

ATOLL RESEARCH BULLETIN

No. 280

A PRELIMINARY SURVEY OF THE VERTEBRATES OF CABARITA ISLAND,  
ST. MARY PARISH, JAMAICA

BY

RONALD I. CROMBIE, DAVID W. STEADMAN AND JOHN C. BARBER

ISSUED BY

THE SMITHSONIAN INSTITUTION

WASHINGTON, D. C., U.S.A.

DECEMBER 1983

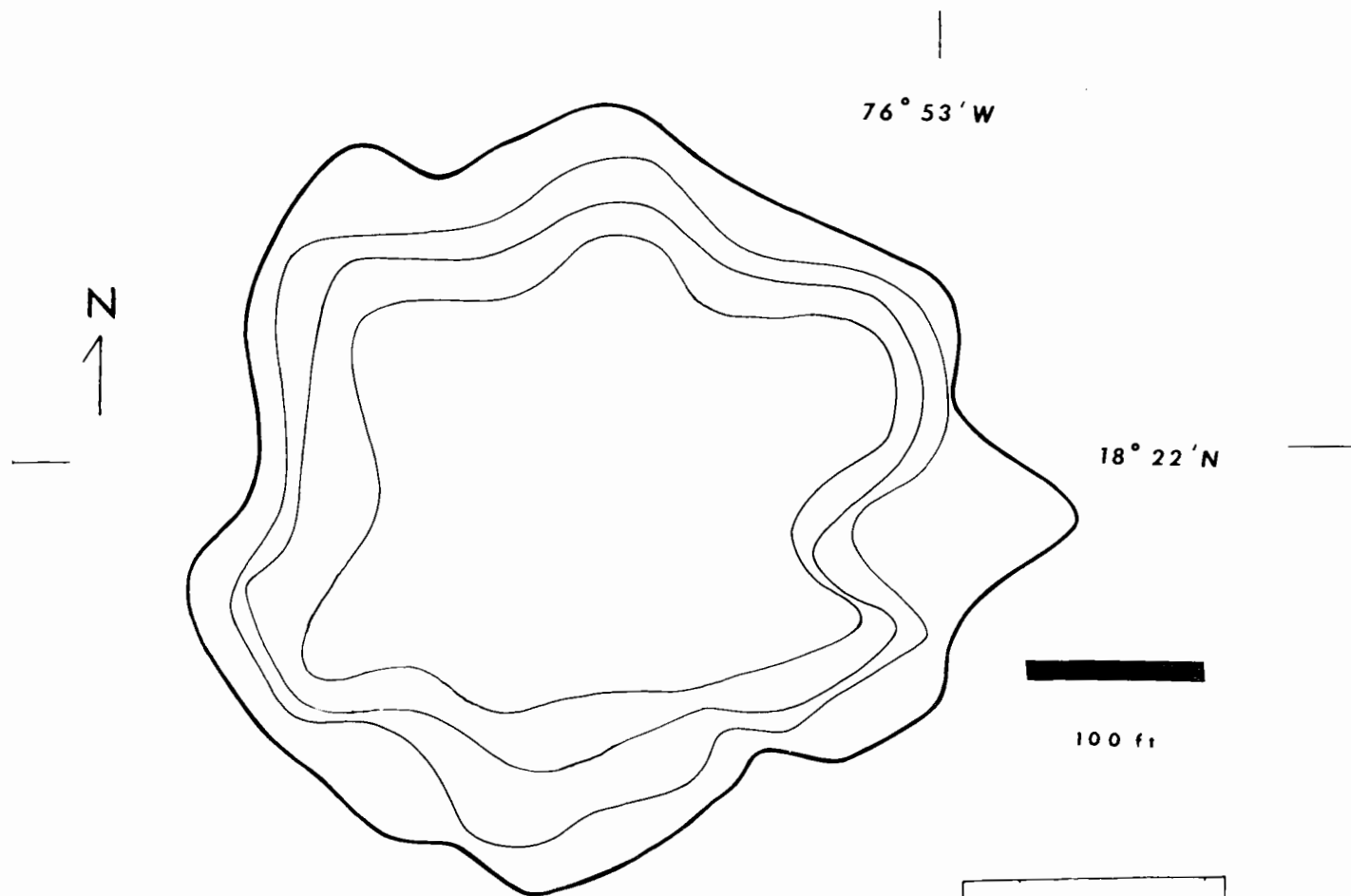


Fig. 1. Outline Map of Cabarita Island. Contour lines = approximately 25'.

A PRELIMINARY SURVEY OF THE VERTEBRATES OF CABARITA ISLAND,  
ST. MARY PARISH, JAMAICA

BY

RONALD I. CROMBIE, DAVID W. STEADMAN AND JOHN C. BARBER \*

Introduction

Jamaica is unusual among Greater Antillean Islands for its paucity of offshore cays and islets. The Pedro and Morant Cays are 50-100 km off the south coast and consequently too far offshore to show strong Jamaican influences. Their terrestrial faunas, while poorly known, appear depauperate and consist of waif species, both Cuban and Jamaican in origin. Closer inshore there are a number of other low cays along the south coast, particularly in Portland Tight and off the Palisadoes Peninsula (the Port Foyal Cays). Several of these islets were discussed and their vegetations mapped by Steers (1940), Steers *et al.* (1940), and Asprey and Robbins (1953); their faunas have never been documented. Even more poorly known are the two north shore islets, Navy Island, off Port Antonio (Portland Parish) and Cabarita Island, off Port Maria (St. Mary Parish). As its name indicates, the former is occupied by a Navy installation and the natural habitats are considerably altered. Cabarita Island, however, is a steep-sided speck of land of no special commercial importance, despite its proximity to the city of Port Maria.

Elsewhere in the Antilles, satellite islands are well known as centers of endemism or as refugia from mainland habitat destruction (see lists in Maclean *et al.* 1977, Honegger 1981, Lazell 1967, Schwartz 1970). With this in mind, we spent 23 hours surveying the fauna of Cabarita Island. Although we do not tout this list as being absolutely complete, we nonetheless feel it valuable to document these preliminary data, particularly considering the rapidity with which small insular faunas can be changed or destroyed.

---

Department of Vertebrate Zoology, National Museum of Natural History  
Smithsonian Institution, Washington, D. C. 20560

\* Present address: 803 Glen Allen Drive, Baltimore, Maryland 21229

## Materials & Methods

We left Pagge Feach, Port Maria in a fishing dinghy on 16 April 1978 at approximately 1000 hours. We circumnavigated Cabarita Island, which is approximately 0.6 km north of Port Maria, and landed at the one ascendable slope on the southwest end of the island, directly opposite the beach. We set up camp on the north, windward side in a semi-open area between the edge of the woods and the sea cliff. In clearing the camp area we each carefully sorted through the leaf litter on hands and knees, collecting any organisms found. We then did a general walking survey of the island; rocks, logs, and other ground cover were turned, dead palm fronds and bark were stripped from trees, cultivated plants were examined and tree holes were inspected. Three mist nets were set (60 total net hours), two in the woodland and one at the ecotone between the garden plot and the forest. Later in the afternoon we spent approximately four man-hours carefully searching additional litter plots (1 x 1 m) in an undisturbed area of the forest about 5-10 m west of camp. A few hours before dark we waded and swam around the base of the island, collecting on the accessible slopes and setting mist nets at two small sea cave entrances. A large cave (Fig. 6) was also examined but no traces of bats were seen or smelled. Several mammal snap traps were also set, on horizontal tree trunks in the forest and on the ground in the garden. After dark, we re-walked the entire plateau using headlamps to search for nocturnal organisms.

We returned to the mainland at approximately 0900 hrs on 17 April. Collections for comparative material on the mainland were made 11-12 and 15 April and additional distributional records for the area were taken from the literature. Faunal samples from the four major habitats on Cabarita (forest, natural clearings, garden, slopes) were kept separate. All vertebrate specimens were identified and deposited at the National Museum of Natural History (USNM). Invertebrate material was also collected and deposited at the Florida State Museum, University of Florida.

In the following species accounts, we use currently accepted systematics: Schwartz & Thomas (1975) for amphibians and reptiles, Bond (1980) for most birds, and Varona (1974) for mammals. Since common names for amphibians and reptiles are not standardized, we have used the Jamaican local term first for each species, then an English common name in parentheses, if one exists.

### Description of the Island

Cabarita Island (Fig. 1) is shown as "Coral Reef--Quaternary" on the 1:250,000 Geological Map of Jamaica (Geol. Survey Dept. of Jamaica, 1959). It is a steep-sided plateau (Fig. 2), roughly 0.01 km<sup>2</sup> in area and 30 m above sea level. The southwest side of the island is sandy and slightly less steep, affording access to the plateau. The vegetation on the slope consists of sea grape, palmetto, ferns, and scrubby vegetation. At the top of the trail, the natural vegetation had been cleared and a garden had been planted (Fig. 3). Active clearing and burning was still going on and most of the destruction did not look more than a year old. The layer of soil was thin and distributed in pockets but beans, corn, and plantain had been planted wherever possible.

Beyond the cleared area the rest of the plateau is covered mainly with a canopied (8-10') hardwood forest (Fig. 4). This woodland is well shaded and open with very little undergrowth except at the ecotone. Leaf litter is thick, particularly in solution holes. The forest thins on the northeast side where it is replaced by a thick growth of a low, windblown, shrub with occasional stunted palms (Fig. 5). There is a small bay on this side with an offshore promontory, connected to the island by a barely inundated reef. The north and west sides are vertical cliffs for 10-15 m, with slightly less precipitous lower slopes that support sparse growths of palms.

Our survey of the island yielded records for twenty-two species of vertebrate (2 mammals, 13 birds, 5 reptiles, 2 amphibians), as outlined below.

## AMPHIBIANS AND REPTILES

Bufo marinus (Linnaeus, 1758)--Bullfrog (Marine Toad)

Although no toads were found by day, at least four individuals (2 adult males, 2 adult females) were seen after dark. All were in the garden area or in the forest immediately adjacent to it but one individual appeared at our camp at about 0400 hours on 17 April, indicating mobility across the whole plateau.

These toads are not native to mainland Jamaica, having been introduced in 1844 (Cosse 1851:425-431). Undoubtedly the Cabarita population was also intentionally introduced, probably by the person who planted the garden. The motivation for the introduction is unknown, but the toads' efficiency in controlling insect pests is well documented. There is also considerable belief in Jamaica that B. marinus can control rat populations (Cosse 1851:431).

Nonetheless, the introduction cannot sustain itself since B. marinus requires standing water to breed. Cabarita has no fresh surface water and although sinkholes could accumulate pools during heavy rain, this water would percolate away before metamorphosis could be achieved (30-60 days; Zug & Zug 1979:11).

We collected one specimen (USNM 233927), a unicolor, keratinized male with nuptial pads and enlarged testes. The other male also had well-developed nuptial pads but neither of the females was obviously gravid (i.e., no substantial egg masses were palpable).

Eleutherodactylus c. cundalli Dunn, 1926--Toad

Of the four species of Eleutherodactylus on the adjacent mainland, E. cundalli was least expected on Cabarita. However, one call of this species was heard an hour after dusk as we checked the net at the garden/forest border. No additional calls were heard but E. cundalli is not an extremely vocal species. The quiet, twittering, insect-like call is typical of frogs of the ricordii group (Schwartz 1958, Crombie 1977) and often is not audible at any distance.

Later in the evening, a 22.7 mm adult male (USNM 233872) was collected as it sat silently on a dead palm frond at the edge of the forest on the west side, from very near where we estimated the call had come earlier. This is a typical calling site but the habitat is somewhat unusual. Eleutherodactylus c. cundalli is a semi-arboreal frog that is most abundant and widely distributed in the wet limestone forest (terminology of Asprey and Robbins 1953) of western and central Jamaica (Schwartz & Fowler 1973, Stewart 1977). It is poorly adapted to hot, dry conditions (Fough *et al.* 1977), but it is found in some coastal areas of dry limestone scrub forest. This is a peripheral habitat, however, and the species is not as abundant there.

It is possible that a single frog or perhaps several individuals were unintentionally introduced on plants in the garden but only a few small banana trees were not grown from seed. Eleutherodactylus cundalli does occasionally use banana axils for a diurnal retreat (Schwartz & Fowler 1973:73; Crombie, pers. obs.).

Anolis g. grahami Gray, 1845--Tree Lizard (Graham's Anole)

Five specimens were collected (3 males and 2 females, USNM 233888-92), primarily around the agricultural area, where it was much more common than A. lineatopus merope. Only a few females were seen in the forested part of the island.

Underwood and Williams (1959:29) comment that Cabarita Island grahami were slightly more yellow-green dorsally than typical for the nominate subspecies and our observations confirm this. Both females were bright lemon yellow ventrally with dull orange in the dewlap area. Dewlaps of males were bright orange with faded yellow scales.

Intergradation with A. g. aquarum occurs ca. 6-7 km east of Cabarita on the mainland.

Anolis lineatopus merope Underwood & Williams, 1959--Tree Lizard (Anole)

Three adult males and five females (USNM 233893-900) were collected in the forested section of the island. They were much less common at the edge of the woods and almost absent from the portion that had been cleared for a garden. A. lineatopus was replaced by A. grahami at the ecotone and more exposed areas.

Underwood & Williams (1959) reported A. l. merope from Cabaritta (sic) Island and commented that males from the island have "a strong orange center to the throat fan in contrast to the more western specimens." In our three males, both USNM 233893 and 233895 had very pale yellow dewlaps with a concentrated bright yellow-orange central blotch. USNM 233894, however, had a faint, diffuse smudge of orange in the middle of the dewlap. Females had bright orange chins and undersides of tails.

Anolis l. merope occurs along the north coast of Jamaica from Hanover Parish to eastern Saint Mary parish, almost invariably in coastal areas but extending inland along the Wag Water River drainage.

Underwood & Williams (1959:37) felt that this species was characteristic of exposed dry coastal areas but the Cabarita Island population definitely preferred the shaded, interior of the island.

Aristelliger praesignis (Hallowell, 1856)--Croaking Lizard

These large geckos were found primarily in the forested part of the island. One large adult male, four females, one subadult and one juvenile were collected (USNM 233873-79); two of the females were gravid but no eggs were found. Most individuals were found under bark on dead trees but the one large male was found under a large flat limestone slab in an open area at the top of the bay slope on the southeast promontory.

Although A. praesignis is normally a very vocal species, we heard no calls at dusk or after dark. Several individuals were observed emerging from tree holes at dusk but they moved toward the tops of the trees without vocalizing.

Sphaerodactylus argus argus Gosse, 1850--Pawli Lizard

This species was only seen on the steep slopes of the island, where two individuals (USNM 233880-81) were collected under limestone rubble and palm trash. Both were strongly spotted with

the ocelli irregularly arranged (see Thomas, 1975). Several hatched eggshells were found but neither of our specimens was reproductively active.

Although S. argus is an ecological generalist and is abundant in virtually all available habitats on the mainland, it was absent from the plateau of Cabarita. Extensive collecting in the forest and the cleared areas yielded only Sphaerodactylus sp.

Sphaerodactylus sp.--Pawli Lizard

This is a new species of the goniorhynchus group, currently under study by Richard Thomas. It is abundant in the forested part of the island, but is apparently absent from disturbed areas and the dry, steep slopes. We collected 6 specimens (USNM 233882-87). They were active in the leaf litter during the day and could also be found under small rocks in leaf litter. One individual was seen under a large rock near the edge of the forest but it escaped down a land crab hole, closely followed by the crab. Several communal nests (30-40 hatched egg shells) were found inside rotten logs but no viable eggs were seen, nor were any of the collected specimens gravid.

On the mainland, this species is widely distributed in primarily coastal areas. Although most of the localities where it has been collected are xeric, the lizards occupy the most moist microhabitats within the area.

BIRDS

Phaethon lepturus Daudin, 1802--White-tailed Tropic bird

One individual was seen at 1100 on 16 April, flying on the south and west sides of the island.

Fregata magnificens Mathews, 1914--Magnificent Frigatebird

One adult male was seen at 0900 on 17 April, soaring directly over the island.

Nyctanassa violacea (Linnaeus, 1758)--Yellow-crowned Night Heron

Fifteen individuals, at least twelve of which were adults, roosted during the day in the trees on the steep slopes of the southwest corner of the island. They were heard often throughout the night on 16-17 April.

Cathartes aura (Linnaeus, 1758)--Turkey Vulture

One to five individuals were usually in evidence both days, soaring above the island throughout the day. On 17 April Crombie found a nest with a clutch of two eggs being incubated by an adult. The nest, at an elevation of 8 m, was on the south side of the island, on a protected ledge of the steep slope. It was a circular depression (25 cm in diameter) in leaf litter, containing no foreign material other than several of the adults' feathers. The adult remained nearby during the investigation of the nest, which was photographed by Earber.



Falco peregrinus Tunstall, 1771--Peregrine Falcon

One individual was seen flying between the island and the mainland at 1100 on 16 April. From its size and color of the back, it was probably an adult male.

Sterna maxima Foddaert, 1793--Royal Tern

One individual was seen flying between the island and the mainland at 0800 on 17 April.

Columba leucocephala Linnaeus, 1758--White-crowned Pigeon

Two individuals were seen flying across the agricultural area the morning of 17 April. No vocalizations were heard.

Zenaida macroura (Linnaeus, 1758)--Mourning Dove

Three different individuals were calling simultaneously on both days, one near the east-northeast side of the island, one near the west edge of the island, and one in the central or south central part of the island. The former two were in the canopy of undisturbed forest, whereas the latter may have been in or near the agricultural area. Lack (1976:219) records this species in Jamaica only from the relatively arid southern coastal area. We did not find Z. macroura anywhere else on the northern coast of Jamaica.

Zenaida aurita (Temminck, 1810)--Zenaida Dove

Two different individuals were calling simultaneously on both days, one near the east edge and the other near the southwest edge of the island. Both were in or near the agricultural area. Two individuals were seen in the agricultural area at 0730 on 17 April.

Hirundo rustica Linnaeus, 1758--Barn Swallow

Two individuals at 1200 on 16 April and three individuals on 17 April were seen flying over the island. In both cases they were feeding with larger numbers of Hirundo fulva.

Hirundo fulva Vieillot, 1807--Cave Swallow

Approximately 50 individuals roosted and nested in a sea cave on the southwest side of the island (Fig. 6). The cave's opening was 4 m high, and approximately 6 m wide, with a maximum depth of about 6 m. Many cup-like mud nests were attached to the ceiling and walls. Although two nests at lower heights in the cave contained no eggs or young birds, our presence in the cave flushed about 25 individuals from their nests, suggesting nesting activity. Cave Swallows foraged about the island and surrounding water throughout both days.

Vireo altiloquus (Vieillot, 1808)--Black-whiskered Vireo

One individual was heard singing, but was not seen, on the northeast side of the island at 1300 on 16 April and at 0720 on 17 April.

Mniotilta varia (Linnaeus, 1766)--Black-and-White Warbler

One individual was taken in a mist net in the forest near the center of the island at 0900 on 17 April. It was preserved as a skeleton, USNM 553107, male, not quite in full breeding plumage, left testis 5x3 mm, fat moderate.

## MAMMALS

Glossophaga soricina antillarum Fehn, 1902--Nectar Feeding Bat

Six pregnant females (USNM: 534887-92) were netted, five at the edge of the agricultural area, and the other within the forest.

Rattus cf. rattus (Linnaeus, 1758)--Black Rat

Rats were extremely abundant on the island, but we were unsuccessful in trapping any. Rat traps, especially those set on tree limbs or horizontal trunks, were sprung during the evening but the rodents escaped, often leaving tufts of hair.

Nocturnal surveys revealed dozens of rats, usually in the canopy of the forest but several were seen near the garden plot. Throughout the night, our bodies and gear were subjected to intense investigation by adult and juvenile rats.

## DISCUSSION AND SUMMARY

With the possible exceptions of Anolis g. grahami and Zenaida macroura, the vertebrate fauna of Cabarita Island is a depauperate subset of that found on the immediately adjacent mainland, with no indications of endemism or differentiation. Anolis grahami on Cabarita differs slightly in coloration from those on the adjacent mainland, but this is not necessarily due to evolution in situ (see below). Zenaida macroura is known only from the arid portions of southern Jamaica but it may be becoming more widespread as habitats are opened up.

The fauna of Cabarita Island consists of forms that arrived by natural means and some that received human assistance, intentional or otherwise. The toads and rats are undoubtedly the result of human introduction. The rats may have been accidentally brought to the island on ships that docked in Port Maria harbour, either recently or with early Antillean explorers. The toads, however, are a recent, intentional introduction. The other frog (Fleutherodactylus cundalli) may also have been an introduction; if so, it was accidentally brought over from the mainland, probably on agricultural material. Since Fleutherodactylus are too small to be of commercial importance, most intentional West Indian introductions of the genus involves species with an aesthetically pleasing call. These "whistling frogs", "bo peeps", or "coquis" have been transported to several Antillean islands where they are not native. Fleutherodactylus cundalli has a quiet, insect-like call that few people would find aesthetic and, considering that nobody resides on Cabarita, F. cundalli is an unlikely candidate for intentional introduction.

Eliminating these "non-natural" elements of the fauna, the problem remains as to how the other 19-20 species arrived on the island. This is simply explained for the volant forms (birds and bats), given the short distance (approximately 0.6 km) to the mainland. In fact, many of the birds and the bat may not be permanent residents on the island. Its small size and limited food resources would make it difficult for Cabarita to support anything

more than very small populations. However, since the island is (or was) somewhat difficult of access, it may have offered a refuge from human-related disturbances on the mainland, thereby explaining the heron roost and vulture nest.

No species of bird endemic to Jamaica was found on Cabarita; the thirteen species we recorded are all widespread in the Greater Antillean region. Two species (Cathartes aura and Hirundo fulva) definitely nest on Cabarita and four species definitely do not (Falco peregrinus, Hirundo rustica, Mniotilta varia are migrants; suitable habitat is lacking for Sterna maxima). We found no nests of Nyctanassa violacea but their roosting area contained possible nesting sites. Phaethon lepturus nests on cliffs facing the sea and Fregata magnificens on low trees near the water's edge, habitats found in abundance on Cabarita. F. magnificens usually nests in conspicuous colonies and we found no traces of them. The remaining four species (Columba leucocephala, Zenaida macroura, Z. aurita, Vireo altiloquus) are all "land birds" (as defined by Lack, 1976) and limited suitable habitat for each is present on Cabarita. It is not surprising that this group contains three species of columbids, which are known to be wanderers and good colonizers. The cleared agricultural area may be partially or wholly responsible for the two smaller columbids, Zenaida macroura and Z. aurita, which feed solely on the ground (Lack 1976:248). Vireo altiloquus occurs in a wide variety of habitats. The presence of Hirundo fulva is explained by the existence of the cave and is largely or completely independent of the island's flora.

Colonization of the island by nonvolant forms is somewhat more problematical, since the dominant wind and current patterns are from the northeast (i.e., from the island towards the mainland), making rafting difficult under normal conditions. Storms could have brought the original propagules to the island since many storm tracks in recorded times have been from the southeast towards the northwest. Hurricanes proceeding across the island in that direction could easily have driven trees, logs or driftwood containing adults and/or eggs of any of the lizards across the narrow channel from the mainland to Cabarita. An equally similar scenario could result in colonization from farther east (i.e., Portland Parish). Storms would swell the streams in the Blue Mountains, causing a rise in the level of the many rivers that drain the northeast coast (Rio Grande, Wag Water, Swift, Spanish, and Puff Pay Rivers). Floating islands of vegetation often result under such conditions (King 1962) and vertebrates can be carried along on these rafts. Upon reaching the coast, currents would carry the islands west or northwest and those that were pushed close to the coast would be caught in the natural trap of Port Maria Bay and Cabarita Island. This could explain the apparent (slight) trend of Cabarita Anolis grahami towards the eastern subspecies, A. g. aquarum, when the adjacent mainland is pure A. g. grahami.

Sphaerodactylus sp., Aristelliger praesignis, and both species of Anolis appear to have been resident on Cabarita for some time, since they occupy the more "natural" habitats and have relatively

dense populations. S. argus, however, seems to be a recent, and probably natural, arrival. Its peripheral, sparse distribution on the slopes of Cabarita and the lack of even slight differentiation from mainland populations makes it a very likely recent adventive. Since S. argus has a calcareous egg that is relatively impervious to sea water and it is found commonly in driftwood of the supra-tidal zone in Port Maria, it is hard to imagine that the species would not have reached the island.

Although a great deal of distributional data on West Indian vertebrates has been accumulated in recent years, much still needs to be done and little time remains to do it. The burgeoning human populations of West Indian islands and their efforts to become economically self-sufficient have put a prime importance on space for development. Entire islands and their faunas can be erased in a span of months; the Bogue Islands off Montego Bay are a good example. Since every piece of the puzzle is important in determining the overall Antillean zoogeographic picture, we cannot afford to lose even small pieces like Cabarita Island without documenting its fauna.

#### ACKNOWLEDGMENTS

This paper is part of a larger project on the distribution of fossil and extant Antillean vertebrates. Funding for early exploratory work was provided by an American Philosophical Society Grant (no. 6027, Penrose Fund) to RIC. Our work on the Jamaican coast, estuaries and offshore cays was facilitated by funds from a preliminary survey of West Indian manatees, coordinated by the late H. W. Campbell of the U.S. Fish and Wildlife Service. Ongoing support was provided by a Smithsonian Scholarly Studies Fellowship (to DWS) and the Alexander Wetmore Fund of the National Museum of Natural History (from Pea Wetmore, through S. L. Olson).

Patrick Fairbairn was instrumental in arranging for our permits from the Jamaican government. Richard Franz helped with the field work and coordinated the invertebrate surveys. Linda K. Gordon verified our bat identification and provided sporadic moral support. Penny Gift typed the manuscript and offered valuable editorial advice. W. R. Heyer and G. R. Zug kindly reviewed the manuscript.

#### LITERATURE CITED

- Asprey, G.F. & R.C. Robbins. 1953. The vegetation of Jamaica. *Ecol. Monogr.* 23(4):359-412.
- Pond, James. 1980. Birds of the West Indies. Houghton Mifflin Co., Boston. 256pp.

- Crombie, Ronald I. 1977. A new species of frog of the genus Fleutherodactylus (Amphibia: Leptodactylidae) from the Cockpit country of Jamaica. Proc. Biol. Soc. Washington 90(2):194-204.
- Gosse, Philip H. 1851. A naturalist's sojourn in Jamaica. Longman's, Brown, Green & Longman's, London. v-xxvi + 508pp.
- Honegger, Rene E. 1981. List of amphibians and reptiles either known or thought to have become extinct since 1600. Biol. Cons. 19:141-158.
- King, Wayne. 1962. The occurrence of rafts for dispersal of land animals into the West Indies. Quart. Journal Florida Acad. Sci. 25(1):45-52.
- Lack, David. 1976. Island Biology, illustrated by the land birds of Jamaica. Univ. California Press, Berkeley. 445 pp.
- Lazell, James P., Jr. 1967. Wiederentdeckung von zwei Angeblich Ausgestorbenen Schlangenarten der Westindischen Inseln. Salamandra 3:91-97.
- Maclean, William P., Richard Kellner & Howard Dennis. 1977. Island lists of West Indian amphibians and reptiles. Smithsonian Herp. Info. Serv. (40):1-47.
- Pough, F. Harvey, Margaret M. Stewart & Richard G. Thomas. 1977. Physiological basis of habitat partitioning in Jamaican Eleutherodactylus. Oecologia (Berlin) 27:285-293.
- Schwartz, Albert. 1958. Four new frogs of the genus Fleutherodactylus (Leptodactylidae) from Cuba. American Mus. Novit. (1873):1-20.
- Schwartz, Albert. 1970. The land birds of Isla Saona, Republica Dominicana. Quart. Journ. Florida Acad. Sci. 32(4):291-306.
- Schwartz, Albert & Danny C. Fowler. 1973. The anura of Jamaica: a status report. Stud. Fauna Curacao & Other Carib. Is. 43(142):50-142.
- Schwartz, Albert & Richard Thomas. 1975. A check-list of West Indian amphibians and reptiles. Carnegie Mus. Nat. Hist. Spec. Pub. (1):1-216.
- Steers, J.A. 1940. The coral cays of Jamaica. Geog. Journ. 95(1):30-42.
- Steers, J.A., V.J. Chapman, J. Colman & J.A. Lofthouse. 1940. Sand cays and mangroves in Jamaica. Geog. Journ. 96(5):305-328.

- Stewart, Margaret K. 1977. The role of introduced species in a Jamaican frog community. *Actas del IV Simp. Internac. Ecol. Trop.* 1:111-146.
- Thomas, Richard. 1975. The argus group of West Indian Sphaerodactylus. *Herpetologica* 31(2):177-195.
- Underwood, Carth & Ernest F. Williams. 1959. The Anoline lizards of Jamaica. *Publ. Inst. Jamaica Sci. Ser.* (9):1-48.
- Varona, Luis S. 1974. *Catalogo de los mamiferos vivientes y extinguidos de las Antillas.* Acad. Cien. Cuba. viii + 139pp.
- Zug, George P. & Patricia B. Zug. 1979. The marine toad, Bufo marinus: a natural history resume of native populations. *Smithsonian Contr. Zool.* (284):1-58.
-

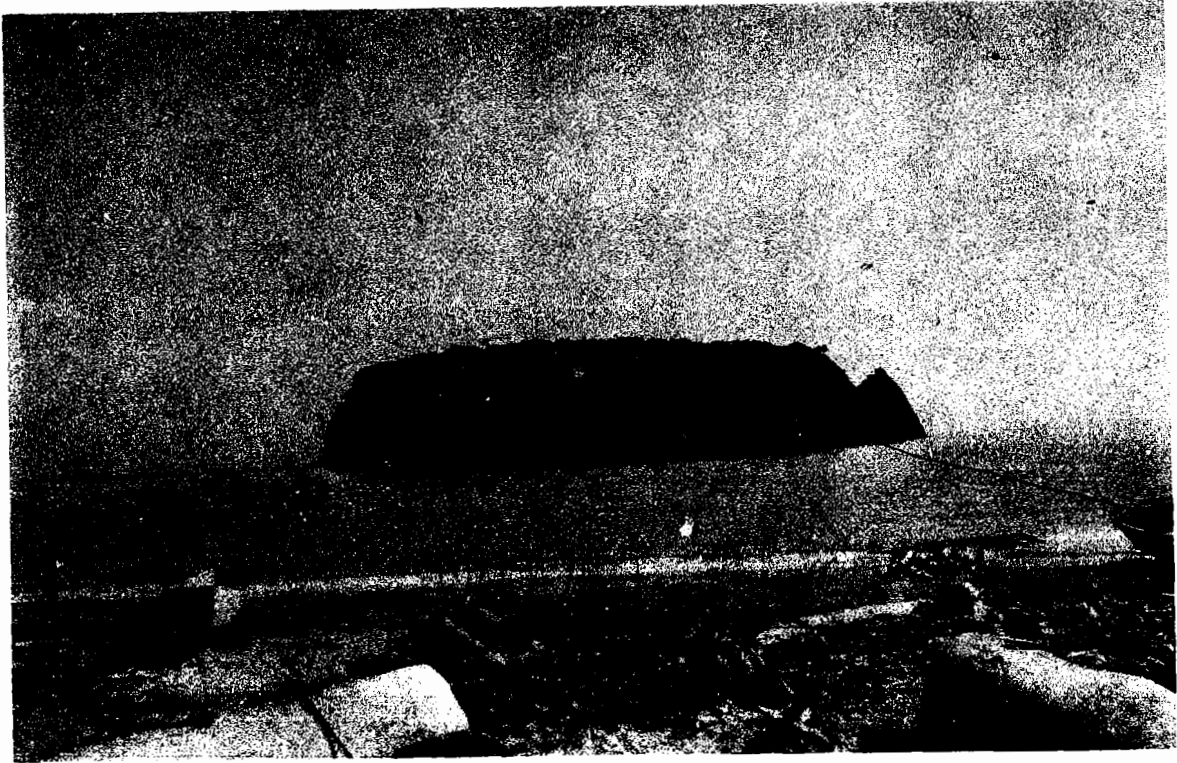


Fig. 2. View of Cabarita Island from Paggee Beach, Port Maria.



Fig. 3. Agricultural area near southwest side of Cabarita Island, showing selected clearing of natural forest.

Fig. 4. Windblown scrub on northeast slope of Cabarita Island.







Fig. 5. Trail through hardwood forest, interior of Cabarita Island, near camp.

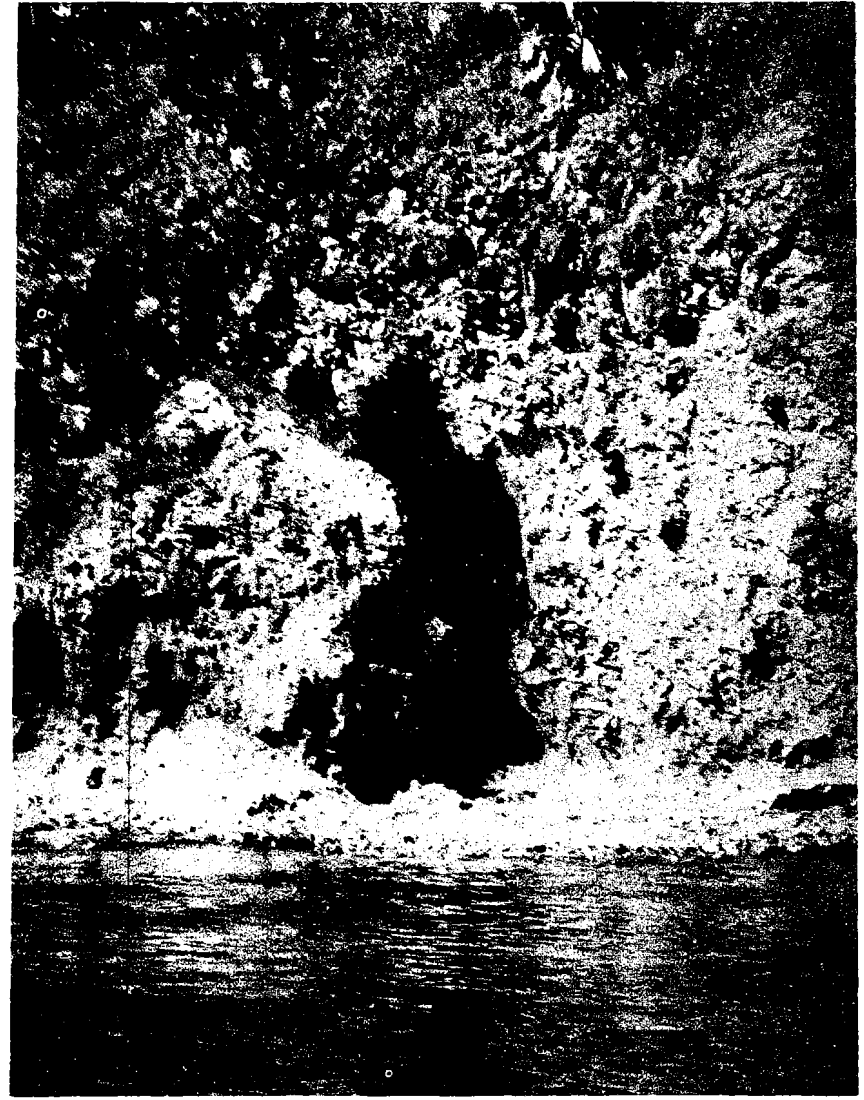


Fig. 6. Sea cave southwest side of Cabarita Island, nesting site for a population of cave swallows (Hirundo fulva).