

AMERICAN MUSEUM
Novitates

PUBLISHED BY
THE AMERICAN MUSEUM
OF NATURAL HISTORY

CENTRAL PARK WEST AT 79TH STREET
NEW YORK, N.Y. 10024 U.S.A.

NUMBER 2599

JUNE 22, 1976

MARY LE CROY

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Number 2599, pp. 1-30, figs. 1-12

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ABSTRACT

Thirty-seven species of birds were observed during six weeks on Francisquí, Los Roques, Venezuela in May to July of 1973. The present report is of these observations with emphasis on the eight species found breeding on the island: Common Tern (*Sterna hirundo*), Bridled Tern (*S.*

anaethetus), Least Tern (*S. albifrons*), Brown Noddy (*Anous stolidus*), Black Noddy (*A. tenuirostris*), Common Ground Dove (*Columbina passerina*), Bananaquit (*Coereba flaveola*), and Yellow Warbler (*Dendroica petechia*).

INTRODUCTION

The islands of the Los Roques archipelago lie about 70 miles north of the port of La Guaira on the Caribbean coast of Venezuela. They are low coral islets, for the most part, but El Gran Roque rises to a height of several hundred feet where resistant rock extends westward from the low sandy portions of the island on the east and terminates in almost vertical sea cliffs on the western end (fig. 1). El Gran Roque has the largest permanent settlement. Now a part of the Venezuelan National Park system, the islands' flora and fauna are protected.

Numerous collections of birds have been made in the archipelago, the most comprehensive being those of the Phelps over a period of many years. Their papers (1951, 1959, 1973, and 1975) reported on these collections, and the first two surveyed the literature on earlier collections by others.

To the northeast of El Gran Roque lies Francisquí, a U-shaped key composed of three islets (see fig. 2). Sara LeCroy and I lived on the northernmost islet from May 25 to July 8, 1973. This islet is separated from the middle islet by a barely submerged reef over which the surf breaks constantly. The middle and south islets are separated by a channel. Francisquí encloses a sheltered shallow bay with much coral and sandy beaches. The tide here measures only about a foot, but at low tide areas of coral and Turtle Grass (*Thalassia testudinum*) are exposed. This bay forms the eastern and southern shores of the islet on which we stayed. The northern shore is eroded coral with ledges 8 to 10 feet high, facing the prevailing wind. The western shore is sandy, and on both the north and west sides there is exposed coral offshore, which is used by resting birds, mainly pelicans (*Pelecanus occidentalis*).

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FIG. 1. El Gran Roque. Foreground, western end of Francisquí showing low coral, Sea Purslane, and grass. Background, El Gran Roque with low coral area on left and area of sea cliffs on right.

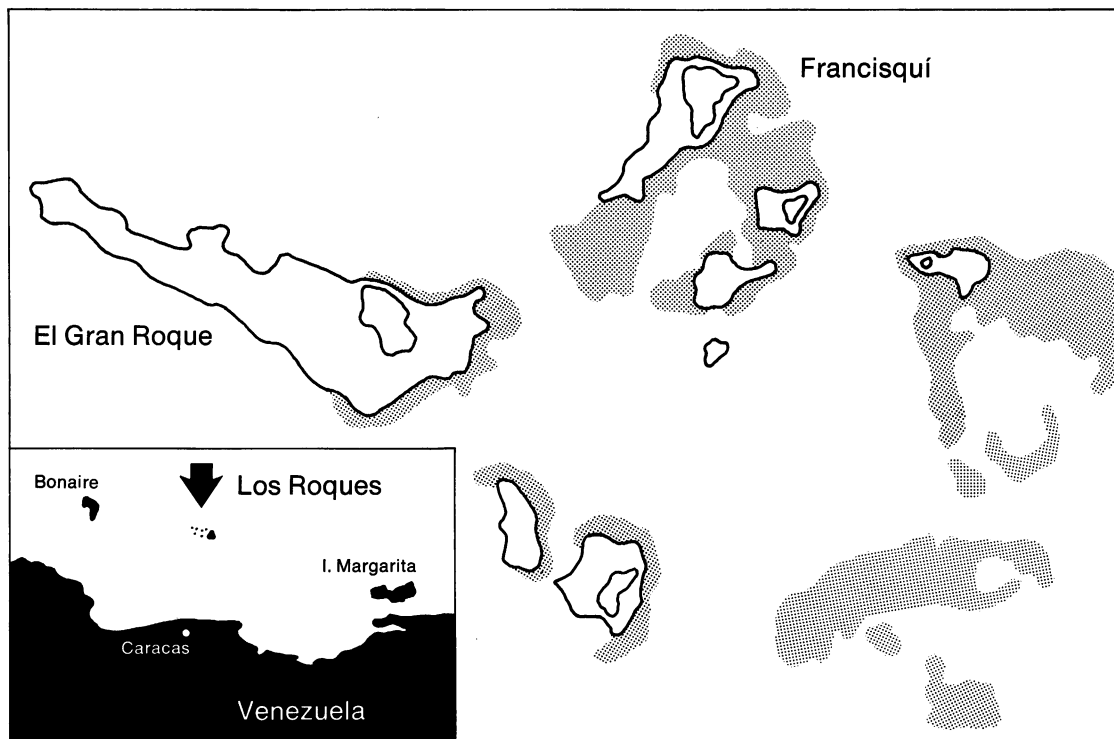


FIG. 2. Location of Los Roques and position of Francisquí in relation to El Gran Roque.

The island is low and flat, stretching northeast-southwest for about a mile and is approximately a quarter of a mile wide at its widest point. Its most prominent feature is a large, very saline, and completely enclosed lagoon surrounded by a border of salt pan during May to July but probably more extensive in other seasons (fig. 3).

Black Mangroves (*Avicennia germinans*) are the most common trees and occur in broad belts to the north of the lagoon and across the middle of the island, with scattered small groups of trees elsewhere. They are large, up to 25 or 30 feet high, with a leafy canopy and an open understory (see fig. 4). Ground cover within the dense groves is mostly broken mangrove limbs and young plants but the edges are thickly overgrown with Saltwort (*Batis maritima*), which covers adjacent areas and extends for some distance into the mangroves. In the morning while it is still cool the leaves of these trees drip salty water. Black Mangrove pneumatophores are a common feature of the southeastern protected shore.

Red Mangroves (*Rhizophora mangle*) are confined to one small area on the southeastern shore. Few birds seem to frequent this area. White Mangrove (*Laguncularia racemosa*) up to 6 feet high occurs in one area at the northeastern point, and Buttonwood (*Conocarpus erectus*) is found in scattered patches at the southern end.

The remainder of the island is covered by low vegetation, large areas of which are Saltwort, a woody scrambling plant with succulent leaves, which covers everything to a depth of 1 to 3 feet, forming a mat on the surface that is almost impossible to penetrate (fig. 5). Other large areas are sparsely grass covered, with scattered Spurge (*Euphorbia mesembrianthemifolia*) or Sea Purslane (*Sesuvium portulacastrum*). Weathered coral ridges on the northeast point have little beside Sea Purslane growing. In the areas of low vegetation at each end of the island are scattered individual plants of Bay Cedar (*Suriana maritima*), never more than 4 feet high, and Sea Lavender (*Tournefortia gnaphalodes*), small, and moribund with only a few green leaves at the tips



FIG. 3. View across a temporary tongue of the lagoon showing salt pan in foreground; shallow water, grass and Sea Purslane, and Black Mangrove in background.



FIG. 4. View into an area of Black Mangrove showing open character of understory.

of the branches. In one area in the center of the island there are two rows of barrel cacti (*Melocactus* sp.) growing on very low weathered coral ridges. They were in bloom in June.

In late May the northeasterly trade winds were very strong and almost constant, but during June they decreased particularly during the day, picking up again in the afternoon. The middle of the day was still and quite hot and most animals were inactive. Clouds swept over almost daily, but no rain fell until June 18, at which time the water level in the lagoon rose considerably, inundating shallow salt-pan areas that had been completely dry. Hard rains fell daily, usually at night, June 20 to 25 and the lagoon continued to rise, with a green algal bloom appearing in the

shallow, usually dry areas on June 21. By June 26, the water began to recede, but hard rains on June 29 and July 3 prevented its receding very much before July 8. One small area, completely cut off from the rest of the lagoon by a sand bar, became a shallow pool after the rains and experienced a red algal bloom. No shorebirds fed in this area as they did in the other shallow-water areas.

Several animals other than birds occurred on the island. By far the most conspicuous was a black lizard (*Cnemidophorus lemniscatus nigricolor*). These lizards have been discussed by Roze (1956). They are extremely common and inquisitive, climbing all over one if given the opportunity, but quick to escape at the slightest hint of danger. They are active from 9 am to 3 pm,

before and after which time they are scarcely to be found, as they retire into holes in the sand. They eat insects on the ground and in the Black Mangroves, and scavenged around our camp. Their fearlessness and large numbers indicate that they have few enemies, although a Laughing Gull (*Larus atricilla*) was seen eating one, and lizard remains were found in gull pellets. On the islands of Aruba, Curacao, and Bonaire these lizards are preyed upon by no less than 10 species of birds, mainly birds of prey (Voous, 1957, p. 14). But in Los Roques, birds of prey are scarce and therefore pose no threat to the lizards. On the other hand, the lizards are not large enough to threaten the eggs of nesting birds. Twice we saw an individual of *Gonatodes vittatus*; each time it had crawled into a folded tarpaulin.

On the nights of July 2 to 5, residents of El Gran Roque came ashore to hunt turtle eggs. The moon was in the first-quarter and high in the sky by dark. The egg hunters indicated that this was the important factor and that turtles were likely to come ashore. However, they were apparently

unsuccessful in finding eggs. Several nights later a turtle crawled ashore and left tracks in a steep sandy bank; I did not find eggs.

Hermit crabs (*Coenobita clypeatus*) were also very common on land and could be heard scuttling about day and night. They seemed particularly responsive to rain and climbed to the tops of the Saltwort in large numbers whenever there was a shower.

Although not abundant, conchs were frequently seen in shallow water along the shore, and El Gran Roque residents came several times to look for them. Mosquitoes and tiny biting flies were abundant after rain and in the evening in sheltered areas. Feral house mice occurred in small numbers.

Pollution of these isolated islands by crude oil must be mentioned. The oil is apparently dumped at sea by tankers washing out their holding tanks. This oil is eventually blown over the reef and into the bay of Francisquí, where it is deposited in fairly firm globules along the high-tide line. The heat of the sun then turns this into a semiliquid which remains until it works its way



FIG. 5. Saltwort expanse, showing denseness, and Bridled Terns on sentinel posts.

into the sand. A few Bridled Terns (*Sterna anaethetus*) had become fouled by oil, presumably at sea, and oil-soaked carcasses of several Brown Boobies (*Sula leucogaster*) were on the island.

ACKNOWLEDGMENTS

My warmest thanks to Mr. and Mrs. William H. Phelps, Jr. of Caracas whose extensive knowledge of Los Roques and its birds made it possible for us to be there at the right time and whose help was essential to us in reaching Francisquí and staying there for six weeks. Messrs. Ramón Aveledo, Luís and Gilberto Pérez, and Paul Schwartz provided much needed assistance. Mr. and Mrs. Rohrscheib kindly gave us transportation back to Caracas. Messrs. Florencio and Rubito Narváez provided us with a link to El Gran Roque while we were on Francisquí.

My especial thanks to Ms. Sara LeCroy for her assistance and companionship in the field as well as for her many contributions to the present paper and for some of the photographs.

Dr. Dorothy Bliss kindly identified the hermit crab, Dr. Charles J. Cole and Mr. George Foley the lizards, Dr. F. R. Fosberg the plants, and Dr. C. Lavett Smith the fishes. Mr. William H. Phelps, Jr., Dr. Wesley E. Lanyon and Ms. Helen Hays read a draft of this paper, and I appreciate their comments. Discussions with Ms. Kathleen Duffin, Mr. David Duffy, Ms. Helen Lapham and Dr. Ralph W. Schreiber were also most helpful.

Financial support from the Leonard C. Sanford Trust Fund and the Mae P. Smith Fund is gratefully acknowledged.

BIRDS

The present report on Los Roques' birds results from observations made during the six weeks' stay on Francisquí, the main purpose of which was to obtain growth data on the young of Common and Least Terns. These data will be reported elsewhere. A very few specimens were collected and these are noted. Only one species is previously unrecorded for the archipelago, the Snowy Egret (*Egretta thula*).

Puffinus gravis

Petrel Caucho

Greater Shearwater

On June 19 Sara LeCroy found a recently

dead Greater Shearwater washed ashore near the eastern end of the island. It was a female with oviduct greatly enlarged and convoluted. This specimen constitutes the second record of the species for Venezuela (Phelps, 1973), although there are several June records for Trinidad (French, 1973).

At dusk of the same day, two birds flew past in strong flight—low over the water. They were white below and dark above. Perhaps they were of this species.

Pelicanus occidentalis

Alcatraz

Brown Pelican

Brown Pelicans are numerous around the island. The two offshore rocks were covered with pelicans every day, sometimes as many as 60 to 75 birds on a rock. Many, but not all, were immature. When fishing, the pelicans were usually accompanied by one or several Laughing Gulls, which immediately snatched up any fish dropped by the birds.

The Black Mangroves at the northern edge of the lagoon were their nightly roost, apparently of long standing. Beneath certain branches stalagmites of droppings up to 18 inches high continued to accumulate despite heavy rains (see fig. 6). Almost no noddies were seen nesting in this pelican-roosting area.

At about 5:30 in the afternoon, pelicans began coming into the roost, flying from the south and southwest into the wind, continuing to arrive until dark (7 pm); the incoming groups grew larger as dusk approached. Two hundred or more pelicans came in nightly. As wind intensity increased toward dusk, the pelicans flew in lower and lower across the lagoon, apparently to avoid the full force of the wind, and swung up into the trees. When the winds were unusually light, some pelicans flew up the south shore and across to the roost.

On one occasion when very dark clouds moved across the sun at about 4 pm, pelicans started arriving at the roost, only to leave again when the sun came out.

In the morning the birds first flew to the mangroves to the west of the lagoon and then to the offshore rock or away from the island. Only once was a pelican seen on the island other than in the



FIG. 6. Stalagmites of pelican droppings, beneath habitual roosting spots, which continued to accumulate despite heavy rains.

roosting trees. This adult individual stood for several hours in the foam at the lagoon edge. There were numerous skeletons of immatures on this lee shore, probably indicating nesting of this species at another season. Pelicans breed on other islands in the archipelago at various times of the year (Phelps and Phelps, 1959, p. 327).

Immatures frequently faced into the wind on the offshore rocks with their wings outspread in the manner of cormorants.

Sula sula

Bobo Rabo Blanco
Red-footed Booby

Red-footed Boobies were seen flying past the island on two occasions: on May 29, a dark-phase bird, on June 28, three dark-phase birds and a white one. The desiccated carcass of an immature was found on the island.

Sula leucogaster

Boba Marrón
Brown Booby

Brown Boobies could be seen at almost any time sitting with the pelicans on the rock off the northern coast or fishing nearby. The maximum counted at any one time was eight. They were mostly immatures.

Two or three oiled and mummified Brown Booby carcasses, as well as a number of skeletons, probably of this species, were on the island.

Fregata magnificens

Tijereta de Mar
Magnificent Frigatebird

I saw only female and immature frigatebirds. Almost any hour of the morning several patrolled the coasts of the islands within sight. They were less common in the afternoons and were never seen to land on the island.

On one occasion two immatures were fighting above the tops of the Black Mangroves near the lagoon. They fought for several minutes, disturbing noddies and Laughing Gulls. Neither bird was seen to disgorge food and they finally soared away. I saw only one other instance of harassment in which a frigate harassed a Least Tern! They were too far away for me to see whether the tern disgorged any food.

Ardea herodias

Garzón Cenizo Cubano

Great Blue (White) Heron

Blue, white, and mixed plumage birds occurred both in the lagoon and along the shores of the bay. Blue birds were perhaps twice as common as white; mottled birds were not numerous but were recognizable individually. These birds fed in the same areas every day.

Daily at dusk 15 to 20 individuals flew past the island singly, moving northeast, apparently to roost.

These large herons were not harassed by the terns unless they flew low over the island. Once a white-phase individual was attacked by a Laughing Gull as it sat in the top of a Black Mangrove. It opened its bill and ducked at each attack and often erected the head and neck feathers. After a brief period it flew away, croaking.

One individual had the inner primaries in molt.

Egretta thula

Garcita Blanca

Snowy Egret

Three Snowy Egrets usually stood in the lagoon during the day and roosted in the Black Mangroves beside it at night. Phelps and Phelps (1951, 1959) did not list this species for Los Roques.

Dichromanassa rufescens

Garza Rojiza

Reddish Egret

A Reddish Egret was a daily visitor to the lagoon, and one was seen along the shore of the island. A chunky white heron seen briefly was probably a white individual of this species.

Hydranassa tricolor

Garza Pechiblanca

Tri-colored Heron

One to five Tri-colored Herons, both immatures and adults, were usually standing or feeding in the shallow water of the lagoon at almost any hour of the day. They were less frequently observed feeding in the shallow water near the shore of the island.

Terns chased Tri-colored Herons although they were never seen in the vicinity of nests. Species observed chasing were Black Noddy, Common Tern, Least Tern, and once a Snowy Egret.

Butorides striatus

Chicuaco Antillano

Striated Heron

The Striated Herons were most frequently seen in both black and red mangroves, and feeding in the shallow water close to a shore on which mangroves grew to the edge of the water. But on occasion, at low tide, individuals ventured out into the areas of exposed Turtle Grass to feed, often as far as 20 or 30 yards from shore.

Striated Herons were pursued by Common and Least Terns and Laughing Gulls. I did not see them actually taking eggs or young terns, but they often skulked near nests of those three species.

Both adults and immatures were present.

Nyctanassa violacea

Chicuaco Nocturno

Yellow-crowned Night Heron

Yellow-crowned Night Herons were probably the most important predator on the island. The Common, Least, and Bridled Terns harassed all Ardeidae when they came near nesting areas, but the Yellow-crowned Night Heron was the only species seen to take young. The number of individuals present on the island was hard to estimate because of their habit of skulking around the edges of vegetation and because individuals seemed to have a regular "path" which they followed daily. Thus, I could depend on seeing one individual near the tent in the evening and often one appeared also in the morning. Numbers were not large, however, and there were probably no more than three or four individuals on the island. On one occasion a fully grown immature

and an adult were together. All others were adult and solitary.

The Bridled Terns were particularly vulnerable to the Yellow-crowned Night Herons, as their nests in the Saltwort were most easily found by individuals walking along the edges of the vegetation. Despite violent and prolonged harassment by the Bridled Terns, the herons seemed little inclined to fly away, preferring to wait out the storm and continue as before. Once one was seen to eat a young Bridled Tern.

The Common and Least Terns were less likely to be surprised by Yellow-crowned Night Herons as their nests were in open situations. The herons did walk about close to these areas near dark and were soundly attacked and often driven away by the two tern species.

The Yellow-crowned Night Herons occasionally fed in very shallow water among the pneumatophores of the Black Mangroves. They also frequently stooped down among these roots to await the retreat of the Bridled Terns.

Phoenicopterus ruber

Tococo

Flamingo

On May 28, about 10 Flamingoes flew southwest of Francisquí, nearer to El Gran Roque.

Pandion haliaetus

Aguila Pescadora

Osprey

On June 17, an Osprey flew past, following the shore and at times flying low over the water. Common, Least, and Bridled Terns and Brown Noddies harassed it, but the Osprey ignored them. Summer records of this species from the Caribbean are not common.

An Osprey skeleton was found on the coral rubble.

Phelps and Phelps (1951) did not list the Osprey, but Phelps and Phelps (1958) included Los Roques in the range of this species.

At some time in the past another bird of prey had been on the island, as I found the dessicated heads and wings of terns, largely noddies, on the coral rubble. W. H. Phelps, Jr. (*personal commun.*) observed Pigeon Hawks (*Falco columbarius*) preying on terns in Los Roques earlier in the year.

Haematopus palliatus

Caracolero Antillano

Oystercatcher

There were perhaps six or eight Oystercatchers regularly on the island. They were occasionally in pairs but most often solitary. There was some indication that the breeding season might be near. For about two weeks one individual appeared behind a certain section of beach and walked ahead, piping and looking back, as though attempting to distract me from a nest. Despite several intensive searches, I found no nest.

Once, investigating unusually loud Oystercatcher vocalizations, I found three circling close together, piping, over a grassy field in the middle of the island. Then they flew up high very close together with rapid wing beats and, continuing their piping, they flew out of sight to the south. They frequently piped late at night as they flew past the tent.

Oystercatchers were attacked by Least Terns, but only when they landed in an area where the terns were nesting. They usually fed in the exposed sand around Black Mangrove pneumatophores.

Arenaria interpres

Playero Turco

Ruddy Turnstone

Ruddy Turnstones were present in small numbers. Most were in winter plumage but a few were in mixed plumage and occasionally one appeared to be in full breeding dress. They fed all around the island and on the lagoon shores. They and the Sanderlings seemed to particularly favor feeding in the salt foam blown up by the trade winds onto the lagoon shore.

Charadrius semipalmatus

Playero Acollarado

Semipalmated Plover

Semipalmated Plovers were present in small numbers. The numbers increased slightly after the rains, but they were never numerous.

Charadrius alexandrinus

Playero Frailecito

Snowy Plover

Small numbers of Snowy Plovers were present

around the edge of the lagoon. During the period of higher water in the lagoon, their numbers increased.

On one occasion a pair made scrapes on hard sand. One scraped while the other watched. The scraping bird would walk a short distance away while the other bird sat in the hollow for a few seconds and then followed. This was repeated several times. Then they ran and halted, ran and halted across the sand together and eventually flew away.

Charadrius wilsonia

Playero Corredor

Thick-billed Plover

At the beginning of June most of the Thick-billed Plovers were in pairs. There were four or five pairs on the island, spread out around the shores of the lagoon. The sexual dimorphism was most noticeable, with the female appearing quite caramel-colored on top of the head and on the breast band and having a narrower black band on the forehead.

Distraction displays were given by three pairs whenever they were disturbed. The female ran toward the intruder with wings out, stooped, spread the tail and beat half-open wings. Sometimes she also ran silently among the rocks. The male usually stood still and piped conspicuously. I was unable to find a nest despite repeated searches.

With the increased water level in the lagoon the numbers of Thick-billed Plovers increased slightly, but the new arrivals did not seem to be paired. About the beginning of July numbers decreased and only one pair was still in evidence at the end of my stay.

Tringa melanoleuca

Tigüi-Tigüe Grande

Greater Yellowlegs

Nearly every afternoon three Greater Yellowlegs fed very actively in the shallow water at the southern end of the lagoon. These birds were in beautiful, fresh plumage. During the period of highest water, I saw up to six individuals.

On June 23, two birds seen alone, at close range, were probably Lesser Yellowlegs. They seemed to be of slighter build and to have a

shorter bill than the usual Greater Yellowlegs. No call was given.

Limnodromus griseus

Becasina Migratoria

Dowitcher

On June 23, six Dowitchers fed briefly in very shallow water of the lagoon.

Calidris alba

Playero Arenero

Sanderling

A small flock of five Sanderlings was visible at most times along the sandy shore of the lagoon. At other times, when rain raised the water level, more individuals appeared along with other shorebirds and these mixed groups foraged in the damp sand and temporarily very shallow water. They also fed actively in the salt foam along the edge of the lagoon in company with Turnstones. All the birds were in winter plumage.

Calidris pusillus

Playerito Gracioso

Semipalmated Sandpiper

These small grayish sandpipers with black bills and legs were not seen until after the rains increased the water level in the lagoon. Then they appeared daily from June 21 through July 3. At first there were 25 to 30 each day, but their numbers gradually decreased until there were only a few.

Calidris mauri(?)

Playerito Occidental

Western Sandpiper

On June 23, one sandpiper appeared to be slightly larger than the Semipalmated Sandpiper. It had a longer bill, slightly decurved at the tip; faint markings on the center breast with slightly more on the sides; and legs and bill blackish. I believe it was an individual of this species.

Himantopus himantopus

Viuda

Black-necked Stilt

There were usually a pair of Black-necked Stilts in the lagoon, and on one occasion there were seven individuals—all adults. When

disturbed, they called with a constant, metallic "yip-yip-yip," occasionally pumping the head up and down. Often they continued for many minutes, with the birds following as I walked along the lagoon edge.

Despite repeated careful searching I was unable to find a nest even though a pair performed an active distraction display whenever I approached the northern shore of the lagoon. They flew back and forth over me, repeatedly giving a loud two-syllable alarm call. As I turned toward the side of the lagoon, they flew to the edge of the water and displayed by bringing the wings down flat and fluttering them. As I walked away from the lagoon, they flew over calling, landed in front of me, and walked ahead calling. Perhaps there were young nearby.

When these birds feed in the shallows they probe, opening and closing the bill rapidly but slightly while it is in the water. They were also seen to raise one wing when feeding, presumably to create a shadow on the surface to improve visibility (fig. 7).

This species was not recorded by Phelps and Phelps (1951) but was reported for Los Roques by Hellmayr and Conover (1948, p. 212), and by Phelps and Phelps (1958, p. 109).

Larus atricilla

Guanaguanare

Laughing Gull

A few Laughing Gulls were nesting. I found three nests (one with one egg and two with two eggs) and saw one nonflying but very large young accompanied by four adults. Two nests were 10 feet apart, each at the base of a small isolated Black Mangrove bush and just at the edge of an area containing five Common Tern nests. These terns were the most belligerent on the island and attacked the gulls whenever they moved. Once one struck a gull in flight. The eggs in all three nests hatched.

On several different occasions a Laughing Gull egg on the beach had been pecked open at the tip of the small end and emptied of its contents. The hole was large and was probably made by the gulls.

Every evening about 6:30 to 6:45 Laughing Gulls, adults and immatures, began flying in from

the west to the east side of the lagoon where they spent the night. Initially, small groups of six to eight birds came in, but as darkness approached the groups became larger, up to 25 to 30. Usually these groups flew in silently with fluttering wings, sometimes zigzagging in unison, silhouetted against the faintly light sky. But at the lagoon edge a veritable cacophony of sound kept up until after dark and the birds had settled for the night. I would estimate that 600 to 800 gulls spent the night in an area 100 feet long by 20 feet wide. A few Cayenne Terns spent the night among the gulls.

At dawn the area was vacated. Gull footprints covered the area solidly and pellets that had been regurgitated during the night were plentiful. By the next evening wind and/or rain had often removed all traces of the previous night's occupancy.

Many of the pellets were composed entirely of fish bones. These were probably obtained from



FIG. 7. Black-necked Stilt raising one wing while feeding, presumably to create a shadow on water to improve visibility.

Brown Pelican catches, because the gulls habitually followed a fishing pelican, alighting on the pelican's head or on the water when the bird surfaced, taking any fish they could grab.

Some pellets appeared to be composed of shell remains and plant matter; only one seemed to have crustacean remains. Three pellets collected away from the roosting area, but assumed to be Laughing Gull pellets because of their size and shape, contained lizard remains. Once a Laughing Gull was seen to eat a lizard. It appeared to be a case of opportunistic feeding—the lizard ran past and the gull reached down and caught it.

Laughing Gulls were attacked by both Common and Least Terns whenever they approached a nesting area but were ignored by Bridled Terns and both noddies. During the day the gulls often patrolled the island singly, usually flying over the mangroves, but they were never seen to take anything.

A gull bathing in shallow water among the Black Mangrove pneumatophores offered a distinct contrast to the splashing and repeated dipping of the terns. The water was thrown over the back with the head and the wings were moved only slightly in the water. A few flaps raised the bird several inches above the water, and then the procedure was repeated once.

An apparently ill gull spent an entire day on the beach near the tent. It stood with its head drawn down near the body, its eyes dull, and gasped audibly each time it drew a breath. I did not see it again.

Sterna hirundo

Gaviota Común

Common Tern

The 42 nests of Common Terns marked for growth studies were probably most of the nests of this species on the island. They were not very numerous compared with other breeding terns. The nests were usually on exposed sand, often on a small rise in grassy areas or in areas of low Sea Purslane. On coral rubble they occurred where there was little or no vegetation. These nests had a lining of grass or other vegetation, which was frequently substantial. On the salt pan at the edge of the lagoon they were not near any vegetation but there was usually a bit of debris beside

which the scrape was made. These nests were lined with sticks and Black Mangrove leaves.

There were almost always three to six nests in a cluster with 6 to 15 feet between them. This is not close compared with nest density in large temperate colonies, but the clumping was very noticeable, with large areas in which no Common Tern nests occurred. Within a cluster the nests all appeared within two or three days.

Growth of the young from all of these nests was studied and will be reported elsewhere.

There were perhaps a dozen Common Terns in winter plumage present on the island. These were probably one-year-old birds, as they had dark bills and feet with some showing a trace of red at the base of the bill. The plumage was very worn, as would be expected of such birds (Stresemann and Stresemann, 1966, p. 250). One such individual, picked up dead and made into a study skin, had the outer primaries in tatters but had replaced the inner ones (through number eight in the right wing, number seven in the left), and had again lost the first primaries in each wing. The tail was also in active molt. It was very emaciated and had probably starved. These young birds frequently flew over the lagoon searching for food, as did adults occasionally. None were seen to catch anything.

There were in addition two or three young birds definitely associated with adults. Their plumage was in good condition and they had very wide black "shoulders," dark bills, and feet. It is possible that these were young of the year that had hatched very early, but no buffy tips were apparent on the mantle feathers and it seems more likely that they hatched late the year before. It is of interest that they were still accompanied by adults.

The immature birds often sat as a group at the southeastern end of the lagoon, particularly at dusk. In this area each day were Common Tern-sized scrapes that were kept fresh but never held an egg. Apparently these nonbreeding birds slept in the scrapes, which perhaps offered them some protection from the very strong wind at night.

Our arrival probably coincided with the beginning of nesting for this species. At first courtship displays and fish flights were seen but these soon decreased to almost nil as egg-laying began.

Common Terns fed mostly out of sight of the

island. Several times small gray terns could be seen fishing with noddies, pelicans, and Laughing Gulls in the deeper water between Francisquí and El Gran Roque. When they were seen fishing near the island (other than the few times they were seen over the lagoon) it was off the western side.

The Common Terns on Francisquí were not nearly so aggressive as Common Terns in temperate colonies. Most of the time they objected to intruders from several feet overhead. I was only struck once; I saw one strike a Laughing Gull. In general, they came much nearer birds they attacked than they did to humans. They also attacked Royal Terns, Yellow-crowned Night Herons (and other herons on occasion), and once a Least Tern carrying a fish.

Predation on Common Tern chicks was not common; once all three chicks within a fence disappeared overnight with no apparent way to escape. However, as all the nests were enclosed by wire fences to contain the chicks for growth studies, it may have offered them some artificial protection from predators such as herons and Laughing Gulls, which might be expected to stalk their prey from the ground. On the other hand, the fences would prevent the escape of the young if a predator did get inside the fence.

A number of recent authors (Voous, 1957; Robertson, 1964; Bond, 1971) have implied that nesting of the Common Tern in the Caribbean is sporadic and fortuitous. However, the Phelps recorded it breeding in 1959 and have seen it breeding annually since then. The timing of our trip was based on their knowledge of when this species would be breeding and where. So apparently breeding in small numbers is regular on Los Roques.

Sterna dougallii

Gaviota Rosada

Roseate Tern

Roseate Terns were seen or heard daily, never more than two at a time. A pair would sometimes join in the calling of disturbed nesting Common and Least Terns. But they never seemed to be in the same place on two successive days and I do not believe they had a nest.

Every Roseate seen closely had red at the base of the bill. If the bill color in these tropical

nesters changes similarly to those in temperate regions (Donaldson, 1968), they probably had eggs or young. That they were in pairs might indicate that they had lost their clutch or brood. It is possible that Roseates nested on the sand spit with the Royal Terns.

Sterna anaethetus

Gaviota Monja

Bridled Tern

Large numbers of Bridled Terns nested on the island, but it was impossible to estimate the population because they nest underneath large expanses of Saltwort and in smaller numbers among the coral rubble at the eastern end of the island. As many as 100 could be seen at any one time sitting on sentinel posts in the Saltwort (see fig. 5) or flying above it at the western end of the island. But the number of birds visible at a particular time gives no indication of actual numbers breeding, as observations reported below indicate that frequently both members of a pair may be out of sight in the vegetation or away from the island entirely. Nor did all individuals flush when disturbed. There were undoubtedly several hundred pairs present on the island.

A few nests occurred in coral rubble, usually under some debris, but for the most part the nests were underneath the Saltwort. This vegetation formed a dense mat over large areas, often reaching heights of 3 feet, scrambling over itself and small Black Mangrove bushes. The upper surface of these areas was a solid mass of intertwined vegetation difficult to see or reach through. However at ground level, once underneath these stands of Saltwort, it was rather open as the stems were bare. In this area the Bridled Terns built their nests, usually with a tunnel of varying length into the vegetation from the nearest edge or opening. On three occasions I saw birds carrying nesting material that looked like stems of the Saltwort into the vegetation.

The single egg was laid in a depression in the sand that was bare or lined with dead stems of Saltwort. The eggs themselves showed striking variation in markings. The background color was usually whitish (although occasionally it was pale green). The spots were large with indistinct reddish brown marks underneath and dark brown spots on the surface, often heavier at the large

end, or they were quite fine and evenly distributed. Drawings showing this variation appear in Muñoz-Tebar (1950, p. 191).

The extreme measurements of 10 Bridled Tern eggs were 45.0 by 32.8, 49.2 by 33.5, 48.3 by 32.4 and 46.7 by 34.5; av. 46.7 by 33.4 mm. These are very close to the extreme measurements of four eggs given by van der Werf, Zaneveld, and Voous (1958, p. 54).

I was particularly anxious to observe courtship in this species as I could find no published accounts. I was probably too late to observe aerial courtship. Late in May a few pairs were observed in a close, coordinated flight in which the wingbeats were slow and shallow. They circled in wide circles high over the water until they disappeared or separated. Once the pair circled to the ground. Another time a pair was observed gliding back and forth in short glides and very rapid zigzagging flight.

Courting pairs were observed in the open on the beach areas adjacent to nests and on limbs which were used as sentinel posts. More often the characteristic sounds made by a courting pair were heard beneath the vegetation. Courting was seen most frequently in the morning and late afternoon although there was much nighttime activity, particularly when the moon was bright.

When the pair was on the ground one member of the pair (the male, whenever copulation and copulatory stands were observed) postured in front of the other with its head usually the lower of the two, folded wings held out from the body, tail slightly up (figs. 8, 9). Often it held a regurgitated fish lengthwise in the bill, sometimes protruding beyond the tip. In display this bird walked back and forth in front of the other, or simply moved the head back and forth. Once when the bird with the fish had its head higher, the other bird attempted several times to take the fish. I did not observe courtship feeding. A sound resembling a child's squeaky toy and a few low intensity "arks" accompanied this display.

The other bird stood in a normal stance; or stood normally but moved its head back and forth alternately with the displaying bird, giving a low chuckling call like maniacal laughter; or postured similarly and moved its head or walked back and forth giving the same chuckling call. In the last case, first one bird and then the other displayed and the displaying bird ducked its head

under that of the watching bird in a quick movement.

The display sometimes occurred on a limb, in which case the two birds sometimes stood side by side, one with the head higher than the other. In most cases, however, one bird stood with its long axis parallel to the limb, head rather low, and folded wings held out from the body; gave the squeaky-toy call; and often regurgitated a fish. Sometimes the wings of this bird hung down below the level of the limb, one on each side. It moved its head back and forth. The other bird frequently had its wings closed and head higher and often did not move its head. Sometimes, however, its head was lowered and moved back and forth alternately with the head of the other bird, making chuckling noises as it moved. Or the birds faced each other on the limb and bowed back and forth past each other.

Occasionally I saw courting pairs in which both birds had their heads up, their wings out, and both uttered "arking" noises. In one case they were probably a pair with a large young under the vegetation nearby. Sometimes two or three pairs were courting near each other on the beach.

I was particularly struck by the restricted movements of the courtship and by how close together the members of a pair stood. This probably developed because much courting goes on underneath the vegetation where movements would necessarily be restricted. That courting took place even more frequently under the vegetation than in the open was attested to by the absolute cacophony of alternating chuckling and squeaky-toy noises heard morning and evening and sometimes all night. So far as I could determine these sounds were heard together only when pairs were courting. An arriving bird may give an "ark-ark" on landing at a sentinel post near its nest and may be answered from below the vegetation, probably by its mate, either with a chuckle or squeaky-toy sound. I believe these sounds may prove to be characteristic—the squeaky-toy noise of the male and the chuckling of the female.

When a pair returned, or one of a pair returned and the other was sitting on a sentinel post, in many cases there was a brief display before one or both birds entered the vegetation.

The Bridled Terns had a distinct daily routine

that began in the morning with birds sitting on their sentinel posts. They were usually quiet, with only occasional "arks" being heard when

the birds were undisturbed. After eggs had been laid, one of the pair was often under the vegetation presumably incubating. The birds were

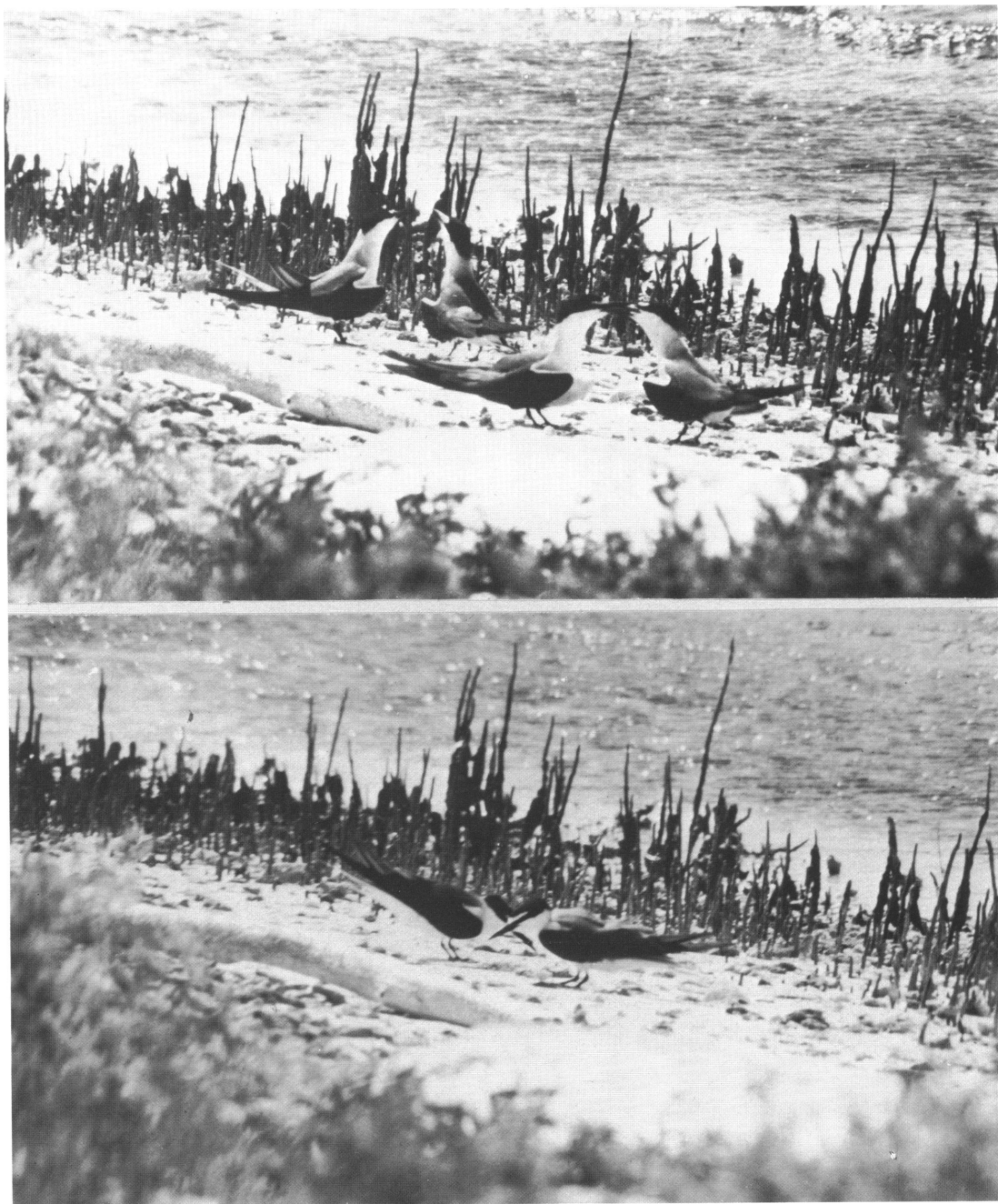


FIG. 8. Displaying Bridled Terns illustrating postures described in text.

usually quiet during the middle of the day. Single individuals and small groups could be seen at

most times flying away from the island in a northerly or easterly direction, presumably to



FIG. 9. Displaying Bridled Terns illustrating postures described in text.

feed. These individuals frequently gave the "hurry-up" call that I came to associate with these directional flights.

As incubation progressed the activity pattern of the adults changed. There were considerably fewer birds on sentinel posts at any one time and the numbers and size of flocks making directional flights increased, particularly in the evening. Groups of five to 30 individuals were seen to take off together, calling "hurry-up" and flying north or east. I believe these birds often fed all night, particularly when the moon was bright, as groups seen near the tent often landed together in the morning. Most of the returning birds arrived late in the evening or at night, when a loud outburst of chuckling and squeaky-toy noises marked their arrival. They flew to sentinel posts and waited for several minutes before quietly walking into the vegetation. I could not be sure, without marked birds, whether the sentinel posts were used by more than one pair, but I think they were on occasion.

I was able to identify individually one pair of birds with a nest near the tent. One individual had its face and vent well fouled by crude oil and the other had only a spot near its bill. They had an egg at the time. The shifts of incubation appeared to be 24 hours although on several occasions it may have been longer. I was able to follow them for 15 days. During this time they were not observed courting. Unfortunately, the egg disappeared after this, probably eaten by a Yellow-crowned Night Heron which I surprised in the vicinity of the tent on the evening before the adult birds disappeared.

Changeover seemed to be without ceremony. A bird came in, called and entered the vegetation. One came out nearby, shook itself, and after standing a moment, flew away.

Once the chicks hatched, both adults probably left the island to feed. In one nest with a chick, there was usually no adult around during the day, although on several occasions I saw one fly in, give squeaky-toy calls and look down into the vegetation repeatedly, enter the vegetation for only a three to five minute stay and then fly away. Presumably it fed the young. When I collected several young for specimens I did not see adults fly up from the vicinity of the young except when they were newly hatched. And the

number of adults around the tent decreased about the time the young were hatching.

At least some of the adults are present at night, for I saw them arriving at dusk and heard them after dark.

Bridled Terns have a very varied vocabulary. The "ark-ark" or single "ark" was given when the birds were mildly disturbed or alert. If the disturbance became more severe, the "arks" increased in number and intensity. At very high intensity—as when a Yellow-crowned Night Heron was in the vicinity—the "arks" alternated with a "trrrrrrrrrrr." On such an occasion the birds hovered in groups of 20 to 25 over the heron, individuals flying quite close to its head but not striking it. The heron often responded by standing quite still for long periods; the Bridled Terns continued to "ark" loudly. On one occasion the heron stood still for more than 20 minutes and one Bridled Tern became progressively hoarser until it lost its voice altogether! I also saw Yellow-crowned Night Herons ignore the Bridled Terns and continue to walk along the edge of the Saltwort and peer in.

Bridled Terns also have a call similar to that of the Sooty Tern. I noted it as "hurry-up." It was given by small flocks flying from the island out to sea, presumably to feed, and was also given when the birds were excited by rain. Bridled Terns became quite noisy as rain approached and several times as the rain began they hovered in groups of 25-30 over the Saltwort and repeatedly called "hurry-up." Noddies also reacted when rain approached, by flying about in pairs over the mangroves, calling. This behavior is quite distinct from their behavior when they are disturbed by a predator.

The chuckles and squeaky-toy sounds were used in courtship and perhaps in calling the young. When numerous pairs were courting, the noise of the colony was eerie.

Another call was noted once. At about 10 pm there was a sudden chorus of Bridled Terns outside the tent. The sound they made seemed related to the "chuckling" but it was more musical and more insistent, almost like small bells ringing. Some of the birds flew away, giving the same call far out over the water. The birds that remained were soon silent.

The Bridled Terns seemed susceptible to

predation. Opened Bridled Tern eggs appeared frequently near the edge of the Saltwort, and once I saw a Yellow-crowned Night Heron eat a downy young Bridled Tern. This happened in mid-morning, and apparently neither parent was present. The heron reached into the vegetation, caught the chick by a wing, and swallowed it.

Young Bridled Terns were variable in down color. Above they ranged from a very light gray (much white down mixed with some gray) to very dark gray (dark gray down with very little white), to dark gray down mixed with varying amounts of tan, to some individuals that were largely tan. The chin and throat were of the same color as the back, except that one individual collected had a white chin. The breast and abdomen were white.

The oldest chicks were just beginning to acquire their juvenal plumage, which was also variable. The feathers on the back and wing coverts were basically very dark gray. One individual had the feathers all dark gray with no lighter tips, but most had light tips on the feathers that varied in width from hardly discernible to about 6 or 7 mm. wide and in color from white to tan. The abdomen feathers were white.

Two newly hatched young weighed 16.0 and 19.5 grams and the wing measured 17.6 and 18.1 mm. Both had an upper egg tooth, blackish skin, and black bill and feet. When they were just dry the down had extraordinarily long, pointed tips (up to half an inch), which broke off at the slightest touch. The down remained pointed, but the tips were not so long. The most striking thing about the young was their relatively enormous eyes (fig. 10). The head was broad, to accommodate the eyes, and proved difficult to skin. The large eye size is probably an adaptation to nocturnal habits.

The young did not form creches as do young Sooties. Whenever I discovered young, they were solitary. There was no evidence of fledged young. The prefledging period is probably similar to that of the Sooty (about eight weeks, Ashmole, 1963; Dinsmore, 1972).

As adult Sooty and Bridled Terns are so similar in appearance, the differences in their behavior and morphology are particularly interesting. The varied vocabulary, nocturnal behavior, courtship, and nesting beneath vege-

tation, lack of creching, and perching on elevated sentinel posts all set the Bridled Tern apart. In addition the webbing between the toes is more incised in Bridled than in Sooty Terns, allowing them to perch more efficiently on small limbs of Black Mangrove or Saltwort. Despite this they frequently had trouble maintaining their balance in the strong and gusty trade winds. Brown and Black Noddies, with their large webbed feet, perched almost exclusively on large limbs of Black Mangrove or on their nests. And the Black Mangroves also serve as an effective windbreak, so that they are not subjected to the buffeting the Bridled Terns receive.

Adult Sooty Terns have the tomia of the bill

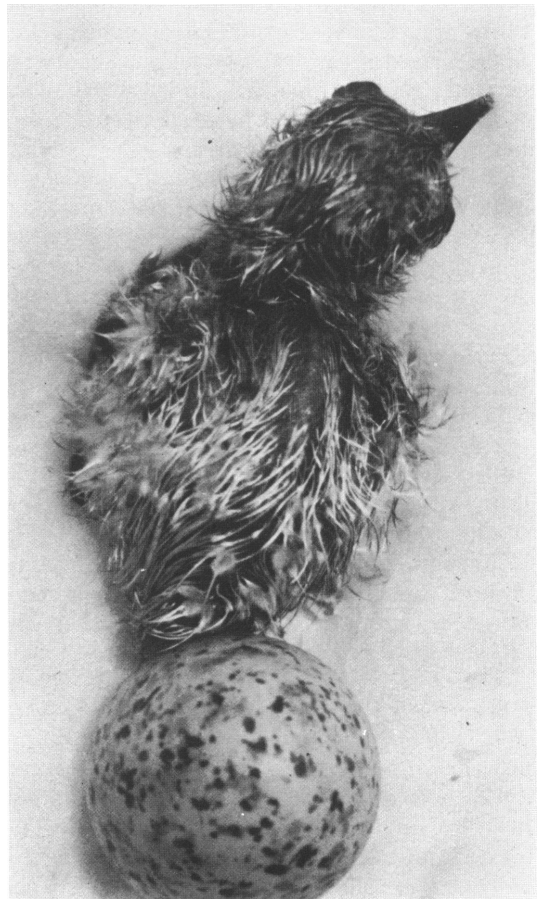


FIG. 10. Newly hatched Bridled Tern showing the breadth of the head and relatively large eyes.

serrated near the tip, presumably for holding on to fish. This is not true of the Bridled Tern, although there are rough, parallel ridges running lengthwise inside the mouth perhaps serving the same function.

I never saw Bridled Terns "dipping," as Sooties and other terns frequently do. On the other hand, once a Bridled Tern entered the water to bathe, which Sooties are presumed not to do because their plumage is not water repellent (Watson and Lashley, 1915, p. 39). The Bridled Tern fluttered straight down to the water from about 20 feet up and sat briefly on the surface making a few bathing motions with the wings. It then flew up and shook. This was repeated four times.

All feeding was apparently done out of sight of land, with groups departing together. I picked up two fish regurgitated by young Bridled Terns. One was a flying fish too digested for identification; the other was a flying gurnard (*Dactylopterus volitans*). Lavett Smith informed me that adults of this species are not usually found at the surface, but that young ones are sometimes abundant near the surface.

Sterna albifrons

Gaviota Pequeña

Least Tern

Least Tern nests are widely spaced (10-30 feet apart) and hard to see. Probably a higher percentage of the nests of this species than of Common Terns were not found (total found, 64). Also the breeding season appeared to be more extended in Least Terns, as I saw flying young in late May, and unhatched eggs remained in early July. The wide spacing and protracted hatching period are probably antipredator devices useful to these small terns. They are, however, able to defend their nests and frequently chased Laughing Gulls out of an area. They were less belligerent toward human intruders, merely staying above their heads giving "chee-wink" calls. Probably some protection is afforded by nesting in close proximity to Common Terns.

In late May I frequently saw pairs courting. The pair landed together with the male (when copulation followed) carrying a fish. They stood side by side with the female slightly in front and

soliciting from a stooping position. The male frequently jerked his head upward, flicking the small silver fish so that it glistened in the sun and appeared alive. (Massey, 1974, and Wolk, 1974, also noted this behavior in other populations of Least Terns.) On three occasions the female turned her head back and tried to snatch the fish, but was unsuccessful. When copulation occurred the female took the fish from the male and ate it.

Groups of adult Least Terns, usually four to six but up to 10, came in and landed in pairs 10-15 feet apart, giving musical "kee-ip" calls. Pairs in these groups made fluttering vertical flights, to 10 or 15 feet high, accompanied by chittering. When they left, they did so as a group. As this is the pattern of nest appearance—from three to seven or eight nests in a group within a day or two of each other—this behavior may function as nest-site selection and may indicate that group adherence is strong in this species, as suggested by McNicholl (1975).

The Least Tern nests were found on bare sand at the edge of the lagoon, on coral rubble with low growth of Sea Purslane, and in small bare spots in grassy areas. Common Terns nested in the same areas. The Least Tern nests appeared to be clumped within these areas. They were usually unlined scrapes (but in a few instances I saw nests lined with small stones) and contained one (22) or two (41) eggs, once three. Sleeping scrapes were also a feature of this species and they could be distinguished from those of the Common Tern by their smaller size. They occurred mainly on the lagoon flat.

The young were extremely difficult to see, even within the hardware cloth fences where they were confined for growth studies. They were fed with very small fish. Tentative identification of some partially digested fish indicates that the following genera are represented: *Harengula*, *Anchoa*, *Jenhinsea*, *Atherinomorus*, *Mugil*, *Parexocoetus*, and *Cypselurus*. Adult Least Terns were the only species frequently seen fishing quite close to shore.

When fishing, Least Terns dive into the water from a greater height than do Common Terns. The dive begins about 30 feet above the water and is very controlled down to about 10 feet—as if the dive could be stopped at will down to that

point. Below 10 feet, the bird plummets into the water.

The "dipping" that is frequent in noddies of both species and observed in Common Terns, is also performed by Least Terns. In the Least the "dip" begins higher above the water (approximately 15 feet up) and, rather than wetting mainly the bill, the Least Tern makes a splash as it skims the surface. This is not bathing; the bird does not pause. Least Terns bathed, floating on the surface and moving the wings to splash water over the entire body.

I found only two instances of predation. One morning an adult was dead just outside a fence containing one young. The night before I had heard a commotion in the area but was unable to see what caused it despite a full moon. The dead adult showed no sign of a blow. The throat was partially eaten, but this was probably the work of hermit crabs. The chick was unharmed and had perhaps been protected by the fence. Feeding was continued by the remaining parent. On another occasion I found a dead young Least Tern. It had a hole pecked in the back of the head, probably by another tern.

After June 28, there was a daily gathering at dusk of adult and flying young Least Terns on the salt flat at the southern end of the lagoon. On several occasions I estimated the number to be near 400. Just as dark descended, approximately half took off, flying to the south, leaving the others to spend the night on the flats. There were probably mostly young remaining behind. In this species sleeping on the flats so that a predator could not approach undetected may be yet another antipredator device.

Sterna maxima

Gaviota Real

Royal Tern

Royal Terns flew past the island daily, fished in the shallow water just offshore, or sat in twos or threes on a sandy spit on the western end of the island, rarely on the edge of the lagoon. They were breeding on an inaccessible sandbar and I could see large young through a telescope.

Individuals often caught fish near the island and flew with them toward the sand bar. Once two birds flew past low over the water, the lead bird holding a fish and calling. Suddenly the rear

bird landed briefly on the water, the lead bird turned and flew over it, giving it the fish. The bird on the water then took off carrying the fish. I assume this is a case of a parent feeding a flying young.

Every indication was that breeding was well along in this species. I only saw one bird with the forehead completely black. Once I observed a copulatory stand but no attempted copulation, and only twice did I see birds engaging in paired flights of short duration. No such activity was noted after the middle of June.

Royal Terns were usually ignored by all other species of terns, but once one Common Tern chased four. Another time a Laughing Gull attacked a Royal Tern carrying a fish, but the tern did not relinquish it.

A Royal Tern flying close to shore with a wide, flat fish in its bill was apparently unable to swallow it. It repeatedly flew up, tossed the fish upward with a quick flick of the head, caught it, and mandibulated it, sometimes turning it around in the process. Several times it flew down to the surface and wet the fish. After several minutes of this behavior it flew out of sight still carrying the fish.

Sterna eurygnatha

Gaviota de Cayena

Cayenne Tern

The Cayenne Tern probably bred on the same small sand spit as the Royal Tern. I saw individuals on and over the islet daily, and some apparently roosted nightly with the Laughing Gulls along the east shore of the lagoon. Nine Cayenne Terns were the most seen at any one time.

Bill color is variable, ranging from "true Sandwich" (black with a yellow tip) to "true Cayenne" (mostly yellow, with darkening along the tomium). There are all degrees of intermediacy (see Junge and Voous, 1955, and Ansingh et al., 1960).

Anous stolidus

Tiñosa

Brown Noddy

Brown Noddies were the most numerous species on the islet. Brown and Black Noddy eggs were regularly taken by eggers from those nests

readily reached. There were relatively few nests below about 10 feet, and this may reflect the constant eggng pressure.

Eggers were first seen on May 29, and continued to visit the island almost daily for the next two weeks. They were usually searching for noddy eggs, although I did see them take a Bridled Tern egg and once they were looking for Laughing Gull eggs. One half-full bucket of eggs contained those of both noddies. After the eggers ceased their activities, eggs appeared in some of the lower nests of Brown Noddies.

When I first arrived, I frequently saw Brown Noddies picking up nesting material from the beach just above the high-water line and from the ground beneath the Black Mangroves. Usually they patrolled the beach, singly or in pairs, dipping down on the wing to pick up some item. Birds thus engaged flew very slowly and constantly looked from side to side. On occasion they lowered their feet to slow them, and sometimes turned their secondaries downward to slow them even more. Beneath the trees and occasionally along the beach the birds landed before attempting to pick up Black Mangrove sticks, of small diameter but up to 2½ feet long, and dead stems of Saltwort. On a number of occasions birds made several attempts to detach these dead stems from plants. Once a bird took a stick from an unoccupied nest, flying off with it, then returned to pull at other sticks in the nest.

The nests were loose aggregates of sticks, without seaweed or leaves, placed in the Black Mangroves, 3 to 25 feet aboveground. They were most often farther out on the limbs than nests of Black Noddies, sometimes very near the end in the leaves. Only one nest that I saw was lined with wave-worn coral and shell. The young apparently do not defecate in the nest.

Paired flights were of several kinds and seemed to be more numerous on sunny, windy days. The most frequently observed pattern was the following: takeoff from the mangroves, gliding or slow flapping flight out over the water at heights of 10 to 40 feet with the birds fairly far apart, circling once or twice at higher elevations with rapid flapping and the birds close together, separation with one or both giving a swinging glide several times just at the end, and a long glide back to the trees. The birds regularly

shake hard at some point during the flight, one bird shaking and the other doing so almost immediately thereafter. The entire sequence usually lasted 30 seconds to three minutes.

This sequence is in many respects similar to the High Flight described by Moynihan (1962, p. 227) for the Brown Noddy. He believed that it perhaps served to strengthen the pair bond or served as an outlet for hostilities between the pair. It is even more similar to the High Flight of the Black Noddy of Ascension Island described by Cullen and Ashmole (1963, p. 437). My impression was that there was an enormous increase in the number of these flights in the period immediately after the cessation of visits by eggers, and I wondered if they might be associated with recycling by the birds to lay another egg. The last 10 days of my stay I saw few such flights. The flights I saw were associated with sunny, windy weather, whereas Moynihan reported flights associated with cloudy, cool weather.

The various components of the above flight pattern were also observed singly. The glide and slow flapping flight out from the mangroves was often followed by an immediate return to land.

The swinging component was usually performed by only one of the pair, and may occur when the birds are close together or widely separated. There was never the close coordination of the Aerial Glide of the Common Tern (Palmer, 1941, p. 45). When two birds were observed swinging at the same time, it was usually a loose crisscrossing when they were widely separated. If they were close together, they appeared to hang in one place and swing back and forth past each other several times.

Pairs were also observed flying close together high over the water. The wing beats were rapid and in unison and there were no glides. Once a bird was seen to have something in its bill. These flights usually lasted 10-15 seconds before the birds circled widely and flew back to land, sometimes separating as they did so.

On a number of occasions there were three birds. Two birds flew more closely together, flapping rapidly, then one of the two joined the third bird and flew with it. There was no sign of aggression. However, aggressive chases were seen several times. One bird chased the other,

"growling." Once a bird seemed to actually peck the bird it was chasing.

Once a group of 14 to 16 Brown Noddies came into an area of several nests with incubating adults. The newly arrived pairs performed courtship displays on the Black Mangrove limbs, interspersed with paired flights over the water and some aggressive chases. They remained for about an hour and departed as a group. They were ignored by the incubating birds.

The Brown Noddies were not particularly aggressive toward humans or other potential predators on the island. They left their nests when someone approached and circled overhead "growling," but only one or two individuals ever swooped at the intruder. Occasionally, however, an incubating bird remained on the nest, pecking if I attempted to touch it, or giving a distraction display in which it fluttered to the ground and along in front of me with wings and tail outspread.

Both species of noddy reacted to the beginning of rainfall by circling above their nests in pairs, vocalizing. They very soon settled back on the nests.

Phelps and Phelps (1959) reported breeding by the Brown Noddy on various of the islands of Los Roques group from February to August. On Francisquí evidence indicates that egg-laying was beginning at the end of May. The eggers were active at that time, and an egg I found on the ground had no embryo visible. However, there was a well-grown young present in one group of low nests, and eggs appeared in the other nests after egg-laying had stopped. With an incubation period close to five weeks and a pre fledging period close to six weeks, it is obvious that Brown Noddies might be found breeding on the islet for at least five months and perhaps seven months of the year.

The single egg is chalky white with reddish brown spots, either scattered fairly evenly over the surface or concentrated at the large end. Measurements of eight eggs show the following extremes: 55.0 by 35.4, 52.0 by 35.8, 48.9 by 34.1. This is within the range of measurements given for this species by Stonehouse (1963, p. 477). The eggshell is apparently not removed from the nest after the chick hatches. In one case it was still present in a nest with a day 5 chick.

The newly hatched young have dark skin and sooty down, except for a trace of grayish white on the front of the head and ends of the wings and occasional small areas of whitish down under the wings and on the belly. The Black Noddy chick is blacker, has more white on the head, and lacks white on the wing tips. Chicks of both species have very fleshy wings and two rows of serrations running along the roof of the mouth toward the throat. Brown Noddy chicks have the inside of the mouth flesh-colored. There was no evidence of any white-phase chicks, but I might have missed them, due to the small number of chicks that hatched and the height of the nests.

There were only three birds of known age, measurements for which were: day 0, wt. 28 gr., 25, 25; wing, 22.5 mm., 19.6, 19.7; day 1, wt. 29.0, 24.5, 27.0; wing 22.4, 19.4, 20.9; day 2, wt. 36.0, 23.0; wing 23.2, 20.2; day 3, wt. 40.0; wing 25.2; day 4, wt. 47.0, wing 25.6; day 5, wt. 42.0, wing 27.8.

The upper egg tooth was present at hatching on these three birds and had been lost by day 3 in one individual. The lower egg tooth was present at hatching in one individual but had disappeared by the next day.

Feather development on the body is very rapid. One individual had pin feathers on the scapulars and back by day 2; by day 4 the scapular feathers were breaking the sheaths and pin feathers had appeared on the breast and head; by day 5 the secondaries were pin feathers but there was no noticeable growth of the primaries. The rapid acquisition of body feathers probably serves to insulate these tropical terns from the sun. As it is about six weeks before they fly, rapid growth of the primaries is unnecessary.

Noddies feed at a distance from the island and could regularly be seen in large groups of undetermined species feeding from one-half to several miles from shore over deep, blue water. I never observed more than a single feeding flock in sight at one time, and these flocks were composed of from 15 to hundreds of individuals. They were very difficult to see when below the horizon and were most noticeable when they wheeled toward me; then their white foreheads were seen as bright flecks dancing on the water. Occasionally they were joined by small numbers

of *Sterna* sp. and once I observed Laughing Gulls and a female frigate bird feeding with them.

Once a Brown Noddy was seen feeding at the lagoon, skimming low and reaching down with its bill as though picking up something from the surface. The only food item identified was a juvenile gurnard (*Dactylopterus volitans*) regurgitated by a chick.

Birds were daily observed "dipping" and bathing in the ocean. Bouts of such activity occurred during the hottest part of the day—from about 10 am to 3 pm. When "dipping" the birds fly out from the mangroves, just break the water surface with their bills (and sometimes breast and/or feet), and fly back to the trees. This activity may serve to cool the adult and/or the egg during this period of high ambient temperature.

When bathing, the birds actually enter the water either landing on the surface or entering in a shallow dive. In either case the wings are flapped and the bird shakes violently as it takes off. This is usually repeated three or four times in rapid succession.

Once after a brief, hard shower about 50 Brown Noddies, all from one area of mangrove, were dipping and bathing. Time after time they repeated this behavior for about five minutes and then returned to the mangroves. Shortly thereafter there was a second, hard shower and after this approximately 10 Brown Noddies from the same area were again observed dipping and bathing.

In contrast to these presumed cooling activities, both noddies sunbathed. The birds gathered in groups of a few birds up to 25 or 30 individuals—with constant turnover—in areas mostly bare of vegetation and sheltered from the wind with the sun shining directly on them. A hotter location is difficult to imagine.

The sunbathing position is similar to that of a stretching bird but is held for many minutes. The Brown Noddy holds the body slightly more horizontal than the Black Noddy, which has the head lower and the wings held more up and out (fig. 11). After sunning for several minutes, the birds effected some cooling by raising the feathers around the vent and on the back and by opening the mouth, raising the base of the tongue, and panting. No gular flutter was observed. If the sun disappeared behind a cloud

during a bout of sunbathing, the birds resumed normal postures and began preening. There may be brief aggressive postures toward or even a run at a newcomer to these gatherings, but this is infrequent.

Incubating Brown Noddies are often exposed to the hot sun and may sit for long periods without leaving their nests. When they are asleep the lower eyelid, which comes up over the eye, is white as are the feathers bordering it. The effect is that of a downward extension of the white cap and is far more obvious than when the eye is open, making the bird appear to be awake. The white on the head may also serve to reflect some of the intense heat of the sun away from the head.

Anous tenuirostris

Tiñosa Negra

Black Noddy

Black Noddy nests average higher than those of Brown Noddies; a few I saw were below 12 feet, but were often much higher. The nest is in Black Mangrove (once in Red Mangrove), usually in a wide crotch composed of more than two limbs or in a horizontal fork; but it may be draped across a limb. It is a compact platform of seaweed held together by droppings, about 8 inches in diameter, and has almost no depression in the top. Apparently the adults defecate over the edge of the nest so that the sides, but not the top, are covered with droppings. In nests with young the entire platform is often covered (fig. 12).

Adult Black Noddies in flight were frequently seen picking up floating seaweed from near the shore or dry seaweed from along the high-tide line. A few times I saw them walking along the tide line picking up material. On these occasions they were not attacked by Bridled Terns which were nesting nearby. Other than these scattered instances, the Black Noddies came to the ground only for bouts of sunning.

Adults appeared to be incubating when I arrived and the height of the nests probably made them somewhat less subject to the depredations of eggers. By the middle of June some of the eggs were hatching, and downy young shared the nest platform with a parent. When the nonincubating or nonbrooding parent was



FIG. 11. Sunbathing Brown and Black Noddies.

present it was usually on a sentinel limb very near the nest.

The single egg is very similar to but smaller than the Brown Noddy egg. At hatching the young are covered with black down except on the forehead and under the wings, where the down is white; the skin is blackish except lighter under the white down. After a few days (five days in one case) even the forehead skin becomes quite blackish. For comparison with Brown Noddy chicks see that species.

Like the Brown Noddy, Black Noddy chicks become feathered very quickly on head and body. Two chicks of known age had pin feathers on the forehead by day 4. One had pin feathers in the scapular area on day 2 and feathers were beginning to break the sheaths all over the body and secondaries by days 5 to 7. Newly feathered young are replicas of the adults, including a yellow mouth lining. They have two rows of serrations in the roof of the mouth, leading toward the throat.

Cullen and Ashmole (1963, pp. 440-441) suggested that similarity in color of downy

chicks and juveniles to adults is an adaptation to cliff nesting in the Black Noddy on Ascension Island. It enables them to assume aggressive postures and defend the nest ledge in the absence of the parents. This could also apply in the case of arboreal nesting Brown and Black Noddies where the young are unable to leave the nest until they can fly. But we did not see aggressive encounters between young and adults such as were common on the Black Noddy ledges on Ascension.

The young Black Noddies are extremely fat when only a few days old, so much so that the few individuals collected were very difficult to skin. The wing is fleshy from hatching, as in the Brown Noddy, particularly over the radius and ulna.

Both of our known-age chicks hatched with the upper egg tooth present; one had lost it by day 2, the other by day 7. One had the lower egg tooth present on the day of hatching.

In three accessible nests checked daily for about two weeks, two of the eggs hatched after showing stress marks for four days and pipping

for one. The third had been stressed for five days when I left the island and was just ready to hatch. (It had stress marks in seven places around the shell but was not yet pipped.) Ashmole (1962, p. 241) reported a similarly long period between "starring" and hatching in the Black Noddies on Ascension.

The following measurements were made of two known-age birds: Day 0, wt. 22 gr., 17, wing 19.2 mm., 18.2; day 1, wt. 24, 21; wing 21.0, 18.8; day 2, wt. 27, 26, wing 22.8, 20.6; day 3, wt. 34, 27, wing 22.8, 21.5; day 4, wt. 35, 29, wing 24.1, 23.4; day 5, wt. 39, wing 27.7; day 6, wt. 42, wing 30.7; day 7, wt. 38, wing 33.1; day 8, wt. 48, wing 36.9; day 9, wt. 53, wing 40.7. These measurements are within those given by Ashmole (1962, pp. 242-243) for Ascension Island Black Noddies. I did not see any flying young and believe the juveniles were still too young to fly when I left.

Aerial activity among Black Noddies was less than among Brown Noddies, perhaps because nesting was already underway in late May. Probably fewer nests were reached by eggers, thus relatively more birds were actively incubating.

The paired flights were less complex than those of Brown Noddies, and those described by Cullen and Ashmole (1963, p. 437) for Black Noddies. Most observations were of a pair flying with coordinated and somewhat exaggerated wing beats, circling out over the water and back to land, sometimes calling. I never observed any crisscrossing or shaking such as I saw in the Brown Noddy. Several times I saw aerial chases.

Later fewer paired flights were observed. There was, however, an increase in the number of individuals flying away from the island, singly, in the evening. As this behavior increased at the time that there were young chicks, the adults may have found it increasingly necessary to feed at night.

There were occasional bouts of Nodding either between birds on adjacent nests or between a bird on a nest and a bird arriving. The nods were shallow, with the heads of the birds never going much below the horizontal, but sometimes the tongue was lifted in the center of the mouth as the head went down. Both Moynihan (1962, p. 233) and Cullen and



FIG. 12. a. Black Noddy nest showing defecation by adults around the edge. b. Black Noddy young in nest showing top of nest covered by droppings.

Ashmole (1963, p. 430) described this low intensity Nodding.

The Black Noddy has a number of vocalizations, all quite different from the Brown Noddy. The ones most often heard I described as "tick-kor-ree" or "tick-tick-kor-ree" and a staccato rattle. Both of these are given when the birds are disturbed, during encounters between individuals, and in flight. There is also a clacking sound made during encounters that reminded me of a woodpecker drumming rapidly. These are probably the "kik-krrrr," the Rattle and perhaps the "krrrrrrr" of Cullen and Ashmole (1963, pp. 430-434) and are probably part of the continuum of calls from Long Caws to rapid rattling Cawing described by Moynihan (1962, p.

234). This species reacted to human approach by flying overhead and calling "tick-kor-ree" and giving the staccato rattle. They never flew close to the intruder.

Columbina passerina

Tortolita

Common Ground Dove

Ground Doves occurred in groups of two or three but were not very common. Once about 12 were feeding together in a sandy area.

One nest was on a horizontal fork, about 3 feet aboveground where a branch had fallen across a living Black Mangrove limb. It was a fairly open spot and sun hit the nest in the early morning. The nest was a fairly substantial platform made of small sticks, dead Black Mangrove leaves, and dry Turtle Grass. When found on June 1, it contained two semigloss white eggs, oval, and measuring 22.2 by 16.3, 21.5 by 16.0.

A second nest, found on June 9, was a similar platform built in an empty Brown Noddy nest about 15 feet up in a Black Mangrove. It already contained two young.

To obtain some evidence on their food, I collected the nestlings from the second nest and saw that their crops were filled with small seeds, later identified as being from the Buttonwood. These bushes were full of seed balls during our stay and the seeds were also found in some areas of beach along the high-tide line. According to Carlton (1975), this species blooms all year and thus would provide a constant supply of food for the doves.

The young in the first nest were followed daily until they fledged. When hatched they had black skin except on the legs, which were flesh color, and almost white, sparse scraggly down. Both an upper and lower egg tooth were present. The bill had a dark gray base and a light tip, separated by a black band. The feet of the young are extremely strong and they clung both to the bottom of the nest when I attempted to pick them up and to my hands when I put them back in the nest. As they grew it became increasingly difficult not to tear up the nest when I picked up the birds to weigh them.

Feather growth is amazingly rapid. Not only is the skin black, but the feather sheaths are as

well. They are hard to see at first and grow quite long before they split to free the feathers. Adults were not seen to brood the chicks after the older was about day 4.

The young doves left the nest on the same day (one on day 12 and one on day 13). The younger individual was not seen again. The older one was seen for several days thereafter in the vicinity of the nest. It already looked like the adult except for a very short tail, which gave it a rail-like appearance. It could fly well by day 15 and was seen on several occasions preening very actively.

Growth and development data for the two birds are summarized in table 1. These data are very similar to data in Nicholson (1937) for a Florida young of this species.

Sublegatus arenarum

Bobito Encrestado

Scrub Flycatcher

The Scrub Flycatcher was present on the island in moderate numbers, but there was no indication of breeding. Only once was a bird heard to sing as a pair moved through the trees.

They seemed to prefer a perch on the near-vertical trunks of the Black Mangroves or the larger limbs, from which to sally out and snap up insects in flight or flutter in front of a Black Mangrove and take an insect from the bark. However, they were seen gleaning for insects on many occasions. They seemed to prefer certain areas of Black Mangrove where there was much underbrush, seldom being seen in areas clear of such debris. They were very tame and came within 10 feet of the observer, often having the feathers of the head slightly erected into a crest. They were seen mostly at heights of from 3 to about 15 feet, and not in the leafy parts of the vegetation. Contrary to what Voous (1957, p. 203) found in the Netherlands Antilles, I never saw them on the ground.

Coereba flaveola

Reinita Común

Bananaquit

Bananaquits are common but rather shy and hard to approach. All individuals that I saw were melanistic; however, many had an olive cast in good light and the rump often looked yellowish

TABLE 1
Growth and Development of Two Young *Columbina passerina*

Day	Chick 1		Chick 2		
	Weight	Wing	Weight	Wing	
0	3.5 gr.	7.9 mm.	3.5	7.5	—
1	4.5	9.4	5.0	9.8	—
2	6.5	13.8	6.5	14.3	Lower egg tooth gone, primaries in pin
3	9.0	19.8	8.5	20.6	Eyes open, wings and tail in pin
4	11.5	26.3	9.5	25.4	Pin feathers all over except abdomen and head
5	15.0	32.5	10.5	31.2	Pin feathers on abdomen
6	16.0	38.8	12.0	35.6	Upper egg tooth gone
7	18.0	42.2	12.5	39.2	Legs getting very dark, wing feathers breaking sheaths
8	17.5	49.4	12.0	43.4	Feathers breaking sheaths all over
9	17.0	53.0	11.0	46.3	Down adhering to feathers on back and wings
10	17.5	56.1	10.0	47.5	—
11	17.5	59.9	9.0	50.1	Black band on bill less obvious
12	19.5	62.0	gone from nest		—
13	gone from nest		—		—

to olive. Perhaps there is a sexual difference. There were juveniles present and these could readily be told by their very short tails and bright yellow mouth flanges. In plumage they were dark gray, somewhat lighter on breast and abdomen. Some very black Bananaquits had bright red rictal areas. These red areas were present in some birds accompanying young. In others the patch was not noticeable but if particularly looked for could be seen to be orange-red to fleshy in both black individuals and those with an olive tinge. Perhaps the bright red spot is characteristic of the male in the breeding season. This bright rictal area was mentioned by Cory (1909, p. 217) in the original description of *C. f. lowii* but seems not to have been mentioned since. It is most noticeable in the field but fades in skins.

I frequently saw an adult accompanying one or two flying young. These young begged incessantly with a “tsip” given about once/second. The sound was amazingly unidirectional and hard to trace.

On June 23 and until the end of my stay, “black” Bananaquits were noted singing a raspy, insect-like song. This coincided with the resurgence of song in the Yellow Warbler and may be a response to increased rainfall.

I found only one very old nest made of stems of Saltwort which was so rotten as to look almost like grass. It also contained a few black (noddy?) feathers. It had been a globular mass about 8 inches in diameter and was about 8 feet up in the top of a small Black Mangrove, resting on a nearly horizontal fork.

Although common in the Saltwort where they often foraged, Bananaquits were hard to see. In the mangroves they moved quickly through the trees, never staying still for any length of time. They were often in the company of Yellow Warblers (see that species) and on occasion were chased by territorial males. I saw no evidence of territoriality in the Bananaquits.

Dendroica petechia

Canario de Mangle

Yellow Warbler

Yellow Warblers were by far the most numerous passerines. They were tame and often perched within a few feet of me.

My time on the island apparently coincided with the end of one nesting period and the beginning of another. On May 30 I found a nest containing two young not quite able to fly. During the following two to three weeks young in

juvenile and immature plumage became much more common in the population and five empty nests were found. By June 6 most adults were molting (this was obvious because they were practically tailless). By June 16 males were again singing and territorial, but some still had very short tails.

One pair had a territory near the tent. The male was first heard singing on June 17; he was observed to exclude both another nearby territorial male and Bananaquits from the territory. The female chased a Scrub Flycatcher on one occasion. On June 19 the female began gathering nesting material. She picked up small bits of dead grass, bits of thread or spider web, and shreds of weathered rope. At this time the female's tail seemed of normal length; but the male's was short, barely extending beyond the under tail coverts.

On July 2 I found the nest of this pair, although they had probably started to build earlier in another locality. The female had been seen carrying nesting materials into the black mangrove via an entirely different route. This nest was about 2½ feet up in Saltwort just at the edge of Black Mangrove. It was a tiny cup of plant fibers, feathers, and other soft materials and had a feather lining. There was no Turtle Grass in this nest as in others I had found, consequently it was less bulky. The first egg appeared on the day I left the island, July 8.

The location of nests was variable. Two were 2 to 3 feet up in Saltwort; two were about 12 feet high in Black Mangrove, in an ascending fork of several branches near the end of a limb; one was 3½ feet up in the horizontal fork of a low bushy Black Mangrove.

The plumages of the Yellow Warbler seem unusually varied, but appear to fall into three age categories. One of the two nearly fledged young found on May 30 was described as having the upperparts, throat, and breast brownish tan with olive margins on the primaries and the abdomen white. It was still downy below and had some down clinging to the head. The facial skin was black; the mouth flanges large and yellow with prominent red blood vessels inside the mouth. Fully fledged birds in this plumage were seen being fed by adults.

Two other plumage types were interpreted as the plumages assumed by immature males and

females after their post-juvenile molt. The presumed female had a gray head with an obscure eyering; an olive back, wings and tail; yellowish crissum and undertail coverts but no yellowish on the face; gray breast; and whitish abdomen. The presumed male had gray head with obscure eyering; olive back, wings and tail; yellowish face, crissum and undertail coverts; gray to yellowish breast, sometimes with some rusty markings; and a whitish abdomen.

Phelps and Phelps (1951, p. 15) described a juvenile male of a color near Dresden Brown of Ridgway. I did not see any individuals of this color.

Yellow Warblers regularly bathed in the sea. They hopped onto the vertical Black Mangrove pneumatophores and from them into the very shallow water at the base. The bathing continued until the bird was struck by a small ripple, at which point it flew back to the pneumatophore. This procedure was repeated five or six times. After a bout of bathing the bird was thoroughly soaked and shook and preened for many minutes. They were slow to dry in the salt air and we often saw individuals that looked wet.

Yellow Warblers and Bananaquits often fed in company, one individual of each species moving through the vegetation together. Differences in foraging were not easily perceived. The Yellow Warblers fed more widely over the island: at the water line and on the sand beach, in the Saltwort, in the branchlets, leaves and blossoms of Black Mangrove, and in Red Mangrove. In fact the only habitat in which they were not seen was in the large expanses of grass with no cover nearby. The Bananaquits seemed to forage more frequently well down in the Saltwort and to confine their activities in Black Mangrove to the growing tips and blossoms. I did not see them on the ground.

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