OBSERVATIONS ON THE BIRDS OF ST. JOHN, VIRGIN ISLANDS

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THE recent establishment of Virgin Islands National Park has brought new impetus to study of the area's natural history. From 10 February to 15 March 1957, I served as biologist with a National Park Service party on St. John. Ornithological results of this survey are reported here.

DESCRIPTION OF ST. JOHN

Location and physiography. St. John (Figure 1) lies about 88 km (55 miles) east of Puerto Rico, centrally situated among the American and British Virgin Islands. It is separated from St. Thomas to the west and from several islands of the British group to the north and east by channels one and one-half to five km wide. St. Croix is directly south about 64 km (40 miles). St. John has an area of about 48 km^2 (19 square miles), of which roughly three quarters is within the tentative boundaries of Virgin Islands National Park.

The topography features deep valleys and slopes that rise abruptly from the shore (Figure 2). Meyerhoff (1926) stated that the present Virgin Islands are the summits of a complex mountain range made up of stratified volcanic accumulations with much intrusive material. With the central mountains of Puerto Rico, they form one of the oldest continuously emerged land areas in the West Indies, having apparently stood above water since the late Cretaceous (Schuchert, 1935: 477). Relationships of geological structure and history are entirely with the Greater Antilles. Ocean depths between the northern Virgin Islands and Puerto Rico scarcely exceed 55 meters (30 fathoms), and a continuous land area probably existed at many times in the past and as recently as late in the Pleistocene (Schuchert, 1935: ff. p. 767). St. Croix is geologically similar but now isolated from the northern islands by depths of more than 3,700 meters (2,000 fathoms). Meyerhoff (1926) considered that the separation resulted from block-faulting during the Pliocene.

Climate. Temperatures are constant and high. Data for Cruz Bay, St. John, for 1939 show a mean annual temperature of 23.9° C (79.9° F), a mean daily range of 6.4° C (11.5° F), and an extreme range of 18–34° C (65–93° F) (Stone, 1942). Rainfall tends to be local and highly variable. Mean annual rainfall at six St. John stations for various parts of the span 1877–1940 was about 100–150 cm (40 to 60 inches), with extremes of about 64 and 240 cm (25 and 95 inches) and frequent wide variation between nearby stations in a given year (Stone, *l.c.*). Areas above 300-meter

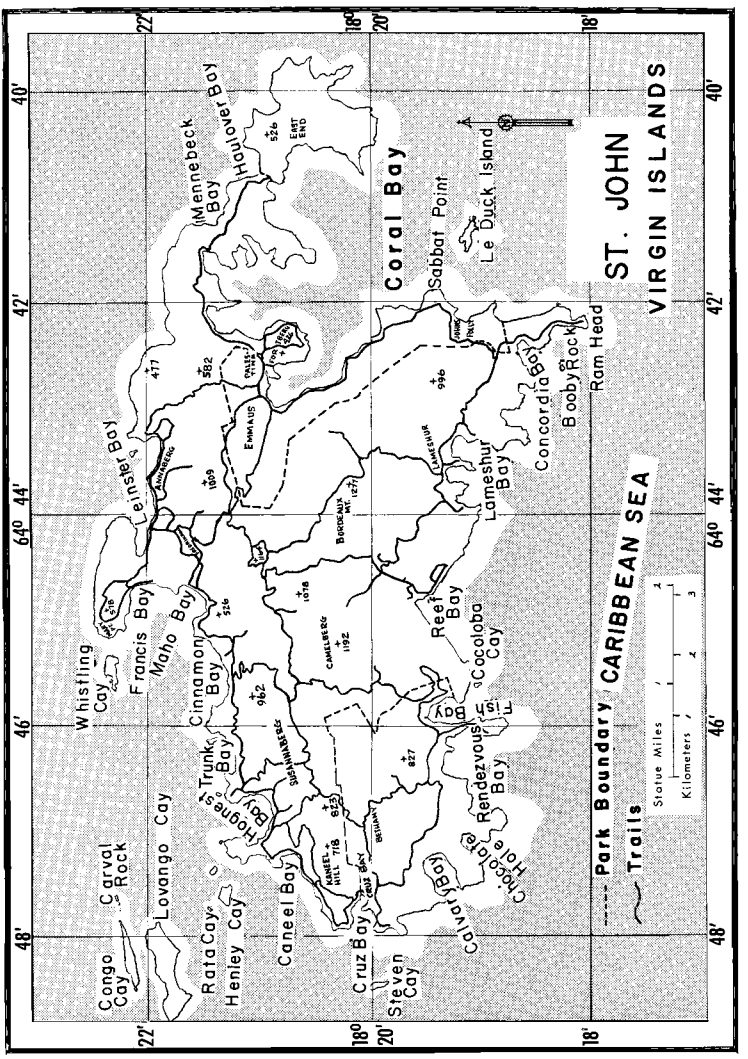

Figure 1. St. John, showing localities that are mentioned in the text. Solid lines in the interior are trails where bird counts were made.

Figure 2. View east toward the west end of St. John. Cruz Bay in center foreground; Great Thatch Island and Tortola, British Virgin Islands, at extreme upper left. (Air photo by Aero Service Corp. from Jackson Hole Preserve, Inc.)

elevation may have a mean annual temperature about 3° C lower (Eggers, 1879) and annual rainfall about 25 cm greater than at sea level. Prevailing winds are from somewhat north of east and are relatively constant except in summer. Rainfall maxima are ordinarily in May–June and October–November, the months from November through April constituting the usual dry season. St. John depends upon rain catch for domestic water supplies and has a chronic water shortage. Torrential runoff occurs after heavy rains, and there are no permanent streams. At the time of our visit open fresh water was limited to a few seeps and pools in the deeper ravines.

Vegetation. Early accounts state that the Virgin Islands were thickly forested and that some forests were burned by colonists in the attempt to improve the healthfulness of their surroundings (Børgeson in Stone, 1942). Forest and scrub now cover more than 75 per cent of St. John, and the distribution of moist and dry forest types probably approximates the original pattern of plant cover. In the interim, however, occurred about 125 years of intensive agricultural use.

Permanent settlement of St. John began in 1717, and an economy of plantation agriculture, chiefly sugar cane and cotton, persisted until the abolition of slavery in the Danish West Indies in 1848. It is likely that virtually all of the original forests were removed during the planatation era. After 1848 St. John was gradually abandoned except for a small Negro population, and the vegetation has recovered with only local disturbance. Other major islands in the area continued to support much larger human populations and considerable agriculture and grazing, and remain extensively deforested. As early as the 1870's, Eggers (1879: 8) termed St. John the "best wooded" island of the group.

The differences in growing conditions between north and south slopes and between sheltered and exposed sites result in a variety of vegetation unusual for so small an area. Physiognomic characteristics of the principal types of plant cover are noted below. Photographs (Figures 3–6) show the appearance of representative stands.

Moist forest. Largely evergreen hardwood forests cover the upper north slopes, ravines, and interior highlands (Figures 3 and 4). These stands occupy areas likely to receive heavier rainfall, because of their elevation and direction of slope, and ravines that benefit from runoff and are protected from wind. The more mature stands, as on Bordeaux Mountain and in the upper Reef Bay Valley, are relatively open beneath and have many large trees, but much of the moist forest area supports a denser growth of small trees. The latter stands may be younger and more recently disturbed. On lower ridges the present type grades into dry forest, but the higher peaks have impenetrable wet thickets, chiefly of *Clusia rosea.*

The moist forests are diverse in composition, including more than 100 species of native and naturalized woody plants. Undergrowth often is sparse or absent because of browsing and trampling by the half-wild goats, donkeys, and cattle that range the

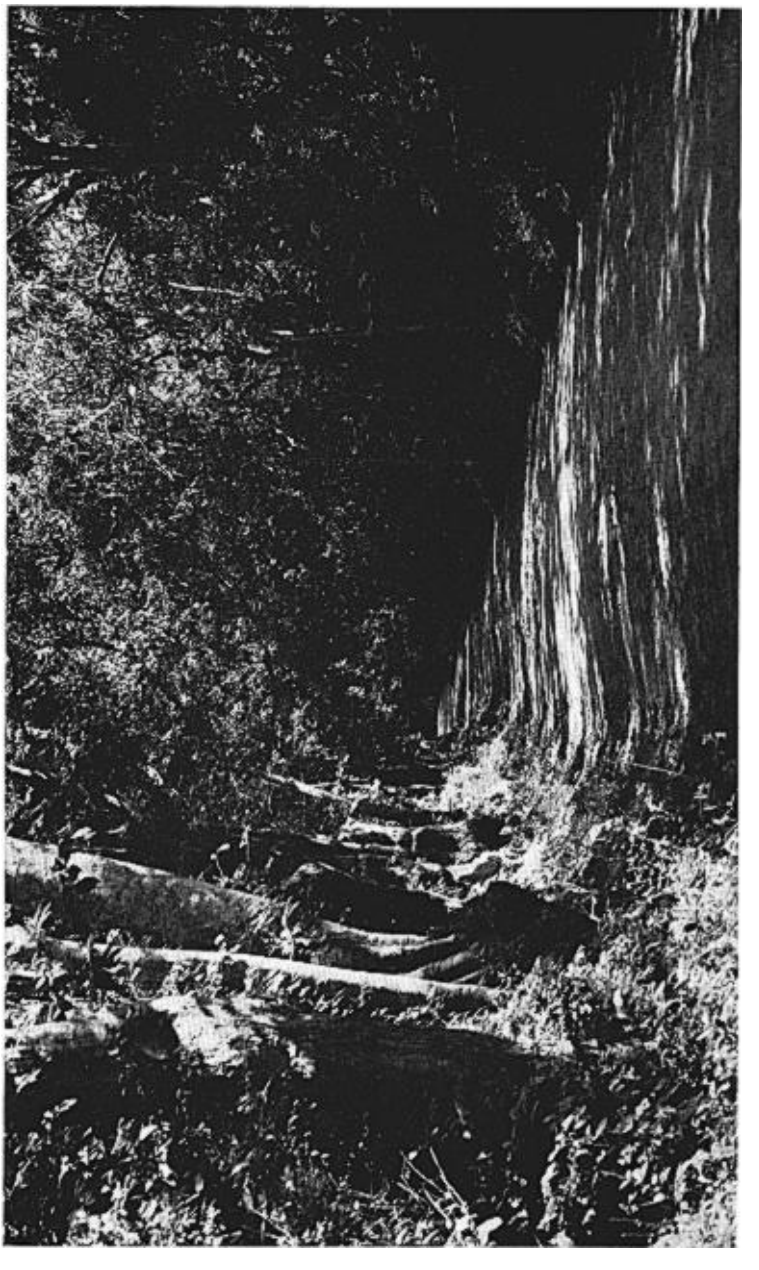

Figure 3. Moist forest, Centerline Road east of Susannaberg. (Photo by Jack E. Boucher, National Park Service.)

Figure 4. Forested slopes of Reef Bay Valley looking south from Centerline Road. The north coast of St. Croix is visible on the horizon. (Photo by Jack E. Boucher, National Park Service.)

island. Places not heavily used by livestock have a fairly dense stratum of shrubs and small trees and several species of large-leaved aroids (*Anthurium*).

Dry forest. Included here are the more open, much less diverse, and mainly dry-weather deciduous forests of interior south and east slopes, lower ridge crests, and less-exposed coastal sites (Figure 5). The characteristic plant is the turpentine tree or gumbo-limbo (*Bursera simaruba*), always prominent in the dry forests and sparingly represented in more mesic stands. In floristics and physiognomy this forest closely resembles some "hammocks" of the Florida Keys.

Cactus woodland. Large columnar cacti and agaves are found to some extent throughout the dry forests. They become generally distributed in the sparse stands of coastal south and west slopes, and in still more arid sections of eastern St. John (Figure 6), *Cephalocereus* and *Agave* dominate extensive areas and few of the associated woody plants exceed shrub stature. At sites most exposed to wind and salt spray (low islets and coastal east slopes at low elevations) the cactus woodlands give way to a low growth of xeromorphic shrubs.

Mangrove. Many of the island's celebrated beaches have built up across stream outlets and blocked drainage. The resulting poorly drained areas are occupied by small mangrove swamps or shallow, mangrove-fringed ponds. Some coastal inlets are bordered by narrow belts of mangrove (Figure 5).

Croton-Acacia scrub (Figure 5). The characteristic vegetation of eroded, overgrazed, or recently cleared land, particularly in drier sections of the island, is an open to impenetrable growth of shrubs and small trees dominated by species of *Croton* and *Acacia*. The *Croton–Acacia* scrub clearly owes its prevalence to disturbance, without which much of it would be replaced by other vegetation.

The more humid forests of St. John may be associated tentatively with the "semi-evergreen seasonal forest" of Beard's (1944) classification. With increasing dryness, climax stands grade into "deciduous seasonal forest" and "cactus forest."

PREVIOUS ORNITHOLOGICAL INVESTIGATIONS

The earliest notice of St. John birds is by Alfred and Edward Newton (1859, 1860), who mention four species reported to occur on or near the island. The Newtons gave rather complete accounts of the birds of St. Croix and St. Thomas but are not known to have visited St. John.

The first collection of birds from St. John was obtained by A. H. Riise, who is known chiefly from the Newtons' brief references to him, including note of Riise's arrival in Europe "bringing with him a small but interesting collection, made chiefly in the Danish islands of St. Thomas and St. John" (Newton, 1860: 307). Included were several Puerto Rican Screech Owls (*Otus nudipes*), apparently the only specimens taken by Riise on St. John that have been mentioned in ornithological literature. The bulk of his collection has remained unknown. Wetmore (1927: 264) noted "Little is known of Riise . . . if he made extensive collections their whereabouts is not known to me." It now appears that most of Riise's specimens were deposited in Denmark. In July 1957 I wrote to Finn Salomonsen asking

Figure 5. South side of Mary Point peninsula. *Croton-Acacia* scrub on the exposed slopes, dry forest in the ravines, and shore fringe of red mangrove. (Photo by Jack E. Boucher, National Park Service.)

Figure 6. *Cephalocereus* and dry forest near Haulover Bay. (Photo by Virgin Islands National Park.)

whether he knew of bird collections from the Virgin Islands in Danish museums. Dr. Salomonsen replied (*in litt.*, 14 August 1957):

> We have a number of skins of birds collected on the islands during the 19. century, mainly by some Mr. Riise who was stationed there as an apothecarian for a long time. He collected various shore birds and also some of the smaller land birds including a good series of the parrot *Conurus pertinax*.

A later letter listed eight skins of six species taken by Riise on St. John. The seven for which dates of collection are recorded were collected in 1859.

The well-known collector, Frederick A. Ober, was apparently the first to visit St. John after Riise. Ober's collection from the island, now in the United States National Museum (Daniel L. Leedy, *in litt.*), comprises 21 specimens of 15 species taken in "1880" and includes the type of the Caribbean Coot (*Fulica caribaea*). A few other specimens collected by Ober are in the Chicago Natural History Museum (Emmet R. Blake, *in litt.*).

After Ober there were no investigations on St. John until Stuart T. Danforth collected there in 1927, arriving 6 January and returning to St. Thomas 8 January (Danforth, 1930). Danforth listed 26 species and collected examples of 13. A few additional observations were made 3 January

1929, as his boat passed near the north and west shores of St. John en route from Tortola to St. Thomas. The Danforth collection is deposited in the United States National Museum.

Harry A. Beatty made a short excursion to St. John in 1938 (Skov, 1944) and also collected there in March 1940 (Beatty, 1941). He may have made still other visits from which no observations were published. Ten specimens of three species of doves collected by Beatty on St. John are in the Conover Collection of the Chicago Natural History Museum (Blake, *in litt.*).

Robert A. Nichols (Nichols, 1943) studied the breeding birds of the northern Virgin Islands during the 1930's, investigating St. John and many nearby cays. His collection of birds' eggs is deposited at the Academy of Natural Sciences of Philadelphia. More recently, George A. Seaman has recorded bird observations and collected specimens during a number of trips to St. John made in connection with his research on Virgin Islands game birds.

Wetmore (1927) surmised that collectors working for Charles B. Cory probably had visited St. John. Cory (1892: 128) includes St. John among islands he considered "well explored," but mentions only four species from there. Several popular articles have dealt with the bird life of the island. Butcher (1956) lists 11 common species seen in late March 1956.

METHODS OF OBSERVATION

A total of 152 hours was devoted to counting land birds, chiefly along jeep trails, forest paths, and dry stream beds that give access to most parts of the island (Figure 1). Records were kept of each bird seen and positively identified (counts representing possible duplications were avoided when a route was retraced on the same day) and of the character of the vegetation at localities where observations were made. Quantitative data obtained in this way may, of course, merely indicate observability rather than abundance. In an effort to minimize this error, only counts based on slow, intensive searches and only individuals seen, not those identified by calls, are included (Table 1).

Observations of land birds were tabulated in relation to three categories of vegetation:

1. *Mangrove swamp,* including the fringing belts of *Rhizophora* around ponds and bays (19 hours of observation);

2. *Dry forest and scrub,* including *Croton–Acacia* thickets, cactus woodlands, and stands of open, mostly deciduous forest (76 hours of observation); and,

3. *Moist forest,* the evergreen or semi-evergreen, mostly closed canopy forests (57 hours of observation).

TABLE 1

SUMMARY OF COUNTS OF LAND BIRDS
ST. JOHN, VIRGIN ISLANDS
February–March 1957

	Dry forest and scrub (76 hrs)	*Moist forest* (57 hrs)	*Mangrove swamp* (19 hrs)
1. Breeding Species			
Pearly-eyed Thrasher, *Margarops fuscatus*	474	420	11
Black-faced Grassquit, *Tiaris bicolor*	765	108	
Zenaida Dove, *Zenaida aurita*	266	175	12
Ground Dove, *Columbigallina passerina*	350	30	
Bananaquit, *Coereba flaveola*	250	79	8
Gray Kingbird, *Tyrannus dominicensis*	232	17	26
Yellow Warbler, *Dendroica petechia*	99		34
Smooth-billed Ani, *Crotophaga ani*	50	34	4
Antillean Crested Hummingbird, *Orthorhyncus cristatus*	61	19	5
Scaly-naped Pigeon, *Columba squamosa*	6	77	
Caribbean Elaenia, *Elaenia martinica*	56	14	
Green-throated Carib, *Sericotes holosericeus*	58	8	1
Bridled Quail Dove, *Geotrygon mystacea*	2	46	
Purple Martin, *Progne subis*	36		
Mangrove Cuckoo, *Coccyzus minor*	12	5	5
Mockingbird, *Mimus polyglottos*	17		
Red-tailed Hawk, *Buteo jamaicensis*	13	3	
Sparrow Hawk, *Falco sparverius*	16		
White-crowned Pigeon, *Columba leucocephala*	2	2	4
Black-whiskered Vireo, *Vireo altiloquus*			4
Stolid Flycatcher, *Myiarchus stolidus*	1		
2. Winter visitant and transient species			
Northern Waterthrush, *Seiurus noveboracensis*	4	41	100
Parula Warbler, *Parula americana*	55	75	10
American Redstart, *Setophaga ruticilla*	27	75	8
Black-and-white Warbler, *Mniotilta varia*	15	70	22
Prairie Warbler, *Dendroica discolor*	37	16	
Ovenbird, *Seiurus aurocapillus*	3	18	
Worm-eating Warbler, *Helmitheros vermivorus*		18	1
Black-throated Blue Warbler, *Dendroica caerulescens*		11	
Hooded Warbler, *Wilsonia citrina*		5	
Cape May Warbler, *Dendroica tigrina*	4		
Magnolia Warbler, *Dendroica magnolia*		3	
Barn Swallow, *Hirundo rustica*	2		
Kentucky Warbler, *Oporornis formosus*		2	
Marsh Hawk, *Circus cyaneus*	1		
Pigeon Hawk, *Falco columbarius*	1		
*Yellow-billed Cuckoo, *Coccyzus americanus*	1		
Black-throated Green Warbler, *Dendroica virens*		1	

* May breed on St. John.

The mangrove swamps are sharply characterized by composition and growth form. The remainder of the natural vegetation of St. John probably represents a continuous distribution of species with plant cover at a given place determined primarily by the position of the site in relation to gradients of moisture and exposure. "Moist Forest" and "Dry Forest and Scrub"

are somewhat arbitrary segments of a probable vegetational continuum. Extremes were easily recognizable, however, and because of the precipitous topography of St. John, transition belts tended to be narrow. Under field conditions most observations could be assigned with little difficulty. Time spent in mangrove swamps overrepresents their rather limited extent on St. John, but field time in moist forests and in dry forests and scrub is roughly proportional to the area of these types.

SPECIES OBSERVED

Satisfactory sight records of 59 species were obtained in February–March 1957. Two are previously unrecorded in the Virgin Islands and at least three others previously unrecorded on St. John. These records are based on observation alone and must be considered provisional pending collection of specimens. Twenty-five additional species reported from St. John or the adjacent cays and waters are included in the list (*). Several of these also need verification. Seaman (1958) lists 22 other species (mainly North American migrants) as occurring throughout the American Virgin Islands, but I find no definite records for St. John. Annotations summarize other references to occurrence as well as our observations. Nomenclature for species not included in the A.O.U. *Check-list* (1957) follows Bond (1956) for technical names and Bond (1961) for vernacular names.

* *Podiceps dominicus.* Least Grebe. Nichols (1943) reported this species at Caneel Bay Pond (now filled) and Mary Point Pond.

* *Podilymbus podiceps.* Pied-billed Grebe. Said by Nichols (*l.c.*) to breed at Caneel Bay Pond. Found in small numbers on St. John (Seaman, *in litt.*).

* *Phaëthon aethereus.* Red-billed Tropic-bird. Listed for St. John (Seaman, 1958).

Phaëthon lepturus. White-tailed Tropic-bird. We saw 14 on the sea cliffs at the north side of Congo Cay, 3 March. Mortensen (Wetmore, 1927) and Nichols (1943) reported the species breeding there, the latter stating that it nests from January to June.

Pelecanus occidentalis. Brown Pelican. In all, 80 adults and immatures were noted at localities all around the island. We were told that Brown Pelicans have nested along the shore of Mary Point, and nests with young were seen on nearby Whistling Cay, 25 October 1958 (Seaman, *in litt.*). Pelicans nest in February and March on St. Croix (Beatty, 1930), and Nichols (1943) collected eggs in mid-April at Dutch Cap northwest of St. Thomas.

Sula leucogaster. Brown Booby. A total of 25 (five adults) was observed along the coast from Cruz Bay to Cinnamon Bay. Brown Boobies breed on several cays north and west of St. Thomas (Beatty, 1938; Nichols, 1943) but apparently not on the islets near St. John.

Fregata magnificens. Magnificent Frigate-bird. Seen daily. The nearest known breeding area is Tobago Island, British Virgin Islands, about 16 km (10 miles) north of St. John (Bond, 1956).

Ardea herodias. Great Blue Heron. Seen three times (26 and 28 February, 1 March)

at ponds around Lameshur Bay, and on Mary Point, 5 March. There is no record of nesting on St. John, although it has nested at Mangrove Lagoon, St. Thomas (Nichols, 1943). Herons of all species were wary and difficult to approach, which suggests that they are hunted.

Butorides virescens. Green Heron. Green Herons inhabited the more remote mangrove swamps, where seven were seen on six dates from 12 February to 7 March. Riise obtained a specimen on St. John, 27 February 1859 (Salomonsen, *in litt.*), Ober collected two in 1880, and Danforth (1930) saw two at Cruz Bay. We found no evidence of breeding, although the species is said to nest throughout the year with a peak in spring (Wetmore, 1927; Beatty, 1930; Nichols, 1943). The subspecific status of winter individuals on St. John is uncertain, because *B. v. virescens* of eastern continental North America is known from St. Thomas (Bond, 1956). Ober's St. John specimens were referred to "*B. v. cubanus*" (Oberholser, 1912), now considered synonymous with *B. v. maculatus*, a resident West Indian race.

Florida caerulea. Little Blue Heron. The only common heron. We saw 42 adults and 21 white immatures. They usually frequented mangroves, but sometimes fed along beaches, on shallowly submerged coral reefs, and on the lawns at Caneel Bay. Nichols (1943) said that Little Blue Herons gather in April to nest on Steven Cay.

* *Casmerodius albus.* Common Egret. Nichols (*l.c.*) found this species once on St. John, Cruz Bay, 3 May 1936. Mrazek repeatedly saw a lone Common Egret on mudflats at Coral Bay during the summer of 1957.

* *Hydranassa tricolor.* Louisiana Heron. Nichols (*l.c.*) located a nest with three eggs on Steven Cay, 21 April. One frequented Coral Bay in the summer of 1957 (Mrazek, *in litt.*).

* *Nycticorax nycticorax.* Black-crowned Night Heron. Adults were seen several times around mangrove swamps at Lameshur, summer 1957 (Mrazek, *in litt.*). The species is rare in the West Indies (Bond, 1956) and previously known in the Virgin Islands only from St. Croix (Seaman, 1958).

Nyctanassa violacea. Yellow-crowned Night Heron. One record: an adult, Cruz Bay, 17 February. Nichols (1943) reported it fairly common at Cruz Bay and Coral Bay, Mrazek (*in litt.*) saw adults at Lameshur in the summer of 1957, and Karraker (*in litt.*) saw an immature at Francis Bay, 18 July 1959.

* *Anas bahamensis.* Bahama Duck. Reported from St. John by Nichols (*l.c.*). Uncommon, breeds locally (Seaman, *in litt.*).

Anas discors. Blue-winged Teal. At least 30 frequented ponds east of Lameshur Bay (26 and 28 February, 1 March), and we saw two 27 February, in the Reef Bay mangrove swamp. The remains of a male, possibly killed by a mongoose, were found at Lameshur.

* *Oxyura jamaicensis.* Ruddy Duck. Said by Nichols (*l.c.*) to occur on St. John.

Buteo jamaicensis. Red-tailed Hawk. Seen throughout the island east to Coral Bay, usually single birds soaring over dry hillsides near the coast. Danforth (1930) and Nichols (1943) mention earlier observations.

Circus cyaneus. Marsh Hawk. I saw a female or immature male Marsh Hawk over Hognest Bay, 11 February. It was closely pursued by a Red-tailed Hawk, and both were in view for several minutes. Seaman (1958) lists the species as an uncommon transient and rare winterer throughout the Virgin Islands, but published records seem limited to Beatty's (1941) for St. Croix.

Pandion haliaetus. Osprey. Three 1957 records: one off Ram Head, 3 March; one over Red Hook Bay, St. Thomas, 4 March; and one seen by Mrazek at Steven Cay, 17 January. None of these was conspicuously white headed, and the records doubtless

pertain to wintering birds from continental North America. Beatty (*l.c.*) and Nichols (1943), however, have suggested that Ospreys (presumably *P. h. ridgwayi*) may breed on cays near Tortola. Karraker (*in litt.*) saw one Osprey at Cinnamon Bay, 28 July 1959.

Falco columbarius. Pigeon Hawk. On 21 February I watched a Pigeon Hawk unsuccessfully pursue Pearly-eyed Thrashers and a Mockingbird on the slopes south of Mary Point Estate.

Falco sparverius. Sparrow Hawk. Rather uncommon and restricted to more open parts of the coastal dry forests. Riise collected one 20 June 1859 (Salomonsen, *in litt.*), and Cory (1892) lists the species for St. John. Breeding apparently begins in late February. A male and female at Emmaus, 22 February, repeatedly entered a hole in a large tree, and a pair at Lameshur was observed copulating, 25 February. In Puerto Rico nesting began in April and extended through May and June (Wetmore, 1927). Nichols (1943: 29) wrote "Eggs are laid throughout the year." He took a set of two on St. Thomas, 16 March, and Beatty (1930) collected a fresh set of three on St. Croix, 28 May, stating that it breeds there from February to May.

* *Rallus longirostris.* Clapper Rail. Said to be abundant in suitable localities (Nichols, 1943).

* *Porzana carolina.* Sora. One collected by Riise, 24 February 1859 (Salomonsen, *in litt.*).

Gallinula chloropus. Common Gallinule. Five were seen at ponds east of Lameshur Bay (28 February, 1 March). Also reported by Nichols (*l.c.*), who considered it uncommon.

* *Fulica caribaea.* Caribbean Coot. Ober took two specimens, one of them the type of the species (Ridgway, 1884). Nichols (1943: 30) calls it "particularly numerous" on St. John, stating that it breeds there. We looked especially for this species, visiting nearly all the areas of likely habitat, but failed to find it.

Haematopus palliatus. American Oystercatcher. We saw two at Reef Bay, 27 February; three in Lameshur Bay, 1 March; and two at Mennebeck Bay, 3 March. They favored headlands along rocky shores and were extremely wary. Nichols (*l.c.*) reported the Oystercatcher from Steven Cay, and a specimen without date taken by Riise is in the collection at Copenhagen (Salomonsen, *in litt.*).

Charadrius wilsonia. Wilson's Plover. Presumably resident, but seen only once, four on mudflats behind Fish Bay, 7 March. Nichols (*l.c.*) listed it from St. John, Steven Cay, and Lovango Cay. Karraker (*in litt.*) saw five at Mary Creek, 22 July 1959.

Charadrius vociferus. Killdeer. Apparently not common. I saw four at Caneel Bay, 14 February, and heard Killdeers calling there on the evening of 6 March. These may have been wintering birds of the nominate race, which is widely reported in the Virgin Islands (Bond, 1940). The resident Antillean race (*C. v. ternominatus*) occurs on St. John, however, because Mrazek (*in litt.*) found a nest at Caneel Bay, 13 August 1957, observing both parent birds and four young partly feathered and still unable to fly. Beatty (1941) saw adults with downy young on St. Croix, 28 October and 10 February, and Nichols (1943) took a set of four eggs on St. Thomas, 15 May. It seems evident that the Killdeer in the Virgin Islands breeds throughout the year.

Squatarola squatarola. Black-bellied Plover. Our only records were: four at Annaberg, 21 February, and one near Fortberg, 9 March.

Actitis macularia. Spotted Sandpiper. Common along the mangrove-bordered shores. We saw none at the few suitable places in the interior. Riise took three specimens, 21 February 1859 (Salomonsen, *in litt.*).

Catoptrophorus semipalmatus. Willet. Mrazek and I observed a Willet at close range on mudflats below Fortberg, 9 March. The species was previously known in the American Virgin Islands only from St. Croix, where it has nested (Bond, 1956; Seaman, 1958).

Totanus melanoleucus. Greater Yellowlegs. A flock of 14 frequented ponds around Lameshur Bay, three were seen in a pond at Francis Bay, 12 February, and three in a pond by Concordia Bay, 1 March.

Totanus flavipes. Lesser Yellowlegs. Much more common than the Greater Yellowlegs and present at most of the shallow ponds. The largest group seen included 28 individuals (Lameshur, 28 February). Danforth (1930) saw six at Cruz Bay, January 1927.

* *Himantopus mexicanus.* Black-necked Stilt. A common summer resident (Nichols, 1943). In 1957 stilts appeared early in April and were seen at Lameshur and Cruz Bay through the summer (Mrazek, *in litt.*).

* *Larus atricilla.* Laughing Gull. Common in summer (Karraker, *in litt.*).

* *Sterna dougallii.* Roseate Tern. Nichols (1943) reported Roseate Terns from Booby Rock, Carval Rock, and Coccoloba Cay. Mrazek and Karraker (*in litt.*) frequently saw flocks of as many as 50 during the summers of 1957 and 1959.

* *Sterna fuscata.* Sooty Tern. The Newtons (1859) state that Osbert Salvin saw Sooty and Noddy terns in numbers off St. John, 29 May 1859. Common in summer (Mrazek, *in litt.*).

* *Sterna anaethetus.* Bridled Tern. Reported from Carval Rock (Nichols, 1943). Summer resident, common (Seaman, *in litt.*).

Thalasseus maximus. Royal Tern. A few were noted regularly in bays along the north and west coasts; seen by Danforth (1930) in the same area, January 1927.

* *Thalasseus sandvicensis.* Sandwich Tern. Karraker (*in litt.*) saw one at Cinnamon Bay, 18 and 24 July 1959. This species has been listed for Puerto Rico by McCandless (1958), but the present report is the first from the Virgin Islands.

* *Anoüs stolidus.* Noddy Tern. Nesting in large numbers on Carval Rock, June 1957 (Mrazek, *in litt.*). Earlier reported to breed there by Nichols (1943).

Columba leucocephala. White-crowned Pigeon. Decidedly the least common of the pigeons and doves on St. John. Our records were: two on Bordeaux Mountain, 10 February; two feeding on gumbo-limbo fruits, Susannaberg, 19 February; and one or two that roosted in mangroves near Lameshur, 25 and 28 February and 1 March. The bulk of the population is said to leave the region in winter, returning in February or March. White-crowned Pigeons were once abundant in the Virgin Islands and gathered in vast breeding colonies, particularly on St. Croix (Beatty, 1930). As documented by Seaman's careful studies, unrestricted hunting has reduced this population to the barest remnant.

Columba squamosa. Scaly-naped Pigeon. Common in the heavier forests of the highlands and interior valleys, occasionally ranging to the coast in this habitat (Cinnamon Bay, 23 February). We saw it in dry forest surroundings only on the east slope of Camelberg, where birds sometimes perched when coming to drink at pools in a deep ravine. The 83 observations understate actual abundance, because the pigeons kept to the forest canopy and were much more often heard than seen. From our camp at Fredrikdal, 20 to 23 February, large numbers were heard calling from heights along the north side of the island in early morning. Ober collected two specimens (Wetmore, 1927), and Danforth (1930) and Nichols (1943) observed the species on St. John.

Zenaida aurita. Zenaida Dove. Common in all of the more open areas, but not

numerous in forests except near roads and at places heavily used by livestock. Ober (Wetmore, 1927) and Beatty (Blake, *in litt.*) collected specimens on St. John, and Danforth (1930) reported Zenaida Doves fairly common at Cruz Bay. Most of the population apparently withdraws to the offshore islets to breed. A number of nests of Zenaida and Ground doves were found on Rata Cay and Le Duck Cay, late July 1957 (Mrazek, *in litt.*). Danforth (1935a) described a breeding colony of thousands on Little Saba Cay, St. Thomas, June 1935, and Nichols (1943) mentions similar aggregations on other cays near St. Thomas.

Columbigallina passerina. Ground Dove. Characteristic of brushy pastures in the coastal arid sections, where flocks of up to 40 were seen. Seldom found within the heavier forests, and apparently absent in higher parts of the interior even from suitable habitat. Ober (Wetmore, 1927), Danforth (1930), and Beatty (Blake, *in litt.*) collected specimens, and Nichols (1943) listed Ground Doves from St. John and many nearby cays.

Geotrygon mystacea. Bridled Quail Dove. One of the few resident land birds whose occurrence was closely associated with dense forest. We found quail doves at many north coast and interior localities, but most commonly in the steep, heavily wooded valleys leading down to Fish Bay and Reef Bay (Figure 4). The population on St. John may never have been so severely reduced as on other islands of the group. On St. Croix, Beatty (1930) once considered the quail dove near extinction, but it has substantially recovered in recent years (Seaman, 1952; Butcher, 1956). The decline is customarily charged to mongoose predation, but forest removal must also have been an important factor. The species was first reported from St. John by Beatty (1941), who collected at least four specimens in March 1940 (Blake, *in litt.*).

Coccyzus minor. Mangrove Cuckoo. Most frequent in *Croton–Acacia* scrub near the coast, but also observed in heavier forests and in mangroves, and ranging at least occasionally to the interior (one near 360-meter elevation, Bordeaux Road, 25 February). Specimens were collected by Ober (Wetmore, 1927) and Danforth (1930).

Coccyzus americanus. Yellow-billed Cuckoo. One was seen well, 17 February, in scrubby dry forest at Cruz Bay. The previous earliest record for its spring appearance in the West Indies was "March 3" (Bond, 1956: 77). An additional record for St. John is one seen in Reef Bay Valley, 20 July 1959 (Karraker, *in litt.*). The Newtons (1859) reported the Yellow-billed Cuckoo nesting on St. Croix, but its status on St. John is uncertain.

Crotophaga ani. Smooth-billed Ani. Anis were typical inhabitants of dry woods and overgrown fields near the coast, and entered heavier forest chiefly where herds of cattle were present. Our only observations in the interior were: two in a cattle pasture at Susannaberg, 19 February; and a flock of 10 on Bordeaux Mountain, 2 March. Ober collected one specimen on St. John (Wetmore, 1927).

* *Otus nudipes.* Puerto Rican Screech Owl. Riise collected "several" specimens (Newton, 1860: 307), probably in 1859. These may have been given to Newton, because Salomonsen does not list them with Riise's material deposited in Copenhagen. The only other report is by Nichols (1943: 34), who called it "Rare on St. Thomas and on St. John" but gave no details regarding his St. John records. None of the islanders to whom I talked seemed to have definite recent knowledge of the species.

* *Anthracothorax dominicus.* Antillean Mango. Ober collected an adult female in 1880 (Wetmore, 1927), and Nichols (1943) listed the species from St. John.

Sericotes holosericeus. Green-throated Carib. The common large hummingbird, apparently restricted to dry areas near the coast. Our record farthest inland was south

of Fredrikdal at less than 150-meter elevation. The Newtons (1859) reported the species from St. John on the authority of a Dr. Lund, Ober collected two specimens (Wetmore, 1927), and Nichols (1943) observed it on St. John and many of the cays.

Orthorhyncus cristatus. Antillean Crested Hummingbird. Partial to drier areas with open vegetation, and particularly numerous in the cactus and agave woodlands of eastern St. John. Although most common near the coast, it ranged sparingly to the interior (Bordeaux Mountain, 10 February; upper Reef Bay Valley, 1 March). Danforth (1930) saw several near Cruz Bay, and Nichols (1943) reported it from St. John, Whistling Cay, and Lovango Cay.

Megaceryle alcyon. Belted Kingfisher. Rather uncommon. Our 15 observations were all at mangrove-bordered bays and ponds. Danforth (1930) collected one at Cruz Bay, 6 January 1927.

* *Sphyrapicus varius.* Yellow-bellied Sapsucker. Mrazek found one near Estate Seeven, 22 January 1958, and was able to study it at close range. At several places on the island we saw trees that bore the marks of sapsucker drilling.

Tyrannus dominicensis. Gray Kingbird. One of the most conspicuous resident birds, generally distributed in dry forests and scrub and mangrove swamps on St. John and the nearby islets (Whistling Cay and Congo Cay, 3 March; Nichols, 1943). Most of those seen in heavily forested areas were near clearings, but in a few instances we observed Gray Kingbirds feeding well within closed forests. Riise, Ober, and Danforth collected specimens on St. John.

Myiarchus stolidus. Stolid Flycatcher. Seaman (1957) first reported the Stolid Flycatcher from St. John and collected one near Reef Bay, 5 March 1956. I saw one in an area of dense scrub near Estate Seeven, 7 March. It perched on a low branch over the trail for nearly 10 minutes. The rarity of this species on St. Thomas and St. John resists ecological explanation. Conditions similar to those at the few localities where it has been found seem widely available on both islands.

Elaenia martinica. Caribbean Elaenia. Common in dry forest and scrub, occasional in heavier forests. Individuals watched at several localities fed entirely on the drupes of gumbo-limbo. Danforth (1930) collected one at Cruz Bay, 6 January 1927.

Hirundo rustica. Barn Swallow. Evidently rare in the Virgin Islands in winter. We saw two at Caneel Bay, 14 February.

Progne subis. Purple Martin. With one exception (Lameshur, 1 March), our observations were at localities along the northwest coast. The species is not restricted to the coasts, however, because I saw many over open fields near the summit of Sage Mountain, Tortola, 5 March. Their numbers increased during our stay on the island, which presumably indicates return of the summer resident population. The species is "very rare or absent in the late autumn and early winter" throughout the West Indies (Bond, 1956: 116). I am following Bond (1961) in treating the Antillean and North American martins as conspecific.

Mimus polyglottos. Mockingbird. Mockingbirds were uncommon but generally distributed in areas of open vegetation close to the coast (Cruz Bay, Kaneel Hill, Caneel Bay, Maho Bay, Mary Point, Emmaus, John's Folly). The species was first noted on St. Thomas in 1916 (Griscom, 1921) and has extended its range east to Anegada (Nichols, 1943). It had reached St. John by January 1927, when Danforth (1930: 126) saw "about half a dozen" and collected two at Cruz Bay.

Margarops fuscatus. Pearly-eyed Thrasher. The Pearly-eyed Thrasher was probably the most abundant bird on St. John and certainly the most conspicuous land bird. We found it from the coast to above 360 meters on Bordeaux Mountain, and at every locality visited except in the dense stands of cactus around Concordia Bay and

Ram Head. The song is thrasherlike, but below the musical standard of the family. In its boldness around camps and the habit of ranging in noisy flocks, and in many of its harsh call notes, it more resembles a jay. Pearly-eyed Thrashers feed principally on fruit and were said to be serious pests in orchards. Observed food included fruits of *Morinda citrifolia, Citharexylum* sp., wild guava (*Psidium guajava*), and cultivated bananas, papayas, and soursops (*Annona muricata*). Seaman (1952) suspected that they also prey heavily upon the eggs and nestlings of other birds. Specimens were taken on St. John by Ober and Danforth.

Vireo altiloquus. Black-whiskered Vireo. On 7 March four were seen and others heard singing in mangroves at Fish Bay. These were probably newly arrived summer residents, the species reportedly returning to Puerto Rico by mid-February (Wetmore, 1927), and to St. Croix (Beatty, 1930: 147) "in December and January." Nichols (1943) observed the Black-whiskered Vireo on St. John and Whistling Cay, Butcher (1956) listed it from St. John in late March 1956, and Karraker (*in litt.*) heard two singing at Lameshur, 21 July 1959.

Coereba flaveola. Bananaquit. Abundant in shrubbery around houses and throughout the hinterlands. Bananaquits were partial to the drier, more open sections but ranged wherever there were plants in flower. A recent study on Tobago (Gross, 1958) describes the Bananaquit's method of feeding on the nectar of *Bryophyllum* flowers by piercing the base of the corolla. On St. John *Bryophyllum* is widely naturalized, and it was unusual to find flowers that were not punctured near the base. In addition to Bananaquits, Green-throated Caribs, and Antillean Crested Hummingbirds frequently fed at the punctures. Ober (Wetmore, 1927) and Danforth (1930) obtained specimens on St. John.

Mniotilta varia. Black-and-white Warbler. Fourth in abundance among wintering wood warblers and more frequent in mangroves than any except the Northern Waterthrush.

Helmitheros vermivorus. Worm-eating Warbler. Surprisingly numerous in the heavier forests of St. John. Localities of record (16 February through 10 March) were: Cinnamon Bay, Bordeaux Mountain, Hognest Bay, Trunk Bay, Reef Bay, and Fish Bay Valley. The species is rare east of Cuba (Bond, 1956) and was previously known in the Virgin Islands from two specimens and a sight record on St. Croix (Beatty, 1941) and one sight record by Seaman on St. John, March 1956 (Bond, *in litt.*).

Parula americana. Parula Warbler. The second most common wood warbler. It exhibited little ecological restriction, but apparently was absent from the cactus areas of eastern St. John.

Dendroica petechia. Yellow Warbler. Common in mangroves and in open vegetation inland to elevations of about 180 meters (Mary Point, slopes above Lameshur). It was the only warbler found in the cactus and agave woodlands of eastern St. John, but was absent from closed forests even at sea level. Males were in full song and defending territories in February. By far the larger part of the population must breed outside of mangrove swamps. Danforth (1930) collected one at Cruz Bay, 6 January 1927.

Dendroica magnolia. Magnolia Warbler. Dull-plumaged individuals, probably immatures, were seen on Bordeaux Mountain, 25 February and 2 March, and at Cinnamon Bay, 8 March. These appear to be the first reported from the Virgin Islands.

Dendroica tigrina. Cape May Warbler. A common winter resident in the Bahamas and Greater Antilles (Bond, 1956), but evidently rare on St. John. Our observations included birds in adult male plumage (two), Cruz Bay, 17 and 18 February. Ober collected one specimen in 1880 (Leedy, *in litt.*).

Dendroica caerulescens. Black-throated Blue Warbler. Uncommon but generally distributed in the humid forests. Our observations (25 February through 10 March) included five birds in adult male plumage. The species was previously known in the Virgin Islands only from St. Croix (Seaman, 1958).

**Dendroica coronata.* Myrtle Warbler. Seaman observed the species on St. John in March 1956 (Bond, *in litt.*).

Dendroica virens. Black-throated Green Warbler. My wife and I saw a female or immature in dense woods at the head of Reef Bay Valley, 10 March. It was with a moving forage party of wood warblers, and we were able to follow it for some time. The species is rare or accidental in the Virgin Islands, where otherwise known from two specimens taken on St. Croix, 18 October 1919 (Beatty, 1930), and a recent sight record on Water Island, St. Thomas (Bond, 1959).

**Dendroica striata.* Blackpoll Warbler. Seaman (*in litt.*) saw several at Maho Bay, 4 November 1949, and at Coral Bay, 6 November 1949.

Dendroica discolor. Prairie Warbler. Common throughout the island east to Annaberg and Bordeaux Mountain. Our data suggest a rather marked association with dry forest vegetation. Danforth (1930) collected one at Cruz Bay, 6 January 1927.

Seiurus aurocapillus. Ovenbird. Uncommon and largely confined to moist forest areas near stream beds.

Seiurus noveboracensis. Northern Waterthrush. In our records the most abundant wintering wood warbler on St. John. Waterthrushes were most frequent in mangroves but also common along stream beds in moist forests to elevations of at least 160 meters (Reef Bay Valley). Danforth (*l.c.*) found it common in mangroves at Cruz Bay, January 1927, and took one specimen.

Several authors (Wetmore, 1927; Bond, 1936, 1956) report that the two waterthrushes tend to be ecologically segregated on their Antillean wintering grounds, the present species largely limited to mangrove swamps, while *S. motacilla* occurs along interior streams. Waterthrushes seen away from mangroves on St. John were studied closely, but we failed to find any that showed the field characters of the Louisiana Waterthrush. This suggests that *S. noveboracensis* may enjoy wider ecological amplitude where its close congener is an uncommon winterer. Comments on the winter habitat of the species in Yucatan (Paynter, 1955), the Dutch Leeward Islands (Voous, 1957), and Trinidad (Snow and Snow, 1960) indicate that it is often found away from mangroves. The Newtons (1859: 142) do not mention mangroves in their account of the Northern Waterthrush on St. Croix, but refer to it as ". . . tolerably common by the side of quick-running streams, and occasionally seen away from them."

Oporornis formosus. Kentucky Warbler. I twice saw adult male Kentucky Warblers in the heavily forested valley behind Cinnamon Bay (19 February and 8 March, possibly the same individual). On each occasion the bird was watched for about five minutes as it foraged in characteristic manner on the ground and from the lower leaves and branches of understory shrubs. Bond (1956: 155) lists the species only as a "very rare transient in Cuba." McCandless (1958) mentions two sight records in October at Cabo Rojo, extreme southwestern Puerto Rico.

Wilsonia citrina. Hooded Warbler. Our records, all in moist forests with heavy undergrowth (Cinnamon Bay, 19 and 23 February; Bordeaux Mountain, 25 February and 2 March; Reef Bay Valley, 1 March), included two birds in adult male plumage. Bond (1956: 159) calls the species a "rare transient" giving "March 16" as the date of its earliest spring occurrence in the West Indies. The earliest spring date perhaps should read "March 6." Voous (1955a: 172) writes "Once collected in a luxuriant forest in one of the deep ravines of Saba on 6.III.1952." Bond (*l.c.*) mentions Saba

in his account, and there is apparently but one record from that island. Dates of our observations suggest that the Hooded Warbler may winter in the West Indies, as does McCandless' (1958: 46) statement, ". . . seen almost regularly in recent years in southwestern Puerto Rico from October to March." The first records on St. John were by Seaman in March 1956 (Bond, *in litt.*).

Setophaga ruticilla. American Redstart. The third most common wintering wood warbler, occurring chiefly in the heavier forests. Approximately half those seen (51) were in adult male plumage, a proportion in strong contrast to that observed by Wetmore (1927) on Puerto Rico and Culebra and by Voous (1957) on Curaçao, both of whom reported adult males greatly outnumbered by females and immatures. Ober collected a specimen on St. John (Leedy, *in litt.*), and Danforth (1930) saw one at Cruz Bay.

**Molothrus bonariensis.* Glossy Cowbird. W. H. Kortright reported "a flock of 10 to 12" on St. John in the summer of 1955 (Bond, *in litt.*). This South American species apparently invaded the Lesser Antilles around 1900 and has extended its range as far as Martinique (Bond, 1956). It was recently seen in numbers at Cabo San Juan, northeastern Puerto Rico (Grayce, 1957).

**Icterus icterus.* Troupial. One was reported by Kortright, summer 1955 (Bond, *in litt.*), presumably a straggler from St. Thomas.

Tiaris bicolor. Black-faced Grassquit. Grassquits were abundant in the drier sections, but most of our records in forested areas were at roadsides or near weedy openings. We saw many paired birds but found no active nests, although the birds are said to breed the year around (Nichols, 1943). Ober (Wetmore, 1927) and Danforth (1930) collected specimens on St. John.

DISCUSSION

Ecological distribution of wintering and breeding birds. St. John differs from other islands of the region in the possession of extensive stands of heavy forest. Similar vegetation apparently was once characteristic of upper north slopes, higher elevations, and sheltered valleys throughout the Virgin Islands. Continued disturbance during more than 300 years of settlement has nearly eliminated it, except for small remnants such as the Sage Mountain forest on Tortola. Land use on St. John followed the same course until the early 19th century, but vegetation there has suffered less disturbance since that time. The utilization of the recovering moist forest habitat by wintering and resident land birds was of particular interest.

The heavier forests on St. John provide conditions especially attractive to wintering and transient parulids from continental North America. The number of individuals of all species seen per hour of observation (Table 1) was more than three times as large in such forests as in the dry forests and scrub. Five of the 13 species identified were found only in moist forests. Present concepts of the local status of several wood warblers, formed chiefly from their occurrence on the well-studied, but extensively deforested, islands of St. Croix and St. Thomas, may need revision when sufficient information is available from St. John. Besides sight records of two species previously unreported, we found three other wood warblers

considered rare in the Virgin Islands (Worm-eating, Black-throated Blue, and Hooded) to be widely distributed on St. John. It is likely that some species now regarded as transients will be found to winter in this favorable habitat.

The ecological distribution of the land birds that breed on St. John was in sharp contrast to that of the wintering and transient species. The number of individuals of the 21 breeding species seen per hour of observation in dry forest and scrub was twice as large as in the moist forests (Table 1). Only two species (Scaly-naped Pigeon, Bridled Quail Dove) were more or less restricted to heavier forests, and of the 13 others recorded, only the Pearly-eyed Thrasher was generally distributed. Most occurrences of other resident species within areas of heavier forest were associated with the openings created by roads, native garden patches, overbrowsed areas, and charcoal burners' clearings. Species characteristic of forest-edge situations in the more open and more arid vegetation types strongly predominate in the breeding land avifauna of St. John. The structurally more complex and floristically more diverse moist forests are sparsely inhabited by breeding land birds.

The scarcity of breeding land birds in the heavier forests of St. John may result in part from deforestation during the period of plantation agriculture. Wholesale removal of forests on such a small island must have greatly reduced or eliminated forest-inhabiting birds. The present breeding land avifauna with its few forest species and predominance of forest-edge species is approximately what would be expected from the history of land use on the island. Although populations of all the land birds that are known to have bred in the Virgin Islands probably still persist, the record of the original avifauna may be incomplete. The earliest reliable information about Virgin Islands birds is provided by collections sent from St. Thomas by Robert Swift in the early 1850's (Wetmore, 1927). By that date, destruction of forests had been accomplished long since and the plantation era was near its close.

Deforestation long antedated the introduction of the mongoose on islands in this area. Some of the faunal depletion on small West Indian islands that is usually charged to mongoose depredations may have resulted from habitat disturbance. The Bridled Quail Dove has increased on several islands with the regrowth of forests despite high mongoose abundance.

Zoogeographical comments. The islands east of Puerto Rico as far as the Anegada Passage belong geologically to the Greater Antilles. A relatively slight depression of sea level would unite all of the Virgin Islands except St. Croix with one another and with Puerto Rico. As might be expected from the geographical location, however, the native land birds

include some that have entered the region from the Lesser Antilles as well as Greater Antillean forms. The intermediate character of the Virgin Islands avifauna was discussed briefly by Danforth (1935a). Our data on the relative abundance of land birds on St. John provide the basis for more detailed examination of ornithogeographical relationships.

The reported breeding land avifauna of the northern Virgin Islands numbers 24 species. They are the 21 species that we observed on St. John (Table 1) and the Puerto Rican Screech Owl (*Otus nudipes*), Common Nighthawk (*Chordeiles minor*), and Antillean Mango (*Anthracothorax dominicus*). The Yellow-billed Cuckoo is said to have nested on St. Croix (Newton and Newton, 1859), and breeding populations of several introduced land birds are established on St. Thomas (*Aratinga pertinax, Passer domesticus, Icterus icterus*) and on St. Croix (*Colinus virginianus*).

A large fraction of the characteristic land birds of the Greater Antilles do not range east into the Virgin Islands. Puerto Rico possessed a breeding land avifauna of 53 native species (at least two of these now extinct), of which only 20 are known to have bred in the northern Virgin Islands. A few others reach the islands closer to Puerto Rico, such as Vieques (Table 2). Conspicuously absent are representatives of the genera *Saurothera, Chlorostilbon, Todus,* the subgenus *Vireo,* and *Agelaius,* and such species as *Geotrygon montana, Tyrannus caudifasciatus, Petrochelidon fulva, Spindalis zena,* and *Tiaris olivacea.* Several other species and genera inhabit Puerto Rico and parts of the Lesser Antilles, but not the intervening land areas. Examples are: *Buteo platypterus, Contopus latirostris, Mimocichla plumbea, Dendroica adelaidae, Tanagra musica,* and the genera *Melanerpes, Quiscalus, Icterus,* and *Loxigilla.*

There is no very satisfactory explanation for the absence of so much of the Greater Antillean land avifauna on islands immediately east of Puerto Rico. To judge from the present vegetation of St. John, habitat suitable for many of the missing species was available in the northern Virgin Islands under original conditions, and land connection probably existed in the glacial intervals of the Pleistocene. Forest obliteration early in the historical period may partially account for present impoverishment, but evidence to support this view is meager. Bone fragments referred to the Greater Antillean *Corvus leucognaphalus* have been identified from midden deposits on St. Croix (Wetmore, 1918, 1925), and there are reports, now generally discounted, of the former occurrence of *Saurothera vieilloti* and *Melanerpes portoricensis* on St. Thomas.

The present breeding land avifauna of the northern Virgin Islands includes a number of widely distributed forms, plus a smaller representation of species that appear from their present ranges to have entered the region from either the Greater or Lesser Antilles. Fourteen of the 24 species

TABLE 2[1]

OCCURRENCE OF GREATER ANTILLEAN AND LESSER ANTILLEAN LAND BIRDS ON ISLANDS FROM PUERTO RICO EAST TO THE NORTHERN LESSER ANTILLES

	Puerto Rico	*Vieques*	*Culebra*	*American Virgin Islands*			*Lesser Antilles*
				St. Thomas	*St. John*	*St. Croix*	*No. of Guadeloupe*
1. Greater Antillean species							
Tyrannus caudifasciatus	X	X					
Quiscalus niger	X	R					
Tiaris olivacea	X	X	?/R				
Saurothera vieilloti	X	?		?			
Melanerpes portoricensis	X	X		?			
Anthracothorax dominicus	X	R/X	R	R	R		
Myiarchus stolidus	R/X	R/X	R	R	R		
Otus nudipes	X	?/R		R	R	R	
Chordeiles minor	R			R		?	
Mimus polyglottos	X	X	X	X	X	X	
Dendroica adelaidae	X	X					X (Barbuda)
2. Lesser Antillean species							
Sericotes holosericeus	R	X	X	X	X	X	X
Margarops fuscatus	X	X	X	X	X	X	X
Orthorhyncus exilis	?/R	X	X	X	X	X	X
Elaenia martinica		X	X	X	X	X	X
Geotrygon mystacea			?/R	R	X	X	R/X

X = fairly common to abundant in suitable habitat.
R = Rare.
? = Reported, breeding status in doubt or records questionable.

[1] Based on the following sources: The region as a whole (Bond, 1956); Puerto Rico (Wetmore, 1916a, 1927; McCandless, 1958); Vieques (Wetmore, 1916b; Danforth, 1937); Culebra (Wetmore, 1917; Danforth, 1935a); American Virgin Islands (Danforth, 1930, 1935a; Beatty, 1930, 1941; Nichols, 1943; Seaman, 1958); Northern Lesser Antilles (Danforth, 1935b; Voous, 1955a, 1955b).

comprise what may be termed the basic Caribbean island land avifauna. These birds occur widely over the Greater and Lesser Antilles, their ranges in many instances including the Bahamas, peripheral islands of the southern and western Caribbean, and coastal areas of Florida and Yucatan. Seven of the 14 do not contribute to the present analysis, because the species are monotypic or are represented in Puerto Rico, the Virgin Islands, and the northern Lesser Antilles by populations referred to the same subspecies. The Bananaquit is also an unrewarding zoogeographical subject in this area, because it has distinct subspecies in both the northern Virgin Islands and St. Croix.

The six other wide-ranging species (*Zenaida aurita, Columbigallina passerina, Coccyzus minor, Tyrannus dominicensis, Vireo altiloquus, Dendroica petechia*) are represented by different subspecies in Puerto Rico and the northernmost Lesser Antilles. In all instances, populations inhabiting the northern Virgin Islands are considered to belong to the subspecies of Puerto Rico. On the more isolated island of St. Croix, populations of the Ground Dove and Black-whiskered Vireo belong to the Lesser Antillean subspecies, while populations of the other four are subspecifically identical with those of the northern Virgin Islands and Puerto Rico.

Geographical relationships of the remaining 10 species of breeding land birds are divided equally between the Greater and Lesser Antilles. In the former group are the Puerto Rican Screech Owl, Common Nighthawk, Antillean Mango, Stolid Flycatcher, and Mockingbird. Lesser Antillean representatives are the Bridled Quail Dove, Green-throated Carib, Antillean Crested Hummingbird, Caribbean Elaenia, and Pearly-eyed Thrasher. The distribution of these 10 species, and six other Greater Antillean land birds that occur on Vieques and Culebra, from Puerto Rico across the American Virgin Islands to the northern Lesser Antilles is shown in Table 2. The larger British Virgin Islands (Jost Van Dyke, Tortola, Virgin Gorda, and Anegada) are not considered because information concerning their land birds is somewhat less satisfactory than for other islands in the area. So far as known, their inclusion would not greatly change the patterns of occurrence illustrated in Table 2.

As may be seen from their relative abundance on St. John (Table 1) and from their general status in the islands east of Puerto Rico (Table 2), the Greater Antillean and Lesser Antillean species differ greatly in the characteristics of their occurrence. Except for the Mockingbird, the Greater Antillean species are rare and irregularly distributed. The Lesser Antillean species have continuous distributions and are among the most abundant breeding land birds. The similarity of composition of the two groups (each contains a hummingbird, a small flycatcher, and a large

mimid) suggests that differences in their regional occurrence may be subject to zoogeographical explanation.

Greater Antillean species. Although it is said to have inhabited heavy forest (Newton and Newton, 1859), a habitat that must then have been in short supply, the Puerto Rican Screech Owl evidently was not uncommon in the Virgin Islands as late as the middle 1800's. The Newtons obtained four specimens on St. Croix and saw others that had been taken by Riise on St. John (Newton, 1860), and both Swift and Riise collected specimens on St. Thomas (Wetmore, 1927). By 1930 Beatty (1930) believed that the species was extinct on St. Croix, although still well known to the older inhabitants. Danforth (1935a) pronounced it extinct in all of its former Virgin Islands range. This was followed by the rediscovery of the Puerto Rican Screech Owl on St. Thomas (Nichols, 1943) and St. Croix (Beatty, 1936), the records including a nest found on St. Thomas and a specimen collected on St. Croix, 6 April 1936. There appear to be no reports of more recent date, and it is again listed as "extinct?" by Seaman (1958).

Nichols (1943) collected eggs of the Common Nighthawk on St. Thomas, apparently the only definite instance of its nesting in the American Virgin Islands, although there are July records for St. Croix (Beatty, 1936). If regularly a part of the breeding avifauna, it must be rare. The Antillean Mango may be more numerous on St. Thomas and some of the smaller cays than elsewhere, but no observer has found it common. The history of the Stolid Flycatcher in the Virgin Islands is brief. Beatty (1944) presented the first records from St. Thomas, and Seaman (1957) the first from St. John. There is little likelihood that the species is a new arrival; rather it appears to be a rare and inconspicuous bird previously overlooked. It is noteworthy that neither the Antillean Mango nor the Stolid Flycatcher is known from St. Croix.

The Mockingbird, although nowhere abundant, is the most successful of the Greater Antillean species in the Virgin Islands. It is well documented that it has invaded the region recently. First collected on St. Thomas by R. H. Beck in 1916 (Griscom, 1921), the Mockingbird was found on St. Croix—where said to have been present for "about ten years" —and St. John in 1926–1927, and on Tortola, Salt Island, and Virgin Gorda in 1928–1929 (Danforth, 1930). It had reached Anegada by the late 1930's (Nichols, 1943). Seaman (*in litt.*) first knew of the Mockingbird on St. Croix "around 1916."

Excepting the Mockingbird, the land birds that entered the area from the Greater Antilles appear to represent a relict and declining element in the Virgin Islands avifauna. The Mockingbird is fairly common and has a continuous range, facts that agree with its status as a recent invader.

The rarity of the four other species is not readily explained. The mongoose would probably present a severe check to nesting of the Common Nighthawk, but the arboreal nesting habits of the others more or less exempt them from mongoose predation. Deforestation doubtless reduced populations of the Puerto Rican Screech Owl and Stolid Flycatcher, but the owl seems to have survived in fair numbers through the time of most extensive forest removal, and there is no evidence of the increase of either species on St. John, where large forested areas have long been available. The Antillean Mango is said to inhabit "low, dry sections" (Nichols, 1943: 35), also the favored habitat of the two Lesser Antillean species. Competition may be a factor in its scarcity.

Lesser Antillean species. Four of the five Lesser Antillean species (Table 2) are common on all of the larger islands east of Puerto Rico. The Bridled Quail Dove is not known from Vieques, is probably no more than casual on Culebra, and is somewhat reduced in numbers elsewhere. The regularity of the occurrence of these species and their general abundance suggest that they represent a more recent and more successful element in the Virgin Islands avifauna.

There are few indications of range extension by any of the Lesser Antillean species into or within the Virgin Islands during the period of ornithological record. The clearest instance is provided by records of the Caribbean Elaenia. The Newtons (1859) did not record it from St. Croix, and neither Riise in 1859 nor Ober in 1880 collected it on St. John, although it is common on both islands today. Seaman (*in litt.*) first became aware of the Elaenia on St. Croix about 1920. There seems little doubt that it has extended its Virgin Islands range in the past century. Specimens were, however, taken on St. Thomas by early collectors (Wetmore, 1927). The Bridled Quail Dove was not reported from several islands until rather recently, but it is unlikely that it is a new colonizer. In addition to its probable rarity when the first collectors visited the region, the local history of the species is somewhat obscured, because it was confused at times with the Ruddy Quail Dove (*Geotrygon montana*), a species erroneously reported from the Virgin Islands.

More satisfactory evidence that Lesser Antillean birds constitute a recent and aggressive element in the regional land avifauna may be found in the history of the Green-throated Carib, the Antillean Crested Hummingbird, the Caribbean Elaenia, and the Pearly-eyed Thrasher in Vieques and Puerto Rico. Vieques was visited by A. H. Riise or someone collecting for him about 1860 (Newton, 1860) and by three separate parties in 1899–1900 (Wetmore, 1916b). One of the latter spent more than three months on the island (Bowdish, 1900). None of these observers found either of the hummingbirds or the Elaenia, although the Pearly-

eyed Thrasher was reportedly fairly common (Bowdish, *l.c.*). Wetmore (1916b) worked on Vieques for about three weeks in March–April 1912 and established the first local records of the Green-throated Carib, the Antillean Crested Hummingbird, and the Caribbean Elaenia. He found both hummingbirds common and the Elaenia uncommon and assumed they were summer residents only, because earlier collectors had failed to obtain them. Danforth, however, collected all three species on Vieques in late December 1935. At the time of his visit the Elaenia was "Very common in brushy country in all parts of the island" (Danforth, 1937: 546). It seems clear that these species reached Vieques around 1900.

Bowdish (1902–1903) did not encounter the Pearly-eyed Thrasher nor either of the hummingbirds during his extended residence in Puerto Rico. At the time of Wetmore's (1927) report on the birds of the island, there were no conclusive records of the Antillean Crested Hummingbird, the Green-throated Carib was restricted to extreme eastern Puerto Rico around Fajardo and Cabo San Juan, and the Pearly-eyed Thrasher, although known from many localities and recorded by Gundlach in the 1870's, was considered rare and local.

Bond (1940: 104) later reported on the authority of Danforth that the Pearly-eyed Thrasher was "becoming more abundant and widespread" in Puerto Rico, and it is now said to be locally common in lowland and mountain areas throughout the island (McCandless, 1958; C. R. Mason, *in litt.*). The Green-throated Carib is still confined largely to eastern Puerto Rico (McCandless, 1958), but evidence of possible range extension is provided by Mason's (*in litt.*) sight records of single birds at Cidra, south of San Juan, 11 April 1958, and at Rincon in extreme western Puerto Rico, 9 April 1959. The Antillean Crested Hummingbird is now "Fairly common near Fajardo," and it is also believed to be extending its range (McCandless, 1958: 36). With the above, Puerto Rico boasts five resident hummingbirds, whereas Jamaica and Hispaniola have three species each, and Cuba but two.

Some of the birds here called Lesser Antillean because of their present ranges may be of ultimate Greater Antillean origin. Bond (1948) believed that such an origin was likely for endemic genera of Mimidae in the Lesser Antilles (*Allenia*, *Margarops*, *Cinclocerthia*, *Ramphocinclus*). The Bridled Quail Dove resembles the Key West Quail Dove (*Geotrygon chrysia*), and their ranges do not overlap. Bond (1936) considered them closely related, representative species. It would seem likely, however, that *G. mystacea* differentiated in the Lesser Antilles from which it has colonized the Virgin Islands. The necessary isolation would have been lacking at least in the northern Virgin Islands, which probably had Pleistocene land connection with areas now occupied by *G. chrysia*.

The Pearly-eyed Thrasher (*Margarops fuscatus*) is of unusual interest, because it is represented in the Greater Antilles by several outpost populations beyond its continuous range. These isolated stations are: Mona and Desecheo Islands in the Mona Passage west of Puerto Rico; Beata Island off the south coast of Hispaniola; and a number of islands in the southeastern Bahamas (Bond, 1956; Voous, 1955c: Figure 2). This range has been interpreted (Bond, 1948: 224) as a relict distribution suggesting former more widespread occurrence of *Margarops* in the Greater Antilles. This interpretation receives support from the fact that bones of the species have been recovered from cave deposits on Great Exuma (Wetmore, 1937) outside of (but near) the limits of its known Bahaman range. Several points in addition to its recent spread in Puerto Rico weigh against the interpretation that the Pearly-eyed Thrasher is a relict Greater Antillean species.

1. No racial differentiation has been detected in the isolated Greater Antillean populations, although the species appears to be fairly plastic (represented by an additional subspecies in the central Lesser Antilles and another on Bonaire).

2. The array of possible close niche competitors seems inadequate to account for exclusion of *Margarops* from a hypothetical range on other major islands of the Greater Antilles. The avifauna of these islands includes either three or four (Jamaica) species of large thrashers and thrushes, counting even those with restricted ranges such as *Mimus gundlachii* in Jamaica and Cuba and *Turdus swalesi* in Hispaniola. On much smaller and ecologically less diverse islands in the Lesser Antilles *Margarops* occurs with as many as four (Dominica), five (Martinique), and six (St. Lucia) species of these families, one of which (*Allenia fusca*) probably should be considered congeneric (Voous, 1955b; Bond, 1959).

3. The abundance of the Pearly-eyed Thrasher at most of its outstations and its lack of marked ecological restriction violate the usual concepts of relict species. *Margarops* is reported to be the most abundant land bird on Mona Island (Bowdish, 1902–1903; Barnès, 1946) and the only resident land bird on tiny Desecheo, where Wetmore (1927) estimated the population to number 1,200. It is probably the most numerous breeding land bird of the Virgin Islands and is said to be common also at some places in the Bahamas. On Great Inagua, for example, *Margarops* is one of the most characteristic birds of the xerophytic scrub that covers much of the island (Alexander Sprunt IV and Robert P. Allen, verbal communication). Wetmore and Lincoln (1933: 50) stated that Pearly-eyed Thrashers were found "in fair numbers" on Beata. The species ranged freely through the varied habitats of St. John, and the same is evidently true in the Netherlands Windward Islands (Voous, 1955b), although it is said to be absent from cloud forests on Saba. Bond (1956), however, speaks of *Margarops* as occurring in mountain forests farther south in its Lesser Antillean range. At the Greater Antillean localities farther west, it inhabits chiefly dry scrub and cactus.

As an alternative explanation, it is suggested that the Pearly-eyed Thrasher differentiated in the Lesser Antilles (perhaps from original Greater Antillean stock), and is extending its range into the Greater Antilles. Populations beyond the continuous range may have resulted from

leapfrog colonizations (cf. some range extensions in the Georgia Piedmont, Odum and Burleigh, 1946; Odum, 1948), perhaps indicating that the species is able to establish more readily on arid islands that have few other land birds.

The Virgin Islands lie at the elbow of the Antillean arc, where waves of dispersal east through the Greater Antilles and north through the Lesser Antilles might be expected to meet. Their land avifauna has been received from both directions, but species whose most recent move appears to have been north from the Lesser Antilles are presently dominant. This seems to agree with general information on recent range extensions by West Indian birds.

Bond (1948) has pointed out that the chief routes of dispersal into the West Indies available to neotropical birds were via Jamaica or Grenada. Each has contributed major elements to the West Indian avifauna, but present ranges suggest greater recent activity at the Grenada portal. In the Greater Antilles exclusive of the Bahamas, all but six species among land birds that appear to have entered the West Indies from Central or North America (the exceptions are Turkey Vulture, Caracara, White-winged Dove, Ruddy Quail Dove, Yellow-billed Cuckoo, and Red-legged Honeycreeper, the last perhaps introduced in Cuba) are at least subspecifically distinct from the most closely related continental population. Recent range extensions by land birds in the Greater Antilles seem limited to the Mourning Dove in Jamaica and Puerto Rico, the Mockingbird in the Virgin Islands, and perhaps the White-winged Dove in Puerto Rico and St. Croix (Seaman, *in litt.*). In clear contrast, approximately 15 species of lands birds whose West Indian ranges are limited to the Lesser Antilles are identical with populations inhabiting Trinidad, Tobago, or northern South America. A number of these are reportedly extending or consolidating their Lesser Antillean ranges. Examples are: *Zenaida auriculata, Elaenia flavogaster, Turdus nudigenis, Molothrus bonariensis, Sicalis luteola* (perhaps originally introduced on Barbados), *Sporophila nigricollis*, and *Volatinia jacarina* (Bond, 1948, 1951, 1952, 1956, 1959). Range extensions by Lesser Antillean birds discussed above may in part represent an earlier "wave" now reaching Puerto Rico.

ACKNOWLEDGMENTS

The active assistance of former Superintendent Harold A. Hubler and Chief Ranger Vincent J. Mrazek of Virgin Islands National Park contributed greatly to the success of field studies. Mr. Mrazek and Park Naturalist David O. Karraker later sent records of many bird observations, and Mr. Mrazek and Frank C. Craighead made available information on the vegetation of St. John. Park Historian Herbert Olsen provided valuable

comments on the history of land use. My wife, Betty, aided substantially with field work and in the tabulation of data. I am indebted to Finn Salomonsen for a list of bird skins from St. John now in the Universitetets Zoologiske Museum, Copenhagen, and to Daniel L. Leedy and Emmet R. Blake for similar lists from the collections of the United States National Museum and the Chicago Natural History Museum. George A. Seaman of Christiansted, St. Croix, graciously gave permission to mention several of his unpublished records. James Bond and Mr. Seaman have read the manuscript and offered many helpful suggestions.

SUMMARY

1. Sight identifications of 59 species obtained during an ornithological survey of the new Virgin Islands National Park in February–March 1957 included two (Magnolia Warbler, Kentucky Warbler) first reported for the Virgin Islands and three others (Willet, Black-throated Blue Warbler, Black-throated Green Warbler) first reported for St. John. Annotations stress quantitative distribution of land birds in relation to moist forests, dry forests, and mangrove swamps.

2. Extensive stands of heavy second-growth forest on St. John contrast with other largely deforested islands in the area, and are especially attractive to wintering wood warblers. Worm-eating, Black-throated Blue, and Hooded warblers, formerly considered rare, were widely distributed in moist forests on St. John.

3. The 21 land birds that breed on St. John primarily inhabit forest-edge situations. Only the Scaly-naped Pigeon and Bridled Quail Dove were largely restricted to heavier forests. Scarcity of breeding land birds in closed forests suggests that forest species may have been eliminated by deforestation during the period of plantation agriculture.

4. The Virgin Islands belong geologically to the Greater Antilles, but lack most Greater Antillean land birds. Their breeding land avifauna of 24 species includes 14 that are widely distributed in the Caribbean and 10 that reach range limits in the eastern Greater Antilles. Of the latter, five apparently reached the area from the Lesser Antilles and five from Puerto Rico and the Greater Antilles.

5. The Mockingbird has recently extended its range into the Virgin Islands. Other Greater Antillean species (Puerto Rican Screech Owl, Common Nighthawk, Antillean Mango, Stolid Flycatcher) are rare and discontinuously distributed on islands east of Puerto Rico and appear to be relict.

6. Five species considered of immediate Lesser Antillean origin all have continuous distributions on islands east of Puerto Rico. All except the Bridled Quail Dove are common and extending their ranges. The Antil-

lean Crested Hummingbird appears to have colonized eastern Puerto Rico recently. The Green-throated Carib and Pearly-eyed Thrasher have become more common and widespread in Puerto Rico.

7. Lesser Antillean forms seem to comprise a more recent and more aggressive element in the Virgin Islands land avifauna. This agrees with general knowledge of recent range extensions in the West Indies, most of which involve birds dispersing from South America into the Lesser Antilles.

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