THE SCARLET IBIS IN SURINAM AND TRINIDAD

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The Scarlet Ibis(*Eudocimus ruber*), for all its striking color, large size, and colonial nature, is not a well known bird. The references in the literature are sparse. Even the fullest account by Penard (1926) consists mainly of second-hand reports garnered from hunters and fishermen. More recently Zahl (1950, 1954), Saunders (1956), and Lindblad (1969) have given us popular accounts; and De Vries (1966) and Haverschmidt (1967) commented on the existence of colonies in Surinam. Palmer, in the North American Handbook (1962) had little to say, indicating how very little we know about this extraordinarily beautiful creature.

We, Haverschmidt working in Surinam from 1946 to 1968 and ffrench in Trinidad from 1956 to 1969, made separate, but parallel, studies of the Scarlet Ibis, concentrating on the birds mostly during the breeding season. Haverschmidt dealt mostly with a colony near Gandoe, Surinam; ffrench studied a population in the Caroni Swamp in Trinidad (Figure 1), visiting this location 44 times from 1963 to 1966, and on 40 occasions during the other years. Because the Scarlet Ibis commonly inhabits desolate mangrove swamps on the sea coast, we were continually at the mercy of the tides that hampered our movements and limited our observations.

General Distribution

The Scarlet Ibis is confined to the northern part of South America – Colombia, Venezuela, Trinidad, the Guianas, and northeastern Brazil (Meyer de Schauensee, 1966). Vagrants show up fairly often on the islands of Tobago and Grenada, and there are a few isolated records from Central America and southern United States. While we know of some breeding localities in Venezuela, Surinam, and Trinidad, clearly we are unaware of a number of others partly because few observers venture into the wild country that Scarlet Ibises prefer.

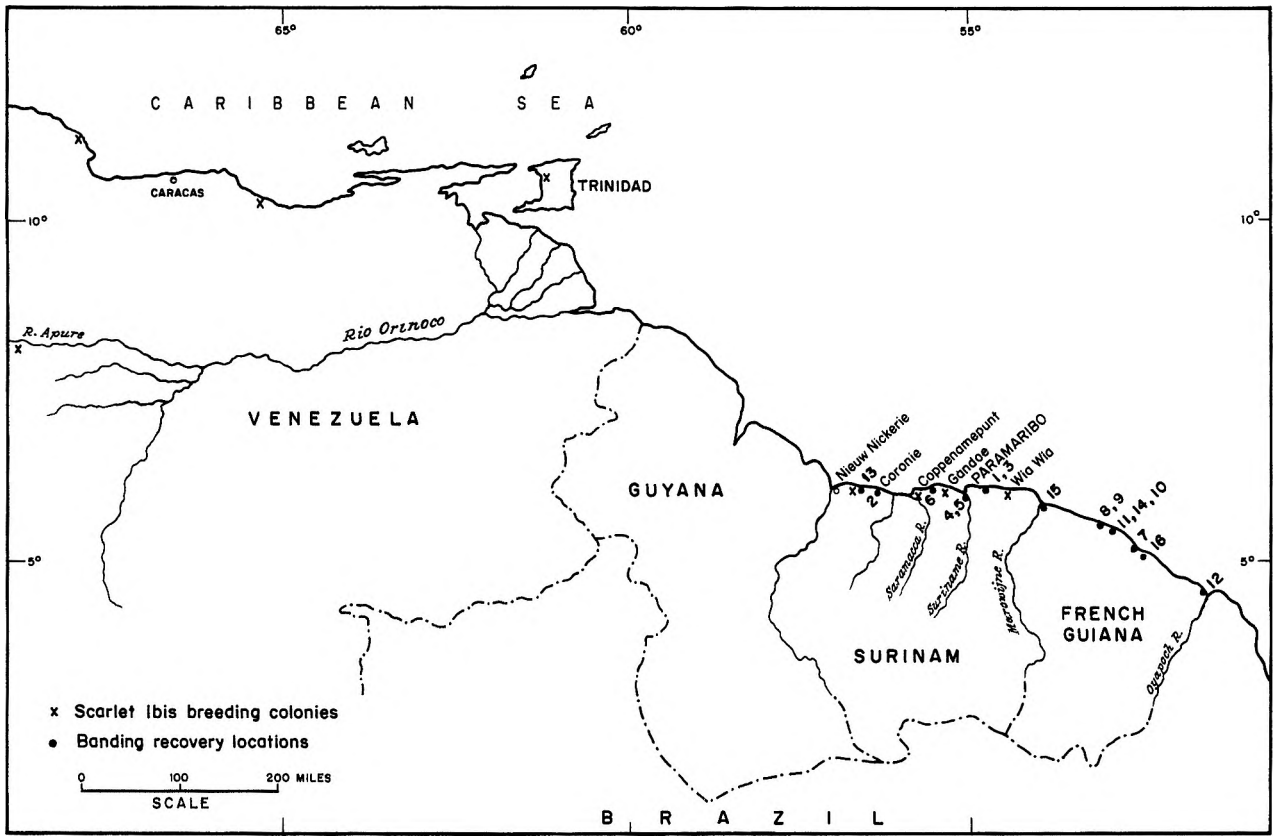

Figure 1. Map showing the sites (X) of Scarlet Ibis colonies studied in Trinidad and Surinam, and the localities (numbered) where ibises banded in the colonies have been recovered.

Colony Sites and Habitat

Although most of the breeding colonies of the Scarlet Ibis are in swamps along the seacoast — as were those we studied, this is not always true. Zahl (1950), in September 1949, found a large breeding colony in Venezuela between the Rios Apure and Matillure, hundreds of miles from the coast. This is the only sizeable inland colony we are aware of. In Guyana, the Scarlet Ibis occurs most commonly in the west near the Wainie River (Snyder, 1966), but no one has recorded it breeding there in the last ten years (Lindblad, 1969). According to reports, the same holds true for French Guiana and northern Brazil although the bird probably breeds there in areas yet to be discovered.

Status and Habitat of the Scarlet Ibis in Surinam and Trinidad

In Surinam the Scarlet Ibis inhabits the coastal mud flats and forests of mangrove (*Avicennia nitida*), venturing up the rivers and into inland mangrove forest only in times of drought. Normally it remains along the coast throughout the year.

We know of four distinct breeding colonies in Surinam in recent years, three of them operating simultaneously (Figure 1). The western colony between Nieuw Nickerie and Coronie was active in 1953 and 1966, that at Coppenamepunt in 1947, 1948, 1952, 1964, and 1965. The Gandoe colony (Figure 2) flourished in 1966 and 1967, when ibises deserted the Coppenamepunt locality, but was not used in 1968 or 1969. Scarlet Ibises were active in an eastern, and somewhat inaccessible, colony near Wia Wia in 1966 and 1967.

In Trinidad the Scarlet Ibis similarly confines its activities mainly to coastal mangrove swamps, in particular the Caroni Swamp (Figure 3). Smaller populations dwell in the mangrove swamps of Oropouche, Rousillac, and Los Blanquisales; but one rarely sees an ibis in the Nariva Swamp, a largely freshwater area with a negligible mangrove belt.

Figure 2. The nesting colony near Gandoe, Surinam seen from the sea at high tide. The birds nest in the low mangroves (*Avicennia nitida*), often just above the level of the high tide. Photograph by F. Haverschmidt.

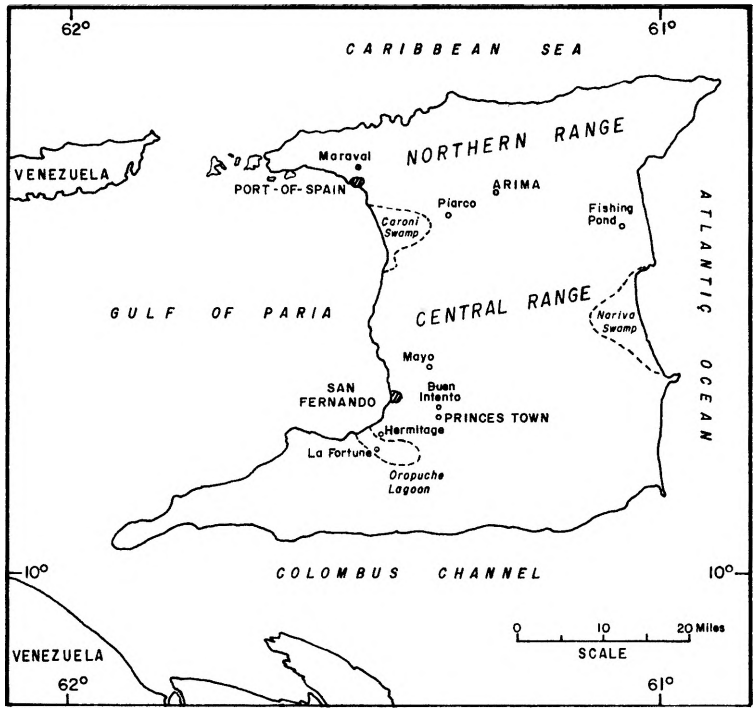

Figure 3. Map showing the location and the extent of the Caroni Swamp, the major breeding area for Scarlet Ibises in Trinidad. While no colony has been discovered in the Oropouche Swamp, about one thousand adults frequent the area, and some movement occurs between the two areas.

In the Caroni Swamp the population seems well established and breeds almost every year. Since 1953, when the government finally provided adequate protection for the Scarlet Ibises, they have nested there every year except 1964 and 1968. The adult population averages about 5,000 birds, diminishing from October to March when some birds depart, probably to Venezuela. Perhaps 1,000 adults frequent the Oropouche Swamp; while we suspect that they breed there, we have no proof. Certainly, the ibises move to some extent between the Caroni and Oropouche Swamps.

Associated Species

In both Trinidad and Surinam the Scarlet Ibis nests and roosts in company with herons, especially the Little Blue Heron (*Florida caerulea*), the Tricolored Heron (*Hydranassa tricolor*), and the Snowy Egret (*Egretta thula*). In addition, smaller numbers of Common Egrets (*Casmerodius alba*), Yellow-crowned Night Herons (*Nyctanassa violacea*), Black-crowned Night Herons (*Nycticorax nycticorax*), and Boat-billed Herons (*Cochlearius cochlearius*) associate with ibis colonies. In Trinidad, the Cattle Egret (*Bubulcus ibis*), having increased rapidly since its arrival in 1951, now probably associates with the Scarlet Ibis at the roost in greater numbers than any other heron. Only a few Cattle Egrets, however, nested in the Surinam colonies, along with some White-necked Herons (*Ardea cocoi*) and Roseate Spoonbills (*Ajaia ajaja*) (Haverschmidt, 1968).

Predation

The Scarlet Ibis appears to have few natural enemies in the mangrove swamps. In Trinidad the water rat (*Nectomys squamipes*) takes uncovered eggs. The Greater Ani (*Crotophaga major*) also takes heron's eggs. In Surinam the Long-winged Harrier (*Circus buffoni*) does the same. The scavenging Yellow-headed Caracara (*Milvago chimachima*) appears regularly in Surinam mangroves and may rob nests although we have not observed it. We have often seen Black Vultures (*Coragyps atratus*), Turkey Vultures (*Cathartes aura*), and even Magnificent Frigate-birds (*Fregata magnificens*) sailing high overhead, but they apparently take only dead nestlings that have fallen from nests.

Other possible predators include the crab-eating raccoon (*Procyon cancrivorus*), crabs, and snakes. Without a doubt the most serious predator is man. Fortunately, now both Surinam and Trinidad have established sanctuaries to protect the breeding birds and passed laws forbidding the hunting of the Scarlet Ibis.

Food

In Surinam the Scarlet Ibis feeds mainly on small crabs and molluscs including the gastropod *Melampus coffeus* and bivalves. In Trinidad the prey is principally fiddler crabs (*Uca* spp., especially *U. rapax* and *U. thayeri*).

The Scarlet Ibis catches a fiddler crab by probing in mud, often deeply, to the base of the bill. The bird brings up its prey in the tip, works it gradually up between the mandibles, and swallows it. Larger prey the bird frequently dismembers, sometimes washing the pieces in a puddle before swallowing them. Usually it discards the large claw of the bigger crabs. Our observations of Scarlet Ibises feeding in different situations indicated that they are more successful in obtaining prey when feeding in shallow water than on exposed mud.

An analysis of the stomach contents of Scarlet Ibises shows that, in Surinam, they also feed on insects, including the larvae of Diptera (Stratiomyidae), shield-bugs (Pentatomidae, including *Edessa* sp., and Naucoridae), and water-beetles (Hydrophilidae). Some fish, including Characidinidae (*Erythrinus erythrinus*) and Cichlidae, comprise part of the diet. In Trinidad, they take small fish and snails, and small amounts of green algae have been found in the stomach.

In Trinidad, adult birds, while ordinarily foraging in saltwater or brackish-water swamps, frequently move to freshwater marshes, rice fields, and flooded savannas when feeding young in the nest. At this time their diet may well consist more of insects and small amphibians, but we have too few data to confirm this.

Breeding Biology

The Breeding Season

According to local belief, the Scarlet Ibis begins to breed soon after the onset of heavy rains, which in Surinam occur in mid-April, and in Trinidad in late May. In neighboring Guyana, Lowe-McConnell (1967) found this same response to the wet season to be true of some species of herons.

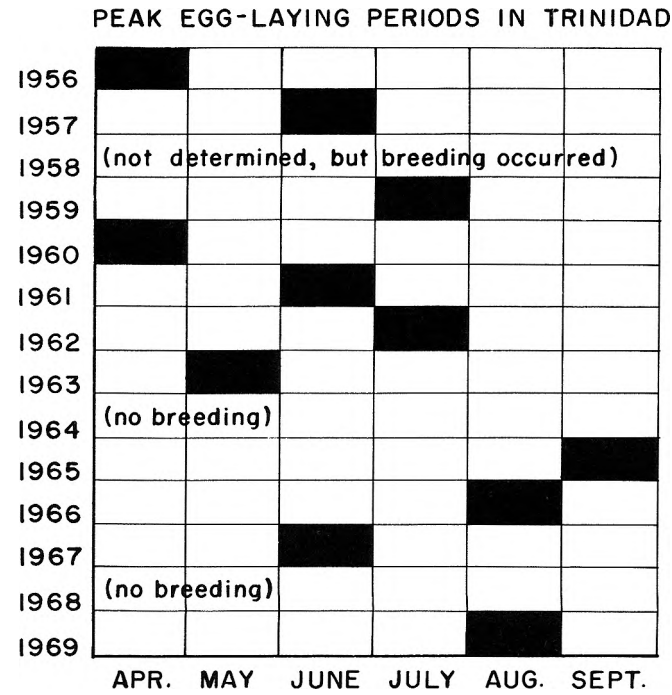

Figure 4. During the fourteen-year period 1956 to 1969, the Scarlet Ibises nested at a different site within the Caroni Swamp each year and also at a different time. The peak month of egg-laying varied from year to year by two months between April and September.

Breeding records of the Scarlet Ibis in Surinam support this view except that throughout the whole rainy season ibises are continually settling down and starting nests. In any one colony at any one time an observer may find nests with fresh eggs and young birds already flying. At Gandoe, in 1967, where a few pairs of ibises had nests with eggs as early as 23 April, there were many nests with eggs on 27 August and a few as late as 24 September.

In Trinidad, Scarlet Ibises maintain a loose temporal cycle, coordinating their breeding to the wet season, normally May to November. Figure 4 shows the peak months for egg-laying. These data do not support the theory that climatic changes trigger the onset of breeding. However, certain factors, such as disturbance by man (tourist, fisherman, or poacher), pollution of parts of the swamp by poisonous effluents from nearby factories, or even competition for nest sites with other species such as the Cattle Egret, may possibly alter or inhibit the beginning of breeding. Some factor or factors affected the breeding cycle in Trinidad in 1964 and 1968, and no nesting occurred.

Compared to the herons, the Scarlet Ibis is nervous and wary. It is much less tolerant of man, so much so that human disturbance at a critical moment in the cycle may prevent the birds breeding that season. The failure of the birds to breed in the Caroni Swamp in 1964 and 1968 may have been due to a shift of part of the population to Venezuela during those years. Many immature birds appeared in the Caroni Swamp in July and August 1964. There were so many more than occurred when the birds bred locally that ffrench felt they must have come from the mainland of South America.

The Shifting of the Breeding Site

One aspect of breeding which at present defies explanation is the tendency of Scarlet Ibises to shift their nesting area from year to year, sometimes only a few hundred yards, occasionally several miles.

In Surinam the existence of the colony at Coppenamepunt for several years up to 1965 and its abandonment in 1966 and 1967, coupled with the appearance of a new colony at Gandoe those last two years, leads us to believe that the Coppenamepunt birds moved to Gandoe, a distance of forty miles.

Close study of the Caroni colony in Trinidad over most of the years 1954–1967 shows that rarely does the Scarlet Ibis nest in exactly the same patch of mangroves in consecutive years. Saunders (1956) found that, soon after the Caroni colony had been established, slightly differing localities were used for breeding from 1954–1956. In the ten breeding sites, recorded during the years 1957–1967, Scarlet Ibises used at least five other sites. Red mangrove (*Rhizophora* sp.) predominated at all the sites, and no one site appeared to have any topographical advantage over the others.

In the later years of this study, especially 1966, the ibises in Trinidad seemed to select for breeding an area already in use by nesting herons, especially the Cattle Egret, although in 1960 the ibises bred earlier than the Cattle Egret.

The Nest Site and Nests

When not breeding, Scarlet Ibises leave the roosts in the morning and return late in the day. The presence of large numbers of birds in a certain area throughout the day indicates that the birds have selected that area for nesting, and breeding will begin soon. At first, except for increasing aggressiveness toward rivals and trespassers, the birds show little activity. After a few days at the site, they start building their nests.

In Surinam the Scarlet Ibis nests low, seldom more than five feet above the high-water mark, in the black mangrove (*Avicennia nitida*), never in the tall *Avicennia* trees. In contrast, ibises in Trinidad build their nests much higher. In the spindly *Avicennia* or the white mangrove (*Laguncularia*) the nests are frequently about 15, or even up to 35, feet above high water. In the robust spreading red mangrove, they may be from eight to 40 feet above high water, the variation in elevation depending entirely on the location and shape of the branches. Of the very few nests below eight feet, two were on the ground, one on a ground level root. These ground nests were fairly substantial, one or more feet deep with the high-tide mark near the top of the nest. The young birds in these ground nests looked stunted.

Ibises construct their nests in the forks of branches or where two branches cross (Figures 5 and 6). They interweave mangrove twigs, mostly dry and a few green with leaves, in and around the supporting branches. Since they place dry twigs in the base of the nest and those with fresh leaves in the upper part, the green leaves, though they soon wither, last long enough to enable one to differentiate between old nests and newly constructed ones. The nests measure about 12 inches across; the twigs making up the framework measure about nine inches. Nests constructed where two branches cross often disappear in bad weather. All are fairly flimsy, yet rarely thin enough to see through and the

Figure 5 (*above*). A sturdy ibis nest constructed in the thick mangroves.

Figure 6 (*below*). A flimsy nest. Such nests often fail to withstand the heavy winds accompanying tropical storms. Photographs by F. Haverschmidt.

ibises frequently add twigs to them even after laying the eggs. Most nests last only one season, hardly ever through the year.

Penard and Penard (1908) remarked that the Scarlet Ibis does not build a nest; instead, it takes over old herons' nests and even ejects smaller herons such as the Snowy Egret. We found no evidence to support the latter statement, but since the Scarlet Ibis in Trinidad now tends to breed later than the herons, it probably uses heron nests in some instances. Conversely, the Cattle Egret, a newcomer, has occasionally taken over a Scarlet Ibis nest, possibly after the latter abandoned its eggs.

We do not believe it possible that the Cattle Egret will ever overcrowd the Scarlet Ibis, as some have feared. Most ibis colonies exist in large areas of mangrove where there is ample room for Cattle Egrets and all other herons besides. The different species associating together in the colony place their nests at most any elevation—in the case of herons from six to 35 feet above high water—the height depending on the type of branches available. Although all the species occupy the same area, each species tends to be separate, with several nests together in groups of 10 to 15 on one branch. A group with species intermixed is unusual. Scarlet Ibises and all the herons rarely build isolated nests, except for the less common Boat-billed Heron, which usually nests rather high in the trees. A nesting colony keeps together either as one unit or two or three closely connected units. Generally a nesting colony covers a wide area and holds a great many birds. One such colony encompassing five acres in Trinidad during 1963 contained over 2,500 nests of the Scarlet Ibis.

The Eggs

The ground color of the eggs varies from dull olive-green to buff, with dark brown markings. One hundred Scarlet Ibis eggs in the Penard oological collection from Surinam, preserved in the Leiden Museum, average 56.03 by 37.06 millimeters, with extremes of 65.3 by 35.5 mm and 50.2 by 42.9 mm, 48.05 by 34.06 mm and 55.9 by 33.4 mm (Hellebrekers, 1942). Twenty-one additional eggs, recently measured in Surinam, fall within these limits. The weight of thirteen fresh eggs averaged 44.8 grams, with the extremes 37.5 and 46.4 gm. Two dwarf eggs measured 31.2 by 27.2 mm and 35.6 by 27.6 mm, the latter weighing only 14.9 gm. Fourteen eggs collected in Trinidad average 55.3 by 37.6 mm, with extremes well within the limits of the Surinam eggs. Four Trinidad eggs averaged 40 gm in weight, ranging from 38 to 43 gm.

The clutch size in Surinam is almost invariably two eggs. On 27 August 1967, only four out of hundreds of nests contained three eggs. Of these four clutches, two had one addled egg. We never saw three nestlings in one nest.

By contrast, the Scarlet Ibis in Trinidad frequently lays two-egg clutches but more commonly three. Occasionally we found four eggs in a nest. Ibises lay eggs at intervals of one or two days, and incubate them for about 23 days. Both sexes share the incubation. The young hatch at intervals of one day or more. The incubation period for captive birds that bred twice in one season in an outdoor aviary in England (Risdon, 1969) was 21–22 days for two eggs.

Breeding Success

In Trinidad, nests with three in a clutch were not nearly as successful as those with two. One factor against three-clutch nests is likely competition for space. The nests often do not seem large enough or deep enough to accommodate three eggs, let alone three young. Figure 7 shows the hatching success of 15 nests, in which we knew the number of eggs and chicks. Less than half of the three-clutch nests were completely successful.

Nestlings from two-egg clutches show greater fledging success than do those from nests with three young. If only two of three eggs hatch, both young usually fledge. When all three hatch, the youngest nestling, considerably smaller than its siblings, suffers in competition for food and may be pushed out of the nest. At any age, falling from the nest is the most common cause of death. Figure 7 shows the fledging success of ten nests where the fate of the full complement of nestlings, except for one in a three-egg clutch, was known up to the time of fledging.

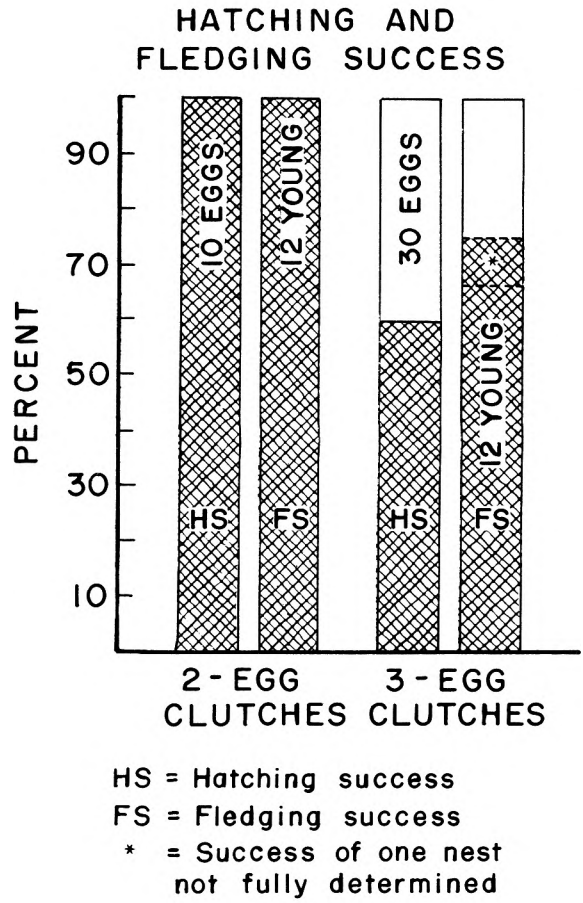

Figure 7. Three-egg clutches are rare in Surinam. In Trinidad they are much more frequent. Although the data presented above from Trinidad are meager, they indicate that two-egg clutches and broods of two survive much more frequently than nests with three eggs or young.

Development and Dispersal of the Young

It is difficult to obtain data on young Scarlet Ibises after they are 12 days old. If disturbed at about that age, they tend to move from the nest and fall from the branches. Thus, human disturbance in the mangroves at that time increases mortality rate of the young. Ibises of known age banded in Trinidad provide the details of growth in Table 1.

In general, very young nestlings are almost naked, with a little blackish gray down on the head and wings and sometimes a white tuft on the crown.

TABLE 1

Growth and Development of the Scarlet Ibis in Trinidad*

Age (days)	*Weight (gm)*	*Wing† (mm)*	*Longest primary‡ (mm)*	*Bill (mm)*	*Tarsus (mm)*
Hatching	27	20	—	18	16
1	47	24	—	22	17
2	57	28	—	22	22
4	80	32	6	24	26
8	178	45	13	30	28
11	195	72	25	36	40
16	over 300	120	55	49	56

†Wing measurement from carpal joint to wing tip.
‡Primary measured from tip to point of insertion of quill in socket.
*Weights and measurements represent means of seven birds.

CHANGES IN PLUMAGE AND SOFT PARTS DURING DEVELOPMENT

Age (days)	*Condition*
Hatching	Eyes shut, bill orange with black tip, egg tooth present, orbital area orange, legs flesh-pink, horny digital claws noticeable.
2	Eyes just opening, orbital area flesh-pink, legs flesh-pink tinged gray.
4	Eyes open, orbital area dull gray, legs dull pinkish gray, bill orange with black tip and other dark marks faintly showing.
8	Feather tracts visible.
11	Feathers sprouting on wings and body, head and neck downy, bill almost all dark with penultimate pink band.
16	Feathers all over, except head still downy. Primaries and tail sprouting, rump whitish. Bill darker but still with faint pink patches. Horny digital claws still present.
23	Feathers complete, both gray and white. Can flutter from branch to branch.
25	Could almost fly.

Their bill is pinkish orange and black and not decurved. Though fairly silent for the first week, they give a squeaky whistle thereafter. To feed, they thrust the bill into the adult's gullet as the latter regurgitates. The young defecate over the edge of the nest. Haverschmidt noted in Surinam that nestlings pant when exposed to direct sunlight and cannot endure it for long.

Although most young birds in Trinidad seem capable of flight at about four weeks of age, they do not always fly then. They may be five or six weeks old before leaving the trees. The captive birds in England left the nest at 40 days of age and first flew after about 52 days.

At twelve days of age well-nourished young can leave the nest; if undisturbed, they probably stay in it longer. After leaving, they move about in the mangroves, using their bills and wings as well as legs for climbing. If they fall in the water they can swim a little. When about three weeks old they tend to concentrate in flocks fairly high in the trees where the parents go to feed them. Separation from their parents may be a significant cause of mortality among these older young. In Trinidad, ffrench found many dead chicks, aged from two to three weeks, below nests in tall trees.

In Surinam, too, the young disperse from the low mangrove forests. They move in large numbers along small creeks or on the mud below the tall mangroves, not straying far from the trees.

By banding young at the nest, we have established some additional facts about their dispersal. Figure 1 shows the recovery localities of 16 of 1,500 young ibises banded at Gandoe, Surinam (500 in June–August 1966; 1,000 in July–October 1967). It is clear from these records that the young birds scatter rather widely. Table 2 shows that some, recovered within five months of banding, were more than 150 miles away from the home colony; others remained close by. The most distant record was that of an ibis recovered about 280 miles from its nest only seven and one-half months after banding.

In Trinidad, 131 young were banded at Caroni, 54 in June 1963 and 77 in September–October 1965. We have two recoveries: one still in the colony five months after banding; the other 200 miles west of Caroni, near the Gulf of Cariaco and Laguna Campona on the northeastern coast of Venezuela 13 months after banding.

Plumage and Molt

The adult is completely bright scarlet with the longest four primaries tipped blue-black. It is somewhat paler on the head, neck, and underparts. The bare face and legs are pinkish red; and the bill appears to vary from pinkish brown or horn to almost black, the blackish color possibly being correlated with the breeding season. The post-breeding molt occurs in Trinidad between October and November, three or more primaries being molted simultaneously. In Surinam an adult male collected in the colony was molting on 7 July 1966.

The immature plumage is generally a dull grayish brown on the head, neck, and upperparts, and white on the lower back and underparts (see Plate I). The bill is brownish orange. Molt into adult plumage is a lengthy process, being known, from banding recoveries in Surinam, to begin as early as the fifth month after hatching. At this stage a few pink, orange, or even red feathers appear. One specimen, banded when ready to fledge in October 1967,

TABLE 2

Recoveries of Scarlet Ibises Banded in Surinam

*Locality No.**	*Band No.*	*Date banded*	*Date recovered*	*Place of recovery (coordinates in parentheses)*
1	696-81633	7 July 1966	16 Mar. 1968	NE of Paramaribo, Surinam (5.5 N. 54.5 W)
2	696-81787	24 July 1966	25 Jan. 1968	Coronie, Surinam (5.5 N 56.1 W)
3	736-37099	1 Oct. 1967	3 Dec. 1967	NE of Paramaribo, Surinam (5.5 N 54.5 W)
4	736-37045	1 Oct. 1967	19 Nov. 1967	near Paramaribo, Surinam (5.4 N 55.0 W)
5	736-37290	10 Oct. 1967	15 Mar. 1968	near Paramaribo, Surinam
6	736-37353	10 Oct. 1967	7 Feb. 1968	Calcutta, Surinam (5.5 N 55.8 W)
7	736-37268	10 Oct. 1967	Sep. 1968	Kourou, Fr. Guiana (5.0 N 52.3 W)
8	736-37363	10 Oct. 1967	6 Feb. 1968	Iracoubo, Fr. Guiana (5.2 N 53.1 W)
9	736-37356	10 Oct. 1967	11 Feb. 1968	Iracoubo, Fr. Guiana
10	736-37310	10 Oct. 1967	1 Mar. 1968	Sinnamary, Fr. Guiana (5.2 N 53.1 W)
11	736-37236	10 Oct. 1967	10 Nov. 1967	Sinnamary, Fr. Guiana
12	736-37212	10 Oct. 1967	29 May 1968	Montagne d'Argent, Fr. Guiana (4.2 N 51.4 W)
13	696-81540	7 July 1966	Feb. 1969	Wageningen, Surinam (5.4 N 56.4 W)
14	736-37427	10 Oct. 1967	15 Mar. 1969	Sinnamary, Fr. Guiana
15	736-37031	1 Oct. 1967	9 July 1969	Pointe Isère, Fr. Guiana (5.4 N 53.5 W)
16	736-36959	1 Oct. 1967	10 Feb. 1969	Macouria, Fr. Guiana (4.5 N 52.2 W)

*See Figure 1 for locations of recoveries.

showed many pink feathers when collected in French Guiana on 1 March 1968 (see Table 2, number 10). The scarlet color appears very gradually, becoming fully acquired when the bird achieves definitive adult plumage at about one year of age. In rare instances (e.g., male taken at Coppenamepunt, Surinam, on 6 June 1948) adult birds wear an entirely pink plumage with no trace of scarlet and no remnants of the brown plumage of the immature. The evidence suggests that individual birds become fully scarlet at different rates. In view of the protracted breeding season and our lack of data from banded birds of known age, we cannot be more specific about the exact age of plumage change.

Examination of many specimens of immature birds in transitional plumage indicates that the order of molt is as follows: The mantle, scapulars, sides of breast, upper and under tail coverts, lesser wing coverts, and central rectrices begin molting first, followed by the white plumage of the lower back and breast, which becomes pinkish or orange, and finally, the rest of the plumage, with the feathers of the head and neck the last to change.

While definite information from birds of known age is lacking, we believe that the Scarlet Ibis first breeds in its third year of life (C. F. Bundy, *in litt.*). We have never found breeding birds with any trace of immature plumage.

In an experiment to investigate the possible conspecificity of the Scarlet Ibis and the White Ibis (*Eudocimus albus*), Bundy (1965) placed Scarlet Ibis eggs from Trinidad under nesting White Ibis in Florida. A few scarlet birds reached maturity and some of them subsequently mated with white birds. Although none of the offspring from these matings was banded, the appearance of several pink birds among them indicates the likelihood of successful hybridization (Zahl, 1967). Gray (1958) had earlier reported hybrids produced from among captive birds. The White Ibis does not normally occur in either Surinam or Trinidad, though an individual was seen in the Caroni Swamp in 1964 (ffrench and ffrench, 1966).

Measurements and Weights

Statistics of 20 birds in Trinidad (Table 3) show that males tend to be larger than females in all respects. The weights of birds taken in Surinam indicate greater variation according to climatic conditions. During droughts an adult male weighed as little as 415 gm, while a female weighed 483 gm. Maximum weights at other times were 890 gm for a male, 855 gm for a female. Five males averaged 683 gm and ten females 595 gm.

Two young birds just out of the nest weighed 455 and 545 gm, while a nearly fledged bird in the nest weighed 495 gm.

General Habits and Behavior

In a usual day's activity Scarlet Ibises leave the communal roost early in the morning, going in large flocks which soon break up to feed on the open mud flats when the tide is low, or in the thick mangrove forest when the tide is high (Figure 8). During the day the birds are often hard to find; but occasionally one sees a large flock as it moves from one feeding place to another.

About one hour before sunset flocks begin to approach the roost, flying in intermittently until after sunset. The numbers in each flock vary from a few to 60, the average being 15 to 20. Sometimes several flocks combine near the roost to form one large one. They either fly in a V-formation or in an irregular skein, alternately gliding and flapping their wings.

Ordinarily the birds use the same roosting site each night, but they sometimes extend it to include the surrounding mangroves. Occasionally, perhaps due to human disturbance, the birds roost in two or three major groups. Though separated by several hundred yards, the birds in one group constantly commute to another. At the roost, ibises do not tolerate human approach closer than 75 yards. Once they have settled in the roost, they move about very little and seldom call, but from close quarters one can hear them uttering soft, plaintive, rather high-pitched notes, quite distinct from the croaks and quacks of the herons with which they associate.

Plate I. The Scarlet Ibis (*Eudocimus ruber*) in various plumages, from a painting by Paul Barruel. *Upper left,* adult male in fresh plumage, Leonsberg, Surinam River, 3 February 1966. *Upper right,* female in intermediate plumage, Maasstroom, Commewijne District, 19 December 1965. *Lower left,* male in very worn intermediate plumage, Leonsberg, Surinam River, 27 February 1964. *Lower right,* nestling about to fledge, colony near Gandoe, Surinam, 5 August 1966. Birds illustrated here are from specimens in the Haverschmidt collection in the "State Natural History Museum" at Leiden, Holland.


F.B.

Owing to the awkward location of the nesting colonies in tidal mangrove forests, we were unable to study adequately the behavior of adults at the nest.

Conservation

The governments in Surinam and Trinidad have provided some protection for the Scarlet Ibis, partly because of their potential value as a tourist attraction. This has not always been so.

Long before European settlers arrived, Indians probably hunted the Scarlet Ibis in northern South America. Kappler (1881) describes such a raid by the Indians of Galibi, west of the mouth of the Marowijne River, in what is now the Wia Wia Reserve in Surinam. Hunters commonly shot ibises at the roost and as they flew to their nests. Quite recently, in 1948, baskets full of nestling ibises were on sale in the Paramaribo market; and, in 1952, a corral of mangrove sticks, an assembly place for captured nestlings, was found in the mud at the Coppenamepunt colony.

TABLE 3

Weights and Measurements of Scarlet Ibises in Trinidad

Measurements	*Males (8 birds)*			*Females (12 birds)*		
	Range	*Average*	*Standard deviation*	*Range*	*Average*	*Standard deviation*
Weight (gm)	710-770	741	21.5	560-640	603	27.5
Wing (mm)	260-275	266	5.5	231-262	247	8
Bill (mm)	150-176	165	8	116-138	132	7
Tarsus	79- 91	85	4	67- 80	74	3.5

In 1953 the Coppenamepunt area was closed to all hunting; in 1954 a new game law protected the Scarlet Ibis throughout the year; and in 1966 the Coppenamepunt became a nature reserve. That year the nesting colony moved to the Gandoe area. Also in 1966 the government set aside the Wia Wia Nature Reserve, 140 square miles of coastal swamp in the region of the Marowijne River, and closed it to hunting. The relative inaccessibility of this reserve may well protect the Scarlet Ibis more effectively than any man-made regulations. The illegal shooting, of which unfortunately there is still a great deal in the country, is not generally in the vicinity of the nesting colonies.

In Trinidad, too, the Scarlet Ibis was regularly hunted during much of the 1800's and in this century as well, rarely breeding undisturbed until 1950 when the Trinidad government appointed four game wardens to patrol the 7,900 acres of the Caroni Swamp. In 1953, a sanctuary consisting of 337 acres in a swamp favored by the species was declared a "prohibited area" to all persons except those holding special passes. Here the Scarlet Ibis bred successfully in 1953 and subsequent years. When in 1966 the ibis established a breeding colony a mile or two farther south, the government set aside another

prohibited area of 207 acres to accommodate them. The authorities are presently considering the possible extension of the sanctuary to link these two areas.

The season for hunting game birds in Trinidad opens on 1 November and on that day each year a large body of hunters go out to hunt in the Caroni Swamp. As many as 500 Scarlet Ibises were often shot on this first day of the season, with smaller numbers thereafter, all outside the sanctuary areas. Under the supervision of the game wardens a bag limit of five Scarlet Ibises per hunter was set for each day. In 1962, when Trinidad achieved political independence, the Scarlet Ibis became the national bird of Trinidad and on 29 September 1965 it was declared totally protected.

Public opinion in Trinidad now seems to favor protection and a thriving tourist industry has built up, allowing some thousands of visitors annually to watch the great flocks assemble at the roost, indeed a spectacular sight. Some poaching still takes place, especially in unpatrolled areas, such as the Oropouche Swamp.

In spite of these very salutary measures in Surinam and Trinidad, we can have no cause for complacency when we consider the facts that no colonies have been located in Guyana for ten years, that the Scarlet Ibis is shot on sight in French Guiana where no game laws exist, and that it is already on the list of birds threatened with extinction in Brazil (Sick, *in litt.*). In Venezuela, too, the species occurs mostly in remote parts of the country where the few inhabitants care very little about protective legislation.

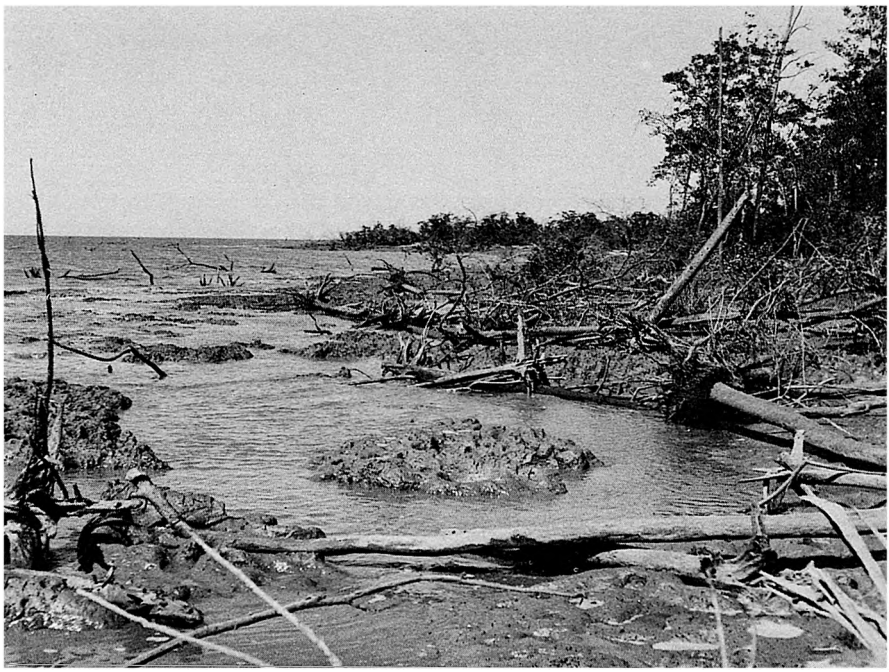

Figure 8. Coastal mudflats west of the mouth of the Surinam River, a favorite feeding place for the Scarlet Ibis. Photograph by F. Haverschmidt.

Summary

This paper contains results of studies of colonies of the Scarlet Ibis (*Eudocimus ruber*) in Surinam and Trinidad, with emphasis on the mangrove swamps at Gandoe in Surinam and at Caroni in Trinidad. Breeding appears to be spasmodic at some colonies; the Caroni Swamp colony has bred annually since 1953, except for 1964 and 1968.

Sixteen recoveries of 1,500 birds banded at Gandoe, Surinam, show that some immatures disperse for considerable distances along the coasts. The most distant recovery is from French Guiana, about 280 miles from the natal colony; one bird from Trinidad was recovered in Venezuela.

The Scarlet Ibis often roosts and nests in company with most of the herons common in the two countries. Predators include a water rat (*Nectomys*), and possibly the Greater Ani (*Crotophaga major*), the Long-winged Harrier (*Circus buffoni*), and the Yellow-headed Caracara (*Milvago chimachima*). The Scarlet Ibis was hunted regularly prior to the recent passage of protective legislation in both countries. The food of the ibis includes crabs, molluscs, insect larvae, and fish. During the breeding season adults move from saltwater areas to freshwater marshes for foraging.

The Scarlet Ibis breeds in the rainy season, but nesting often covers a lengthy period and is not definitely triggered by the onset of heavy rains.

The breeding site is often shifted to a new locality, usually within a few hundred yards of the old; but circumstances suggest that they may have moved one year to a site 40 miles away.

The nests, situated in mangroves, vary in height from a few feet up to 40 feet. They consist of dry mangrove twigs with fresh leaves added on top. They last one season. Though the Scarlet Ibis often nests in company with various heron species, each species tends to group its nests on separate branches. The colony keeps together, 2,500 nests being counted in one five-acre area in Trinidad.

The eggs are rather variable in appearance. Clutch size is usually two in Surinam, three in Trinidad, but the third egg rarely survives to hatch, and even more rarely does the third chick survive. The incubation period is about 23 days. Nestlings begin to climb about the trees at between two and three weeks of age. They can fly when about four weeks old, but probably do not do so until their sixth week.

Molt into the adult plumage may begin as early as the fifth month after hatching, and is complete when the young bird is about one year old. Captive birds, deprived of carotenoids, fade to a dull pink. Various experiments appear to indicate that the Scarlet Ibis is not conspecific with the White Ibis (*Eudocimus albus*).

During the day Scarlet Ibises disperse in flocks to feed on mud flats and in mangrove forests. In the evening they assemble at a communal roost.

The history of hunting and conservation measures in the two countries is outlined. In Surinam, indiscriminate hunting took place until a 1954 game law protected the Scarlet Ibis. In addition two of the colonies are now in nature reserves. In Trinidad, hunting prevented breeding until 1953, when the colony was protected as part of a sanctuary, prohibiting unauthorized

entry. In 1965 the Scarlet Ibis became fully protected, and is now Trinidad's national bird, being an important tourist attraction.

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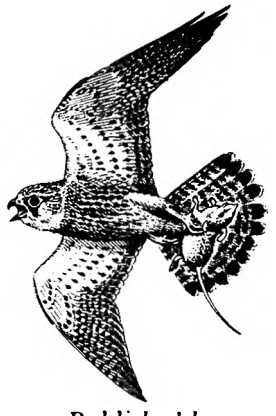

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