totalling 2 per cent was found in one stomach, which was the only vegetable matter.

98. *SEIURUS AUROCAPILLUS* (Linnaeus). Oven-bird. *Pizpita. Pizpita dorada.*

The Oven-bird is a very rare migrant at Cartagena Lagoon, my only record being a bird observed April 18, 1924, in the Bamboo association. At Mayagüez it is a common winter visitant. It is found most commonly in the coffee *fincas.* In 1922 a pair spent the last part of the winter in our back dooryard. It was well shaded by orange and banana trees. The Oven-birds picked up scraps of food that were thrown to the chickens and became very tame. They were not seen after April 20. In 1924 none were seen after April 10, and the first fall birds were noted on September 24. The familiar call note heard in the North is heard only when they first arrive in the fall. They are very silent during most of the time spent on the Island.

A male collected at Mayagüez December 21, 1923, had eaten 18 per cent of animal matter and 72 per cent of vegetable matter. A weevil and some other comminuted insects constituted the animal part, and some Guinea Grass (*Panicum maximum*) seeds and a little rubbish formed the vegetable part. Gravel to the extent of 15 per cent of the stomach contents was also eaten.

99. *SEIURUS NOVABORACENSIS NOVABORACENSIS* (Gmelin). Northern Water-thrush. *Pizpita. Pizpita de los manglares.*

The Northern Water-thrush is a common winter visitant at Cartagena Lagoon, but is commoner during the spring and fall migrations. My first fall record is September 3, 1924, and my latest spring record April 30, 1924. These birds are most commonly seen in the narrow strip of Persicarias fringing the rather steep south shore of the lagoon, frequently apreading out into the Varronias. They are also common along the quebrada in the Bamboo association and in the Tachuelo association, and they occasionally occur in other parts of the marsh. In other parts of the Island I have found this species in the mangroves swamps near Boquerón and Cape Rojo Lighthouse, and also on the seabeach near the latter place where there was a little scrubby vegetation. Their characteristic call notes are constantly uttered, but I have not heard their song in Porto Rico.

Four specimens were collected at Cartagena Lagoon (April 4, 8 and 11 and September 23, 1924) and one on the beach at Cape Rojo, near the lighthouse, on April 27, 1924. All but one of the April birds were extremely fat. The Cartagena birds had eaten 95 per cent of animal matter and 5 per cent of vegetable matter. Identified items in the vegetable matter were: 3 damselflies, 10 per cent; 20 large fleabeetles (*Haltica jamaicensis*), 19 per cent; 2 fleabeetles (*Systena basalis*), 1.3 per cent; Carabid beetles (*Stenous* sp.), 26.2 per cent; pupa of a Sesban weevil (*Tyloderma* sp.), 1.2 per cent; other Coleopterous fragments 5 per cent; 2 Noctuid caterpillars, 5 per cent; 1 Syrphid fly (*Volucella obesa*), 2 per cent; 3 caseworms (*Tineola uterella*), 6.1 per cent; 1 slug, 2.5 per cent. The vegetable matter (5 per cent) consisted of a few seeds, among which was one of some plant of the Composite family, probably *Pluckea purpurascens.* The stomach of the Cape Rojo bird was empty except for a small fragment of some beetle.

It thus appears that this species eats slightly more injurious than beneficial species, although Carabidæ form quite a large percentage of its food.

100. *SEIURUS MOTACILLA* (Vieillot). Louisiana Water-thrush. *Pizpita. Pizpita de los manglares.*

The Louisiana Water-thrush is a winter resident at Cartagena Lagoon, though much less common than S. n. novaboracensis. It is more common by the swiftly flowing streams than in other parts

of the Island, although it is sometimes seen in the coastal mangrove swamps. While at Cartagena Lagoon it is found in the same regions as the Northern species. Last spring dates are April 10, 1924, and April 22, 1922, and my first fall record is September 6, 1924. No specimens were collected, so I can say nothing at first hand about the food habits of this species.

101. *GEOTHLYPIS TRICHAS BRACHIDACTYLA* (Swaison). Northern Yellowthroat. *Reinita.*

The only definite record for Porto Rico that I know of for the Northern Yellowthroat is of a male that I observed in the Bamboo association at Cartagena Lagoon on April 18, 1924. It was in a pile of bamboo brush near a pool of water. After I had observed it a few seconds it disappeared in the brush. I was hurrying to catch the only train of the day else I would have stopped to collect it. This record appears in the October, 1925, *Auk.*

102. *SETOPHAGA RUTICILLA* (Linnaeus). Redstart. *Reinita. Candelita.*

The Redstart is only a migrant at Cartagena Lagoon, though it is a winter resident in other parts of the Island. At the lagoon it is found only in the Bamboo association, where it is fairly common at times. I have records there from October 7 (1924) to December 22 (1923); and from April 1 to 22 (1924). At Mayagüez it is found all winter. My latest spring record for the Island is April 26, 1924, near Cape Rojo Lighthouse. In April a few Redstarts are singing.

The only bird collected at Cartagena Lagoon was a male on April 18, 1924. Its stomach contained animal matter exclusively. Small beetles formed 90 per cent, a weevil 1 per cent, a small ant 2 per cent, and some much-comminuted insect fragments 7 per cent.

103. *MIMUS POLYGLOTTOS ORPHEUS* (Linnaeus). Jamaican Mockingbird. *Ruiseñor.*

The Mockingbird is a common resident species at Cartagena Lagoon, living in the Varronia and Tachuelo associations, and sometimes feeding in the open-fields association. It is also common throughout the lowlands of Porto Rico, and in open places at higher elevations. It is most abundant on the south coast, seeming to prefer a semiarid climate, where it is most often found in brushy places. It is quite shy, and it is seldom possible to approach it very closely. The males sing from the tops of low trees, but they

quickly hop out of sight when they realize they are watched. They sing throughout the year with the exception of the months of July and August. A female collected in August was molting badly. These birds are very poor mockers, in fact only once have I heard one imitate any other bird. One heard at Mayagüez on December 27, 1923, imitated an Ani very cleverly. There is much individual variation in the songs of this species. One bird which sang constantly near a hut in the hills between Mayagüez and Añasco in which I spent two months had a very distinctive song which might be likened to the syllables *Pea acre, pea acre, pea, pea, pea.* The call note is a sharp *tzeck.*

Apparently the nesting season extends from February to June. The nests are large affairs built of sticks and lined with grasses and other fine materials, placed in shrubs or shrubby trees at heights of eight to fifteen feet above the ground. Young birds are frequently noted in the summer months.

Two birds were collected at Cartagena Lagoon (August 13 and September 30, 1924). Animal matter formed 64.5 per cent of the food in these stomachs, and vegetable matter 35.5 per cent. Animal matter found consisted of 2 Geometrid caterpillars, 15 per cent; 1 Sphingid caterpillar, 15.5 per cent; 1 Noctuid caterpillar, 7.5 per cent; and 5 butterfly caterpillars, 49.5 per cent, making a total for Lepidopterous larvæ of 84.5 per cent of the animal matter. The other 15.5 per cent was formed by 2 slugs (15 per cent) and fragments of a tumble beetle (0.5 per cent). The vegetable matter consisted of 13 fruits of *Cordia* sp., 50 per cent, and some unidentified seeds. In the field I have observed one eating fresas (*Rubus* sp).

104. *MARGAROPS FUSCATUS FUSCATUS* (Vieillot). Pearly-eyed Thrasher. *Zorzal. Zorzal pardo.*

The Pearly-eyed Thrasher is an uncommon resident in the vicinity of Cartagena Lagoon. It is fairly common on Tinaja Hill, but at the lagoon is found only rather irregularly in the Bamboo association. It is quite similar to *Mimocichla* in form, though more robust and with larger feet. In flight it bears a slight resemblance to a pigeon, and the white tips of the tail feathers show conspicuously. While singing it remains concealed by the foliage. The song is very varied, but many of the notes are quite similar to those of *Mimocichla.* This species is found rather commonly in semiarid brushy regions along the south coast, where I have observed it from

Ensenada to Cape Rojo Lighthouse. I have also heard one several times on a hill near Mayagüez.

A male collected at Cartagena Lagoon on September 30, 1924, was molting badly. It had eaten 40 per cent of animal matter and 60 per cent of vegetable matter. The animal matter consisted of fragments of a large brown and green Cerambycid beetle, 60 per cent, and a smooth caterpillar, 40 per cent. The vegetable matter consisted of fruit pulp.

105. *MIMOCICHLA ARDOSIACEA PORTORICENSIS* (Bryant). Porto Rican Thrush. *Zorzal. Zorzal de patas coloradas.*

The Porto Rican Thrush is a rare resident at Cartagena Lagoon, being found in the Bamboo association. Once I observed a bird in the Varronias. In the more wooded parts of the Island this is a common species. It feeds almost exclusively upon the ground, but when alarmed flies up into the trees, and it also perches in trees to sing, and the nests are placed in trees. Rustling sounds in the leaves are frequently found to have been produced by the scratching of a Zorzal, for in Porto Rico it takes the place of the Towhees and White-throats of the North.

These Thrushes begin singing at the first streak of dawn and sing until about 7 a. m. Their song is quite similar to that of the Robin, but is less varied and the tones are not so rich. The notes are also more disconnected. In other words, it sounds like a crude imitation of a Robin's song. Another note heard at times is a *wicky, wicky, wicky, wicker* sound similar to that made by the Sparrow Hawk.

Birds were observed gathering nest material as early as January 23, 1924, and many were seen carrying it in February and March. Badly molting birds, some without tail feathers, were noted in June, while a female collected in September appeared to be nearly ready to breed, so there is a possibility that some birds raise a second brood. The only nest I actually observed was found on March 30, 1924, at Mayagüez. It was composed of shreds of bark, fine twigs, a small piece of partly rotted burlap, some string, pieces of fern leaf, and three feathers of domestic poultry. It was lined with shredded inner bark. It was placed among some upright shoots growing from a branch of a Guanábano tree (*Anona muricata*) at a height of nine feet from the ground. Some *Allamanda hendersonii* vines also partly concealed the nest. It was somewhat oval in shape. The inside diameters of the nest were 4.5 and 3 inches, and the

outside ones 6 and 4 inches. When the nest was discovered the female was just laying the first egg. She never returned to lay another egg, so after some time I collected the one egg. It has a putty-colored background, and is heavily and evenly mottled with rufous-brown, and is decidedly pointed at one end. Its measurements are 33 × 22 millimeters.

A female collected in a coffee *finca* near Mayagüez September 25, 1924, had eaten 85 per cent of animal matter and 15 per cent of vegetable matter. A large Tenebrionid beetle formed 35 per cent of the animal matter, and 6 white grubs (Phyllophaga vandinei) 60 per cent. The vegetable matter consisted of angular seeds, apparently of some pulpy fruit. A bird with the habits of this species has great possibilities in obtaining injurious ground-inhabiting insects found in more or less wooded regions, such as coffee *fincas* and orchards. As there is no other Porto Rican bird with very similar habits, the Zorzal should by all means be encouraged.

SUMMARY

A total of 105 species of birds are found at Cartagena Lagoon and its immediate vicinity. Of these, 42 are migrants from North America. Another 42 species breed there either regularly or occasionally. Two of these (*Progne dominicensis* and *Vircosylva c. calidris*) breed in Porto Rico but winter in South America, and it is possible that a third species (*Himantopus mexicanus*) does likewise. Twenty-one species come to the lagoon only to feed, though breeding in other parts of the Island.

An average of 36 species of birds per day were recorded at the lagoon. The largest day's list was 48 species on April 11, 1924, and the smallest 26 species on August 13, 1924 (when the lagoon was nearly dry). The largest list in the fall was 45 species on September 30, 1924.

Of the 42 species of birds breeding at or in the immediate vicinity of the lagoon, 19 might be called typical lagoon species. Nine of these are entirely dependent upon the marsh for food and shelter, while 10 visit it primarily for food. Three of the ten, namely, *Poecilonetta b. bahamensis, Butorides virescens maculatus* and *Oxyechus vociferus rubidus,* visit it because they show a preference for marsh conditions and aquatic food. The other seven occur at the lagoon because of the abundance of food found there rather than on account of any special preference for marsh conditions or aquatic food. In this class I would include *Zenaida zenaida lucida, Chaemepelia passerina trochila, Crotophaga ani, Tyrannus d. dominicensis, Agelaius xanthomus, Holoquiscalus niger brachypterus* and *Dendroica petechia bartholomica.* Although some of these birds, namely, *Zenaida zenaida lucida, Holoquiscalus n. brachypterus* and *Dendroica p. bartholomica,* nest more or less regularly in the marsh, there are no birds which appear to visit the marsh primarily for shelter.

Of the 9 species which are entirely dependant upon the marsh for food and shelter, *Colymbus d. dominicus* is almost entirely restricted to the cat-tail zone, and *Podilymbus podiceps antillarum* to the open-water association. *Erismatura alleni* prefers the sedge and cat-tail zones for nesting. *Ixobrychus e. exilis* is entirely restricted to the cat-tails for breeding. *Porzana flaviventris* is found chiefly among the cat-tails and sedges, but its nesting habits are unknown. *Gallinula chloropus portoricensis* and *Fulica caribæa*

major are chiefly birds of the cat-tail, sedge and grass associations, while *Ionornis martinicus* prefers the cat-tails for nesting. *Himantopus mexicanus* prefers the grass association, but it is very adaptable, and establishes itself in almost any zone when it is molested in another.

CONCLUSION

Cartagena Lagoon is to-day the most important breeding ground for resident waterfowl as well as the most important refuge for migrant water birds in Porto Rico. It also supplies food for thousands of other birds which are not primarily marsh birds. There is probably no other spot on the Island where so large an assemblage of birds of so many species can be found. It will be a sad day indeed for the bird life of Porto Rico when the lagoon is drained. It will probably mean the extermination of certain species as far as Porto Rico is concerned, and a great diminution in the numbers of others. Many of these birds are of great value, either to the agriculturist or to the sportman. It would be a great economic asset to the people of Porto Rico if, before it is drained, the lagoon could be obtained either as a private, or preferably as a government wild-life preserve where the birds would be strictly protected while breeding, and hunting carefully regulated and supervised at other seasons.

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APPENDIX

To Vol. X, No. 1, of the Journal of the Department of Agriculture of Porto Rico, containing legislation in force regarding the protection of birds in Porto Rico, Compiled by F. A. López Domínguez, Director, Insular Experiment Station, and editor of the Journal. (See footnote, page 25, Vol. X, No. 1, of this Journal.)

ACT 45

TO PROVIDE FOR THE DEVELOPMENT AND PROTECTION OF AGRICULTURE; THE CREATION OF A BOARD OF COMMISSIONERS OF AGRICULTURE, DEFINING THEIR POWERS AND DUTIES; TO AMEND AN ACT ENTITLED "AN ACT TO PREVENT THE INTRODUCTION INTO PORTO RICO OF PLANT AND INSECT DISEASES, AND PESTS, AND FOR OTHER PURPOSES", APPROVED SEPTEMBER 3, 1910; TO PROVIDE FOR THE INTRODUCTION AND PROTECTION OF BIRDS BENEFICIAL TO AGRICULTURE, FIXING PENALTIES FOR THE DESTRUCTION OF SAME; MAKING AN APPROPRIATION TO CARRY OUT ITS PROVISIONS, AND FOR OTHER PURPOSES. APPROVED MARCH 9, 1911.

Section 5.—That it shall devolve upon the board:

* * * * * * *

Fifth: To prepare, print, publish, and furnish on request, a list of birds beneficial to Agriculture, as provided for in Section 6 of this Act; the Board having the right to amend said lists from time to time.

Section 6.—That the act of seizing, killing, destroying or keeping in one's possession, any bird beneficial to agriculture, be and is hereby declared to be unlawful. Whosoever seizes, kills, destroys, or keeps in his possession any bird beneficial to agriculture shall be guilty of a misdemeanor and punished therefor with a fine of not less than five nor more than twenty-five dollars or with imprisonment for not more than ten days, or with both penalties. The board shall prepare, print, publish and furnish on request, a list of birds which in their opinion are beneficial to agriculture, and any bird comprised in said list shall be conclusively considered as beneficial to agriculture for the purpose of this Act.

CHAPTER XIV, REVISED STATUTES AND CODES OF PORTO RICO, ISSUED MARCH 1911

Section 5969.—Every person who, within any public park, plaza or highway, kills, wounds, or traps any bird, or destroys any bird's nest, or removes any eggs or young birds from any nest, is guilty of a misdemeanor.

ACT 60

TO PROVIDE A GAME LAW

Be it enacted by the Legislative Assembly of Porto Rico:

CHAPTER I

CLASSIFICATION OF ANIMALS

Section 1.—Wild animals found in public lands, as well as those found in private lands, are hereby declared to be the property of The People of Porto

Rico. The wild goat, the wild hog, the rat and the mangouste or pharaon rat are the only wild quadrupeds that may be hunted in Porto Rico. In the appendix attached hereto, which shall form part of this Act, there will be found a classified and specified list of the animals that may be hunted in the Island which, with the exception above stated, belong to the genus of birds.

CHAPTER II

HUNTING RIGHT

Section 2.—The word "hunt" shall be taken to include all legal means of looking for, pursuing, harassing, catching or killing all wild animals or animals which may have become wild.

Section 3.—All persons of legal age, possessing a hunting certificate, shall have the right to hunt, but shall exercise such right subject to the provisions of this Act.

Section 4.—The right to hunt may be exercised on lands of The People of Porto Rico without the necessity of obtaining a permit therefor, provided they are not closed for that purpose or the entrance thereto prohibited by competent authority. This prohibition shall be advertised by various means, such as posters placed at conspicuous points in the boundaries of the lands where hunting shall have been prohibited.

Section 5.—The right to hunt may also be exercised without previous permit, on private lands not under cultivation which are not visibly enclosed or bounded or not having signs prohibiting hunting in the same manner and form prescribed in the preceding section. In lands provided with these requirements only the owners, lessees and judicial administrators thereof, or the persons authorized by them, shall have the right to hunt provided they possess the necessary hunting license.

Section 6.—For the purposes of this Act the words "enclosed lands" shall be taken to mean all those having any of the different classes of fences used in Porto Rico, and by "bounded lands" shall be understood all those whose boundaries are marked by permanent stone, concrete, masonry or wooden monuments. Game lands whose owners or lessees do not use the game for selling or other commercial purposes shall not be assessed as such.

Section 7.—A hunter shooting from game lands where hunting is permitted and wounding a bird or animal which falls or enters into private property shall have right to the same, but in order to recover it he shall first obtain due permission from the owner or lessee of the property if the same be enclosed by any of the means recognized by this Act. In case the hunter is authorized to enter the property he shall at all times be responsible for damages caused to crops or property.[1]

CHAPTER III

EXERCISE OF THE RIGHT TO HUNT

Section 8.—Hunting shall be absolutely prohibited during the closed seasons which shall be as follows:

(*a*) Wild pigeons of all kinds: From the first day of January until the fifteenth of July.

(*b*) For ducks: From the first day of May until the thirty-first of December.

[1] The equivalent of the words "or property" does not appear in Spanish text.

(*c*) For the birds of the *Rallidæ* family (American coot, gallinule, etc.): From the first day of December until the last day of February.

(*d*) For all other birds and mammiferous animals: From the first day of February until the thirtieth day of June.

Section 9.—At no time shall the birds included in list number 2 of the appendix to this Act either be killed or caught. In accordance with the provisions of section 5 hereof, domestic pigeons may only be caught or killed by their owner or by virtue of written authorization from him. Carrier pigeons shall in no case either be caught or killed.

Section 10.—The firing of shotguns and other firearms at a distance of less than one kilometer from any town is hereby prohibited.

Section 11.—The owners or lessees of rural properties may install in them all kinds of devices for the destruction of animals comprised in list number 3 of the appendix; but at no time shall such device be installed in public roads or trails.

Section 12.—The handling or sale of game animals during the closed seasons specified in section 8 hereof is absolutely forbidden.

Section 13.—The closed seasons shall be advertised each year in the newspapers of larger circulation in the Island. The *alcaldes* shall make known its provisions by means of posters and placards posted in the town and *barrios*. The Secretary of Porto Rico shall see that this requirement is complied with.

Section 14.—Any person destroying the nest of game birds or those of birds comprised in list number 2 of the appendix hereto shall be guilty of a violation of this Act and shall be liable to the penalties fixed herein.

Section 15.—It shall be the duty of the police and employees of the Irrigation Service at the lakes and canals of the Irrigation Service to denounce any violation of this Act that they might see or which might come to their knowledge. Any citizen will also have the right to denounce the violators of the same.

CHAPTER IV

HUNTING AND FIREARMS LICENSES—PROCEDURE.

Section 16.—No person shall have the right to carry shotguns or hunt unless he has first obtained the corresponding license, which license shall be issued by the Secretary of Porto Rico subject to the provisions of law. Said license shall be good for a term of one year from the date of issuance and may be renewed on petition of the interested party upon payment of the fee.

Section 17.—The police shall require the presentation of the hunting license and of the permit to carry shotguns, and upon failure of the huntsman or huntsmen to exhibit same his or their arms shall be confiscated, but the same shall be returned to the respective owners if within a term of eight days they should present the license issued on a previous date to that of the confiscation.

Section 18.—Upon the expiration of the term of eight days, should the above condition not have been complied with said arms shall definitely be confiscated and sold by public bids.

CHAPTER V

VIOLATIONS—PENALTIES

Section 19.—Any wilful violation of the provisions of this Act shall be deemed as a misdemeanor and shall be punished by fine of not less than twenty-five dollars or imprisonment of not to exceed thirty days.

Section 20.—The fee for the hunting license shall be of ten dollars per annum and shall be payable in internal-revenue stamps. The authorization to which this section refers shall include all kinds of shotguns of whatever caliber and all other arms the use of which may be adapted to hunting.

Section 21.—All laws or parts of laws in conflict herewith are hereby repealed.

Section 22.—This Act shall take effect from and after the first day of June, nineteen hundred and sixteen.

APPENDIX

LIST NUMBER 1

GAME BIRDS

1st order: *Columba*
Unique family: *Columbidæ*

Domestic dove	Cinerious pigeon of savanna
Turtle dove	Wood pigeon
Savage partridge	White-crowned pigeon
Partridge of Martinica	Portorican dove
Small turtle dove	

2d order: *Cranes*
Family *rallidæ*

American coot	Yellow rail
Florida gallinula	Jacana
Purple gallinule	Limpkin
Sora rail	Clapper rail

3d order
Family *scolopacidæ*
Snipe

4th order
Family *adeidæ*

Yellow-crowned night heron — Black-crowned night

5th order: *Palmipedæ*
Family *anatidæ*

Goose	Florida goose or of border
Snow goose	Ruddy duck
Tree duck	Green-winged teal duck
Small spoon duck	Black-streak duck or dominic
Domestic duck	Rustic duck of the middle
Long-neck duck	Dark rustic duck

6th order
Family *laridæ*

Sea gull	Royal gull
Exotic sea gull	Sharp-billed gull
Gull of Paradise	Black sea gull
Antilles gull	Dark sea gull

7th order
Family *colymbidæ*

Red-billed grebe — Least grebe

LIST NUMBER 2

BIRDS USEFUL TO AGRICULTURE

1st family: *Lanidæ*

Jamaican vireo
Látimer vireo

2d family: *Turdidæ*

Wood thrush
Portorican thrush
Pearly-eyed thrasher

4th order

Family *ardeidæ*

Great blue heron
Little blue heron
Snowy heron
Spotted heron
Agret royal
Little green heron
Great white heron
Least bittern
Reddish egret

3d family: *Sylvidæ*

Maryland yellow throat
Mirtle warbler
Yellow warbler
Magnolia warbler
Black polt warbler
Cape May warbler
Black and white warbler
Ovenbird
Palm warbler
Water thrush
Prairie warbler
Parula warbler
Yellow-throated blue warbler
Worm-eating warbler
Adelaide's warbler
American red start
Black-throated blue warbler

4th family: *Tyranidæ*

Gray kingbird
Portorican flycatcher
Portorican Petchary
Portorican wood pevee

5th family: *Tanagridæ*

Portorican euphonia
Portorican spindalis
Portorican tanager

6th family: *Fringillidæ*

Portorican glod finch
Scarlet-cheeked weaber-finch
Antillean grasshopper sparrow
Carib grassquit
Hooded weaber-finch
Bryant's grassquit

7th family: *Icteridæ*

Fawny-shouldered blackbird
Troupial
Portorican grackle
Portorican oriole, calendar

8th family: *Corvidæ*

Portorican crow

9th family: *Dacnididæ*

Portorican bananaquit

10th family: *Alcyonidæ*

Portorican tody

11th family: *Hurundinidæ*

Church swallow
Rustic swallow
Cave swallow
Green blue swallow
Bank swallow

12th family: *Cipselidæ*

Black swift

13th family: *Caprimulgidæ*

Nighthawk
Coat sucker of Carolina

14th family: *Piscidæ*

Woodpecker

15th family: *Cuculidæ*

Ani
Bird booby larger
Mangrove cuckoo
Black-billed cuckoo

1st family: *Falconidæ*

Small falcon

LIST NUMBER 3

BIRDS PREJUDICIAL TO AGRICULTURE

5th order—Rapacious of the day

1st family: *Falconidæ*

Fish hawk or osprey
Red-tailed hawk
Pennsylvania falcon
Barn owl

2d family: *Strigidæ*

Rapacious of the night

Owl of savanna or coruja
Common owl.

Approved April 13, 1916.

ACT 22

TO PROVIDE A FOREST SERVICE IN PORTO RICO

Approved November 22, 1917

BIRD REFUGES

Section 5.—That the Governor may, with the advice of the Commissioner, by executive order or proclamation declare any or all of the Insular Public Forests to be a bird refuge for any game or other kind of bird or birds which it may be seen desirable to especially foster, encourage and protect. It shall thereafter, and as long as any such refuge be and is continued, be the duty of the Commissioner and all the Service subordinates to exercise special vigilance in the enforcement of any and all laws or the rules and regulations of the Commissioner supplementary thereto pertaining to the protection of the bird or birds thereon.

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