American Museum Novitates

PUBLISHED BY THE AMERICAN MUSEUM OF NATURAL HISTORY
CENTRAL PARK WEST AT 79TH STREET, NEW YORK 24, N.Y.

NUMBER 1836 JUNE 28, 1957

The Van Voast-American Museum of Natural History Bahama Islands Expedition Record of the Expedition and General Features of the Islands

BY GEORGE B. RABB[1] AND ELLIS B. HAYDEN, JR.[2]

INTRODUCTION

There has long been interest at the American Museum of Natural History in the land and marine fauna of the Bahama Islands, British West Indies. This is attested to by the publications of Allen (1891), Chapman (1904), Wheeler (1905), Banks (1906), and Noble and Klingel (1932). The establishment of the Lerner Marine Laboratory of the American Museum of Natural History on North Bimini Island in 1947 has stimulated more studies in the Bahamas. In 1950 and 1951 staff members of the Department of Insects and Spiders of the American Museum made extensive entomological and arachnological collections on the Bimini Islands, and an excellent general account of these activities has been presented by Vaurie (1952). In addition to the papers listed by Vaurie, the following are based wholly or in part on these Bimini collections: Arnett (1953), Barber (1953, 1954), Cazier and Lacey (1952), Chamberlin (1952), Darlington (1953), James (1953), Krombein (1953), Metcalf (1954), Muma (1953), Park (1954), Rindge (1952), Ruckes (1952), Smith (1954), Strohecker (1953), Valentine (1955), and Young (1953).

[1] Chicago Zoological Park, Brookfield, Illinois.
[2] University of Kansas, Lawrence, Kansas.

In consequence of these recent studies on the fauna of the small Bimini Island group, considerable interest developed at the American Museum of Natural History in the possibility of making an extensive survey of the rest of the Bahama Islands. An expedition was organized for this purpose in 1952 when Horace S. Van Voast, Jr., of Schenectady, New York, offered the use of his 43-foot auxiliary schooner, "White Wing," and his services as captain for a cruise through the Bahamas. The other members of the company were Leonard Giovannoli of the University of Florida and the present authors.

The Van Voast-American Museum of Natural History Bahama Islands Expedition spent 20 weeks, from December, 1952, to May, 1953, in the Bahama Islands. This paper presents a record of the expedition and also gives an account of present knowledge concerning the general features of the Bahamas. The greater part of the paper was completed in 1954, and only a few passages and certain references have been added since that time.

GENERAL FEATURES OF THE BAHAMAS

Geography

The Bahama archipelago extends about 700 miles in a northwest-southeast direction between latitudes 27° 30′ and 19° 40′ N. and longitudes 79° 20′ and 68° 40′ W. "In other words, the Bahama Islands occupy a region nearly as extensive as Great Britain, and if superimposed on the surface of the United States they would extend from New York southward to Atlanta, and in their widest part from Cape Hatteras, westward to New Bern, in the heart of the Alleghany mountains in western Virginia" (Shattuck and Miller, 1905). The total land area of the Bahamas is about 4569 square miles (Richardson, 1944; Great Britain, Colonial Office, 1952). There are 29 major islands and over three thousand smaller islands, cays, and rocks in the Bahamas. Most of the larger island groups with their areas and populations are listed in table 1. In the northwest the Bimini Islands lie 45 miles off southern Florida, while in the south Great Inagua is 50 miles from Cuba, and the Turks and Caicos Islands are 75 miles north of Hispaniola. Politically, the Turks and Caicos Islands are a dependency of Jamaica, but geographically, geologically, and biologically they are part of the Bahamas and are so considered in this account.

Except where noted, throughout this paper all names, latitudes, and longitudes are taken from the decisions of the United States Board on Geographical Names (1947) and from the charts issued by the Hydrographic Office of the United States Navy. Hydrographic Office Chart No. 1290 (scale, 1:3,322,500) covers the entire Caribbean area; Hydrographic Office Charts Nos. 0944 (1:875,958) and 0948 (1:915,530) cover the northern and southern portions of the Bahamas, respectively. Hydrographic Office Charts Nos. 0026a–0026e and 5394 show the areas north of the Crooked Island Passage in greater detail, but no detailed charts exist for all the southeastern part. In addition to these, the Hydrographic Office has issued 23 other charts showing some of the individual anchorages and harbors. It is ironical to note that at present the best charts of the Bahamas, where Columbus made his first landfall in the New World, are largely based on sporadic and often inadequate surveys made between 1830 and 1870.

Population and Trade

The last census, in 1943, lists the population of the Bahamas as about 75,000 persons, of whom more than a third live in or near Nassau on New Providence Island (see table 1). Most of the people are Negroes, chiefly descendants of slaves who worked the plantations of former years.

TABLE 1

Areas and Populations in the Bahamas

Island Group	Area in Square Miles	Percentage of Total Area	Population in 1943	Population per Square Mile
Andros	1,600	35.02	6,718	4.2
Abaco Islands	776	16.98	3,461	4.5
Great Inagua	560	12.26	890	1.6
Grand Bahama	430	9.41	2,333	5.4
Crooked Island Group	204	4.46	2,923	14.3
Turks and Caicos	166	3.63	6,136	37.0
Eleuthera	164	3.59	6,430	39.2
Cat	160	3.49	3,870	24.2
Long	130	2.83	4,564	35.1
Exuma and its cays	100	2.19	3,784	37.8
Mayaguana	96	2.10	591	6.2
San Salvador	60	1.31	693	11.6
New Providence	58	1.27	29,391	506.7
All others	66	1.44	3,198	—
Totals	4,570	100.00	74,982	16.4[a]

[a] Average population per square miles in Bahamas.

Whites are concentrated in the Abaco Islands, Eleuthera, and New Providence.

The basic industries of these people are fishing, farming, lumbering, and salt production. The chief income at the present time is from the tourist trade which has increased steadily in the past 20 years. Sponges have ceased to supply work for hundreds of people owing to a disease which wiped out many of the beds in 1939. More complete information on economics and trade in the Bahamas is given in the Colonial Office Annual Reports on the Bahamas and by Richardson (1944).

Topography

In contrast to many of the West Indian islands, the Bahamas are a low-lying group. Throughout the archipelago the windward or eastern sides of the islands are higher than the leeward or western sides. The highest elevation, in the hills above The Bight, Cat Island, is about 220 feet. Britton and Millspaugh (1920) recorded their highest aneroid barometer reading there as 205 feet. According to reliable local sources, two different groups of surveyors within the past 10 years have established the elevation of these hills as about 220 feet. (Many published records, including the Hydrographic Office charts, have given the height of these hills as being over 400 feet.)

Generally, a large island has several lengthwise ranges of hills, with the range farthest from the windward shore being the rockiest (and probably the oldest). The low valleys between the hills are original depressions and not products of solution according to Mooney (1905). The submergence of these valleys seems to be a reasonable explanation for the topography of certain areas, such as San Salvador with its lagoons and the New Providence-Hog Island-Rose Island area (Agassiz, 1894). Beaches of calcareous sand occur on both windward and lee shores, especially where there are indentations of the coastline. The aeolian limestone may be well consolidated at the surface ("plate rock" or "bedrock") and is often extremely pitted and honeycombed. The holes in the rock are usually less than 2 feet deep, but larger "banana holes" are found occasionally. The soil varies from coarse sand to a red loam, the latter being the most mature of all Bahama soil types. Detailed descriptions of the soils and soil maps of six major islands are given by Mooney (*op. cit.*).

With the exception of Andros, there are no running streams on any of the islands. The area occupied by fresh water is seasonally variable and depends primarily on the amount of rainfall. Large parts of Andros are covered by fresh-water lakes characterized by their high calcium content (Breder, 1933, 1934; Newell *et al.*, 1951). Large temporary ponds and swamps are found on northern Cat Island (Clench, 1938) and also on Long Island near Deadman's Cay Settlement. Smaller, but more permanent fresh-water areas occur on these latter islands and also on San Salvador, Great Inagua, and New Providence. In periods of drought most of these ponds are quite small or even dry, as in the case of a mile-long lake at the southwestern end of Fortune Island in the Crooked Island group mentioned by Rigg (1951). At the time of our visit, this lake was reported by the natives to have been completely dry for three months, owing to a year's drought.

"Wells" containing drinkable water are found throughout the Bahamas. These may be shallow depressions in sand or holes 5 feet or more deep in "bedrock." Potable water was found seeping from the "bedrock" just above the high-tide level on the northeastern shore of Great Abaco near Marsh Harbour. Deep "ocean holes," or salt-water wells, are found on several of the islands, e.g., Pine Ridge, Grand Bahama; Tar Bottom, Little Abaco; James Cistern, Rock Sound, and Hatchet Bay, Eleuthera; Landrail Point, Crooked Island; and near Arthurs Town, Cat Island. Most of these contain salt water rising and falling with the tides, but a few have a layer of fresh water as much as 4 feet in depth on top of the salt water (Pine Ridge, Tar Bottom, and James Cistern). Large parts of many islands are taken up by salt ponds and lakes—some man-made and others natural. The largest is the main lake of Great Inagua, while another of considerable size is on San Salvador. The commercial production of salt by precipitation from saturated brine in salt ponds has been a major industry in the southern islands for over a hundred years.

Geological History

According to the interpretation of under-water contours by Schuchert (1935), the Bahama Islands and Banks consist of two very different parts. The northern part, comprising the Great Bahama, Little Bahama, and Cay Sal Banks, is composed of fragments of an ancient Antillean foreland or Gulf of Mexico plate. The southern, containing Cat Island, San Salvador, Rum Cay, Mayaguana, Great and Little Inagua, Crooked and Acklins Islands, the Turks and Caicos Islands, and the Mouchoir, Silver and Navidad Banks, represents remnants of a Cretaceous volcanic arc. Recent geophysical surveys of the Bahamas may indicate that the windward volcanic arc included Eleuthera and extended north to the Abaco region (Lee, 1951). Illing (1954) has recently analyzed the production of the calcium carbonate sediments which have formed the bulk of the Great and Little Bahama Banks since the Cretaceous (a well drilled

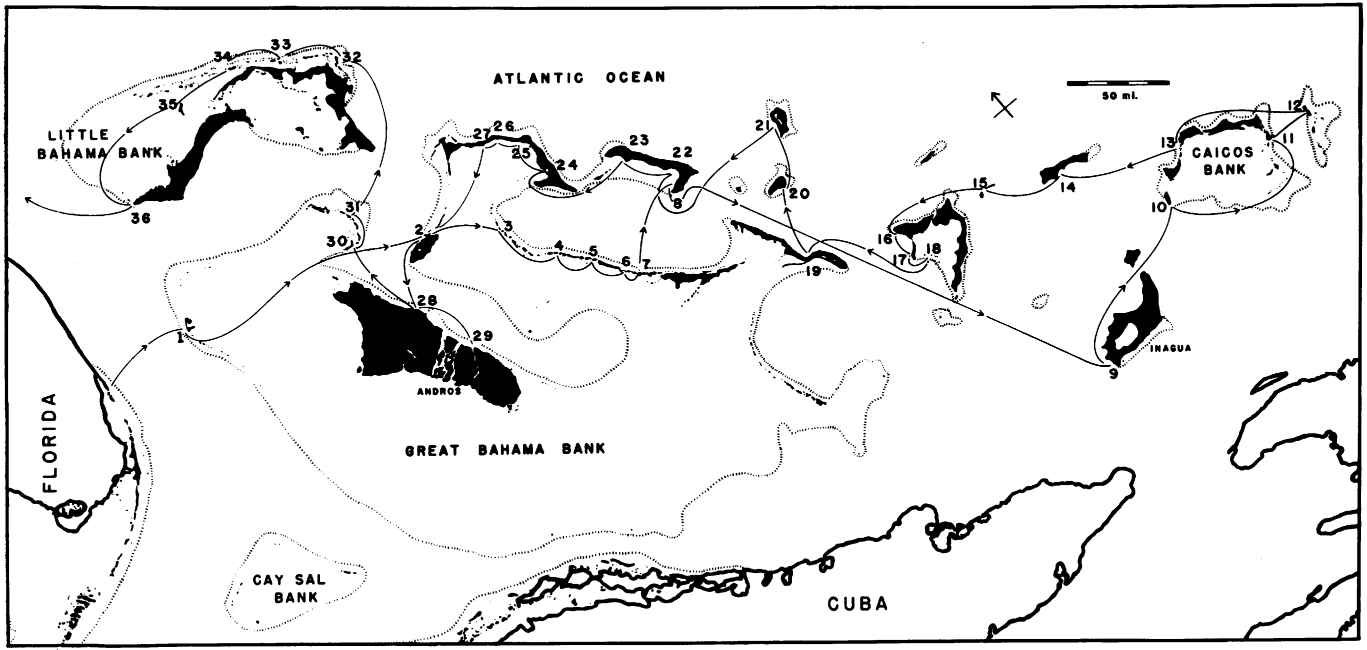

FIG. 1. The Bahama Islands, with route of the expedition indicated. The banks, which are generally less than 10 meters below the water surface, have been outlined. The numbers represent collecting localities as listed on the next page.

1. North Bimini Island
2. New Providence and Rose Island
3. Leaf Cay of Allens Cays
4. Warderick Wells Cay and Bell's Island
5. Stanyard Cay and Bitter Guana Cay
6. Big Farmer's Cay and Little Farmer's Cay
7. Darby Island and "Guana Cay" off Norman Pond Cay
8. McQueen, Cat Island
9. Matthew Town, Great Inagua
10. West Caicos Island
11. South Caicos, Long Cay, and Six Hill Cays
12. Grand Turk and Long Cay
13. Pine Cay and unnamed cay next to it
14. Mayaguana, Abraham Bay
15. East Plana Cay
16. Landrail Point, Crooked Island
17. Fortune Island
18. North and Fish Cays
19. Long Island
20. Rum Cay
21. San Salvador and Green Cay
22. The Bright and Tea Bay, Cat Island
23. Bennetts Harbour, Cat Island
24. Rock Sound, Eleuthera
25. Governors Harbour, Eleuthera
26. James Cistern, Eleuthera
27. Hatchet Bay, Eleuthera
28. Fresh Creek, Andros
29. South Bight, Andros
30. Fraziers Hog Cay
31. Little Harbour Cay and Devils Cay
32. Hope Town and Marsh Harbour
33. Green Turtle Cay
34. Allans Cay of Pensacola Cay
35. Great Sale Cay
36. West End, Grand Bahama

on Andros traversed 4400 meters of limestones and dolomite to a lower Cretaceous level). Such sediments also overlie the presumed igneous strata of the windward island arc. Lee has suggested that the deep troughs dissecting the banks (e. g., the Tongue of the Ocean) are simply areas where relatively little of this shallow-water sedimentation has taken place but which have been subject to isostatic settlement as have the Banks themselves (where the settlement is matched by the sedimentation); this may also partially account for the separation of the Banks from Cuba and Florida, although faulting and the action of the Gulf Stream and other currents may have been more important. During the Pliocene the Bahamas were probably completely submerged, and the islands were subject to floodings if not total submergences in the Pleistocene. Aeolian dune formation during the Pleistocene emergent periods appears to account satisfactorily for the present-day topography discussed above.

Hubbell (*in* Olson *et al.*, 1954) has summarized in diagrammatic form the changes of the sea level during the Pleistocene in Florida. His representation, based on the work of Cooke (1945), indicates that the sea level was 20 meters lower than at present during the last glaciation and as much as 100 meters lower during earlier glacial periods. The sea may have been 90 meters above the present level in the earliest interglacial period and reached levels progressively lower than this in the subsequent interglacial periods. The history of the Bahamas during the Pleistocene was probably not very different from that of Florida. The estimates of sea levels lower than the present one agree with the elevations necessary for the formation of under-water escarpments found off Andros (Newell *et al.*, 1951) and Eleuthera (Schalk, 1946) and of the "ocean holes" in the Bahamas (Agassiz, 1894; Shattuck and Miller, 1905). As can be seen from figure 1, vast land areas now under water in the Bahamas would be exposed by a drop of merely 10 meters in the ocean level. The scattered evidence for higher ocean levels in the Bahamas seems to indicate that there were rises of as much as 20 meters (Rosen, 1911), although most of the figures are on the order of 5 to 10 meters.

In his discussion of the history of the Bahamas, Clench (1938) postulated that during the Pleistocene periods of emergence dune formation occurred on the windward sides of the Great and Little Bahama Banks, resulting in the present hills of the larger easterly islands, such as Eleuthera, Long, Cat, and Great Abaco Islands. At the same time the areas encompassing the windward sides of the present Andros and Grand Bahama Islands were in the lee, and as the prevailing winds had lost the necessary velocity to form high dunes, these islands now have a low altitude. The recent study of Andros Island by Newell *et alii* (1951) seems to substantiate this explanation. Clench accounts for the chains of cays (Exuma Cays, Ragged Islands, Berry Islands, and Abaco Cays) as representing high points of larger islands which have been cut through by tidal channels as the sea level rose. Presumably this process and the other features of the topography attributed to submergence date from the last glaciation. Recent geophysical work indicates that the rise of the sea level since the last glacial period has been very gradual (Shepard and Suess, 1956). From paleotemperature and carbon-14 measurements, this rise started about 10,000 years ago. One of the sediment cores used in this dating was taken off the island of Eleuthera (Ericson *et al.,* 1956). Slight elevation of the Caicos Bank and Great Inagua (Noble and Klingel, 1932) within the past one hundred years may indicate a somewhat different recent history for the southern islands.

Climate

The climate at Nassau can be assigned the symbol Aw′ in the Köppen system of climatic classification, i.e., tropical savanna climate, with the temperature of the coolest month above 64.4° F. and the rainfall maximum in the autumn. However, at Grand Turk (fig. 2) the climate approaches Aw″—tropical savanna with two distinct rainfall maxima separated by two dry seasons (Trewartha, 1943). The weather data given in figure 2 are from the United States Weather Bureau (1947) and the United States Hydrographic Office (1951).

The mean annual temperature (in degrees Fahrenheit) and the annual range at Nassau are 77° and 11°, respectively, while at Grand Turk they are 79° and 9°. At both stations the day temperatures in the warm season, June to October, range between 85° and 89° and at night between 75° and 80°, although Grand Turk tends to be slightly warmer. The extreme maximum recorded at both localities is 94°.

During the winter the coolest month (January) averages 71° at Nassau and 75° (February) at Grand Turk. The winter day temperatures at Nassau range between 75° and 80°, while at night the range is between 65° and 70°. Grand Turk is warmer, the winter day temperatures being between 80° and 85°, and those at night between 70° and 75°. The recorded extreme minimum is 51° at Nassau and 60° at Grand Turk.

Although the temperature differences between Nassau and Grand Turk are slight, the rainfall dissimilarity is striking. Grand Turk is drier than Nassau (annual amount of rainfall of 28.7 inches and 49.7 inches, respectively) and has a more even yearly distribution of rainfall. Nassau

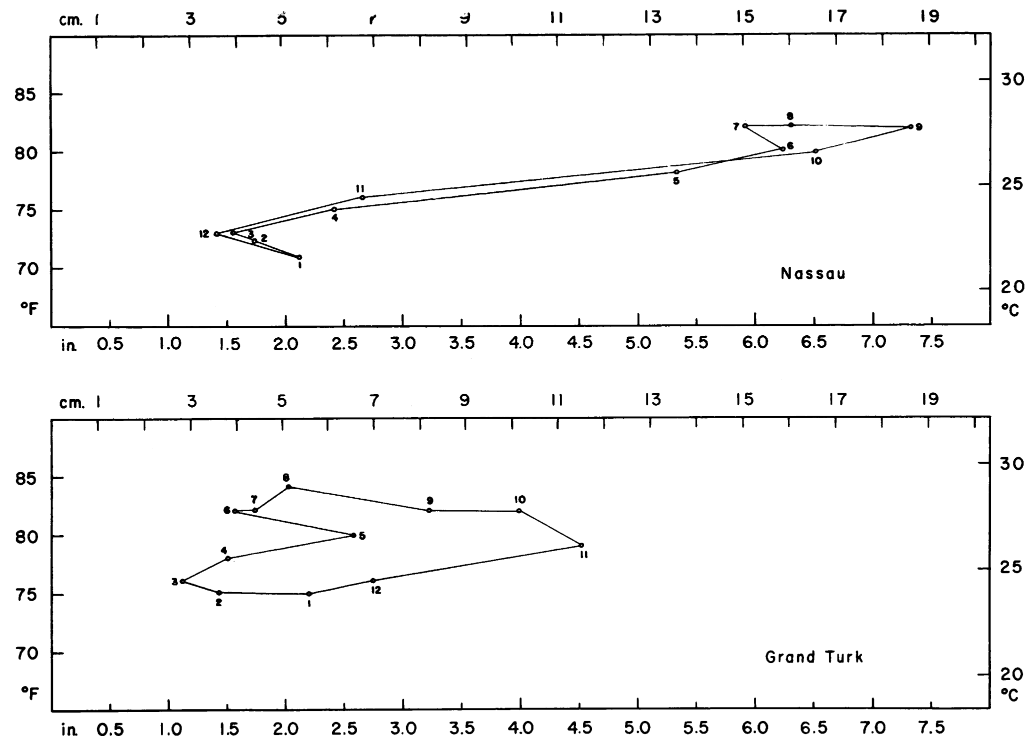

FIG. 2. Climographs for two stations in the Bahamas. Temperature and rainfall on the vertical and horizontal scales, respectively. Points are averages for the months (1, January; 2, February; etc.).

has distinct wet (May to October) and dry (November to April) seasons. At Grand Turk November (4.51 inches) is the wettest month, while March (1.11 inches) is the driest month. After the dry winter an increase in rainfall comes in May (2.59 inches) followed by a drop in June (1.58 inches).

About Grand Turk, the wind generally blows from the east throughout the year. During warmer months there are relatively more days of southeast winds than in winter. In the northern Bahamas, the prevailing wind tends to be southeasterly in the summer and northeasterly during the cooler months. The average velocity at Nassau ranges from a low of about 5 knots in July to a high of 8 in December. The low at Grand Turk is about 8 knots in October, the high about 11 knots in June and July. The winds at Grand Turk are thus stronger and less variable in direction than at Nassau. The character of the winds and Grand Turk's slightly higher temperatures obviously result in relatively greater evaporation. This factor and the smaller amount of precipitation are reflected in the more xerophytic vegetation of the southeastern islands.

In the winter season "northers" are common in the Bahamas. A "norther" is caused by a cold air mass of anticyclonic winds from the continental United States which travels southward and eastward across the Caribbean. Usually the "norther" is preceded by a cold front that brings cloudiness, low visibility, a change in pressure, lower temperatures, and steady or squally rains. As the "norther" approaches, the wind drops in velocity and shifts from easterly through the west, freshens again from the west-northwest, and may reach gale force from this direction. The wind settles in the northwest or north with lessened force for 24 to 36 hours, though occasionally blowing for several days. We used a "norther" to advantage to travel southward under sail from Cat Island to Great Inagua.

The western Caribbean Sea and the Atlantic Ocean just south of the Cape Verde Islands are the two main centers of origin of West Indian hurricanes. Hurricanes from the Atlantic travel on a west-northwestward course in August or September and are quite likely to pass over some of the Bahamas. From the end of September into November hurricanes of the western Caribbean move north-northeastward through the Bahamas. These tropical cyclones have probably been an important agent in the dispersal of the land biota.

Vegetation

From an ecological standpoint, the vegetation of most of the Bahamas belongs as a formation type to the Thorn Forest or Scrub category of

Schimper and von Faber (1935). It appears likely that edaphic factors, such as the porosity of the soils and the immense areas of exposed "bed-rock," have modified in a xerophytic direction the influence of the meteorological climate on the structural development of the vegetation.

The vegetation of a typical Bahama island can be divided roughly into five zones: pioneer shore, shore scrub, palm savanna or thicket, coppice, and mangrove. These zones are represented in figures 3 and 4 on two

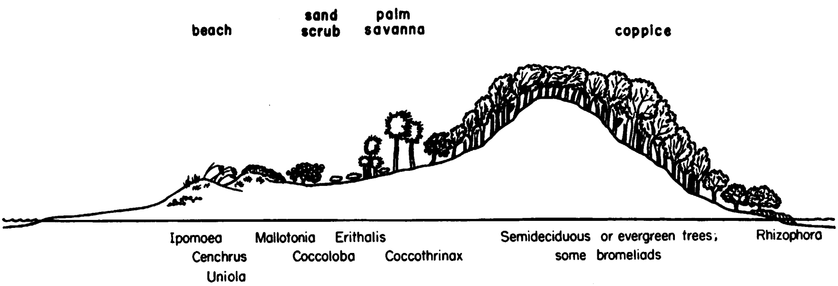

FIG. 3. Schematic vegetational profile of a Bahama island with a sandy windward shore. Zones labeled are discussed in the text. Generic names are given for the common plants represented in the zones.

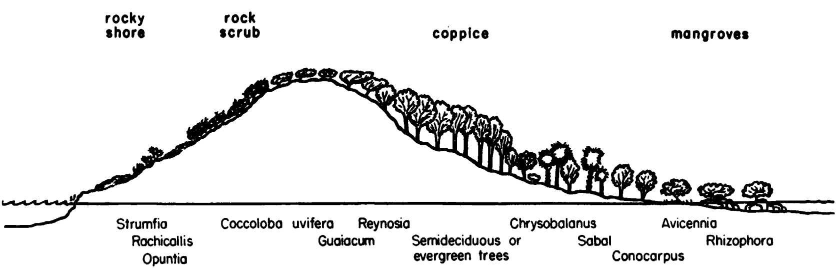

FIG. 4. Schematic vegetational profile of a Bahama island with a rocky windward shore.

hypothetical islands with, respectively, a sand beach and a rocky shore on the windward side. As may be seen from the figures, this arrangement is most generally modified by the nature of the substratum and by exposure, the influence of the latter being somewhat determined by the size and shape of the island, which are perhaps the basic limiting factors. Thus in the pioneer-shore zone the vines and grasses of sandy shores are replaced by low matted shrubs such as *Strumfia maritima* on rocky shores, and in the shore-scrub zone the open and varied sand scrub is often supplanted by a compressed bank of shrubs, principally sea grape (*Cocoloba uvifera*), on rocky shores. The palm savanna or thicket is characteristically clumped and may occur on both leeward and windward sides of an island. The coppice is composed of evergreen and semi-deciduous trees of no great stature (20 meters, maximum) and may be subdivided into high and low coppice, depending on composition and development. This zone may be considered the present-day climax of the region on the best sites, and the subdivisions correspond approximately to Thorn Forest and Thorn Scrub, the latter perhaps most accurately applied to the "forest" formation found on the dry southern islands.

The optimal vegetational development on certain low, apparently poor sites of extensive area is not coppice but pine savanna or forest with an understory of palms. As depicted in figures 3 and 4, on shores having little current or wave action, there is generally a hydrarch succession of mangroves which may grade into the interior vegetation. Richards (1952, pp. 299–312) has described the last situation in some detail, and he also has pointed out that the zones of vegetation on tropical shores should be regarded as edaphic climaxes, as there is ordinarily not much active succession, although the zones have that potential. In this connection, examples of each of the above types forming the "most advanced" or optimal vegetation, apparently chiefly under control of the size and exposure factors, are as follows:

Pioneer shore: The smallest rocks and cays, such as Seal Cays, Caicos Islands
Shore scrub: Long Cay off Turks Island; Bitter Guana Cay, Exuma Cays
Low coppice: Fraziers Hog Cay, Berry Islands
High coppice: Cat Island
Pine savanna: Pine Cay, Caicos Islands
Mangrove: Cays or spits in Bimini lagoon

Unfortunately we were not adequately prepared to record the vegetation from either a structural or compositional standpoint. Consequently most of the descriptions in the annotated account are sketchy and should be used with reference to these introductory remarks and the reports of Coker (1905), Howard (1950), and Proctor (1954a, 1954b, 1955). Howard's paper describes the plant associations of the Bimini Islands and is valuable when one is considering the smaller northern islands, but Coker's work is more complete in regard to the larger islands and also contains many facts of historical interest. Proctor has described, in considerable floristic detail, parts of certain islands of the Turks and Caicos groups. He has also furnished useful sketches of the topography and vegetation zones of South Caicos. Coker's terms of "high" and "low" coppice for the forest formation subtypes have been used throughout the present paper. Howard's nomenclature has been followed in this paper, although the standard taxonomic reference on the flora of the islands is that by Britton and Millspaugh (1920).

Conspicuous elements in the floristic composition of the vegetation are trees of the families Sapotaceae and Palmaceae, the several genera of mangroves (*Rhizophora, Avicennia,* and *Laguncularia*), and buttonwood (*Conocarpus*). The large examples of certain hardwood tree species, such as the mahoganies described by Catesby (1743, p. xl) have long since disappeared from the Bahamas, although, as Clench (1938) points out, and Catesby himself intimates, it is doubtful that forests containing such trees were extensive. Perhaps these forests should be regarded as post-climaxes that persisted on soils which formed on land masses of greater bulk than the present islands. However, the cutting and burning of trees and other plant cover coupled with too intensive cultivation have allowed for rapid erosion of most of the richer top soils. As the soil replacement rate is probably very slow (cf. Mooney, 1905), large forest stands have likely been eliminated on this account for a long period to come. On the other hand, the areas where the soil appropriately known as Bahamas Stony Loam supports stands of *Pinus caribaea* probably have not changed substantially since Catesby's time. This commercially usable timber occurs on Abaco, Grand Bahama, Andros, New Providence, Pine Cay, and North Caicos Island.

Stands of planted "Australian pine," or beefwood (*Casuarina*), are scattered throughout the islands, and some trees have apparently established themselves from the parent stocks. Disease seems to be taking a great toll of this tree in places. Numbers of another commonly planted tree, the coconut palm, are also being depleted by disease. Plants now in cultivation include the coconut, papaya, pineapple, tomato, okra, sisal, corn, sweet potato, onion, pepper, pigeon pea, mango, banana, sapodilla, orange, lime, grapefruit, and sour orange.

Land Animals

The terrestrial vertebrate fauna is indicative of the oceanic status of the islands in the extreme paucity of amphibians and mammals (except bats), the limited avifauna, and the relative abundance of lizards.

The mammals include eight species of bats, the agouti (*Geocapromys ingrahami*), now restricted to East Plana Cay, and the probably introduced house rat, house mouse, and raccoon (cf. Rosen, 1911, and Clench, 1938). A swallow (*Callichelidon cyaneoviridis*), a hummingbird (*Calliphlox evelynae*), and a wood warbler (*Geothlypis rostrata*) are the only endemics among the 42 nesting land birds. Only three species of hawks and owls nest in the Bahamas, although three more do winter in the islands. The pinelands of the northern islands appear important to the distribution of several species of birds, both resident and wintering. One of the most interesting birds occurring in the islands from a zoogeographical standpoint is Kirtland's Warbler, which breeds in central Michigan and winters solely in the Bahamas, as far as is known (although there are no records for recent years). Twomey (1936) has shown by means of climographs that conditions on the wintering grounds fall within those of the optimum breeding area during the breeding season, which suggests that narrow climatic tolerances may partially explain the distributional pattern of this warbler.

Two amphibians, *Eleutherodactylus ricordi,* which lays its eggs on land, and *Hyla septentrionalis,* a widespread West Indian species, occur in the Bahamas. These frogs are apparently absent from Great Inagua and the Turks and Caicos Islands and may not occur on many of the smaller uninhabited northern islands. Among the lizards, the nocturnal geckoes, with eight species in three genera, and the diurnal iguanids, with about 13 species in three genera, dominate the picture. Snakes are represented by two boid genera, one colubrid, and three kinds of blind snakes. Two forms of fresh-water turtles of the genus *Pseudemys,* known from Great Inauga and Cat Island, may prove to be introductions. The few fresh-water fish are all marine derivatives, and most of them can tolerate exposure to salt water.

Although the terrestrial invertebrates are primarily insects, to a certain degree the scavenging land crabs and hermit crabs have filled some of the insects' niches. White land crabs (*Cardisoma*) even assume direct economic importance when their sporadic great marches on Andros bring numbers of them to the Nassau market for sale. In regard to the relative poorness of the Bahama insect fauna it is interesting to note that here among the iguanid lizards, an insectivorous family on the whole, members of two genera (*Leiocephalus* and *Anolis*) were found to have eaten budding flowers and small berries, behavior unrecorded for the latter genus elsewhere, as far as is known, and but once before for the former; the other iguanid genus (*Cyclura*) is almost entirely vegetarian. In another insect predatory group, the birds, the Bahamas appear to have a higher proportion of primarily vegetarian species of nesting land birds (25 to 30% of 42 species) than the near-by continental area of peninsular Florida (15 to 20% of about 59 species).

The land mollusks number about 300 species, with perhaps 10 to 15 per cent endemic. Members of the genus *Hemitrochus* are usually the most abundant forms throughout the islands. The widespread genus *Ce-*

rion is extremely variable morphologically in the Bahamas and according to Clench, the principal authority on them, an unwarranted number of forms have been named. A recent intensive study of these snails in the Bimini area brought Mayr and Rosen (1956) to the conclusion that "The characteristics that adapt *Cerion* so superbly to its continuously changing habitat make it exceedingly difficult to classify the populations of this genus in the conventional categories of species and subspecies."

Relationships of the Land Biota

The origin of the present Bahama biota and its affinities have been touched upon by many writers. Britton and Millspaugh (1920), Bond (1934), Barbour and Shreve (1935), Schuchert (1935), and Clench (1938) all agree that the Bahama flora and fauna show a stronger relationship to those of Cuba, Hispaniola, and the other West Indian islands than to those of Florida. More recent studies, as shown in table 2, also support this view. Even the Bimini Islands, which are the group closest to Florida, have more in common with the other West Indian islands than with the continental mainland, as is shown in table 2 by Howard's (1950) thorough study of the Bimini vegetation.

Apparently the earlier life, whether of Floridian or West Indian origin, was drowned out during the late Pliocene and early Pleistocene. As the Bahamas have had no connection with either Florida or other West Indian islands since the Pliocene, the present biota seems to have "arrived by fortuitous means since that time" (Clench, 1938). Obviously, the prevailing southeasterly winds and ocean currents could have carried many waifs from other West Indian islands to Bahama shores. Darlington (1938) in reference to the Greater Antilles points out that the part played by storm winds in dispersal should not be slighted. Gulich (1932) considers winds more important than rafting in the colonization of oceanic islands in general. In the case of the Bahamas, man may be responsible for the introduction, intentionally or otherwise, of certain species. For example, Goin (1955) has suggested that certain aspects of the Bahama distribution of the frog *Eleutherodactylus ricordi* are due to human activities.

Many problems involving the relationships of the biota remain to be explored. For example, analyses of the Bahama biota can be directed towards the determining of the relative importance of winds and currents, storms, and changes in ecological conditions, as well as age, area, and proximity of islands in the dispersal and differentiation of populations. From Clench's account, the present proximity of islands is more important than their connections in the recent geological past as an ex-

TABLE 2

RELATIONSHIPS OF THE BAHAMA LAND BIOTA

Taxonomic Group	In Common Only with Florida	In Common Only with Other West Indian Islands	In Common Only with Florida and Other West Indian Islands	Endemics
Vascular plants (Data from Coker, 1905) 795 species	5%	31%	57%	7%
Reptiles and amphibians 36 species	0	45	8	47
Land birds (Data from Bond, 1947) 42 species	10	57	26	7
Bimini vegetation (Data from Howard, 1950) 207 species	2	19	77	2
Buprestid beetles (Data from Cazier, 1952) 19 species	11	11	26	52
Cerambycid beetles (Data from Cazier and Lacey, 1952) 50 species	4	40	26	30
Homoptera (Data from Metcalf, 1954) 31 species	6	13	42	39

planation of present land mollusk distributions in the Bahamas. Contrariwise, in accounting for the distribution of the reptiles of Great Inagua and their high degree of endemism, Noble and Klingel (1932) indicate that age and former area are the most important factors. Unfortunately, further work on this type of problem with Bahama material will be hampered by the poorly known geological history of the islands.

That a more diversified fauna than that of present times inhabited the "island-banks" in the late Pleistocene (and early Recent?) is indicated by the two hawks and large barn owl described by Wetmore (1937) from cave deposits on Great Exuma Island.

It is apparent from previous studies that among land animals of the Bahamas a fair amount of divergence has taken place at the lower systematic levels, but also that the fauna in general is young in a distributional sense. Studies of the expedition's collections from this area of presumably active speciation may help to resolve some of the problems connected with insular speciation, such as the biogeographic one noted above.

RECORD OF THE EXPEDITION

Equipment and Collection Methods

During the six-month expedition, the auxiliary schooner "White Wing" served not only as our means of transportation but also as our home and laboratory. The "White Wing" has an over-all length of 43 feet, with a water-line length of 32 feet, a beam of 11 feet, and a 6-foot 3-inch draft. The inboard engine of the schooner allowed a cruising speed of 6 knots per hour, although with slight winds the canvas sails alone could carry us just as fast. The full complement of four sails provided 923 square feet of surface. Living space below decks was limited, because the substantial supply of canned foods and scientific equipment overflowed the ordinary storage space.

The "White Wing's" draft was too deep for much of the Bahama coastal waters, and we were often obliged to anchor from one-quarter of a mile to a full mile offshore. In these cases we went ashore in the 8-foot plastic dinghy which the "White Wing" carried. On land, travel was ordinarily limited to walking, though on some of the larger islands we made use of an automobile or bicycle for transportation.

Daytime collecting was done in the morning and latter half of the afternoon, as midday was often too hot for insects, reptiles, and collectors. Whenever weather permitted, we also collected at night. Daytime insect collecting involved sweeping or beating the vegetation, netting individual specimens as they passed by, hand picking under dead palm fronds and logs, examining bromeliads, and searching the walls and crevices of caves. An aquatic dip net was used wherever fresh-water ponds or wells were found.

On many occasions night insect collecting proved more profitable than daytime collecting. Two Coleman gasoline lanterns were employed, with white canvas ground cloths. If collecting was poor at the lanterns, we turned to inspecting the vegetation and ground with a four-celled head lamp.

In the collecting of reptiles, a .22 caliber target pistol was used with dust shot for "curly-tail lizards" (*Leiocephalus*) and for "line lizards" (*Ameiva*), and with both dust shot and solid cartridges for "guanas" (*Cyclura*). While this type of collecting was generally practiced along beaches and over the smaller islands, many other hours were spent turning palm fronds, rocks, and logs (particularly for *Sphaerodactylus*) and stalking anoles on tree trunks and posts. Many frogs and a few lizards were secured at night from their perches on plants with the aid of a head lamp, while other frogs were taken during the day from bromeliads, cave entrances, and crevices in wells.

Various methods of preservation and storage were used for the insects. Many dipterans were pinned in Schmitt boxes, while dragonflies, butterflies, and moths were placed in individual glacine envelopes, but most of the insects were placed in packets which contained several layers of cellucotton. These packets were made to fit snugly in cigar boxes, thus simplifying the storage problem. Labels were written directly on each packet and glacine envelope, and a numbering system was used for the pinned flies. Most of the aquatic insects were stored in bottles of alcohol, as were ectoparasites, mites, and spiders. General data for each locality were put down in a field catalogue.

The larger live reptiles and amphibians were killed by small injections of veterinary nembutal and the smaller specimens by submersion in a saturated solution of chloretone and detergent. The relaxed specimens were then injected with a 10 per cent solution of formaldehyde and laid out on cheesecloth in enamel pans. When the pan was filled with specimens, a covering layer of cheesecloth was added and formaldehyde was poured on to keep the specimens moist during their overnight hardening. A numbered parchment fiber field tag was subsequently attached to each specimen, and data corresponding to the numbers were entered in a field catalogue. For storage, the specimens were either placed in bottles of formalin or wrapped in wet cheesecloth, packed in plastic bags, and placed in shellac-coated 5-gallon tin cans.

General Plan of the Cruise

The plan of the expedition was to reach the southern parts of the Bahamas as soon as possible in order to work northward with the spring season. This we accomplished fairly well, entering at Bimini, crossing the Great Bahama Bank to Nassau for papers, advice, and supplies, stopping along the Exuma Cays, and after a slight mishap making the run to Great Inagua. From Inagua we went on to visit the Caicos and Turks Islands before turning northward to collect on Mayaguana, in the Crooked Island Group, on Long Island, Rum Cay, and San Salvador, Cat, and Eleuthera Islands. After a pause in Nassau for ship's work, we sailed to Andros, thence to the Berry Islands, over to the Abaco Islands, and then across the Little Bahama Bank to Grand Bahama Island, our final collecting grounds in the Bahamas. The entire route can be followed on the map (fig. 1). The annotated account of the trip is arranged chronologically, while table 3 provides an alphabetical list of localities with collecting dates and map positions for convenient cross reference to the account.

TABLE 3

COLLECTING LOCALITIES OF THE VAN VOAST-AMERICAN MUSEUM OF NATURAL HISTORY BAHAMA ISLANDS EXPEDITION

Locality	Date	Latitude N.	Longitude W.	Location on Map (Fig. 1)
Abaco Cays				
Allans Cay of Pensacola Cays	May 8–9	26° 29′	77° 40′	34
Hope Town, Elbow Cay	May 4–5	26 32	76 56	32
Great Sale Cay	May 10	27 00	78 10	35
New Plymouth, Green Turtle Cay	May 7	26 45	77 19	33
Andros Island				
Bastian Point, Mangrove Cay	April 26–27	24 15	77 37	29
Driggs Hill, on South Bight	April 27	24 13	77 36	29
Fresh Creek Settlement	April 22–24, 28	24 44	77 47	28
Lisbon Creek, on South Bight	April 28	24 13	77 38	29
Berry Islands				
Devils Cay	May 2	25 36	77 42	31
Fraziers Hog Cay	April 29–30	25 24	77 50	30
Little Harbour Cay	May 1–2	25 34	77 42	31
Cat Island				
Bennetts Harbour	March 23–25	24 34	75 39	23
McQueen	Jan. 21–24	24 12	75 27	8
The Bight	March 21–22	24 18	75 25	22
Tea Bay	March 21	24 24	75 30	22

TABLE 3—(*Continued*)

Locality	Date	Latitude N.	Longitude W.	Location on Map (Fig. 1)
Crooked Island				
Landrail Point	March 5–6	22 49	74 20	16
East Plana Cay, or East French Cay	March 4	22 37	73 32	15
Eleuthera Island				
Governors Harbour	March 30–31	25 12	76 15	25
Hatchet Bay, near Alicetown	April 2	25 21	76 29	27
James Cistern	April 1	25 17	76 20	26
New Portsmouth, Rock Sound	March 7–29	24 53	76 12	24
Exuma Cays				
Bell's Island	Jan. 14	24 19	76 32	4
Big Farmer's Cay	Jan. 15–17	23 56	76 16	6
Bitter Guana Cay	Jan. 13	24 08	76 23	5
Darby Island	Jan. 18–19	23 50	76 11	7
"Guana Cay," off northern end of Norman Pond Cay	Jan. 16	23 48	76 07	7
Leaf Cay of Allens Cays	Jan. 6–7	24 45	76 50	3
Little Farmer's Cay	Jan. 17	23 56	76 16	6
Stanyard Cay	Jan. 12–14	24 09	76 24	5
Warderick Wells Cay	Jan. 9–11	24 23	76 37	4
Fish Cay, south of Fortune Island or Long Cay	March 8	22 32	74 17	18
Fortune Island, or Long Cay				
Albert Town	March 7	22 37	74 20	17
Grand Bahama Island				
Eight Mile Rock	May 14	26 32	78 43	36
Pine Ridge	May 13	26 35	78 40	36
West End	May 11–14	26 42	78 58	36
Great Abaco Island				
Marsh Harbour	May 5–6	26 33	77 02	32
Great Inagua Island				
Matthew Town	Jan. 27–Feb. 2	20 57	73 41	9
Green Cay, north of San Salvador	March 19	24 09	74 30	21
Long Island				
Clarence Town	March 9–14	23 06	74 58	19
Deadman's Cay Settlement	March 10–11	23 10	75 07	19

TABLE 3—(*Continued*)

Locality	Date	Latitude N.	Longitude W.	Location on Map (Fig. 1)
Mayaguana Island				
Abraham Bay	March 1–3	22 22	73 00	14
New Providence Island				
Nassau	Jan. 2–6 April 3–20	25 05	77 20	2
North Bimini Island				
Alicetown	Dec. 29–31	25 44	79 18	1
North Cay, south of Fortune Island or Long Cay	March 8	22 29	74 16	18
Rose Island, northeast of New Providence Island	April 5	25 06	77 13	2
Rum Cay				
Port Nelson	March 15–16	23 38	74 50	20
San Salvador Island				
Cockburn Town	March 18–19	24 03	74 31	21
Turks and Caicos Islands				
Grand Turk Island	Feb. 17–26	21 27	71 08	12
Long Cay, south of Grand Turk Island	Feb. 25	21 25	71 05	12
Long Cay, south of South Caicos Island	Feb. 8, 10	21 29	71 32	11
Pine Cay	Feb. 27–28	21 54	72 07	13
Six Hill Cays, south of South Caicos Island	Feb. 12	21 28	71 37	11
South Caicos Island	Feb. 7–15	21 30	71 37	11
West Caicos Island	Feb. 4–5	21 38	72 28	10

Annotated Account of the Expedition

Van Voast, accompanied by Mont A. Cazier and Rudolph Schrammel of the Department of Insects and Spiders of the American Museum of Natural History, left New York on December 16, 1952, by station wagon with the bulk of the scientific equipment. The "White Wing" was loaded at her berth near Myrtle Beach, South Carolina, and motored to Charleston, where Cazier and Schrammel left the ship and Hayden and Rabb came aboard. Despite rough weather off the South Carolina and Georgia coasts, good time was made to St. Augustine, Florida. Giovannoli joined the party there on December 23. The full crew sailed the "White Wing" to Miami, where three days were spent securing food stores, personal supplies, and the proper ship's papers. On the night of December 28 we set sail for the Bimini Islands in the Bahamas.

DECEMBER 29–31: North Bimini Island (1).[1] After being cleared by the Acting Commissioner, we made collections in the area between the southern end of North Bimini and the Australian pine (*Casuarina*) grove north of Bailey Town. Strong southwest winds made sailing to Nassau impractical on the next two days. Marine waterstriders (*Halobates*) were common behind the rocks of the rugged western shore where they were blown by the high winds. This was our first of several encounters with the "norther" of the winter months in the Bahamas. Excellent descriptions of the Bimini Islands have been given by Vaurie (1952), Howard (1950), and Oliver (1948).

JANUARY 2–6: Nassau, New Providence Island (2). New Year's Day, 1953, was spent crossing the Great Bahama Bank, still roiled by the "norther." We docked at the Nassau Yacht Haven on January 2. Little daytime collecting was done on New Providence, as we were busy attending to ship's business and securing gun permits. Insect collecting at night by the lighted Bay Street windows proved profitable. On the morning of January 6 we headed south towards the 125-mile long chain of Exuma Cays.

JANUARY 6–7: Leaf Cay of Allens Cays, Exuma Cays (3). Uninhabited Leaf Cay is well known in the Bahamas because of its large lizards (*Cyclura*), which the natives call "guanas." The shore of this little cay is mostly gray-brown, sharply eroded limestone which occasionally gives way to a sand beach. Dunes capped by sea oats (*Uniola*) rise slightly above the loose slabs of limestone rock scattered along the highest tide line of the northern and eastern shores. Small palmettos or thatch palms (*Sabal palmetto*) predominate over the interior, but such diverse habitats as a patch of spider lilies (*Hymenocallis declinata*) on the northwestern shore and a dry temporary pond of rushes and grasses behind the dunes on the southeastern shore were also found. During the morning, several specimens of *Cyclura* were secured from under the loose limestone slabs, along with large whitish geckoes (*Tarentola*) and curly-tail lizards (*Leiocephalus*), but by afternoon the guanas were active and wary. Insect collecting with Coleman lanterns at night was fruitless, and during the day the only conspicuous arthropods were scorpions, large roaches, and silverfish in the palmetto thickets.

---

[1]The numbers after each locality are the same as those used on the map (fig. 1).

January 9–11: Warderick Wells Cay, Exuma Cays (4). Along most of the eastern, windward side of this wild, uninhabited cay are rocky bluffs topped with windswept and salt-sprayed plant cover, but occasional stretches face the sea with low dunes. Thatch palm and hog palmetto (*Pseudophoenix vinifera*) grow in extensive savannas over the flat interior of the island and on the lee slope of the island's ridge. We found a few of the solution holes, or wells, which may give the island its name, and also discovered several brackish ponds on the western side of the island, some of which are surrounded by thick growths of mangroves (*Rhizophora* and *Laguncularia*). Though squally weather detained us here, collecting was good.

January 12–14: Stanyard Cay, Bitter Guana Cay, and Bell's Island, Exuma Cays (5, 4). Stanyard Cay has a small settlement whose proud inhabitants fish and farm near by. Close to the sandy cemetery we had profitable day and night insect collecting around a small, fresh-water pond containing algal growth and surrounded by buttonwood (*Conocarpus*). Noteworthy were the black widow spiders, called "peggies" by the natives, which we found under the bark of Australian pines in the cemetery. Farther inland near the center of the island tiger beetles were abundant on the shores of two brackish ponds, and we also found large gray termitaria first encountered on Warderick Wells Cay.

On the thirteenth Rabb, Giovannoli, and Van Voast made a trip of several miles in the dinghy to visit rugged, uninhabited Bitter Guana Cay in search of *Cyclura*. The northern end, a great tangle of sea grape (*Coccoloba uvifera*), prickly pear (*Opuntia*), bay cedar (*Suriana*), other rocky shore shrubs, and loose rock, forms a refuge for the guanas. The southern end is said to be similarly populated with guanas. The windward side of the island is rather varied, from open grasslands with a few spider lilies to broad expanses of sharply eroded and honeycombed limestone. The rock-covered ridge of this cay rises to an elevation of about 60 feet.

On January 14 Giovannoli and Hayden went in a native sloop to picturesque Bell's Island, where the people from neighboring cays come to farm in a fertile red loamy soil. A few frogs (*Eleutherodactylus* and *Hyla*) were taken from under dead palm fronds along the edges of several extensive permanent fresh-water ponds.

January 15–17: Big Farmer's Cay, Little Farmer's Cay, and "Guana Cay" off Norman Pond Cay, Exuma Cays (6, 7). A short run on the fifteenth ended with the aid of a pilot at a safe anchorage between Big and Little Farmer's Cays. On January 16 Rabb and Hayden went with the pilot in his sloop to "Guana Cay," the most windward of three small cays off the northern end of Norman Pond Cay, on a successful trip for guanas. This islet, covered with prickly pear, other cacti, and sea grape, supports a heavy guana population and not much else. The guanas apparently thrive off the prickly pear fruit and the fruit and leaves of the sea grape. The natives of the Exuma Cays and other parts of the Bahamas, situated where fresh meat is a rarity, deem guana stew a delicacy and hunt the lizards with dogs, guns, and nooses.

That the *Cyclura* populations were once much more widespread than at the present time, and the animal consequently more of a staple than a delicacy, is attested to by Catesby's description (1743, p. 64): "These *Guana's* are a great Part of the Subsistance of the Inhabitants of the *Bahama* Islands, for which Purpose they visit many of the remote *Kays* and Islands in their Sloops to catch them, which they do by Dogs trained up for that Purpose, which are so dexterous as not often to kill them, which if they do, they serve only for present spending; if otherwise they sew up their Mouths to prevent their biting, and put them into the Hold of their Sloop till they have catched a sufficient Number, which they either carry alive for Sale to *Carolina,* or Salt and barrel up for the Use of their Families at Home. These *Guana's* feed wholly on Vegetables and Fruit, particularly on a Kind of *Fungus,* growing at the Roots of Trees, and of this and others of the *Anona* Kind."

Collecting on the seventeenth about the settlement on Little Farmer's Cay and on the eastern side of uninhabited Big Farmer's Cay was poor and uneventful, except that on the latter cay our pursuit of the numerous little geckoes (*Sphaerodactylus*) under fallen palm fronds was quickly halted when we uncovered several wasp nests.

JANUARY 18–19: Darby Island, Exuma Cays (7). A morning's motoring under the guidance of our pilot brought us to a dock at Darby Island, a former millionaire's retreat now returning to natural conditions. Only a caretaker, his tick-laden dog, and a few sheep and pigs remain to watch over the hundreds of planted coconuts which are still bearing. The caretaker showed us two caves, long ago stripped of their guano, in one of which we collected a single bat (*Macrotus waterhousei compressus*). During the afternoon of the nineteenth all the crew made use of the fresh water in the rain-storage tanks by the abandoned house to bathe and wash clothes. This luxury had repercussions about a week later when we found that our feet were infected with the "chigoe" flea (*Tunga penetrans*).

JANUARY 21–24: McQueen, Cat Island (8). We departed from the Exuma Cays via turbulent Rudder Cut, bound for Great Inagua. Changing winds, coupled with the fact that the light at the northern end of Long

Island was not sighted, forced us to heave to in the early morning of January 21, and daybreak found us drifting off the southeastern end of Cat Island. Later, while attempting to enter a shallow harbor near Hawks Nest Point, we went aground on a reef, but luckily a near-by construction crew pulled us off with their barge. We then motored into the Bight of Cat Island, anchoring off the village of McQueen, which is about 6 miles northeast of Hawks Nest Point. After repairing some damage caused by the encounter with the reef, we tried to set sail on the twenty-third for Great Inagua, but head winds from the beginning of a "norther" caused us to return to our anchorage.

Most of the coast from Hawks Nest Point to McQueen is sand beach, with heavy coppice growth behind the dunes, while eastward from the settlement a rocky piece of coastline, backed by dunes and sloping abruptly down to a large mangrove swamp, runs for a mile to the entrance of Joe Sound Creek. On the trail from McQueen to Devils Point we came across two large fresh-water ponds containing much algal growth and a few aquatic insects. Otherwise only a few trailside corn fields relieved the monotony of the coppice.

JANUARY 25–26: After moving from McQueen to Port Howe on the tip of Cat Island the previous afternoon, we set sail on the morning of January 25 for Great Inagua, aided by powerful northerly winds. Thirty-six hours later a weary crew dropped anchor at Matthew Town.

JANUARY 27 TO FEBRUARY 2: Matthew Town, Teal Duck Pond, and Salt Pond Hill, Great Inagua Island (9). Matthew Town is the main settlement of Inagua and the center of the present-day salt industry in the Bahamas. The Erickson family has introduced modern machinery and methods and brought a sizable international trade to this barren island. Great Inagua is one of the few islands where the flamingo still maintains a rookery; there are about 5000 birds on the island. The "forests" of Inagua are well characterized by the term "thorn scrub," although most of the island is occupied by a great salt lake bordered by grassy palmetto-studded savanna.

Our first day on Inagua was taken up making arrangements for shore quarters, the constant swell in the open roadstead being too uncomfortable for working aboard ship. On January 28 we engaged a guide, the local Audubon Society warden, and traveled in his truck and on foot to Teal Duck Pond near Northwest Point. In this fresh-water pond resides one of the two species of fresh-water turtles (*Pseudemys*) known from the Bahamas. A growth of *Polygonum,* under the roots of which the turtles burrow, reaches a height of 3 feet above the water level at irregular intervals, according to our guide. Some duckweed (*Lemna*) was

FIG. 5. Great Inagua, near Northwest Point, January 28, 1953. The white material under foot is foam which has been blown off the salt pond to the right. The foam appears to be responsible for the dearth of herbs and other low growth in the surrounding coppice. A buttonwood tree (*Conocarpus*) is behind the collectors, who include Rabb and Giovannoli on the left.

present in parts of the pond, and our guide told us that sometimes it completely covered the areas of the pond that were open. At the time of our visit the muddy pond was at a low water level (about 4 feet at the deepest point). The mud coating on the lower parts of the trees surrounding the pond gave evidence of extensive overflows in past rainy seasons. In addition to a good series of turtles, a host of aquatic and semi-aquatic insects was secured here.

On the twenty-ninth we again traveled with our guide, this time in search of bats. The caves at Salt Pond Hill and Maroon Hill were investigated, and a few bats (*Artibeus jamaicensis parvipes* and *Macrotus waterhousei compressus*) were collected in separate sections of the former. Camel-crickets and tailless whip-scorpions were found on the walls of both caves. On the way to the caves we passed many salt flats in which numerous herons, a few black-necked stilts and smaller sandpipers, and a single flock of flamingos were seen, and on two occasions we startled wild donkeys from the salina margins. We completed the day by making a huge collection of aquatic insects at drying "Horse Pond," about a mile east of Matthew Town.

During our entire stay on Inagua we were plagued by mosquitoes. The operation of a DDT fogging machine in Matthew Town twice a day relieved the situation there, but away from town where there was little wind they covered even the repellent-coated parts of our bodies. This was the only time during the trip that we were hampered by mosquitoes.

FEBRUARY 4–5: West Caicos Island, Turks and Caicos Islands (10). A 24-hour sail brought us to this apparently uninhabited island. By the edge of the almost completely dry salt pond in the middle of the island there are the remains of a narrow guage railroad, evidently built during a prosperous salt-producing era. From the eastern or Caicos Bank side to the salt pond a profile of the island would show three parallel dune ridges. The sandy beach is succeeded progressively by easily crumbled limestone slabs, prostrate shrubs (*Strumfia maritima* and *Bumelia*), and sand dunes which form the first and highest of the three ridges (fig. 6).

FIG. 6. West Caicos, February 5, 1953. On the loose limestone outcropping in the foreground are *Phyllanthus* (right) and *Strumfia maritima* (left). In the upper right on more sandy substrate is a light gray clump of *Mallotonia gnaphalodes*. The "White Wing" is in the background.

Behind this first dune ridge, sparsely covered with clumps of sea oats and vines, there is a dense palmetto thicket (fig. 7). The palmettos thin out over the top of the second ridge, which is composed chiefly of limestone slabs. Beyond the second ridge begins a low thorn scrub which continues over the third ridge down to the edge of the large salt pond. Buttonwood, a few cedars (*Juniperus*), and some mangroves, interspersed with palmettos, border the salt flat. For the first time since leaving

Nassau insect collecting at night was good, especially with lanterns and ground cloths.

FEBRUARY 7–15: Cockburn Harbour on South Caicos Island, Long Cay, and Six Hill Cays (5 miles southwest of South Caicos); Turks and Caicos Islands (11). While skirting the southern end of the Caicos Bank on our way from West Caicos to South Caicos Island, motor trouble developed and we were obliged to sail into Cockburn Harbour despite head winds. This slowly deteriorating settlement has piles of salt about the shore in readiness for ships that rarely come, while the salinas or salt pans are kept in a stand-by condition. Fishing is at present the principal industry. Crawfish (clawless lobsters) are frozen in a small packing plant and flown to the United States, and dried conch meat is sold in

FIG. 7. West Caicos, February 5, 1953. The silver thatch palm thicket shown above extended for a considerable distance parallel to the shore behind the beach scrub illustrated in figure 6. This photograph gives an impression of the density but not of the clumping of the trees.

Haiti. During our stay night collecting was profitable on the island. Aquatic collections, including a few fresh-water fish, were made at two open muddy cattle ponds near the end of the gravel airstrip built during World War II.

On February 10 Hayden and Rabb went in the dinghy of the "White Wing" to Long Cay, half a mile south of South Caicos Island. A continuous line of bold cliffs of chalky white limestone faces the Turks Island Passage and extends around the northern end onto the Caicos Bank side. The vegetation on most of the island consists of clumps of sea grape and low matted shrubs in the sand and rocks, alternating with open grassy areas, but on the low and flat southern end of the island there is a stunted palmetto savanna of considerable extent. The crashing of guanas through the sea grape and palmettos often breaks the silence for the rare visitor.

Six Hill Cays were the sites of collecting by Rabb and Giovannoli on February 12 for a large gecko (*Aristelliger*) known only from these islets in the Bahamas. Prickly pear cactus covers about 40 per cent of the eastern cay and 90 per cent of the western cay. Loose slabs of rocks, sea grape, a beach pea, and Turk's cap cactus occupy the rest of the eastern cay. Five species of lizards, including *Cyclura carinata*, were seen on these small, forbidding cays.

FEBRUARY 16–26: Grand Turk Island and Long Cay, Turks and Caicos Islands (12). We sailed to Grand Turk on the sixteenth in order to collect there while awaiting the arrival of the necessary motor parts. On Grand Turk, as on South Caicos, the salt industry has declined owing to a lack of modernization. This desolate, dry island has sand beaches and low rocky shores on the western side facing the Turks Island Passage, whereas cliffs about 80 feet high front the northern end and extend for a considerable distance along the eastern side. Grand Turk has the

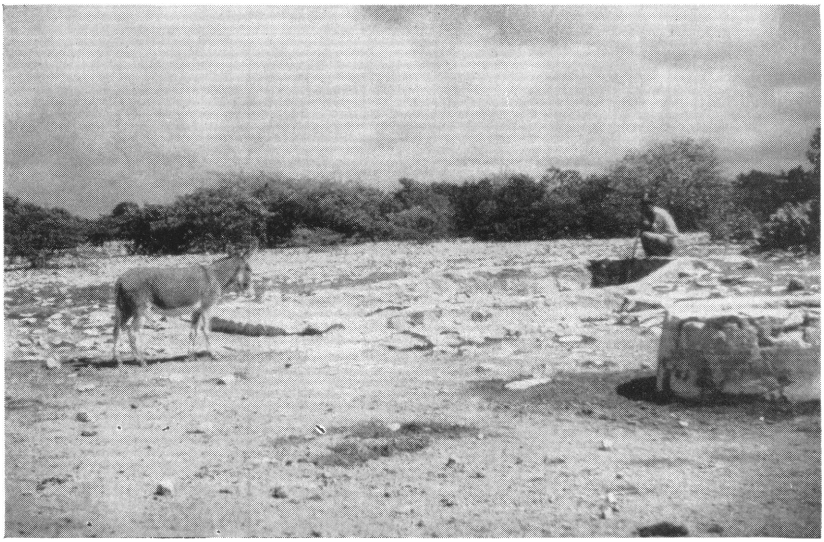

FIG. 8. Grand Turk Island, February 19, 1953. Hayden is dipping for aquatic insects in a "cattle well"; a drinking well is on the right. The vegetation in the background is about the most luxuriant found on this arid island.

most xerophytic vegetation in the Bahamas for an island of its size, and it appears that several cattle wells are the only permanent sources of fresh water (fig. 8). Much of the water supply for the people here and on South Caicos comes from tanks fed by large rain sheds. High winds, night and day, contributed to making the insect collecting poor.

FIG. 9. Long Cay, Turk's Island Group. Prickly pear (*Opuntia*) and the dense masses of sea grape (*Cocoloba uvifera*) hampered our pursuit of large iguanid lizards (*Cyclura carinata*) on this bleak cay. Note the denuded branches of the shrubs in the foreground (also appearing as large gray patches on the bushes in the background), probably a salt-spray effect. Grand Turk is on the horizon.

On February 25 Rabb and Hayden made a short visit in a native sailing dinghy to Long Cay, 2 miles southeast of Grand Turk Island. Sea grape, prickly pear cactus, and burr grass (*Cenchrus*) constitute the major vegetation (fig. 9). Our search for guanas was successful, but insect collecting was disappointing on this bleak cay.

FEBRUARY 27–28: Pine Cay and the unnamed cay north of it, Turks and Caicos Islands (13). After the long-delayed arrival of our motor parts, we set sail northward from Grand Turk and by nightfall of the twenty-seventh we anchored a mile off Pine Cay. Between the extensive stretches of *Pinus caribaea* on Pine Cay (fig. 10) and the low dunes of its sand beaches, palmettos and bulky shrubs occur among the large outcroppings of friable limestone. A slightly brackish pond about 7500 square feet in area was situated about 25 feet from the beach dunes on the northern end of Pine Cay (fig. 11). In addition to the very shy guanas on these uninhabited islands, a rat was seen running up a tree on the small unnamed cay.

FIG. 10. Pine Cay, Caicos Islands, February 28, 1953. The pine savanna shown here was a very open stand. Silver thatch palm (*Coccothrinax argentea*) was common in the lower growth. The net is resting on vines of *Smilax*.

FIG. 11. Pine Cay, Caicos Islands, February 28, 1953. Hayden is here collecting along the margin of a slightly brackish pond. Masses of midge skins line the edges, and some can be seen floating in the center foreground. *Cyperus* stems can be seen in the immediate foreground.

Caribbean pine was also noticed from shipboard on North Caicos Island. A puzzling hiatus in its distribution exists in the Bahamas, as it is known only from these two southerly islands, Grand Bahama, Abaco, Andros, and New Providence.

MARCH 1–3: Abraham Bay, Mayaguana (14). We arrived here after a pleasant day's sail from Pine Cay. Behind the entremely narrow beach, covered with sargasso weed, is a dense mat of vines and burr grass. The parasitic vine *Cassytha* extends onto the first shrubs and forms effective barriers to one's progress, a characteristic that has earned it the native name of "whoa vine." Scattered stands of silver thatch palm (*Coccothrinax argentea*) separate the sand scrub vegetation from the coppice of the rest of the island. Although no large trees were seen, some young

FIG. 12. Abrahams Bay, Mayaguana, March 3, 1953. This recently cut roadside vegetation gives some idea of the structure of the low coppice; the twisted trunks or stems are very close together and impede one's progress considerably. The debris along the road furnished excellent collecting for beetles and anoline lizards.

mahoganies (*Swietenia*) were found among the other plants of the coppice. We later saw a cross section measuring 2 feet in diameter taken from one of the large mahogany trees that once occurred here. Dead trunks and branches along the sides of recently built roads (fig. 12) furnished some good night collecting for cerambycids and other beetles.

During the day anoline lizards were conspicuous in their pursuit of insects in this roadside debris.

FIG. 13. East Plana Cay, March 4, 1953. The widely spaced palms here are probably silver thatch palm. The strikingly spaced dark shrubs were not identified. The rocky eastern edge of the island can be seen in the right background.

MARCH 4: East Plana Cay (15). An early departure from Mayaguana allowed us to spend three hours in the late afternoon at this small, uninhabited cay. East Plana Cay is the last stronghold of the agouti or "cootie" (*Geocapromys ingrahami*) in the Bahamas. This mammal was apparently much more widespread in the past, as fossils are known from Great Abaco and Crooked Islands (Lawrence, 1934). Barbour and Shreve (1935) reported its occurrence as late as 1931 from Atwood or Samana Cay.

A continuous reef lines the island on the southwestern side, while a broken but wider belt of coral protects the windward coast. Judging from Ingraham's notes as given by Allen (1891), the interior of the island has changed little in the past 60 years. The northern end has a stand of tall, slender, silver thatch palms that gives way to the low shrubs covering most of the island (fig. 13). Several dry (brackish water?) ponds surrounded by large buttonwoods extend for a considerable distance parallel to the northeastern shore. The sandy soil is generally devoid of grasses and low vines, and the droppings of the agouti were seen everywhere. Shortly after we landed, an agouti seen romping through the low shrubs was shot, and a second specimen was bagged from the limb of a buttonwood tree about 10 feet from the ground. A third specimen, blind in one eye, was run down and captured alive. Other noticeable inhabitants were the abundant curly-tail lizards (*Leiocephalus greenwayi*) and an osprey which had a nest on one of the rocks along the cliffs of the northeastern side.

MARCH 5–6: Landrail Point, Crooked Islands (16). Fearful that the surge of the sea might work loose our anchor and take us onto the reef of East Plana Cay, we set sail in the night and on the morning of the fifth anchored off this small farming and fishing community. Behind the narrow rocky shore sea grape fronts the larger trees of the coppice. Along trails in the coppice we saw bromeliads, occasional clumps of cattails, and plantings of sorghum and sugar cane in small pockets of humus in rock cavities. However, small cattle ponds near Marine Farm Hill known as "East Wells" furnished the only existing fresh-water habitat. Profitable night collecting was chiefly done in an overgrown sisal field south of the settlement.

FIG. 14. North Cay, The Bight of Acklins, March 8, 1953. Small geckos (*Sphaerodactylus*) are being searched for by Rabb at the base of a young hog palmetto (*Pseudophoenix vinifera*) in the beach scrub of this island.

MARCH 7: Albert Town, Fortune Island, or Long Cay (17). A short move the preceding afternoon brought us to anchor here. Immediately about Albert Town there is a large area of sand scrub dominated by shrubby sea grape and *Bumelia* but also containing numerous small palmettos. This vegetation gives way to low coppice as the large salt flat in the center of the island is approached. Though the town is small, the two-story buildings and well-constructed walls show signs of a more prosperous past when steamers plying the Crooked Island Passage stopped at the settlement to take on deck hands. Poor collecting rewards here were probably due to the extreme drought conditions which prevailed.

MARCH 8. North and Fish Cays, south of Fortune Island in The Bight of Acklins (18). These two small islands were visited in the hope of securing another species of guana recorded from them, but we saw no traces of it. Most of our collecting was done in the beach scrub (fig. 14). Although the natives at Albert Town name these cays in a different order from that given on Hydrographic Office Chart No. 5392, we have followed the chart's usage.

MARCH 9–14: Clarence Town and Deadman's Cay Settlement, Long Island (19). Near Clarence Town the remains of eighteenth century plantations, salt pans, and drainage canals hewn through the rock can be seen. Long before 1833 rapid depletion of the soil had already limited agricultural pursuits (Wright, 1905). The people today still plant small crops, principally in blasted cavities filled with soil gathered from pockets in the aeolian rock.

On March 10 Hayden and Rabb went to Deadman's Cay Settlement, 10 miles north of Clarence Town, with the local Benedictine priest in his truck and stayed there overnight in a native home. Spread out over a distance of 10 miles, this settlement ranks as one of the larger out-island population centers. To find such a large settlement removed from a good harbor is not so surprising as Rigg (1951) would have one believe, for Deadman's Cay Settlement is an agricultural community, not a seafaring one. This region is more cleared than elsewhere on the island, the farm plots reaching from the range of hills paralleling the eastern shore down to the mangroves bordering the Great Bahama Bank.

Near Deadman's Cay Settlement, at Scrubby Hill, a mostly dry swamp at least a square mile in area showed evidence of holding water to a depth of 2 or 3 feet during the rainy season. Rushes, buttonwood, water lilies (*Castalia*), ferns, and large bromeliads contributed to the jungle-like appearance of the center of the dried swamp, which was unlike any other vegetational structure encountered on the expedition. At the time of our visit fresh water was confined mostly to wells and shallow, livestock ponds.

Shortly after we anchored at Clarence Town, the wind shifted to the northeast and increased in velocity, making it impossible for us to leave the harbor.

MARCH 15–16: Port Nelson Rum Cay (20). When the "norther" dissipated, we left Long Island, and a day's sailing brought us to Rum Cay in the late afternoon of the fifteenth. The settlement of Port Nelson has a park-like appearance due to the wide streets lined by large drooping casuarinas and many coconut palms. Although Coker's (1905) description of the sandy plain of thorn scrub immediately around the village is still valid, he made no mention of the fresh-water pond about a half mile from the village on the northern side of Strong Hill. Mayflies, hitherto unrecorded from the Bahamas, came to the lantern set up by the pond on the night of March 15. Daytime collecting in the pond yielded an excellent lot of aquatic insects, but not a single ephemerid nymph was seen. On the next night several caddisflies came to the light in addition to more mayflies. Caddisflies were also previously unknown from the Bahamas.

MARCH 18–19: Cockburn Town, San Salvador; Green Cay (21). Here also Coker's descriptions are still pertinent, although recent construction of roads north of Cockburn Town has disturbed the associations somewhat. A narrow fresh-water pond margined by a dense growth of cattails (*Typha domingensis*) parallels the beach for about a mile south of town. Smaller marshes occur sporadically farther south and also north of town. On the road between the cattail marsh and the beach excellent series of dragonflies were netted, and from the blooms of two poisonwood trees (*Metopium toxciferum*) at the roadside we secured some eight species of bees. Two miles north of town a curious vegetational mixture occurs on very sandy soil. Here silver thatch palm is seen in company with the rocky-shore shrub *Phyllanthus* and many small coppice trees. Further, though the whole area was dry, there were many large bromeliads growing on the ground and the trees. These plants contained an assortment of roaches and scorpions and a few frogs (*Hyla* and *Eleutherodactylus*).

On March 19 Rabb, Giovannoli, and Van Voast made a brief and successful sortie for guanas to Green Cay, 1 mile north of San Salvador. This rocky cay is about a third of a mile long and 200 feet wide. It has some grasses and low shrubs, such as thyme (*Rachicallis*) and bay cedar (*Suriana*), hiding patches of prickly pear, as well as clumps of shrubby sea grape and buttonwood trees (fig. 15). Most of these larger shrubs were on the eastern half of the islet, and a Louisiana heron rookery of some 50 birds was situated in them about the middle of the eastern side.

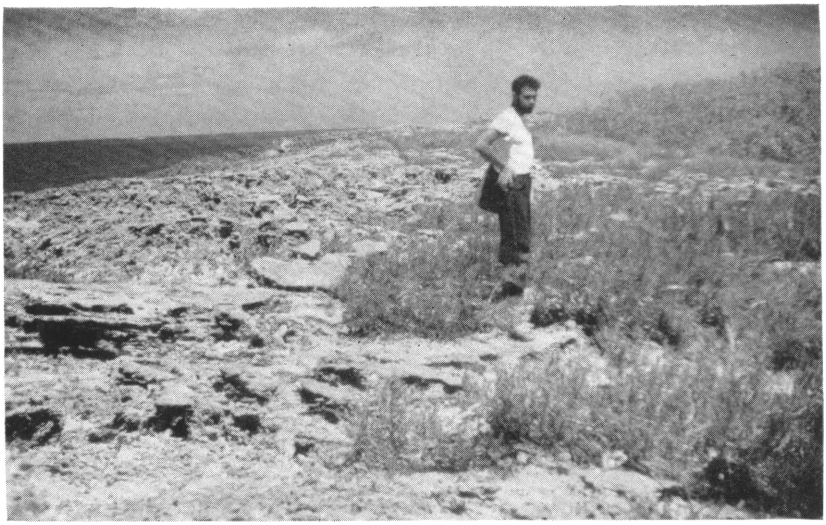

FIG. 15. Green Cay off San Salvador, March 19, 1953. *Rachicallis* and *Borrichia* in the foreground around Rabb, a grassy swath and buttonwood in the background. Note the sharply eroded rock.

MARCH 21–22: The Bight and Tea Bay, Cat Island (22). The weather continued hot and fair, but windless, and we had to motor from San Salvador to Cat Island. The highest elevation in the Bahamas (about 220 feet) is found on the crest of the ridge of hills above the town of The Bight. Walking eastward, one must cross this ridge and another high ridge before the Atlantic shore is reached. The thick coppice on the ridges is liberally sprinkled with dangerous openings in which grow ferns and trees such as sapodilla (*Manilkara*). We were surprised to see several manchineel trees (*Hippomane mancinella*) along some of the footpaths in the coppice. Usually, when the natives find this tree, they cut it down close to the base—the stumps being easy to identify later by the black, tar-like sap that is exuded. Reputedly, a severe skin rash and other painful consequences develop after one comes in contact with the leaves, sap, or fruit of this tree. The toxicity of the more common poisonwood varies to some degree with each individual. At times during the trip we all had mild rashes which seemed to be due to poisonwood.

On March 21 the local Benedictine priest took Rabb and Hayden in his car to Tea Bay, about 12 miles north of The Bight. Along the road cultivated fields of tomatoes and peppers frequently break the coppice growth and the comparatively open areas where palmetto is dominant. Excellent insect collections were made in the few large ponds and sink holes occurring in the coppice. At Tea Bay several sink holes, usually bordered by custard apple (*Anona glabra*), are the habitat of a fresh-water turtle of the genus *Pseudemys* which is closely related to a Jamaican form. Insect collecting around and in these Tea Bay ponds was good. In the rainy season, when the turtles move about (and are easily caught at night), the natives use them to supplement their limited diet of fish, rice, and pigeon peas. About a mile south of the settlement turtles were collected in wooded sloughs that connected with large, shallow, open ponds which contained extensive beds of *Chara*.

MARCH 23–25: Bennetts Harbour, Cat Island (23). The land about this settlement is sandy and supports limited patches of coppice. A large mangrove swamp, connected with the harbor, has fresh water at the northern end where it is surrounded by custard apple trees. Several grazed clearings with tall palmettos towering above the grass occur between the dock and the village. The sandy beach on Alligator Cay (called Rock Cay by Clench) at the entrance to the harbor is backed in places by large blocks of limestone. From a crevice in one of these blocks Rabb collected the largest snake taken by the expedition, a 5½-foot boid (*Epicrates striatus*) which had apparently been feeding on mice. The area around Arthurs Town, just north of Bennetts Harbour, has been described at length by Coker (1905) and by Clench (1938).

MARCH 27–29: New Portsmouth (or Rock Sound), Eleuthera Island (24). After bucking head winds and rough seas on the trip from Cat Island, we tied up at a dock in New Portsmouth. Though shown on all Hydrographic Office charts as New Portsmouth, this settlement is called Rock Sound by everyone in the Bahamas. There is a deep ocean hole southeast of town. As collecting in New Portsmouth was unprofitable, we walked the 3-mile road across the island to the Atlantic side of Eleuthera. The low coppice near the settlement gradually changes to high coppice as the hills east of town are ascended. As on Cat Island the region of the hills contained several shallow caves and deeper sink holes. In one of these caves staphylinid beetles and frogs (*Eleutherodactylus*) were taken under rocks and the rotting fruit of sapodilla trees which stood at the entrance. On the Atlantic side of the island the sandy beach, interrupted in places by coral rock, has low scrubby vegetation broken by occasional clumps of cocoa plum (*Chrysobalanus icaco*) or sea grape. Behind the single line of steep, high dunes bordering the beach we found a boggy cattail marsh and a large brackish pond containing some aquatic vegetation.

MARCH 30–31: Governors Harbour, Eleuthera Island (25). The vicinity of this resort town has not changed much since Coker's time. The casuarinas are still standing, but few young trees are to be seen. The dunes did not seem to be so high as Coker described them, and groups of palms have moved into the region of the dunes. There is now a heavy growth of *Acacia* at the eastern end of the slope of the central ridge of the island, but agaves and spider lilies are still to be found there. The cold weather at night was probably the cause of the poorness of insect collections obtained both at Rock Sound and here.

April 1: James Cistern, Eleuthera Island (26). We had heard several reports that fresh-water turtles were common near James Cistern, so we stopped here to search for them. We were guided to the center of the island to an ocean hole having a layer of fresh water on top of salt water. We were surprised and disappointed to find that the natives call the large black beetles of the family Haliplidae "fresh-water turtles." In addition to the "turtles," water striders, gyrinids, and other aquatic insects were in the ocean hole. Near the ocean the land levels off and is cultivated. Directly behind the dunes and rocky shore were large dry marshes of *Cyperus*.

April 2: Hatchet Bay, Eleuthera Island (27). With the loan of an automobile, we were able to collect within a 5-mile radius of Hatchet Bay and the large agricultural development there. A granary, fresh-water marsh, pasture lands, the rocky northeastern shore, and natural grasslands furnished excellent collecting for insects.

April 3–20: Nassau, New Providence; Rose Island (2). Our return visit to the capital of the Bahamas was a prolonged one, as the "White Wing" was hauled and painted. By use of bicycles and private automobiles we occasionally managed to collect outside the city during this time. One particularly interesting trip was made to Hunt's Cave, 4 miles southwest of Nassau. We estimated that there were 2000 bats (*Erophylla sezekorni planifrons*) in this cave, the largest explored by the expedition. As usual, camel crickets, tailless whip scorpions, and spiders were collected just inside the entrance. The area around Hunt's Cave is a dry pine barren, the rocky ground having a cover of bracken fern (*Pteris caudata*) and various grasses, with scattered poisonwood trees and silver thatch palm forming a weak under-story to the pines.

An area west of Windsor Field, a civilian air field, was found to be referable to the wet pine barrens of Coker. Palmetto replaces the silver palm and grows to a greater height in this situation. A large part of this land was under a few inches of water on the day of our visit, which was during one of the few full days of rain we experienced in the Bahamas. Following this rain the herpetofauna was especially active, and for a few days frogs and lizards were uncommonly obvious. Excellent insect collections were made at lighted store windows by Hayden on nightly walks on Nassau's main street.

The afternoon of April 5 was spent on Rose Island, 3 miles off the northeast end of New Providence. The wider western end of this island supports a rich coppice and remains of *Casuarina* plantings. The shore fronting Northeast Providence Channel is generally rocky, with occasional gaps of sandy beach, behind some of which are situated a few residences. Collecting on Rose Island was poor.

APRIL 22–24, 28: Fresh Creek Settlement, Andros Island (28). At the mouth of Fresh Creek the erection of a modern yacht club and development of real estate were making some headway against the inhospitable coppice. A road leads from the yacht clubhouse to a recently completed house about a mile up the creek. As the street lights and the newly cut brush along this road attracted many insects, we made it a profitable practice to collect along it every night. The situation was similar to that already mentioned on Mayaguana (fig. 12), except for the addition of the helpful lights. The ocean front at Fresh Creek is fronted by a rather narrow sandy beach having few dunes or dune vegetation. In places the coppice behind the beach quickly gives way to mangrove and buttonwood swamps. We took mayflies for the second time on the trip at lights placed by these swamps.

A short trip was made to inland Andros where the Caribbean pine grows in fantastically eroded rock. Our main stop was at Bosun Point, but the treacherous holes in the rock made walking and collecting difficult. Pockets of cattails and ferns grew in the hot pineland not over 20 feet from similar pockets of mangrove. The marine waterstrider was abundant along the shore. Our guide informed us that the fresh waters of an inland lake of Andros emptied into shallow Rock Creek, which in turn discharges into Fresh Creek. Fresh Creek gradually becomes wider, more convoluted, and more saline as it gets closer to the ocean. At the settlement by the mouth of Fresh Creek, salt water ebbs and flows strongly with the tide.

APRIL 25–28: South Bight, Andros Island (29). After motoring down the eastern Andros shore we dropped anchor just inside the mouth of South Bight and were able to put in a night's collecting near Bastian Point of Mangrove Cay. Hydrographic Office Chart No. 0026a shows that Andros is not a single island, but rather a series of large islands separated by large tidal creeks or sounds. The three largest creeks are the North, Middle, and South Bights. Confusion results over the name Mangrove Cay, as it refers not only to one of the islands of Andros, but also to an extensive settlement on that island. We use Mangrove Cay to refer to the island, and Mangrove Cay Settlement for the town, which is, incidentally, one of the largest in the out-islands. Our collecting areas around South Bight can easily be located on Hydrographic Office Chart No. 1612. Day collections were made between Bastian Point and Lisbon Creek, a distance of 2 miles. The alternately rocky and sandy shore of the area facing the Tongue of the Ocean is backed by sea grape, casuarinas, and coconut palms. The Bight-side road is lined with coconut palms and occasionally fruit trees such as sapodilla. Coker (1905) has described the more northern portions of Mangrove Cay's eastern coast.

Because moderate winds made dinghy trips from the "White Wing" to Bastian Point rough and wet, we turned our attention to the Driggs Hill shore across South Bight on South Andros Island. Here a thin strip of sand with coconut palms hides large areas of mangrove swamp from view. At places the mangrove all but disappears, but along most of the shoreline a bit of swamp, which may be largely rock with mangrove in every hole and pocket, intervenes between the coconut of the strand and the pine of the interior.

On April 28 we made an overnight stop at Fresh Creek for more street-light collecting before going on to the Berry Islands.

April 29–30: Fraziers Hog Cay, Berry Islands (30). A quick sail from Andros allowed us to collect in the afternoon and evening on this island, and on the thirtieth stiff winds forced us to remain for another day. The cay is ladle-shaped, with the bowl consisting largely of a rock and mangrove swamp. The "handle" has a ridge some 50 feet high that supports low coppice on its leeward side, and windblown and salt-sprayed rocky shore scrub on the windward slope. Long stretches of sand beach also occur on the windward side. We found little fresh water, but all of it contained aquatic insects. Three Negro families live on the island near the middle of the "handle" where a few tall coconut palms stand.

May 1–2: Little Harbour Cay and Devils Cay, Berry Islands (31). Two nights were spent in the uncomfortable anchorage in the lee of Little Harbour Cay. The island supports a small settlement whose people fish, raise some fruit, and occasionally build boats. Coconut and papaya trees occur around the settlement in addition to the almond tree (*Terminalis catappa*) and wild cotton (*Gossypium*), both of which seem to be remnants of larger and more prosperous communities. The coast of this cay is as varied as any in the Bahamas, for it has wide sandy beaches, gleaming white, wave-washed cliffs, sandy coral flats, and grotesquely worn pinnacles of gray and brown calcareous rock. Most of the front beach vegetation consists of a dense tangle of sea grape, though sea oats cap the dunes at the northern end. Night collecting with lanterns was excellent.

Giovannoli and Rabb made a short visit in the dinghy to Devils Cay, north of Little Harbour Cay, on May 2. The ridge of this island is more pronounced than that of Little Harbour Cay, and there seems to be more low coppice vegetation. Abandoned, overgrown farm plots on the lee side are still bounded by rock walls.

May 4–5: Hope Town on Elbow (or Little Guana) Cay, Abaco Cays (32). On the third we sailed from the Berry Islands, stopped at Cherokee Sound, Great Abaco Island, to pick up two native pilots, and anchored overnight behind Linyard Cay, opposite Wilson City on Great Abaco Island. In the morning of the fourth we dropped anchor at Hope Town on Elbow Cay. The people of this and other communities in the Abaco Cays are wealthy by Bahama standards. Chiefly of the Loyalist stock that left the United States during the Revolutionary War period, they show many peculiar traits in their manners and speech (Penrose, 1905). Fishing, guiding yachtsmen, and collecting shells and sea fans later sold in Florida shell shops are the main occupations. The few bearing coconuts and an orchard of lemons and sour oranges on the island seem to be neglected. The shore facing the ocean is lined with steep dunes, with few rocky sections. The western side is lined with mangroves, which give way to the well-protected harbor. Collecting during the day produced a large and interesting lot of insects, but night collections were poor.

May 5–6: Marsh Harbour, Great Abaco Island (32). An hour's motoring put us at anchor in the early afternoon in this well-sheltered bay. The town has a mixed population of Whites and Negroes, in contrast to Hope Town. Some boat building is carried on, but it is only a remnant of past activity of this nature. A few large boats of schooner type are still built on near-by Man-of-War Cay. An area about a half mile east of Marsh Harbour has been cleared for a sisal plantation. Papayas, tomatoes, and other fruits are also grown on this tract. Sapodillas, papayas, and mangoes were bearing in the town and on the surrounding farms. Behind the town a low ridge has coppice noteworthy for its large trees on both slopes. West of the town there is pine forest. The shore behind Marsh Harbour facing Elbow Cay consists of smoothly eroded limestone with few mangroves. The vegetation is mixed, with coconuts and old casuarinas, large sapodillas, and sour-orange trees standing out above the native strand plants. Collecting was generally good at Marsh Harbour, and a large series of 309 frogs (*Eleutherodactylus*) was purchased from local children.

MAY 7: New Plymouth on Green Turtle Cay, Abaco Cays (33). A morning's travel left us with the afternoon and night to collect on this cay. A trail passing through the coppice eastward from the town opens on a coconut grove surrounded by a narrow sandy beach. Northwestward from this point mangroves and buttonwood form an impenetrable tangle. Along the trail there are several clearings where crops of papayas, bananas, and other fruits were being raised. Night collecting in these clearings was hampered by strong winds.

MAY 8–9: Allans Cay of Pensacola Cays, Abaco Cays (34). Two days were spent at this pleasant anchorage while the water was alternately smooth and roiled during a spell of squally weather. As far as we could ascertain, this uninhabited cay is continuous with Pensacola Cay. This seems to be a single, large, irregularly I-shaped island, the northern end and bar of the I being called Allans Cay, and the larger southern part, Pensacola Cay. Here, not more than a decade ago according to our guides, fishermen came from all the Abaco Cays settlements to spear thousands of crawfish or lobsters. Today both conches and lobsters are on the wane owing to the heavy fishing pressure. Fresh water is common on the sandy belt which forms the bar of the I. We found four ponds, all small, but with sweet water, in addition to two wells about 5 feet deep that were built during the crawfish times by the government. Aquatic insects and tree frogs (*Hyla*) were in most of them. Our competent guides left us here.

MAY 10: Great Sale Cay, Abaco Cays (35). Brief parts of the afternoon and night were spent collecting on this desolate island situated on the interior of the Little Bahama Bank. We landed on the western side and walked to the end of the western peninsula at the southern end of the island, where there is a mangrove and buttonwood-ringed harbor. From what we could see from the western side, most of the interior is mangrove swamp. The 100-foot wide strip of scrubby shore vegetation furnished extremely poor collecting.

MAY 11–15: West End, Pine Ridge, and Eight Mile Rock, Grand Bahama Island (36). We anchored in the slight lee afforded by Settlement Point at the western end of the island after a trouble-free crossing of the Little Bahama Bank. The town itself is about a mile eastward, on the northern side of the island. Between the end of the island and the town stood the remains of a resort. Following a night of profitable collecting in the shore vegetation of the western end, daytime sweeping around the resort yielded a great number of insects, particularly leafhoppers. Some collecting was done about the town, especially for butterflies, which seemed rather common. The butterflies collected on the expedition have been reported on by Rindge (1955).

On May 13 Hayden and Rabb made a trip with the commissioner at West End to Pine Ridge, in the interior of the island. A lumber company has its modern sawmills at Pine Ridge, which is approximately in the location given as "Fairfield," north and east of the mouth of Hawksbill Creek, on Hydrographic Office Chart No. 0026e. This is a region of dry pine barrens, with sharply eroded rock, soil limited to pockets and sink holes, and sparse under-story. Poisonwood, palmetto, bracken fern, *Smilax,* and other vines are the main constituents of the open under-story. The natural reforestation rate seems sufficient to replenish the cut-over areas. In general, collecting was extremely poor. However, at night by one particular light above the door of a lumber company storehouse an amazing variety of insects was taken, including an extraordinary assemblage of moths. None of the other many lights about the camp approached this particular light in numbers or variety of insects attracted. On the return trip to West End we collected around Eight Mile Rock while waiting for transportation.

Final packing of specimens and equipment, clearing with the commissioner, and readying the "White Wing" for the homeward cruise consumed our last day in the Bahamas. At 4:00 A.M. on May 16 we got under way. Good weather, fair winds, and the northward boost from the Gulf Stream enabled us to enter the St. Johns River below Jacksonville, Florida, 36 hours later on May 17. We anchored for the night about 10 miles up the St. Johns River and on the morning of May 18 docked in Jacksonville, where the expedition disbanded.

SUMMARY

In the 20 weeks from December, 1952, to May, 1953, spent in the Bahamas, the Van Voast-American Museum of Natural History Bahama Islands Expedition collected 48,500 insects and arachnids, 2106 reptiles, 684 amphibians, and 67 mammals. With the exclusion of the arachnids, the composition of the collection is:

INSECTS

Thysanura	50
Collembola	100
Orthoptera	470
Isoptera	500
Neuroptera	140
Ephemeroptera	5
Odonata	300
Corrodentia	92

Thysanoptera	50
Hemiptera	6,560
Homoptera	5,970
Dermaptera	78
Coleoptera	9,450
Trichoptera	2
Lepidoptera	8,330
Diptera	11,980
Hymenoptera	1,850

REPTILES

Anolis	991
Leiocephalus	518
Ameiva	249
Sphaerodactylus	202
Cyclura	63
Tarentola	14
Aristelliger	12
Mabuya	11
Alsophis	12
Tropidophis	9
Epicrates	4
Pseudemys	21

AMPHIBIANS

Eleutherodactylus	411
Hyla	273

MAMMALS

Artibeus	32
Erophylla	27
Macrotus	5
Geocapromys	3

Cold, dry weather and high winds during the first seven weeks contributed to the poor entomological and herpetological collecting results. Evidence of this is that we collected as many insects during the last two weeks as we did during the first six weeks. Our collecting sites, with their latitudes, longitudes, dates, and locations on the map (fig. 1), are given in table 3.

This expedition made the first comprehensive entomological survey of the Bahamas, added many new locality records for the reptiles and amphibians, and substantially augmented the existing series of Bahama herpetological material. With the exception of Great Exuma Island, the Ragged Island Group, and Samana Cay, the expedition collected on all the major islands and island groups in the Bahamas. Collections made between May and October would greatly help to complement our material. Likewise, intensive work on individual islands, such as that described by Vaurie (1952), Howard (1950), and Oliver (1948) for Bimini, will be necessary in order to gain a clearer understanding of the Bahama biota.

ACKNOWLEDGMENTS

We wish to express gratefully our indebtedness to the many people who extended favors to us and the expedition. Foremost, we thank Mr. Horace S. Van Voast, Jr., whose generous aid made possible the expedition. In addition to serving as captain aboard the "White Wing," he willingly undertook the housekeeping chores so that we would have more time ashore. Mr. Leonard Giovannoli, our experienced companion collector, contributed much to the success of the expedition both in the field and aboard ship.

For the hospitality and facilities extended to us while on Bimini, we thank Dr. C. M. Breder, Jr., and Mr. Marshall Bishop, Director and former Resident Director, respectively, of the Lerner Marine Laboratory.

In Nassau Mr. T. R. Pyfrom, Mr. Elgin Forsythe, Mr. Donald Lawrence, and Mr. J. V. Malone provided much valuable information on conditions in the out-islands. Mr. Bruce McKie, Mr. Lawrence, and Mr. Pyfrom helpfully furnished transportation to various collecting sites near Nassau. We are especially indebted to Mr. Pyfrom and his family for the hospitality shown us at their home and for acting as our agents while we were in the out-islands of the Bahamas.

For welcoming us into their homes and providing transportation facilities in the out-islands, we thank Fr. Cornelius, O.S.B., O.B.E., of Clarence Town, Long Island; Fr. Herman, O.S.B., of The Bight, Cat Island; Fr. Gall, O.S.B., of Cockburn Town, San Salvador; Mr. and Mrs. Devere Hollenbeck of Hatchet Bay, Eleuthera; Mr. and Mrs. Douglas Erickson and Mrs. A. W. Erickson, Jr., of Matthew Town, Great Inagua; Mr. William Achurch and Mr. Bo Rodehne of Fresh Creek Settlement, Andros; and officials of the Abaco Lumber Company at Pine Ridge, Grand Bahama.

We wish to thank the officials of the Bahama Government in Nassau and throughout the islands for their co-operation, and also would like to indicate that the friendly interest and help of the people throughout the islands contributed greatly to the accomplishments of the expedition.

Our stay on Grand Turk was made a pleasant one by the Commissioner of the Turks and Caicos Islands, Mr. Peter Bleakley, M.B.E., and his family.

The Department of Entomology, University of Kansas, and the Museum of Zoology, University of Michigan, respectively, supplied some of the entomological equipment and the bulk of the herpetological equipment. Dr. C. D. Michener and Drs. C. F. Walker and N. E. Hartweg of these institutions have given parts of the manuscript the benefit of critical readings.

Mr. H. J. Walter of the University of Michigan contributed the drawings for figures 3 and 4.

We also wish to acknowledge our especial gratitude to Dr. Mont A. Cazier of the Department of Insects and Spiders, the American Museum of Natural History, who guided the expedition from its inception through the sometimes trying days in the Bahamas to its conclusion in this report.

LITERATURE CITED

AGASSIZ, ALEXANDER

1894. A reconnoissance of the Bahamas and of the elevated reefs of Cuba in the steam yacht "Wild Duck", January to April, 1893. Bull. Mus. Comp. Zool., vol. 26, no. 1, pp. 1–203, 47 pls.

ALLEN, J. A.

1891. Description of a new species of Capromys, from the Plana Keys, Bahamas. Bull. Amer. Mus. Nat. Hist., vol. 3, pp. 329–336, figs. 1–10.

ARNETT, ROSS H., JR.

1953. The oedemerid beetles of the Bimini Island Group, Bahama Islands, British West Indies. Amer. Mus. Novitates, no. 1646, pp. 1–13, figs. 1–23.

BANKS, NATHAN

1906. Arachnida from the Bahamas. Bull. Amer. Mus. Nat. Hist., vol. 22, pp. 185–189, figs. 1–4.

BARBER, HARRY G.

1953. A new subfamily, genus, and species belonging to the family Enicocephalidae (Hemiptera, Heteroptera). Amer. Mus. Novitates, no. 1614, pp. 1–4, figs. 1–6.

1954. A report on the Hemiptera Heteroptera from the Bimini Islands, Bahamas, British West Indies. *Ibid.*, no. 1682, pp. 1–18, figs. 1–3.

BARBOUR, T., AND B. SHREVE

1935. Concerning some Bahamian reptiles, with notes on the fauna. Proc. Boston Soc. Nat. Hist., vol. 40, pp. 347–365.

BOND, JAMES

1934. The distribution and origin of the West Indian avifauna. Jour. Amer. Phil. Soc., vol. 73 p p. 341–349.

1947. Field guide to the birds of the West Indies. New York, the Macmillan Co., ix–257 pp., illus.

BREDER, C. M., JR.
1933. The Bacon-Andros Expedition. Bull. New York Zool. Soc., vol. 36, pp. 54–65.
1934. Ecology of an oceanic fresh-water lake, Andros Island, Bahamas, with special reference to its fishes. Zoologica, vol. 18, pp. 57–88, figs. 26–35.
BRITTON, NATHANIEL LORD, AND CHARLES FREDERICK MILLSPAUGH
1920. The Bahama flora. New York, publ. by the authors, viii + 695 pp.
CATESBY, MARK
1743. The natural history of Carolina, Florida and the Bahama Islands. London, publ. by the author, vol. 2, [iii] + 100 + xliv pp., 100 pls.
CAZIER, MONT A.
1952. Additions to the buprestid fauna of the Bahama Islands, British West Indies (Coleoptera, Buprestidae). Amer. Mus. Novitates, no. 1562, pp. 1–10, figs. 1–5.
CAZIER, MONT A., AND LIONEL LACEY
1952. The Cerambycidae of the Bahama Islands, British West Indies (Coleoptera). Amer. Mus. Novitates, no. 1588, pp. 1–55, figs. 1–13.
CHAMBERLIN, RALPH V.
1952. The centipeds (Chilopoda) of South Bimini, Bahama Islands, British West Indies. Amer. Mus. Novitates, no. 1576, pp. 1–8, figs. 1–6.
CHAPMAN, FRANK M.
1904. A flamingo city. The Century Illus. Monthly Mag., vol. 69, pp. 163–180, illus.
CLENCH, WILLIAM J.
1938. Origin of the land and freshwater mollusk fauna of the Bahamas, with a list of the species occurring on Cat and Little San Salvador Islands. Bull. Mus. Comp. Zool., vol. 80, pp. 481–541, figs. 1–2, 3 pls.
COKER, WILLIAM C.
1905. Vegetation of the Bahama Islands. *In* Shattuck, George Burbank (ed.), The Bahama Islands. New York, the Macmillan Co., pp. 185–272.
COOKE, C. WYTHE
1945. Geology of Florida. Florida Geol. Surv., Geol. Bull., no. 29, ix + 339 pp., 1 map in folder.
DARLINGTON, P. J., JR.
1938. The origin of the fauna of the Greater Antilles, with discussion of animals over water and through the air. Quart. Rev. Biol., vol. 13, pp. 274–299, figs. 1–5.
1953. West Indian Carabidae (Coleoptera). The Bahama species. Amer. Mus. Novitates, no. 1650, pp. 1–16.
ERICSON, D. B., W. S. BROECKER, J. L. KULP, AND G. WOLLIN
1956. Late-Pleistocene climates and deep-sea sediments. Science, vol. 124, no. 3218, pp. 385–389.
GOIN, COLEMAN J.
1955. Description of a new subspecies of the frog *Eleutherodactylus ricordi* from the Bahama Islands. Amer. Mus. Novitates, no. 1708, pp. 1–7, 1 fig.

GREAT BRITAIN, COLONIAL OFFICE
1952. Report on the Turks and Caicos Islands (Dependency of Jamaica) for the years 1949 and 1950. London, H. M. Stationery Office, 32 pp. and map.

GULICH, ADDISON
1932. Biological peculiarities of oceanic islands. Quart. Rev. Biol., vol. 7, pp. 405–427, 1 fig., 3 tables.

HOWARD, RICHARD A.
1950. Vegetation of the Bimini Island Group, Bahamas, B.W.I. Ecol. Monogr., vol. 20, pp. 317–349, figs. 1–28.

ILLING, L. V.
1954. Bahaman calcareous sands. Bull. Amer. Assoc. Petrol. Geol., vol. 38, no. 1, pp. 1–95, 9 pls., 13 figs.

JAMES, MAURICE T.
1953. The Stratiomyidae (Diptera) of Bimini, British West Indies. Amer. Mus. Novitates, no. 1613, pp. 1–6.

KROMBEIN, KARL V.
1953. The wasps and bees of the Bimini Island Group, Bahamas, British West Indies (Hymenoptera, Aculeata). Amer. Mus. Novitates, no. 1633, pp. 1–29, figs. 1–5.

LAWRENCE, BARBARA
1934. New *Geocapromys* from the Bahamas. Occas. Papers Boston Soc. Nat. Hist., vol. 8, pp. 189–196, figs. 1–3.

LEE, C. S.
1951. Geophysical surveys on the Bahama Banks. Jour. Inst. Petrol., vol. 37, no. 334, pp. 633–657, 13 figs.

MAYR, ERNST, AND CARMELA BERRITTO ROSEN
1956. Geographic variation and hybridization in populations of Bahama snails (*Cerion*). Amer. Mus. Novitates, no. 1806, pp. 1–48.

METCALF, ZENO PAYNE
1954. Homoptera from the Bahama Islands. Amer. Mus. Novitates, no. 1698, pp. 1–46, figs. 1–76, 1 table.

MOONEY, CHARLES N.
1905. Soils of the Bahama Islands. *In* Shattuck, George Burbank (ed.), The Bahama Islands. New York, the Macmillan Co., pp. 147–184.

MUMA, MARTIN H.
1953. A study of the spider family Selenopidae in North America, Central America, and the West Indies. Amer. Mus. Novitates, no. 1618, pp. 1–11, figs. 1–2.

NEWELL, NORMAN D., J. KEITH RIGBY, ARTHUR J. WHITMAN, AND JOHN S. BRADLEY
1951. Shoal-water geology and environments, eastern Andros Island, Bahamas. Bull. Amer. Mus. Nat. Hist., vol. 97, pp. 1–30, figs. 1–5, pls. 1–8.

NOBLE, G. K., AND G. C. KLINGEL.
1932. The reptiles of Great Inagua Island, British West Indies. Amer. Mus. Novitates, no. 549, pp. 1–25, figs. 1–5.

OLIVER, JAMES A.
1948. The anoline lizards of Bimini, Bahamas. Amer. Mus. Novitates, no. 1383, pp. 1–36, figs. 1–3, 2 tables.

OLSON, ADA L., T. H. HUBBELL, AND H. F. HOWDEN
1954. The burrowing beetles of the genus *Mycotrupes*. Misc. Publ. Mus. Zool. Univ. Michigan, no. 84, pp. 1–59, 7 pls.

PARK, ORLANDO
1954. The Pselaphidae of South Bimini Island, Bahamas, British West Indies (Coleoptera). Amer. Mus. Novitates, no. 1674, pp. 1–25, figs. 1–22.

PENROSE, CLEMENT A.
1905. Sanitary conditions of the Bahama Islands. *In* Shattuck, George Burbank (ed.), The Bahama Islands. New York, the Macmillan Co., pp. 387–418.

PROCTOR, GEORGE R.
1954a. Notes on the vegetation of the Turks and Caicos Islands. Nat. Hist. Notes Nat. Hist. Soc. Jamaica (mimeographed), no. 68, pp. 149–152, 1 fig., 1 map, 1 table.
1954b. Notes on the vegetation of the Turks and Caicos Islands (Part II). *Ibid.*, no. 69, pp. 170–174, 2 maps.
1955. Notes on the vegetation of the Turks and Caicos Islands (Part III). *Ibid.*, pp. 199–203, 1 fig.

RICHARDS, P. W.
1952. The tropical rain forest; an ecological study. Cambridge, England, Cambridge University Press, xvii + 450 pp., illus.

RICHARDSON, JOHN HENRY
1944. Review of the Bahamian economic conditions and post-war problems. Nassau, Nassau Guardian Ltd., 150 pp., incl. tables.

RIGG, J. LINTON
1951. Bahama Islands. Second edition. New York, Van Nostrand, 167 pp., illus.

RINDGE, FREDERICK H.
1952. The butterflies of the Bahama Islands, British West Indies (Lepidoptera). Amer. Mus. Novitates, no. 1563, pp. 1–18.
1955. The butterflies of the Van Voast-American Museum of Natural History Expedition to the Bahama Islands, British West Indies. *Ibid.*, no. 1715, pp. 1–20.

ROSEN, NILS
1911. Contributions to the fauna of the Bahamas. Lunds Univs. Arsskr., new ser., Afd. 2, vol. 7, pp. 1–72, 13 figs., 1 pl., 2 maps.

RUCKES, HERBERT
1952. Some scutelleroid Hemiptera of the Bahama Islands, British West Indies. Amer. Mus. Novitates, no. 1591, pp. 1–9.

SCHALK, M.
1946. Submarine topography of Eleuthera Island, Bahamas. (Abstract.) Bull. Geol. Soc. Amer., vol. 57, p. 1228.

SCHIMPER, A. F. W., AND F. C. VON FABER
1935. Pflanzengeographie auf physiolischer Grundlage. Jena, G. Fischer, vol. 1, pp. i–xx, 1–588; vol. 2, pp. i–xvi, 589–1613.

SCHUCHERT, CHARLES
1935. Historical geology of the Antillean-Caribbean region of the lands bordering the Gulf of Mexico and the Caribbean Sea. New York, John Wiley and Sons, Inc., xxvi + 811 pp., 107 figs., 16 maps.

SHATTUCK, GEORGE BURBANK (EDITOR)
1905. The Bahama Islands. New York, the Macmillan Co., xxxii + 630 pp., 93 pls.

SHATTUCK, GEORGE BURBANK, AND BENJAMIN LEROY MILLER
1905. Physiography and geology of the Bahama Islands. *In* Shattuck, George Burbank (ed.), The Bahama Islands. New York, the Macmillan Co., pp. 3–22.

SHEPARD, F. P., AND H. E. SUESS
1956. Rate of postglacial rise of sea level. Science, vol. 123, no. 3207, pp. 1082–1083.

SMITH, MARION R.
1954. Ants of the Bimini Island Group, Bahamas, British West Indies (Hymenoptera, Formicidae). Amer. Mus. Novitates, no. 1671, pp. 1–16, 1 table.

STROHECKER, H. F.
1953. The Gryllacrididae and Gryllidae of the Bahama Islands, British West Indies (Orthoptera). Amer. Mus. Novitates, no. 1618, pp. 1–11, figs. 1–2.

TREWARTHA, GLENN T.
1943. An introduction to weather and climate. Second edition. New York, McGraw-Hill Book Co., Inc., xi + 545 pp., illus.

TWOMEY, ARTHUR C.
1936. Climographic studies of certain introduced and migratory birds. Ecology, vol. 17, no. 1, pp. 122–132, figs. 1–12.

UNITED STATES BOARD ON GEOGRAPHICAL NAMES
1947. Directions for the treatment of geographical names in the Bahama Islands. Spec. Publ., no. 67, pp. 1–16.

UNITED STATES HYDROGRAPHIC OFFICE
1951. Sailing directions for the West Indies, volume I. The Bermuda Islands, Bahama Islands and Greater Antilles. Second edition. U. S. Hydrographic Office Publ., no. 128, xxvi + 432 pp.

UNITED STATES WEATHER BUREAU
1947. Weather summary, West Indies, for use with naval air pilots. U. S. Hydrographic Office Publ., no. 530, v + 199 pp.

VALENTINE, BARRY D.
1955. The Anthribidae of the Bahama Islands, British West Indies (Coleoptera). Amer. Mus. Novitates, no. 1741, pp. 1–11.

VAURIE, PATRICIA
1952. Insect collecting in the Bimini Island Group, Bahama Islands. Amer. Mus. Novitates, no. 1565, pp. 1–24, figs. 1–9.

WETMORE, ALEXANDER
1937. Bird remains from cave deposits on Great Exuma Island in the Bahamas. Bull. Mus. Comp. Zool., vol. 80, pp. 427–441.

WHEELER, WILLIAM MORTON
1905. The ants of the Bahamas, with a list of the known West Indian species. Bull. Amer. Mus. Nat. Hist., vol. 21, pp. 79–135, figs. A–W, 7 pls.

WRIGHT, JAMES M.
1905. History of the Bahama Islands, with a special study of the abolition

of slavery in the colony. *In* Shattuck, George Burbank (ed.), The Bahama Islands. New York, the Macmillan Co., pp. 419–586.

YOUNG, FRANK N.

1953. The water beetles of the Bahama Islands, British West Indies (Coleoptera, Dytiscidae, Gyrinidae, Hydrochidae, Hydrophilidae). Amer. Mus. Novitates, no. 1616, pp. 1–20.