1976


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SYSTEMATICS OF THE ANTILLEAN BLIND
SNAKES OF THE GENUS TYPHLOPS (Serpentes:
Typhlopidae).

The Louisiana State University and
Agricultural and Mechanical College,
Ph.D., 1976
Zoology

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SYSTEMATICS OF THE ANTILLEAN BLIND SNAKES
OF THE GENUS TYPHLOPS
(SERPENTES: TYPHLOPIDAE)

A Dissertation

Submitted to the Graduate Faculty of the Louisiana State University and Agricultural and Mechanical College in partial fulfillment of the requirements for the degree of Doctor of Philosophy

in

The Department of Zoology and Physiology

by

John Paul Richard Thomas
B. A., University of South Florida, 1969
August, 1976
ACKNOWLEDGEMENTS AND ABBREVIATIONS

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The following is a list of abbreviations used in this study for collections from which specimens were examined or cited.

- AMNH - American Museum of Natural History
- ANSP - Academy of Natural Sciences of Philadelphia
- ASFS - Albert Schwartz Field Series, Miami
- BMNH - British Museum (Natural History)
- CM - Carnegie Museum
- DRP - Dennis R. Paulson private collection (now in Los Angeles County Museum)
- FGT - Fred G. Thompson field series, Florida State Museum
- IZ - Instituto de Zoología, La Habana, Cuba
- JRD - James R. Dixon field series, Texas A & M University
- KU - University of Kansas Museum of Natural History
- LDO - Lewis D. Ober private collection, Miami

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LSUMZ - Louisiana State University Museum of Zoology
MEZH - Museo y Biblioteca de Zoología de la Habana (probably no longer extant)
MCZ - Museum of Comparative Zoology, Harvard University
MNHN - Muséum National d'Histoire Naturelle, Paris
MNHNSD - Museo Nacional de Historia Natural, Santo Domingo, República Dominicana
RNH - Rijksmuseum van Natuurlijke Historie, Leiden
RT - Richard Thomas private collection, Baton Rouge, Louisiana
SC - Séminaire Collège, Fort de France, Martinique
SMF - Natur-Museum und Forschungs-Institut Senckenberg, Frankfurt am Main
TCWC - Texas Cooperative Wildlife Collection, Texas A & M University
TU - Tulane University
UF/FSM - Florida State Museum, University of Florida
UMMZ - University of Michigan Museum of Zoology
UPRM - University of Puerto Rico, Mayagüez
USNM - National Museum of Natural History
YPB - Yale–Peabody Museum, Yale University

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ABSTRACT

The following species and subspecies of West Indian Typhlops are recognized: *T. sulcata* Cope (Navassa I., Hispaniola, Ile Grande Cayemite, Ile de la Gonâve, Isla Alto Velo); *T. jamaicensis* Shaw (Jamaica); *T. lumbricalis* Linnaeus (Cuba and the Isla de Pinos; the Bahamas, including Grand Bahama, Water Cay, Great Abaco, South Bimini, Andros, New Providence, Eleuthera, Great and Little Exuma, Pipe Cay (Berry Is.), Cat, Long, and Little Ragged I.); *T. hectus* Thomas (Hispaniola, including Ile Grande Cayemite); *T. pusilla* Barbour (Hispaniola, Ile Grande Cayemite, Ile de la Gonâve, Ile de la Tortue, Isla Catalina, and Isla Saona); *T. capitulata* Richmond (Hispaniola and Ile de la Gonâve); *T. syntherus* Thomas (Hispaniola); *T. rostellata* Stejneger (Puerto Rico); *T. richardi* Duméril and Bibron (the Puerto Rico region, including Puerto Rico, Isla Caja de Muertos, Cayo Palominitos, Cayo Diablo, Isla Vieques and Cayo de Tierra, Isla Culebra, St. Thomas, Prickly Pear I., St. John, Tortola, St. Croix, Beef I., Virgin Gorda, and Anegada; also known from North Caicos in the Caicos Is. and Pear Cay in the Turks Is.); *T. monensis* Schmidt (Isla Mona); *T. granti* Ruthven and Gaige (Puerto Rico, Isla Caja de Muertos); *T. monastus* Thomas (*T. m. monastus*, Montserrat; *T. m. geotomus* Thomas, Barbuda, Antigua and Great Bird I., St. Christopher, and Nevis); *T. dominicana* Stejneger (*T. d. dominicana*, Dominica; *T. d. guadeloupensis* Richmond, Guadeloupe); *T. caymanensis* Sackett (Grand Cayman); *T. biminiensis* Richmond (*T. b. biminiensis*, the Bahamas, including North and South Bimini, Andros, New Providence, Elbow Cay of the Cay Sal Bank, and Little Ragged I.; Cuba. *T. b.
paradoxus Thomas, Great Inagua and T. b. epactia Thomas, Cayman Brac; T. tasymicris Thomas (Grenada). Two undescribed species from Hispaniola are designated Typhlops I and Typhlops II.

Each species is described on the basis of 33 characters or character complexes based on external morphology, skeleton, hemipenes, and rectal caecum. Two Antillean groups are recognized: the biminiensis group, including T. biminiensis and T. caymanensis, and the major Antillean radiation, including all other species except T. tasymicris, which is closely related to South American species. The biminiensis group has its closest relatives in Central America. The major Antillean radiation has no known close relatives in the New World or elsewhere. The evolution of the major Antillean radiation (MAR) is discussed. Within the MAR a paraphyletic primary group of convenience is recognized; it consists of generalized species inhabiting Jamaica (T. jamaicensis), Hispaniola (T. sulcata), the Puerto Rico area and the Turks and Caicos islands (T. richardi), the northern Leeward Islands (T. monastus), and the southern Leeward Islands of Guadeloupe and Dominica (T. dominicana). A phylogeny of the Hispaniolan species is presented. The Hispaniolan radiation has resulted in dispersals northward into Cuba and the Bahamas (T. lumbricalis) and eastward to Puerto Rico (T. rostellata). Due to conflicting or insufficient data, a complete phylogeny of the MAR species is not presented. The entry of the various species groups into the Antilles is discussed, including the possibility that the occurrence of Typhlops in the Antilles is best explained by a vicariance hypothesis coupled with plate tectonic movements of the islands.
INTRODUCTION

The virtually circumtropical burrowing snakes of the genus *Typhlops* Oppel are represented in the West Indies by an assemblage of forms that has grown markedly in recognized species in the last dozen years. Although it would be foolish to assume that the typhlopid fauna of the Antilles is completely known, it is probably largely known—enough so that a systematic review of the forms should be rewarding both in increasing our knowledge of an adaptively singular group of organisms and in increasing our understanding of West Indian faunal patterns. A preliminary knowledge of the species of Antillean *Typhlops* indicated to me that they might be the products of one or two intra-Antillean radiation and therefore particularly amenable to study without extensive involvement with non-Antillean species.

Although typhlopids are generally regarded as rare and comparatively inconsequential members of their faunas, in the West Indies they are numerically important, even though not conspicuous. At least since Thomas Barbour was instrumental in collecting large series from Soledad in Cuba, it has become increasingly evident that these small snakes are very abundant in some areas. The Chapman Grant collections from Puerto Rico and the Virgin Islands during the 1930's further demonstrated this, and the collections made more recently by Albert Schwartz and his field parties in many parts of the Antilles have shown the near ubiquity and often astounding abundance of fossorial squamates (including amphisbaenians) in the
region. The result is an unprecedented sampling of these forms, although distributional lacunae remain, and some species are still poorly known.

As used herein the terms "West Indies" and "Antilles" are synonyms for a faunally defined region including the Greater and Lesser Antilles (exclusive of Trinidad-Tobago and the Dutch islands of Bonaire, Aruba, and Curacao), the Bahamas Islands (including the Turks and Caicos islands), the Cayman Islands, the Swan Islands, the the Colombian islands of San Andres and Providencia (no species of Typhlops are known from the last three named islands or island groups). The boundaries are slightly arbitrary; the rationale for them was given by Schwartz and Thomas (1975). At any rate, species of Typhlops are unknown from the peripheral Caribbean islands other than Trinidad and Tobago.

In reference to the island of Hispaniola, the terms "North Island" and "South Island" (Williams, 1961) refer to the two main physiographic subdivisions, separated by the profound Cul de Sac-Valle de Neiba plain. These are convenient terms of reference when discussing the distribution of organisms on the island.

The first name applied to a species of Typhlops under the Linnaean system was Linnaeus' Anguis lumbricalis, a name now generally agreed, despite the meager description originally given, to apply to a West Indian species. Between 1758 and 1802, when Shaw described Anguis jamaicensis, no additional species of Antillean Typhlops were known. In 1830 the next Antillean species was brought to light but was misidentified as Typhlops cinereus Schneider by
Guerin and was not to be correctly named until 1904, when Stejneger proposed the name *Typhlops dominicana*. In 1844 *Typhlops richardi* was described by Duméril and Bibron from St. Thomas in the Virgin Islands, and in 1868 Cope named *Typhlops sulcata* from a single specimen from the small island of Navassa. Rosen in 1911 recorded *Typhlops tenuis* Salvin (a Central American species) from the island of Andros in the Bahamas; this misidentification was not rectified until 1955, when Richmond described *Typhlops biminiensis* from North Bimini in the Bahamas. The next person to name a species now recognized as valid was Barbour, who in 1914 described *T. pusilla* from Haiti. Nevertheless, until 1924 confusion outweighed enlightenment regarding the identify of a number of the West Indian populations. In 1919 Barbour and Ramsden could state the *Typhlops lumbricalis* was found throughout almost the entire Antillean region and on the mainland of South America. In 1924 Cochran showed that the name *lumbricalis* should be applied to the populations on Cuba, the Bahamas, and Hispaniola having low longitudinal scale counts and 20 scale rows anteriorly.

Cochran attributed the name *jamaicensis* to the 22 scale-row, high-count populations on Jamaica, Puerto Rico, and the Virgin Islands. Schmidt (1926) described *T. monensis* from Isla Mona and in 1928 recognized *T. jamaicensis* (Jamaica), *T. platycephalus* (Puerto Rico), and *T. richardi* (Virgin Islands). However, Parker (1933) thought it best to apply the name *jamaicensis* to that entire assemblage, including also the populations in the northern Leeward Islands, at least until variation in the various populations became better known. In 1935 Ruthven and Gaige reviewed the Puerto Rico bank *Typhlops* on
the basis of the extensive material collected by Chapman Grant. They described the amazingly ectomorphic Typhlops granti from southwestern Puerto Rico and nearby Isla Caja de Muertos. They retained the names T. jamaicensis, T. platycephalus, and T. richardi as distinct species but did not allocate the northern Leeward Islands populations to any of the named forms.

The next Antillean species to be recognized was T. caymanensis, described by Sackett in 1940 from Grand Cayman. Fifteen years later Richmond described T. biminiensis from North Bimini in the Bahamas and in 1964 described T. capitulata from Haiti.

In 1965 Thomas described T. syntherus from the Barahona Peninsula of Hispaniola and the next year (1966a) re-examined variation in the Puerto Rico region jamaicensis-group Typhlops. He used the trinomials T. richardi richardi and T. r. platycephalus for the central Virgin Islands populations and the Puerto Rican populations respectively, proposing the names T. r. catapontus and T. r. naugus for the Anegada and Virgin Gorda populations. In another paper that year Thomas (1966b) described the northern Leeward Islands populations as T. monastus, recognizing a nominate subspecies on the island of Montserrat and T. m. geotomus on Antigua, Barbuda, St. Kitts, and Nevis. In 1968 Thomas reviewed T. caymanensis and T. biminiensis, showing the latter to be widespread in the Bahamas and Cuba and to occur on Cayman Brac; he described T. b. paradoxus (Great Inagua) and T. b. epactia (Cayman Brac). Thomas (1974a) described Typhlops hectus from southwestern Hispaniola and (1974b) Typhlops tasymicris from Grenada at the southern extreme of the Lesser Antillean chain.
METHODS AND CHARACTERS

I took measurements on head scales and crania with an ocular micrometer (linear scale or protractor for angular measurements) at 20X magnification (15X for exceptionally large specimens) and measured total length (TL) to the nearest millimeter on a mm rule. I measured tail length (TA) and midbody diameter (MBD) to the nearest tenth of a mm with vernier or dial calipers. Tail length can usually be best measured accurately in specimens that have been relaxed before preservation; I attempted to straighten tails as much as possible and disregarded measurements of excessively curled tails.

For skeletal preparation, after being skinned through a midlateral incision (taking care not to remove the hyoid and pelvis with the skin), specimens were cleared in 1-5 percent KOH (concentration was varied according to state of preservation, stage of clearing, and size of specimen) and then stained with alizarin red dissolved in an ethanol-acetic acid mixture, adding the staining solution to the specimen in 1 percent KOH. I often stained a specimen before it was completely cleared so that the progress of clearing could be more accurately observed. Cleared and stained specimens placed in glycerin for observation and storage. Although more than one specimen of many of the species were cleared and stained, I made X-rays of additional specimens of most species to provide supplementary information on variation in some of the skeletal characters. X-rays were made with an industrial machine; most were taken at 15 milliamperes, 40 volts on the primary, and a subject-to-filament distance of 76 cm. No screen was used; the film was Kodak Industrex M54. Time of exposure

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varied according to size of specimens but was usually 10-15 seconds for average sized specimens.

I sexed specimens by checking for presence or absence of hemipenes through a midventral slit in the tail and in some specimens by dissection of the body cavity to ascertain gonads or associated structures. I did not sex many of the older, less well preserved specimens and some that I borrowed early in the study. Sexual dimorphism in middorsal counts is weak, although significant differences do exist, and I have not presented data for males and females separately.

The characters used in this study I chose 1) for their value in discriminating taxa, 2) for their potential value in indicating primitive and derived character states, and 3) for their possible comparative value to workers dealing with non-Antillean forms. These considerations are, of course, not mutually exclusive. Many of the characters used are found on the head and are probably to some extent correlated. This bias is almost unavoidable, as the head is the site for most of the most trenchant (or at least most apparent) adaptive modifications in these fossorial animals. I have tried to avoid completely redundant characters, except in one or two instances, noted below, where they are retained for their discriminant value.

A listing of the characters used, an evolutionary assessment of their states (where feasible), and their occurrence in the Antillean species is presented below. I have not used the following characters employed by some other workers in typhlopid systematics, since the Antillean forms show no significant variation in these features: The internasal suture always extends to the rostral
(except in some pre-shedding specimens); the nares are situated laterally on the snout in approximately the same position in all of the species; no species have papillae on the tongue.

Assessment of primitive versus derived character states is based, where possible, on knowledge of character states in non-Antillean species. I employ the following criteria.

A. A character state is primitive if it is widespread among non-Antillean species.

B. Lacking knowledge of a character in non-Antillean species, I consider it primitive if it is widespread in the Antilles and occurs in species judged on other criteria to have a preponderance of primitive character states.

C. Character states found in one or two species only and lacking other criteria for assessment I consider derived.

D. In skeletal features I consider fusion or loss of elements more advanced than the converse.

The numbers in parentheses in the following list and in the taxonomic descriptions are for convenience in making comparisons and in many cases designated character complexes rather than single characters.

(1) **Head shape.** I used the following categories (Fig. 1):

- Rounded—sides of head essentially parallel, snout broadly rounded.
- Tapered—sides of head taper anteriad, snout somewhat pointed.
- Truncate—snout flattened on apex.
Ogival—snout with a distinct median extension or tip.
The term "flattened" I apply to several species in which the snout is
noticeably depressed. The categories of head shape must be carefully
ascertained, as over-injection during preservation may alter the
outline. This occurs if preservative is forced into the spaces
beneath the skin of the head, or if the coelom is over-injected
forcing the soft tissues of the oral cavity forward and altering the
shape of the head. The rather rigid integumental capsule of the snout
region is capable of some dorsoventral movement; this is probably
responsible for the apparent cranial kinesis noted by McDowell (1975),
as the cranium itself is rigid.

(2) Rostral shape. I use the following shape categories for the
rostral scale in dorsal aspect (Fig. 1, Table 2):

Oval—widest at the midpoint.
Sagittate—widest point anterior to the midpoint
Clavate—broadening gradually anterior to posterior,
widest point posterior to midpoint.
Parallel—sides essentially parallel, no regional
widening
Waisted—like the preceding category, except that the
sides are indented slightly, producing a somewhat
hourglass-shaped effect.

Width of the rostral in dorsal is given as a decimal fraction of the
length; width (RW), unless otherwise specified, is measured at the
midpoint; length (RL) is measured from the internasal suture to the
posterior tip. Expansion of the rostral on the apex of the snout
(apical flare) is categorized as present or absent. Expansion of the
posterior end of the rostral in ventral aspect (labial flare) is categorized as 0 (absent), 1, 2, or 3 (Fig. 1). The primitive rostral condition in dorsal aspect is evidently one of moderate width and oval shape; specializations involve broadening on the one hand and narrowing on the other. I can ascertain no obligate sequence for the evolution of the various shapes.

(3) Preocular. The angle formed by the upper and lower edges of the anterior projection of the preocular is measured to the nearest $5^\circ$ (Fig. 2). In addition the apex may be rounded, sharp, or truncate (Fig. 2); the upper edge may be straight or slightly curved inward; the lower edge is decurved but may have a pronounced curvature or a gradual one. Larger preocular angles are primitive and at the extreme may not be angular at all but broadly curved. A divided preocular I regard as derived.

(4) Ocular. Ocular scales are categorized as narrow (length less than or approximately equal to $1/2$ height), moderate (length equal to about $2/3$ height), or broad (length approximately equal to height). Because of the vertical extent of the ocular and consequent curvature, exact height measurement is difficult; therefore approximations have been used. The degree of curvature (sinuosity) of the anterior edge of the ocular is stated as a decimal fraction: length of ocular at greatest indentation/maximum length of ocular, the foregoing subtracted from 1 (Fig. 2). I regard the moderate ocular length category as primitive; narrow and broad are derived.

(5) Rostronasal pattern. Viewed from above, the rostral and upper limbs of the two posterior nasals form a pattern I categorize as divergent (edges of posterior nasals essentially straight and not
diverging or only slightly divergent), or calyculate (edges of posterior nasals not diverging but curved outward in a parenthesis-like fashion—Fig. 1). Although the correlation is not perfect, there is a tendency for divergent nasals to occur with relatively broad, usually rostrals; parallel nasals are usually associated with narrow oval or parallel rostral shapes. I regard the divergent rostronasal pattern as primitive and the parallel and calyculate patterns as derived.

(6) Postoculars. In most species the postocular condition (number of scales in contact with the ocular between the first parietal and the fourth upper labial) consists of a pair of cycloid scales essentially equal in size and shape to the body scales. A single cycloid postocular or a single postocular that is very high and short may occur. Three postoculars occur as a rare variant, usually in conjunction with an abnormally shortened first parietal (Fig. 2, Table 6). I regard two postoculars as the primitive condition, the two categories of single postocular being nonsequential specializations.

(7) First parietal. I categorize the first parietal as standard if the width spans two of the scale rows following it on the head and neck (it may be slightly narrower); it is expanded if it is broader than the two succeeding scale rows. In the expanded condition the lateral end narrowed, and the entire shape is bladelike (Fig. 2, Table 6). Aberrantly, the parietal may be very narrow, only slightly wider than one succeeding scale row. The standard condition I regard as primitive, the expanded one derived.

(8) Second parietal. The second parietal may be equal in size
and shape to the first in the standard condition but never to the expanded condition; it may be slightly narrower than the standard. If the first scale following the first parietal forms part of a graded series reducing gradually in size to the width of one normal scale row—in fact being the beginning of the paravertebral row—the second parietal is scored as absent. The second parietal is also absent if two scale rows abut directly on the first parietal.

(9) **Total length (TL)**. The maximum length for a species is given in the description, but the variation is shown in Table 19.

(10) **TL/TA**. This ratio is expressed to the nearest whole number; male and female values are given separately when some difference exists (usually in those species in which specimens were relaxed before preservation).

(11) **TL/midbody diameter (MBD)**. This ratio is expressed to the nearest whole number.

(12) **Middorsal scales**. Counts are taken beginning with the first median scale behind the rostral and ending with the last scale before the caudal spine (actually overlying it). Intercalary scales are not counted unless they occur in pairs and occupy the position of a single middorsal scale. (Intercalary scales indicate no vertebral abnormality, but two occurring together occupy the position of one middorsal scale; not to count such pairs would give a false count relative to the vertebral number.) For convenience in discussion, counts are categorized as low (ca. 220-300), moderate (ca. 300-350), or high (ca. 375-400+). Within a given species different high-count and low-count categories may be used. I have used the middorsal scale count categories as supporting evidence in associating apparently
related forms, but I have not assumed a priori that evolution has proceeded from high to low counts. Nevertheless, in the phylogeny hypothesized, the changes are from high to low counts with no reversal.

(13) Scale rows. Scale row reduction occurs ventrally and paramedially by fusion of scale rows; each major reduction (24–22, 22–20, 20–18 rows, etc.) occurs in two steps (e.g., 20–19 and 19–18 for a major 20–18 row reduction) over a variable distance. I record reduction level as the midventral scale (posterior to the mental) at which fusion takes place or as the distance in mm from the snout to the point of reduction. In presenting reduction data, the point of reduction is expressed as a percentage of the total length of the animal: either the number of the midventral scale at the point of reduction as a percentage of the total number of middorsals or the point of reduction in mm as a percentage of the TL. These two modes of presenting reduction data are equivalent enough to be used interchangeably. The mensural method is more easily used on poorly preserved specimens, and I decided to switch to that method after having begun using the meristic method on well-preserved specimens. As with middorsal counts, I made no a priori assumption about direction of evolutionary change in scale row number, but in the postulated phylogeny evolution has been by reduction in scale row number.

(14) Coloration. Pigmentation occurs on the dorsal scale rows, at least, and fades by gradual reduction in chromatophore density or is lost by abrupt but not completely regular "dropping out" of pigment on individual scales. Often it is a combination of fading and dropping out that accounts for the ventral pigment reduction.
Pigmented scales may also extend onto the venter so that the entire ventral surface is pigmented (total pigmentation, indicated by T). In this condition ventrad fading may occur, or the intensity may remain virtually undiminished; light spots lacking in pigment usually occur around the mouth and vent. With a lesser degree of total pigmentation (T-), an irregular midventral zone lacking in pigmentation may occur. Pigmentation is quantified by counting the number of pigmented scale rows at midbody.

(15) Rectal caecum. A blind pocket of the large intestine, variable in size, may occur at the junction with the small intestine.

(16) Hemipenes (Fig. 3). I use the term "expanded" for hemipenes if they have a terminal expansion. Included within this category are the subcategories trumpet-shaped (capitate with a distinct circumferential sulcus spermaticus) and oblique (with a differentiated, somewhat flattened region on one side of the organ; no peripheral sulcus; when incompletely everted these organs appear to have a pouch on one side). Hemipenes are also categorized as attenuate (slender, almost filiform with a swollen base but no apparent terminal expansion). The organs are often not completely everted, and although it may be possible to categorize them as expanded or attenuate, it may not be possible to describe the course of the sulcus spermaticus or determine the exact nature of the terminal expansion. An expanded condition is evidently primitive and the attenuate condition derived.

(17) Cranial shape. I categorize crania as broad or tapered. The lateral parietal and prootic walls of broad crania are nearly parallel, as are the walls of the frontals between the orbits, and
the width across the prefrontals is nearly as broad as the width across the prootics. In tapered crania the walls of the parietals and prootics taper noticeably, and the walls of the frontals continue this taper; the width across the prefrontals is usually distinctly narrower than the width across the prootics. I regard broad crania as primitive and tapered crania as derived.

(18) Premaxilla. In dorsal aspect the premaxilla varies in extent of exposure, width, degree of concavity or convexity (on the apex of the snout) and protuberance, in which the outer surface is set beyond the surface of adjacent bones rather than being in line with them. Ventrally, the posterior edges may be transverse (Fig. 75 S, T, U) or angled forward (Fig. 75 V); they may meet the median blade in an angular juncture (right or obtuse) or may form a continuous curve with the sides of the blade (Fig. 72 G, H, J). The blade may be broad and subtriangular or narrow with the sides essentially parallel.

(19) Nasals. Nasals have the lateral edges broadly curved or with a distinct angle.

(20) Septomaxilla. The portion anterior to the vomers may taper posteriord from its maximum width just posterior to the naris, or it may be broad with comparatively little taper. A sliver of the septomaxilla may extend anteriad along the lateral margin of the naris, forming a hooklike process; this process is absent in the broad, untapered septomaxillae, in which case the bone is notched anteriorly (Fig. 4, Table 11). I regard hooked and tapered septomaxillae as primitive and broad notched septomaxillae as derived.
(21) **Frontal-parietal suture.** The suture is transverse or V-shaped and sinuous or straight.

(22) **Frontal.** An anterior ventral bladelike process may be present on each side, delimited dorsally by a slitlike opening, the base of which forms the optic foramen. The bladelike process may be fused with the overlying part of the frontal so that the entire blade (or its outline) is still visible, or only vestiges of the blade may remain as small, wedgelike processes on the anteromedial edge of the frontal anterior to the tip of the sphenoid. These vestiges may be present on one side only. Some frontals show no evidence of the bladelike processes. The conditions exhibited by the anterior ventral edge of the frontal are shown in Fig. 5 and their distribution among the species in Table 12. I regard the presence of bladelike processes as primitive and their reduction through the various stages of fusion as derived.

(23) **Optic foramen.** The optic foramen may be slitlike, as described above when the bladelike process of the frontal is unfused, or it may be canalicular when the bladelike process is fused or absent.

(24) **Postorbital process of parietal.** This process is categorized prominent, moderate, or reduced (including absent).

(25) **Temporal ridge of parietal.** The dorsolateral portion of the parietal may bear a ridge demarcating the origin of the temporal muscle, or the ridge may be absent. This is not a wholly ontogenetic feature; it is lacking in most species and present in all specimens examined of one species, and another may show geographic variation.
in this feature.

(26) **Prootic.** The prootic forms the posterior edge of the trigeminal foramen, and two processes of this bone serve to delimit a subsidiary foramen, which may be absent, in a complex fashion. The lappet of the prootic (Fig. 5) has a variable extent antero-ventrally (it may be absent or extremely reduced), the greatest extent occurring when the lappet makes a firm contact with the basisphenoid thereby completely separating the smaller secondary foramen from the main one. The tongue of the prootic is a ventral process projecting anteriorly along the edge of the sphenoid; it is variable in development and may extend far enough forward to contact the parietal, thereby forming a complete ventral border to the major trigeminal foramen. When the lappet is prominent, it may fuse with the tongue with or without contacting the sphenoid, another condition in which two foramina are delimited. The tongue may be extremely reduced (almost absent) and the lappet broad and projecting beyond, a condition I term "blunt." I regard a strong lappet, contacting the sphenoid broadly and isolating isolating two foramina, as primitive; a prominent tongue contacting the parietal is also primitive. The various other conditions of reduction of the lappet and tongue are therefore derived (Fig. 6, Table 13).

(27) **Supraoccipitals.** Supraoccipitals are separate or fused with the exoccipitals, either partially or completely (Figs. 68, 70). When separate they may meet one another in a broad, moderate, or narrow median suture; or they may be excluded from contact by processes of the exoccipitals extending forward to contact the
parietal (Fig. 70, Table 14). Unfused supraocciptals with broad median contact are primitive and the various stages of reduction and fusion with the exocciptals are derived.

(28) Exocciptals. These are either separate (primitive state) or fused with the prootics (derived).

(29) Angular. I categorized the angular as normal (primitive state) or sliverlike (derived) (Fig. 7).

(30) Quadratus. The dorsal process of the quadratus is roughly triangular or hooked, i.e., with a concavity on the anterior edge.

(31) Hypophyses. I categorized the atlantal hypophysis as tablike (short, rounded, and dorsoventrally flattened but at times with a median keel), bladelike (long and laterally compressed), or spinelike (pointed, not compressed). Total hypophyses include those on all vertebrae; there may be as many as six and always on the anteriormost vertebrae.

(32) Hyoid (Fig. 10). The basihyal may be present or absent (terminology follows List, 1966); when present it is Y-shaped or U-shaped with each limb of the Y or U contacting a ceratobranchial on the anterior end. The basihyals are cartilaginous and the ceratobranchials ossified, when they are evident as separate elements (apparent co-ossification of the two occurs). With the basihyal absent, the ceratobranchials may be separate or may be fused at their anterior ends to form a U-shaped or V-shaped structure. A completely ossified Y-shaped structure presumably involves ossification of the basihyal and fusion with the ceratobranchials. The condition in which the basihyal is Y-shaped I regard as primitive. Fig. 10
presents a hypothetical evolutionary sequence for the states of the hyoid, and Table 15 shows the occurrence of the states among the species.

(33) Pelvic girdle. The pelvic girdle may be absent; when present it may exist as a pair of rodlike bony ischia somewhat expanded at the anterior ends (simplest state). Ilia and pubes may be present as separate cartilaginous elements attached to the ischia, a condition I term tripartite, or they may be bony and fused with the ischia (triradiate). A completely ossified condition occurs in which the pubic process is greatly expanded and curved toward the midline; the ilium is prominent but more rodlike; I call this condition hatchet-shaped. A bony L-shaped girdle, in which the pubis is reduced, also occurs; in this state there is a cartilaginous extension of the ilium. Some sexual dimorphism occurs in the pelvic girdles. Males tend to have the more elaborate condition (triradiate, tripartite, hatchet-shaped, or L-shaped), while the females often have small rodlike ischia as the only elements, although males may have this condition also. Caution must therefore be used in assessing the condition of the pelvis, and sufficient specimens examined to assure observing the most elaborate condition. Fig. 9 shows the hypothetical evolutionary sequence of the states, and Table 16 shows the occurrence of the various conditions among the species.
SYSTEMATIC ACCOUNTS

In the following accounts I have designated two undescribed species with the Roman numerals I and II to avoid creating nomenclatural problems with manuscript names.

**Typhlops jamaicensis Shaw**

*Anguis jamaicensis* Shaw, 1802:588. Type-locality: Jamaica.

Type material: unlocated.


*Meditorina nasuta* Gray, 1845:139. Type-locality: Berbice (=Guyana), probably in error. Holotype: BMNH 1946.1.10.45.

Description. (1) Head ovoid, somewhat flattened. (2) Rostral broad in dorsal aspect (RW/RL 0.58-0.81), parallel (mode), oval, or tapered; flared on apex; no labial flare. (3) Preocular angle 70-95°, apex rounded or angled; lower portion contacting only the 3rd of the upper labials. (4) Ocular length about 1/2 height, sinuosity 0.12-0.05. (5) Rostronasal pattern divergent. (6) Postoculars 2 (cycloid or narrow), occasionally 1 or 3. (7) First parietal standard, width spanning 2 scale rows or less. (8) Second parietal present and equal to first, narrower or absent. (9) TL to 445 mm (Table 19). (10) TL/TA: females 37-44, males 27-38. (11) TL/MBD 34-45. (12) Middorsal scales 379-448. (13) Scale rows 22-22, rarely 22-20 (7 percent of the specimens) with reduction occurring far posteriorly (89-97 percent of TL); reduction, when occurring, often incomplete with only 22-21 reduction step taking place. (14)

**Distribution.** Jamaica.

**Geographic variation.** Middorsal counts show an apparent mean decrease from west to east (Fig. 11), but sampling is insufficient to firmly establish this trend. In general sampling is poor in the
southern part of the island, and no trends are evident from the specimens available. All in all, diversification of *T. jamaicensis* appears to be very limited.
Typhlops sulcata Cope

*Typhlops sulcatus* Cope, 1868:128. Type-locality: Navassa Island.
Holotype: USNM 12371.


Description. (1) Head rounded. (2) Rostral moderate in dorsal aspect, (RW/RL 0.48-0.60), oval (mode) to parallel, often somewhat asymmetrical; no apical flare; labial flare category 1. (3) Preocular angle 65-95°, apex angled; lower portion contacting only the 3rd of the upper labials. (4) Ocular length approximately 1/2 height, sinuosity 0.37-0.21. (5) Rostronasal pattern divergent. (6) Strong mode of 1 postocular, but 2 often present (on at least 1 side in 40 percent of the specimens. (7) First parietal expanded and bladelike, spanning more than 2 scale rows. (9) Total length to 319 mm (Table 19). (10) TL/TA: males 36-52, females 40-60. (11) TL/MBD 37-44. (12) Middorsal scales 371-447. (13) Scale rows 20-20, very rarely 20-28 with reduction occurring shortly anterior to vent. (14) Coloration bicolour with dorsal pigmentation pale brown to dark brown; dorsal pigmentation (dark scale centers in less heavily pigmented specimens producing a lineate pattern) fading over a narrow midlateral zone to an unpigmented venter or extending well onto venter but leaving irregular midventral areas of unpigmented scales (transition abrupt or gradual). (15) Rectal caecum present. (16) Hemipenes attenuate. (17) Cranium broad, width across prefrontals 91-100 percent of width across prootics. (18) Premaxilla broad, 47-51 percent of width across prefrontals; not protuberant, slightly convex

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**Distribution.** *Typhlops sulcata* is known from southwestern Hispaniola, including the Tiburon Peninsula of Haiti, west to the Morne Dubois "Peninsula" east of Aquin, the Cul de Sac-Valle de Neiba plain, north along the Golfe de Gonaives to about 10 km SE Montrouis, and the Peninsula de Barahona; the species is also known from Isla Alto Velo, Ile de la Gonâve, Ile Grande Cayemite, and Navassa Island (Fig. 12).

**Geographic variation.** Fig. 13 shows the variation in middorsal counts throughout the range of the species. The Manneville specimens (paratypes topotypes of *T. haitiensis* Richmond), aside from their high average counts, are notable for the darkness and extent of their pigmentation; pigmented scales extend completely across the ventral surface, but irregular median unpigmented patches remain. Although
Although with considerably more fading ventrally, extensive ventral pigmentation occurs in specimens from elsewhere in the range. Occasional specimens from other parts of the range also show the contrasting mode of pigment reduction rather than fading. The preocular angle averages greater in the Manneville specimens than in those of other samples, although the overlap is complete. The Manneville sample thus shows trends in several features, but neither singly nor in conjunction are the trends strong enough to warrant nomenclatural recognition for that population.
Typhlops I

Description. (1) Head rounded. (2) Rostral in dorsal aspect narrow to moderate (RW/RL 0.43-0.60), oval (mode), parallel, or waisted; apex not flared; labial flare category 1. (3) Preocular angle 50-80°, apex rounded, rarely angled or truncate; lower portion contacting only 3rd of upper labials. (4) Ocular length about 2/3 height, sinuosity 0.16-0.07. (5) Rostronasal pattern divergent or calyculate-divergent. (6) Postoculares 2 (cycloid) or 1 (modal condition higher than long). (7) First parietal standard, spanning 2 scale rows or greatly expanded and bladelike (geographically variable). (8) Second parietal spanning 2 scale rows or absent. (9) TL to 326 mm (Table 19). (10) TL/TA: males 22-37, females 26-41. (11) TL/MBD: 23-38. (12) Middorsal scales 237-294. (13) Scale rows 20-18 with reduction occurring at about midbody (44-65 percent of TL). (14) Coloration bicolor with dorsal pigmentation (light to dark brown) fading over a midlateral zone to unpigmented venter, or pigmentation extending onto ventrolateral surface and fading onto venter. (15) Rectal caecum present. (16) Hemipenes expanded, apical region oblique (in completely everted organs). (17) Cranium broad, width across prefrontals 84-94 percent of width across prootics. (18) Premaxilla broad, about 40 percent of width across prefrontals, slightly convex, not protuberant; posteroventral edges transverse, making right-angle juncture with blade; blade narrow. (19) Nasals without lateral angle. (20) Septomaxilla with sliver, anterior portion tapered. (21) Frontal-parietal suture transverse, slightly sinuous. (22) Frontal with unfused anterior ventral bladelike process.
(23) Optic foramen canaliculur. (24) Postorbital process of parietal prominent. (25) Lappet of prootic very prominent, in broad contact with sphenoid and parietal (apparently fused with tongue; tongue not visible); prominent secondary foramen isolated. (27) Supraoccipitals unfused, in broad median contact (ASFS V26847 with left supraoccipital very reduced). (28) Exoccipitals not fused with prootics. (29) Angular not sliverlike. (30) Dorsal process of quadrate of prootics.

(31) Atlantal hypapophysis prominent, bladelike; 5–6 total hypapophyses. (32) Hyoid U-shaped, composed of 2 fused cerato-branchials; basihyal absent. (33) Pelvic moieties absent, composed of 2 small rodlike ischia (females), or prominent and hatchet-shaped with broad pubic process and more slender ilium and ischium.

**Distribution.** Typhlops I is known from the Cul de Sac Plain of Haiti north into the Montagnes de Trou d'Eau (Fond Michelle) and south into the foothills of the La Selle (1 mi. NW Pétionville); also eastern Hispaniola from 1.8 mi. W, 10.2 mi. N Azua east to Higüey and north to Sánchez and Puerto Plata, República Dominicana.

**Geographic variation.** This species is found in two, apparently disjunct, centers of distribution (Fig. 18). The differences between the specimens from these two areas are strong enough that subspecific recognition is warranted. They may be diagnosed as follows:

**Subspecies A.** Rostronasal pattern divergent; first parietal expanded, bladelike; second parietal absent; 1 postocular; middorsal scales fewer (243–282); size large (Table 19).

**Distribution.** Eastern Hispaniola from 1.8 mi. W, thence 10.2 mi. N Azua, east to Higüey and north to Puerto Plata and Sánchez (Fig. 18).

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Subspecies B. Rosotronosal pattern divergent-calyculate; first parietal standard, not expanded; second parietal present, equal to first; 2 postoculars; middorsal scales more numerous (248-294); size smaller (Table 19).

Distribution. The Cul de Sac Plain of Haiti, north into the Montagnes de Trou d'Eau (Fond Michelle) and south into the foothills of the La Selle (1 mi. NW Pétionville).

Remarks. Several of the diagnostic features overlap to some extent but taken together are sufficient to distinguish the two forms. In the one skeleton of Subspecies B (Cul de Sac), the prootic lappet makes less extensive contact with the sphenoid, so there may also skeletal differences.
Typhlops lumbricalis Linnaeus


Description. (1) Head rounded. (2) Rostral broad in dorsal aspect (RW/RL 0.54-0.73), oval or sagittate (rarely parallel); not flared on apex; labial flare category 1. (3) Preocular angle 40-80°, apex round (rarely angulate), lower portion contacting only 3rd of upper labials. (4) Ocular roughly 2/3 as long as high, sinuosity 0.26-0.09. Rostronal pattern divergent. (6) Postoculares 2 (cycloid), rarely 1 or 3. (7) First parietal standard, width spanning 2 scale rows—occasionally narrower, spanning slightly more than 1 scale row. (8) Second parietal variable: equal in size to first, smaller or absent. (9) TL to 257 mm (Table 19). (10) TL/TA 32-48. (11) TL/MBD 22-40. (12) Middorsal scales 224-329. (13) Scale rows 20-18 with reduction occurring at about midbody (45-64 percent of TL). (14) Coloration bicolor with dorsal pigmentation (pale tan to dark brown) fading over a midlateral zone to an unpigmented venter; most specimens with narrow collar of pigment across throat; at least one population with dark pigmentation extending onto ventral surface. (15) Rectal caecum present. (16) Hemipenes expanded but with no well-defined apical region; apical

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apical region in completely everted organs probably oblique. (17) Cranium broad to slightly tapered, width across prefrontals 85-94 percent of width across prootics. (18) Premaxilla broad, its width about 40 percent of width across prefrontals, slightly concave anteriorly, not protuberant; posteroventral edges transverse or angled forward to form slightly obtuse or right angle with blade; blade narrow. (19) Nasals without lateral angle, narrowly bordering narial opening. (20) Septomaxilla with hook, anterior portion tapered. (21) Frontal-parietal suture transverse, slightly sinuous. (22) Frontal with anterior ventral bladelike process. (23) Optic foramen slitlike. (24) Postorbital process of parietal moderate. (25) Parietal with or without temporal ridges. (26) Lappet of prootic fused with long tongue (not quite reaching parietal) isolating small secondary foramen or lappet not reaching short tongue. (27) Supraoccipitals unfused, in broad median contact. (28) Exoccipitals not fused with prootics. (29) Angular not sliverlike. (30) Dorsal process of quadrate low and wedgelike to moderate, not hooked. (31) Atlantal hypapophysis tablike; total hypapophyses 4. (32) Hyoid with separate ceratobranchials or with ceratobranchials fused into U-shaped structure; no basihyals. (33) Pelvis absent or moieties very weakly L-shaped with cartilaginous or tendinous extension to ilial process.

Distribution. Typhlops lumbricalis is known from Cuba, the Isla de Pinos, and the Bahama Islands (Grand Bahama, Water Cay, Great Abaco, South Bimini, Andros, New Providence, Eleuthera, Great and Little Exuma, Pipe Cay, Cat, Long, and Little Ragged I.) (Figs. 14, 15).
Geographic variation. The major trends are seen in middorsal scale counts (Fig. 16). The east-west clinal trend in Cuba is reversed in the Sierra de los Organos series, in which relatively low counts are found. Although the sample is small (9 specimens), the northeastern Cuban specimens (Banes, Oriente Province) are small, comparable to the Bahamian specimens (Table 19). Except for the Sierra de los Organos series, in which pigmentation extends far onto the venter or completely across it, there is no evident geographic variation in coloration. Although occasional specimens are dark, it is difficult to assess their significance because of small sample size. The Sierra de los Organos specimens also have narrower, more nearly parallel rostrals and at least modally straighter anterior edges to the oculars.

Remarks. The name Typhlops cubae, proposed by Bibron in de la Sagra (1838 or 1839) may not have been based on specimens of lumbricalis, since the description mentions 22 scale rows and a preocular contacting the second supralabial. Both of the characters pertain to T. biminiensis Richmond. Additionally, the illustration of T. cubae is peculiar and does not clearly pertain either to lumbricalis or to biminiensis. The Museum National d'Histoire Naturelle specimens now catalogued as the sytypes of cubae are, however, lumbricalis and do not agree with the description of cubae. Since there is some ambiguity about the description, I give precedence to the catalogued sytypes of T. cubae in regarding that name a synonym of T. lumbricalis.

Because my treatment of T. lumbricalis involves an altered concept of the taxon, it becomes necessary to restrict the
type-locality. Of those populations to which the name *lumbricalis* has been applied, only those occurring in the Bahamas have low enough scale counts (Linnaeus gave a ventral count of 237) and reasonable provenance. Therefore I restrict the type-locality to the island of New Providence, which has long been the governmental and economic center of the Bahamas. Considering the time cultural milieu when *lumbricalis* was described, New Providence has a higher probability as a source the type than do other areas where low-count populations of 20-18 row *Typhlops* occur (northeastern Cuba, Parts of Hispaniola).

The dichotomies in the osteological portion of the description are the result of differences between Cuban and Bahamian specimens examined. In Cuban specimens the posteroventral edges of the premaxilla are transverse (angled forward slightly in the Bahamian specimens), the blade broader; the parietals have temporal ridges (absent in Bahamian specimens); the lappet of the prootic is fused with the tongue in Cuban specimens (unfused in Bahamian specimens); the tongue of the prootic is longer in Cuban specimens; the ceratobranchials of one Cuban specimen (the only one for which they are available) are joined and U-shaped (separate in Bahamian specimens). Whether these differences are uniform enough to be of taxonomic significance remains to be determined. Resolution of the problem will necessitate skeletal material of the species from northeastern Cuba. The available specimens from that area (Banes) are small, have scale counts similar to the Bahamian material, and some qualitative and nonabsolute features of head scalation seem to ally them with the Bahamian specimens.
Typhlops II

**Description.** Head rounded. (2) Rostral narrow in dorsal aspect (RW/RL 0.42-0.55), parallel, waisted to oval; not flared on apex; labial flare category 1. (3) Preocular angle 50-50°, apex truncate (mode) or rounded; lower portion contacting only 3rd of upper labials. (4) Ocular length approximately 2/3 height, simuosity 0.17-0.05. (5) Rostronal pattern parallel to very slightly divergent. (6) Postoculars 2 (cycloid), 1 or 3 as variant conditions. (7) First parietal standard, width spanning 2 scale rows. (8) Second parietal present and equal in size to first or absent. (9) TL to 192 mm (Table 19). (10) TL/TA: males 21-23, females 26-34. (11) TL/MBD 25-30. (12) Middorsal scales 231-256. (13) Scale rows 20-18 with reduction taking place at about midbody (61-68 percent of TL). (14) Coloration bicolor with dorsal pigmentation (gray-brown to tan) fading over a midlateral zone to an unpigmented venter. (15) Rectal caecum present. (16) Hemipenes expanded, no apparent apical region; hemipenial shape in fully everted condition probably with oblique apical region. (17) Cranium broad, width across prefrontals 88 percent of width across prootic. (18) Premaxilla moderate in width (33 percent of width across prefrontals), slightly concave anteriorly and slightly protuberant; posteroventral edges transverse, forming slightly greater than right-angle juncture with blade; blade broad, subtriangular. (19) Nasals without lateral angle, narrowly bordering narial opening. (20) Septomaxilla with sliver, anterior portion tapered. (21) Frontal-parietal suture forming shallow V. (22) Frontal with broad, wedge-shaped, anterior ventral bladelike process partly fused with overlying portion of frontal. (23) Optic foramen

**Distribution.** *Typhlops II* is known only from a limited region of the southern slopes of the La Selle–Baoruco massif between Colombier, Dépt. de l'Ouest, Haiti, east to the vicinity of Mencia, Pedernales Province, República Dominicana (Fig. 18).

**Remarks.** This forms shows some resemblances to both *T. hectus* or hectus-like individuals from the northern slopes of the massif (see *T. hectus* account beyond) and to *Typhlops I*, as follows:

**Similarities to Typhlops hectus**

- condition of prootic lappet
- fused bladelike process of frontal
- narrow parallel rostrals
- parallel rostonasal configuration (the last two items are similar to the peculiar north slope individuals)

**Similarities to Typhlops I**

- broad cranium
- scale row reduction level
number of middorsal scales

The L-shaped pelvic moieties are more like those of the one large male *T. lumbricalis* examined, in which the girdle elements are rod-shaped with a slight mid-region bend. The affinities of this population of snakes are not clear beyond their obvious association with the *Typhlops lumbricalis*-I-hectus assemblage.
Typhlops hec tus Thomas

Typhlops hec tus Thomas, 1974a:12. Type-locality: Martineau, ca. 9 km W Jérémie, Dépt. du Sud, Haiti. Holotype: MCZ 81149.

Description. (1) Head tapered. (2) Rostral narrow in dorsal aspect (RW/RL 0.44-0.57), clavate (mode) to parallel; not flared on apex; labial flare category 1. (3) Preocular angle 40-60°, apex angled to rounded; lower portion contacting only 3rd of upper labials. (4) Ocular length approximately 2/3 height, sinuosity 0.23-0.10. (5) Rostronasal pattern calyculate to parallel. (6) Postoculars 2 (cycloid), aberrantly 1 or 3. (7) First parietal standard, spanning 2 scale rows—occasionally narrower, spanning slightly more than 1 scale row. (8) Second parietal present and equal in size to first or absent. (9) TL to 237 mm (Table 19). (10) TL/TA: males 23-30, females 28-43. (11) TL/MBD: 26-37. (12) Middorsal scales 284-324. (13) Scale rows 20-20 or 20-18 with reduction in some populations occurring far posteriorly (69-93 percent of TL); far posterior reduction often incomplete with only initial step of major reduction occurring; reduction in other populations occurring at about midbody or beyond (43-78 percent of TL). (14) Coloration bicolor with dorsal pigmentation (pale tan to dark brown) fading over a narrow midlateral zone to an unpigmented venter; collar sometimes present. (15) Rectal caecum present. (16) No everted hemipenes available; in situ organs moderate in size, probably expanded; males few (6 of 84 specimens). (17) Cranium tapered; width across prefrontals 84-85 percent of width across prootics. (18) Premaxilla narrow, about 35 percent of width across prefrontals, concave
anteriorly, not protuberant; posteroventral edges transverse, forming right angle juncture with blade; blade narrow. (19) Nasals without lateral angle, narrowly bordering narial opening or excluded from it by prefrontals contacting premaxilla. (20) Septomaxilla without sliver; anterior portion broad. (21) Frontal-parietal suture transverse, slightly sinuous. (22) Frontal with bladelike anterior ventral process, process fused distally. (23) Optic foramen canalicular. (24) Postorbital process of parietal moderate. (25) Parietal without temporal ridges. (26) Lappet of prootic vestigial, nearly absent, tongue not contacting parietal; or lappet moderately developed and slender, overlapping tongue and tongue in broad contact with parietal. (27) Supraoccipitals separate, in moderate median contact. (28) Exoccipitals not fused with prootics. (29) Angular not sliverlike. (30) Dorsal process of quadrate hooked anteriorly. (31) Atlantal hypapophysis tablike with keel; total hypapophyses 5. (32) Hyoid U-shaped with ceratobranchials fused to one another anteriorly, no basihyal. (33) Pelvis of small rodlike ischia or absent.

**Distribution.** *Typhlops hectus* is known from southwestern Hispaniola, including the Tiburon Peninsula and excluding the lowland areas of the Barahona Peninsula, north to the region of Mirebalais and Lascahobas in Haiti and the northern Valle de San Juan (Río Arriba del Norte and 4 km N Sabaneta). No records exist for the Cul de Sac Plain of Haiti, but specimens are known from Duvergé, La Descubierta, and El Iguito (3.1 km NE Fondo Negro) in the Valle de Neiba of the República Dominicana. The species is also known from Ile Grande Cayemite. Altitudinal distribution is from sea level.
to 2630 feet (7 km W Vallejuelo, República Dominicana).

Geographic variation. A few additional specimens have been taken since the description of *T. hectus*; to no significant extent do these new specimens alter the previously known range or the variational picture presented by Thomas (1974a). Although a small preocular angle, clavate rostral and calyculate rostronasal pattern are characteristic of the species, there is some geographic variation in these features. The preocular in the North Island and eastern South Island (including the Valle de Neiba from La Descubierta and Duvergé to localities farther east) has a round apex and greater curvature to the upper and lower edges, in contrast to the modally more acuminate, more straight-edged preoculars of the Tiburon Peninsula specimens (68 percent versus 32 percent with rounded to truncate apices). The reduction level is farther anterior in these more eastern and northern specimens (48-78 percent of TL versus 69 percent to no reduction in the southern and western specimens). North Island and eastern South Island *T. hectus* are dark brown, whereas those from the Tiburon Peninsula are paler and often have a collar of pigment across the throat. The dichotomy in development of the prootic lappet noted in the description (above) is the difference between North Island (SW Lascahobas) and South Island (Tiburon Peninsula). There are probably taxonomically distinct populations within what is now called *T. hectus*, but evidence is presently insufficient to indicate to what extent differentiation has occurred.

Specimens from the Trouin Valley (1.5 mi. S Trouin), 7-9.6 km W Pétionville, and the foothills south of the western Valle de Neiba
(15 km W Puerto Escondido, 6 km SW El Limón; Fig. 18) have some peculiar features: broad heads (and crania), narrow rostrals (parallel to waisted or oval), parallel to slightly divergent rostronal patterns, and apically truncate preoculars. In head scale features these specimens somewhat resemble Typhlops I, but they have the typically hecutus middorsal counts, reduction characteristics, and larger size. The populations represented by these individuals remain to be adequately evaluated.

Thomas (1974a:17) noted the existence of divided preoculars unilaterally or preoculars with partial divisions or grooves in three specimens of T. hecutus from the North Island and the two specimens from Duvergé in the Valle de Neiba. Although these specimens are extreme, it is characteristic of hecutus that the preoculars have a strong eye-level indentation (Figs. 45-46); at times, even in the Tiburon Peninsula specimens, this indentation is distinct enough to almost form a groove. Initially I thought that perhaps these aberrant specimens were hybrids between hecutus and pusilla (the only Antillean species of Typhlops characterized by divided preoculars), which hecutus resembles in the calyculate rostronal condition. This explanation may yet turn out to be true; however, there is another consideration: Of 84 specimens of T. hecutus that I have sexed, only six are males. There is therefore the possibility that some or all populations of hecutus parthenogenetic. If this be so, the possibility also exists that hecutus is itself derived from a hybrid population (Typhlops I and T. pusilla would be the most likely parental species). However, the evidence available at this time is too scanty for more than speculation.
Typhlops pusilla Barbour


Description. (1) Head rounded. (2) Rostral narrow in dorsal aspect (RW/RL 0.48-0.56), clavate (mode), parallel, or oval; apex not flared; labial flare category 2. (3) Preocular divided; lower portion contacting only 3rd of upper labials. (4) Ocular length about 1/2 height, sinuosity 0.35-0.12. (6) Postoculars 2 (cycloid), rarely 3 or 1. (7) First parietal standard, spanning 2 scale rows or slightly less. (8) Second parietal present and equal to first parietal, narrower, or absent. (9) TL to 226 mm (Table 19). (10) TL/TA: males 23-27, females 32-39. (11) TL/MED 27-37. (12) Middorsal scales 245-332. (13) Scale rows 22-22, 22-20-28 (rarely), or 20-18 with reduction (22-20 or 20-18) occurring at about midbody. (14) Coloration bicolor with dorsal pigmentation (pale brown to dark brown) fading to unpigmented venter over a narrow midlateral zone to completely pigmented with light areas around mouth and vent; intermediate conditions with unpigmented midventral zones of variable extent. (15) Rectal caecum absent. (16) Hemipenes expanded, apical region oblique. (17) Cranium tapered, width across prefrontals 80-88 percent of width across prootics. (18) Premaxilla narrow, about 30 percent of width across prefrontals, concave anteriorly, not protuberant; posterovenral edges angled forward, forming angular junction with narrow blade. (19) Nasals with lateral angle, narrowly bordering narial opening. (20) Septomaxilla without hook, anterior portion broad. (21) Frontal-parietal suture transverse, sinuous to nearly straight. (22) Frontal with anterior
ventral wedgelike process distinct to nearly absent; no bladelike process. (23) Optic foramen canalicular. (24) Postorbital process of parietal without temporal ridges. (26) Lappet of prootic small, not small, not reaching, overlapping or fusing with tongue. (27) Supraoccipitals separate, in very broad contact medially. (28) Exoccipitals not fused with prootics. (29) Angular not silverlike. (30) Dorsal process of quadrate hooked. (31) Atlantal hypapophysis tablike to bladelike; total hypapophyses 4–5. (32) Hyoid with ceratobranchials fused anteriorly into V-shaped structure; no basihyal. (33) Pelvis in males well developed, hatchet-shaped; females with rodlike ischia only.

**Distribution.** *Typhlops pusilla* occurs throughout Hispaniola (Figs. 21, 22), except for the Península de Barahona lowlands and is known only from as far west as 0.6 km W Aquin on the Tiburon Peninsula, but its occurrence on Ile Grande Cayemite suggests that it is more widespread on the peninsula. The species also occurs on Ile de la Gonâve, Ile de la Tortue, Isla Catalina, and Isla Saona. Altitudinal distribution is from sea level to about 2400 feet (15 km S Loma de Cabrera, Dajabón Province, República Dominicana).

**Geographic variation.** Over much of the North Island, the populations fall into a high-count category of middorsal scales in which the means of samples occur over an approximate range of 280–300, with the samples from the extreme eastern part of the island (including Isla Saona and Isla Catalina) being the highest (Fig. 22). The South Island samples, including those from Ile Grande Cayemite and Ile de la Gonâve, have low counts (means below 270). Samples from the Cul de Sac Plain, parts of the Valle de Neiba, and the

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eastern South Island (vicinity of Barahona) are intermediate between the high and low count samples. The specimens from the localities near Fondo Negro and El Iguito (Barahona Province in the eastern Valle de Neiba) have, however, decidedly high counts, indicating an abrupt transition over a distance of about 20 km to the intermediate count population at Laguna Rincon. The specimens from Pierre Payen along the northern coast of the Golfe de Gonaives is in the low range of the high-count category, showing some influence of the low- and intermediate-count populations to the south. The two Ile de la Gonâve samples, although both having low counts, are markedly different from one another (Fig. 22). Although the sample is small, the Presqu'ile de Baradères population appears to differ significantly from the population on adjacent Ile Grande Cayemite, represented by a large sample (Fig. 22).

Most populations of *T. pusilla* have 20 scale rows anteriorly with reduction to 18 rows taking place at about midbody. However, the populations in the eastern part of the island, east of a somewhat sinuous north-south line through Santiago, La Vega, and Peravia provinces (Fig. 23), have 22 scale rows anteriorly with reduction taking place at about midbody. The line curves eastward curves eastward, as the specimens from the coastal plain of the eastern part of the island have a 20-18 row reduction formula. The samples from the extreme northwestern part of the island at Môle St. Nicolas and Bombardopolis also have the 22-20 scale row pattern. Otherwise, 22 scale rows occur only rarely and for a very short distance in the neck region, usually not extending more than 10-14 scales posterior to the mental. In the 22 row eastern populations the full
complement is not present initially, but the two additional rows are added in the neck region.

In coloration the majority of the populations are bicolor with the number of pigmented scale rows varying from 9-17. In the east, partly congruent with the 22 row populations, the snakes are more extensively pigmented., with pigmentation often being complete, although irregular unpigmented midventral areas may occur. In these snakes the areas around the mouth and vent are often unpigmented. Some individuals, particularly some from the Península de Samaná, appear bicolored; but close examination shows that the scales are extensively pigmented onto the ventral surface with the pigmentation merely becoming very faint ventrally but not being lost entirely. At the extreme eastern part of the island (including Islas Saona and Catalina) the snakes are truly bicolored—although pallid—and have low numbers of pigmented scale rows.
Typhlops syntherus Thomas


Description. (1) Head tapered, weakly ogival. (2) Rostral narrow in dorsal aspect (RH/RL 0.39-0.47), oval, rarely parallel or clavate; not flared on apex; labial flare category 3. (3) Precocular angle 20-40°, apex rounded (mode), acute, or truncate; lower portion contacting only 3rd of the upper labials. (4) Ocular length modally less than 1/2 height, sinuosity 0.25-0.10. (5) Rostronasal pattern calyculate. (6) One cycloid postocular, rarely 2. (7) First parietal expanded, bladelike, width spanning 3 scale rows (rarely standard with width spanning 2 scale rows). (8) Second parietal spanning 2 scale rows (rarely absent). (9) TL to 209 mm (Table 19). (10) TL/TA: females 27-51, males 29-50. (11) TL/MBD 25-36. (12) Middorsal scales 299-353. (13) Scale rows 22-22. (14) Coloration extensive, dorsal pigmentation (medium to light brown or pale tan, often with lighter mottling) fading gradually on the venter but extending entirely across venter in places; melanophore distribution on individual scales uneven, adding to mottled effect. (15) Rectal caecum present. (16) Hemipenes expanded with flat apex and sulcus spermaticus on raised ridge (but not dividing to follow circumference of apical area. (17) Cranium tapered, width across prefrontals 85-90 percent of width across prootics. (18) Premaxilla narrow (36-38 percent of width across prefrontals), protuberant, slightly concave anteriorly; posteroventral edges angled forward, joining blade in obtuse angle; blade narrow. (19) Nasals with lateral angle, excluded or nearly excluded from narial opening by

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contact or close approach of prefrontals and premaxilla. (20)
Septomaxilla without hook; anterior portion broad. (21) Frontal-
parietal suture V-shaped, simous. (22) Frontal with small wedgelike
anterior ventral process, no blade. (23) Optic foramen canalicular.
(24) Postorbital process of parietal prominent. (25) Parietal without
temporal ridges. (26) Lappet of prootic prominent, overlapping short
tongue; tongue not extending to parietal. (27) Supraoccipitals
small, unfused or partly fused to exoccipitals, not in contact with
one another or only in narrow contact. (28) Exoccipitals not fused
with prootics. (29) Angular sliverlike. (30) Dorsal process of
quadrate slightly hooked anteriorly. (31) Atlantal hypapophysis
tablile with weak keel; total hypapophyses 6. (32) Hyoid with
Y-shaped basihyal and rodlike ceratobranchials. (33) Pelvic
moieties weakly triradiate with cartilaginous hypoischial and
prepubic extensions.

Distribution. *Typhlops syntherus* is known only from the xeric
lowlands of the Península de Barahona in Hispaniola; the northernmost
localities are 8 km N Pedernales and 17 km NW Oviedo (Fig. 24).

Geographic variation. Comparison of the samples from the
eastern and western parts of the Península de Barahona shows
significant differences in middorsal counts, although the ranges
overlap broadly (Fig. 25).
Typhlops capitulata Richmond


Typhlops gonavensis Richmond, 1964:3. Type-locality: Pointe à Raquettes on the south shore of Ile de la Gonâve, Haiti. Holotype: YPM 3003.

Description. (1) Head tapered, snout rounded to weakly pointed and somewhat flattened. (2) Rostral broad in dorsal aspect (RW/RL 0.43-0.63), clavate (strong mode) to oval; not flared on apex; labial flare category 1. (3) Preocular angle 30-50°, apex round to angulate; lower portion contacting only the 3rd of the upper labials. (4) Ocular length about 3/4 height, simuosity 0.30-0.13. (5) Rostronasal pattern calyculate to weakly divergent. (6) Postoculars 2 (cycloid), rarely 1. (7) First parietal standard, width spanning 2 scale rows. (8) Second parietal standard, width spanning 2 scale rows, or occasionally absent. (9) TL to 267 mm (Table 19). (10) TL/TA: Gonâve sample, males 38-54, females 50-88; others 29-46. (11) TL/MBD 46-57. (12) Middorsal scales 358-457. (13) Scale rows 20-20. (14) Coloration unicolor brown (pale to dark reddish brown) or with irregular midventral unpigmented areas, fading slightly on venter and distinctly paler on head; unpigmented areas around mouth and vent. (15) Rectal caecum present but small. (16) Hemipenes expanded (none completely everted). (17) Cranium pronouncedly tapered, width across prefrontals 77-87 percent of width across prootic. (18) Premaxilla narrow (about 30 percent of width across prefrontals), not protuberant, inset between nasals in
a shallow V; posteroventral edges angled forward, meeting blade in angular junction; blade narrow. (19) Nasals elongate with no lateral angles, border narial opening. (20) Septomaxilla without sliver; anterior portion not tapered. (21) Frontal–parietal suture V-shaped, simuous. (22) Frontal without anterior ventral bladelike process or wedgelike process. (23) Optic foramen canalicular. (24) Postorbital process of parietal very reduced or absent. (25) Parietal without temporal ridges. (26) Lappet of prootic blunt, extending beyond very short tongue; tongue not extending to parietal. (27) Supraoccipitals fused with exoccipitals. (28) Exoccipitals fused with prootics. (29) Angular not sliverlike. (30) Dorsal process of quadrate with pronounced hook. (31) Atlantal hypapophysis tablike (fused with axial hypapophysis in one of four specimens); total hypapophyses 4 or 5. (32) Hyoid with Y-shaped basihyal having short entoglossal process; ceratobranchials long. (33) Pelvis absent or extremely reduced to small bones of indeterminate homology (from X-ray).

**Distribution.** *Typhlops capitulata* is known from the type-locality in the Cul de Sac Plain, from the vicinity of Pétionville, and west along the Tiburon Peninsula to the Miragoâne area (below Paillant). On the southern coast the species is known from between 3.6 mi. E to 5.1 mi. SW Jacmel. The species also occurs on Ile de la Gonâve.

**Geographic variation.** When the samples from the Cul de Sac Plain and Pétionville areas are compared with those of Gonâve, the scale count differences noted by Richmond (1964) for *T. capitulata* versus *T. gonavensis* hold up well, although with the increased sample
sized now available there is some overlap (Fig. 26). However, both
the Paillant specimen and the series from the vicinity of Jacmel have
high counts and agree better with the Gonâve sample. There are at
least modal differences in other features between the Gonâve and
Pétionville area samples:

1. The Pétionville snakes are larger (Table 19).
2. The range in TL/TA for the Gonâve sample is 38-88,
   for the Pétionville sample 29-40.
3. The rostral averages narrower in the Gonâve sample.
4. The preocular is more acuminate on the average in
   the Gonâve sample.
5. The calyculate rostronasal pattern is more
   pronouncedly developed in the Pétionville sample
   (i.e., the lateral edges of the postnasals are
   more bowed; see Fig. 27).
6. The Gonâve snakes are more darkly colored.

The Paillant specimen is closer to the Gonâve snakes in most of these
features, except coloration. The Jacmel samples seems intermediate
in some of the head scale features between the Gonâve and Pétionville
snakes (also in size); and, as mentioned above, it has the high
middorsal counts of the Gonâve specimens. Presently it seems
inadvisable to recognize more than one taxon for this assemblage of
snakes.
Typhlops rostellata Stejneger


Description. (1) Head rounded. (2) Rostral narrow in dorsal aspect (RW/RL 0.42-0.52), clavate to parallel (rarely oval or waisted); not flared on apex; labial flare category 0-1. (3) Preocular angle 30-40°, apex rounded; lower portion contacting only 3rd of upper labials. (4) Ocular length about 2/3 height, sinuosity 0.29-0.16. (5) Rostronasal pattern calyculate. (6) Postoculars 2 (cycloid), rarely 1. (7) First parietal standard, spanning 2 scale rows. (8) Second parietal absent (rarely present). (9) TL to 222 mm (Table 19). (10) TL/TA 33-52. (11) TL/MBD 32-52. (12) Middorsal scales 314-358. (13) Scale rows 20-18 with reduction occurring at about midbody or slightly beyond (53-62 percent of TL). (14) Coloration uniformly dark brown, fading slightly ventrad; light (unpigmented) areas around mouth, snout, and vent plus underside of tail. (15) Rectal caecum present. (16) Hemipenes expanded, apical disklike area oblique; sulcus spermaticus raised, progressing to apex along one side of disk (Fig. 3K). (17) Cranium tapered, width across prefrontals 81-82 percent of width across prootics. (18) Premaxilla narrow (about 28 percent of width across prefrontals), slightly concave anteriorly, not protuberant; posteroventral edges angled forward and in continuous juncture with sides of narrow blade. (19) Nasals without lateral angle; nasals forming part of narial margin. (20) Septomaxilla without sliver, broad anteriorly. (21) Frontal-parietal suture transverse, slightly sinuous. (22)

**Distribution.** *Typhlops rostellata* occurs on Puerto Rico, where it is widespread but generally restricted to relatively mesic situations. The species is apparently absent from much of the southern part of the island, although it extends into the Reserva Forestal de Susúa (Fig. 28).

**Geographic variation.** *T. rostellata* is too poorly sampled for a clear assessment of variation. Some trends in middorsal counts exist (Fig. 29); specimens from the western part of the island average lower than those from the east, with extreme low counts occurring in the two specimens from the extreme southwest (Río Loco). This last area is also a habitat extreme for the species, being an area where semi-xeric woods interdigitate with scrub.
Typhlops richardi Duméril and Bibron


Typhlops platycephaeus Duméril and Bibron, 1844:293. Type-locality: Martinique (in error); corrected to Puerto Rico by Stejneger, 1904:687. Holotype: MNHN 1066.


Description. (1) Head rounded to ogival and flattened. (2) Rostral narrow to broad in dorsal aspect (RW/RL 0.38-0.60), oval, parallel, or tapered; flared or not flared on apex; labial flare category 0-1. (3) Preocular angle 60-80°, apex angled or rounded; lower portion contacting only 3rd of upper labials. (4) Ocular length roughly 1/2 to 2/3 height, sinuosity 0.18-0.05. (5) Rostronasal pattern divergent. (6) Postoculares 2 (cycloid), rarely 1. (7) First parietal standard; width spanning 2 scale rows, occasionally narrower. (8) Second parietal present and equal to first or absent. (9) TL to 342 mm (Table 19). (10) TL/TA 30-48. (11) TL/MBD 29-49. (12) Middorsal scales 312-425. (13) Scale rows 22-20, 22-20-18, or 20-18 with reduction occurring at variable distances along the body in different populations (Fig. 35). (14) Coloration bicolor with dorsal pigmentation (pale tan to dark brown) ending abruptly along a midlateral line, the pigmented scales
dropping out over 1-2 scale rows or fading along a midlateral zone; some populations and individuals much lightened and mottled, with areas of no pigmentation on dorsa; many specimens with light band across tail. (15) Rectal caecum present. (16) Hemipenes attenuate. (17) Cranium broad, width across prefrontals 90-95 percent of width across prootics. (18) Premaxilla broad, about 44-48 percent of width across prefrontals, slightly convex anteriorly, not protuberant; posteroventral edges transverse or angled slightly forward, making continuous or angular juncture with blade; blade moderate to broad. (19) Nasals without lateral angles, narrowly bordering narial openings. (20) Septomaxilla with hook, anterior portion tapered. (21) Frontal-parietal suture transverse, straight. (22) Frontal without anterior ventral bladelike process (sometimes with line of fusion evident), with or without wedgelike process. (23) Optic foramen canalicular. (24) Postorbital process of parietal moderate. (25) Parietal without temporal ridges. (26) Lappet of prootic absent, present and overlapping tongue, or fused with tongue (and secondary foramen isolated); tongue long and abutting firmly on parietal. (27) Supraoccipitals unfused, in broad median contact. (28) Exoccipitals not fused with prootics. (29) Angular not sliverlike. (30) Dorsal process of quadrate not hooked. (31) Atlantal hypapophysis tablike, keeled; total hypapophyses 5-6. (32) Hyoid with Y-shaped basihyal and rodlike ceratobranchials. (33) Pelvic moieties tripartite; hypoischial cartilages present.

**Distribution.** *Typhlops richardi* is known from a number of islands in the Puerto Rico region (Figs. 31-33): Puerto Rico, Isla Caja de Muertos, Cayo Palominitos, Cayo Diablo, Isla Vieques (and

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Cayo de Tierra), Isla Culebra, St. Thomas, Prickly Pear I., St. John, Tortola, St. Croix, Beef I., Virgin Gorda, and Anegada. The species is also known from North Caicos in the Caicos Islands and Pear Cay, Turks Islands.

**Geographic variation.** Figs. 34, 35, and Table 19 show the variation in middorsal scales, scale row reduction, and size among the populations of *T. richardi*. Thomas (1966a) noted differences between *richardi* and *platycephalus* in amount of labial and apical flare of the rostral; additionally there are subtle, non-absolute differences in the preocular shape and head shape. The head shape differences (flatter and more ogival in *platycephalus*, more rounded in *richardi*) initially suggested that there might be two species involved, one (*platycephalus*) confined to Puerto Rico and its close offshore islands and another (*richardi*) occurring both on Puerto Rico and the eastern islands of the bank. On Puerto Rico proper there is variation in head shape, apical flare of the rostral, and preocular shape, so that one encounters *richardi*-like individuals. Intermediates exist, however, and the meristic features of the proximal Virgin Islands (St. John, St. Thomas, Tortola, St. Croix and associated islets) populations are not shared by these individuals. Thus there appears to be no evidence from sympatry for the existence of two *richardi*-like species in the Puerto Rico area.

The Virgin Gorda and Anegada populations, to which I have given the names *T. r. naugus* and *T. r. catapontus* are definable on combinations of characters (labial flare, coloration, size).
However, the reduction features distinguishing these outer Virgin Islands populations have since been blunted by the discovery of overlapping variation (far anterior 22–20 scale row reduction) in the populations of southwestern Puerto Rico (Fig. 34). The proximal Virgin Islands populations (St. Thomas, St. John, Tortola, St. Croix) are not sufficiently distinguishable from Puerto Rican populations for continued taxonomic recognition. Variation in this species throughout the Puerto Rico region is either clinal or such that the various populations show considerable overlap; I do not thing that recognition of subspecies is warranted.

Thomas (1966a) observed that the Virgin Gorda and Anegada T. richardi resembled in several respects Puerto Rican richardi more than the snakes from the intermediately positioned "proximal" Virgin Islands. This point bears reiteration and elaboration; this end-of-bank similarity is found in the following features:

1. Labial flare of rostral: weak to absent in Anegada specimens and in those from Puerto Rico, moderate to prominent in intermediate populations.

2. High middorsal counts: counts for the Anegada–Virgin Gorda specimens are not as high as for the Puerto Rican material but are distinctly higher than the counts for the other Virgin Islands samples.

3. Far anterior reduction from 22 to 20 scale rows: as noted, the Anegada–Virgin Gorda specimens are most like those from southwestern Puerto Rico.

4. Large size (Table 19): the intermediate Virgin Islands specimens are smaller.
5. Coloration: tail bands or indications of them are found in the Anegada-Virgin Gorda specimens and in Puerto Rican specimens but not in material from the other Virgin Islands.

A similar variational pattern has been observed in the widespread Puerto Rico bank species *Anolis cristatellus* (Gorman, et al., 1969).
**Typhlops monensis** Schmidt


Holotype: HZM 1528.

**Description.** (1) Head ogival, flattened. (2) Rostral width moderate in dorsal aspect (HW/RL 0.46–0.60), parallel; flared on apex; no labial flare. (3) Preocular angle 55–70°, apex rounded; lower portion contacting only the 3rd of upper labials. (4) Ocular length about 1/2 height, sinuosity 0.21–0.07. (5) Rostronasal pattern divergent. (6) Postoculars 2 (cycloid). (7) First parietal standard: width spanning 2 scale rows, or narrower, spanning 1 row. (8) Second parietal present and equal to first or absent. (9) TL to 207 mm (Table 19). (10) TL/TA 39–58. (11) TL/MED 34–39. (12) Middorsal scales 302–345. (13) Scale rows 20–18 with reduction occurring at about midbody (37–58 percent of TL). (14) Coloration bicolor with dorsal pigmentation (medium to light brown) fading over midlateral zone to unpigmented venter; pattern finely lineate as a result of dark centers to scales. (15) Rectal caecum present. (16) Hemipenes attenuate. (17) Cranium slightly tapered, width across prefrontals 85 percent of width across prootics. (18) Premaxilla broad (about 40 percent of width across prefrontals), slightly protuberant and convex anteriorly; posteroventral edges transverse and in continuous juncture with sides of broad subtriangular blade. (19) Nasals without lateral angle, narrowly bordering naris. (20) Septomaxilla with hook, anterior portion tapered. (21) Frontal-parietal suture transverse, straight. (22) Frontal with small anterior ventral protuberance (=vestige of wedgelike process). (23) Optic foramen canalicular.

**Distribution.** Isla Mona (Fig. 31).

**Remarks.** This form is unquestionably allied with Puerto Rican T. richardi: a) its ogival, flattened head shape represents the condition found in many Puerto Rican richardi carried to a greater extreme, b) its apically flared rostral shape with no labial flare is very similar to that of Puerto Rican richardi, as is c) its subtriangular premaxilllary blade meeting the posteroventral edges of the premaxilla in a continuous curvature, and d) its attenuate hemipenes. The 20-18 scale row formula, used by Schmidt (1926) along with its low middorsal counts as evidence of its relationship with T. lumbricalis, can be seen as the culmination of the trend found in southwestern Puerto Rican richardi toward anterior progression of the zone of 22-20 scale row reduction.
Typhlops granti Ruthven and Gaige

Typhlops granti Ruthven and Gaige, 1935:2. Type-locality: Isla Caja de Muertos, 8 mi. off Ponce, Puerto Rico.

Description. (1) Head truncate. (2) Rostral broad in dorsal aspect (HW/RL 0.66–0.84), oval to parallel; not flared on apex; no labial flare. (3) Preocular angle 100–115°; lower portion contacting only the 3rd of the upper labials. (4) Ocular length about 2/3 height, sinuosity 0.17–0.00 (or reversed sinuosity). (5) Rostro-nasal pattern divergent. (6) Postoculares 2 (cycloid). (7) First parietal narrow, spanning 1 to less than 2 scale rows. (8) Second parietal absent, scales following first parietal grading to size of one scale row. (9) TL to 210 mm (Table 19). (10) TL/TA 43–55. (11) TL/MMD 54–60. (12) Middorsal scales 370 (ca.) to 421. (13) Scale rows 18–16, reduction occurring at about midbody or more anteriorly (33–61 percent of TL). (14) Coloration bicolor with dorsal pigmentation (very pale brown) occupying about the 7 dorsalmost scale rows, most pigmented scales fading and pigmentation dropping out on the next most ventral 1 or 2 rows. (15) Rectal caecum present. (16) Hemipenes attenuate. (17) Cranium broad, width across prefrontals about 89 percent of width across prootics. (18) Premaxilla broad (about 50 percent of width across prefrontals), slightly concave anteriorly, not protuberant; posterodorsal edges transverse, meeting blade in right-angle junction; blade moderate in size with constricted base. (19) Nasals slightly angled; prefrontals excluding nasals from narial margins. (20) Septomaxilla with hook, anterior portion tapered.
(21) Frontal-parietal suture transverse, slightly sinuous. (22) Frontal without anterior ventral bladelike process; with wedgelike process and lines of fusion. (23) Optic foramen canalicular. (24) Postorbital process of parietal reduced. (25) Parietal without temporal ridges. (26) Lappet of prootic fused with long tongue (tongue not reaching parietal); minute secondary foramen isolated. (27) Supraoccipitals narrow, somewhat arcuate (Fig. 68), partly fused with exoccipitals and in narrow (almost apical) contact with one another. (28) Exoccipitals not fused with prootics. (29) Angular not sliverlike. (30) Dorsal process of quadrate slightly hooked. (31) Atlantal hypapophysis tablike, keeled; total hypapophyses 4. (32) Hyoid with separate ceratobranchials, no basihyal. (33) Pelvic moieties triradiate; hypoischia present.

**Distribution.** *Typhlops granti* is known from the xeric southwestern part of Puerto Rico, from Parguera eastward to the vicinity of Guánica (Fig. 28). The species also occurs on Isla Caja de Muertos off the south-central coast of Puerto Rico.

**Geographic variation.** The mainland specimens have higher middorsal counts than those from Caja de Muertos (Fig. 30); however, the latter specimens are in such poor condition that counts may well not be accurate. The difference is probably real, but assessment of its magnitude must await more specimens. The preocular angle of the mainland specimens also appears to be greater, but the small size and relatively non-angulate preoculars of this species makes accurate measurement difficult.
**Typhlops monastus** Thomas


**Description.** (1) Head rounded. (2) Rostral moderate to broad in dorsal aspect (RW/RL 0.42–0.68), oval; not flared on apex; labial flare category 1–2. (3) Preocular angle 55–80°, apex rounded; lower portion contacting only 3rd of the upper labials. (4) Ocular length between 1/2 and 2/3 height, simousity 0.17–0.09. (5) Rostronasal pattern divergent. (6) Postoculars 2 (cycloid). (7) First parietal standard, width spanning 2 scale rows (or less, spanning slightly more than 1 row). (8) Second parietal equal to first, narrower, or absent. (9) TL to 258 mm (Table 19). (10) TL/TA 29–44. (11) TL/MBD 37–46. (12) Middorsal scales 329–394. (13) Scale rows 22–20 or 22–22 (2 of 65 Montserrat specimens) with reduction occurring at about midbody or beyond (51–79 percent of TL). (14) Coloration bicolor with pigmentation (medium brown) fading laterally but also dropping out abruptly along a midlateral zone; darker centers of scales often producing a lineate effect. (15) Rectal caecum present. (16) Hemipenes expanded, no well-defined apical disk (Fig. 3). (17) Cranium broad, width across prefrontals 89 percent of width across prootics. (18) Premaxilla broad (about 40 percent of width across prefrontals), slightly concave anteriorly, not protuberant; posterolateral edges angled forward, joining broad subtriangular blade in continuous curvature. (19) Nasals without lateral angle, narrowly bordering narial opening. (20) Septomaxilla with hook, anterior portion tapered. (21) Frontal-parietal suture

**Distribution.** *Typhlops monastus* is known from Montserrat, Barbuda, Antigua (including Great Bird Island), St. Christopher, and Nevis.

**Geographic variation.** The following insular subspecies are recognizable:

*Typhlops monastus monastus* Thomas

**Diagnosis.** Middorsal scale counts high (351-394); rostral with slight labial flare (0.72-0.94); pigmented scales at midbody 13-15, pigmentation extending onto underside of tail.

**Distribution.** Montserrat.

*Typhlops monastus geotomus* Thomas, 1966b:260. **Type-locality:** approximately 1 mi. N Carlisle, St. Mary's Parish, Angigua, West Indies.

**Diagnosis.** Middorsal scale counts low (329-367); labial flare of rostral pronounced (0.61-0.74); pigmented scale rows at midbody few (9-13), pigmentation not extending onto underside of tail.
**Distribution.** Barbuda, Antigua (including Great Bird Island), St. Christopher, and Nevis.

**Remarks.** No data additional to those presented by Thomas (1966b) have been incorporated. Variation remains to be adequately assessed for this species on the islands of Barbuda, St. Christopher, and Nevis, from each of which few specimens are known.
Typhlops dominicana Stejneger

Typhlops dominicana Stejneger, 1904:687. Type-locality: Dominica.
Syntypes: BMNH 65.5.4.177, BMNH 89.8.14.1-8, BMNH 91.5.11.2.

Description. (1) Head rounded. (2) Rostral broad in dorsal aspect (HW/RL 0.64-0.77), oval to nearly parallel; not flared on apex; no labial flare. (3) Preocular angle 70-95°, apex rounded; lower portion contacting only the 3rd of the upper labials. (4) Ocular length 1/2 to 2/3 height, sinuosity 0.23-0.04. (5) Rostronasal pattern divergent. (6) Postoculars 2 (cycloid). (7) First parietal standard, width spanning 2 scale rows or slightly less. (8) Second parietal present (mode) or absent. (9) TL to 385 mm (Table 19). (10) TL/TA 60-63. (11) TL/MED 38-56. (12) Middorsal scales 393-499. (13) Scale rows 24-22 with reduction occurring at about midbody (46-63 percent of TL). (14) Coloration bicolor with dorsal pigmentation (medium to dark brown) dropping out abruptly along a midlateralline or coloration extending completely across venter (fading somewhat ventrally) leaving unpigmented areas around snout plus mouth and vent plus underside of tail. (15) Rectal caecum present. (16) Hemipenes attenuate. (17) Cranium broad, width across prefrontals 90 percent of width across prootic. (18) Premaxilla broad (about 40 percent of width across prefrontals), slightly convex anteriorly, not protuberant; posteroventral edges transverse, joining with broad blade in continuously curved juncture. (19) Nasals without lateral angle. (20) Septomaxilla with hook, anterior portion tapered. (21) Frontal-parietal suture transverse, slightly sinuous. (22) Frontal without anterior ventral badelike process or wedgelike process. (23) Optic foramen canalicular.

**Distribution.** *Typhlops dominicana* is known from Dominica and Guadeloupe (both the Basse-Terre and Grande-Terre portions).

**Geographic variation.** I recognize the following insular subspecies:

*Typhlops dominicana dominicana* Stejneger

**Diagnosis.** Number of middorsal scales high (434-499); pigmentation very dark, extending completely across venter; rostral modally oval in dorsal aspect; ocular of about equal width ventrally as at eye-level.

**Distribution.** Dominica.


**Diagnosis.** Number of middorsal scales low (393-430); pigmentation bicolor (medium to dark brown), dropping out abruptly along a midlateral zone; rostral modally parallel in dorsal aspect; ocular narrower ventrally than at eye-level.
**Distribution.** Guadeloupe (both the Grande-Terre and Basse-Terre portions).

**Remarks.** The magnitude of the head scale differences is not great and some overlap occurs; the differences in middorsal counts will almost certainly be found to overlap when more specimens are available. The coloration difference between the two subspecies is apparently absolute, but coloration is very labile in response to habitat among these snakes. It is my assessment that the strong similarities and, for the most part, non-absolute differences make it preferable to include these two forms in the same species.
Typhlops biminiensis Richmond

Typhlops biminiensis Richmond, 1955:2. Type-locality: Near Nixon's Harbour, along trail to "Buck Lands" (=Black Lands), South Bimini, Bahama Islands. Holotype: CM 32604.

**Description.** (1) Head rounded (weakly truncate-ogival). (2) Rostral broad to very broad in dorsal aspect (RW/RL 0.69-0.95), oval (almost circular) to subparallel; not flared on apex; no labial flare. (3) Preocular angle 100-110°, apex rounded; lower portion contacting labials 2 and 3 of upper labials. (4) Ocular length about 1/2 height, sinuosity 0.28-0.09. (5) Rostronasal pattern divergent. (6) Postocular 3-4 times higher than long, rarely 2 postoculares as a result of a second scale on the postocular space. (7) First parietal standard, spanning 2 scale rows or slightly less. (8) Second parietal present and similar in size to first or absent. (9) TL to 363 mm (Table 19). (10) TL/TA 42-73. (11) TL/MBD 42-59. (12) Middorsal scales 454-537. (13) Scale rows 22 with no posterior reduction or occasionally 24, reducing to 22 at about midbody or more anteriorly. (14) Coloration bicolor with dorsal pigmentation (pale brown) ending abruptly along a midlateral or dorsolateral line by dropping out of pigmentation on scales. (15) Rectal caecum present. (16) Hemipenes attenuate. (17) Cranium broad, width across prefrontals 100 percent of width across prootics. (18) Premaxilla broad (about 48 percent of width across prefrontals), slightly convex anteriorly, not protuberant; posteroventral edges transverse (asymmetrical in only specimen examined), making right angle junction with broad blade; blade with notches for tips of vomers (19) Nasals without lateral angle, excluded from narial opening by union of...

**Distribution.** *Typhlops biminiensis* is known from the Bahama Islands (North and South Bimini, Andros, New Providence, Elbow Cay of the Cay Sal Bank, Little Ragged I., and Great Inagua), Cuba, and Cayman Brac.

**Geographic variation.** I recognized the following subspecies; see Thomas (1968) for details:

*Typhlops biminiensis biminiensis* Richmond

**Diagnosis.** Rostral very broad in dorsal aspect (0.85-0.95), nearly round; pigmentation pale gray-brown, occupying at most the 11 dorsal most rows and involving 1 row in dropping out of pigment from
scales, giving an evenly serrate-edged effect; size large (Table 19), body relatively stout (TL/MBD 42-47).

**Distribution.** *Typhlops b. biminiensis* is known from the Bahama Islands of North and South Bimini, Andros, New Providence, Elbow Cay of the Cay Sal Bank, and Little Ragged I. (Fig. 36).  
**Diagnosis.** Rostral relatively narrow in dorsal aspect (RW/RL 0.78-0.85), more nearly oval; pigmentation dark brown, occupying 15-17 dorsalmost scale rows and involving 3-5 rows in dropping out of pigmentation from scales; body stout (TL/MBD 46).  
**Distribution.** *T. b. paradoxus* is known only from Great Inagua, Bahama Islands (Fig. 36).  
**Diagnosis.** Rostral distinctly elongate and oval in dorsal aspect (RW/RL 0.69-0.76); pigmentation pale gray-brown, somewhat redder than in the nominate subspecies, occupying 11 dorsalmost scale rows at midbody and involving 1 row in dropping out of pigmentation from scales, giving an evenly serrate-edged effect; size small (Table 19), proportions slender (TL/MBD 53-59).  
**Distribution.** *T. b. epactia* is known only from the island of Cayman Brac, Cayman Islands (Fig. 36).
Typhlops caymanensis Sackett

Typhlops caymanensis Sackett, 1940:1. Type-locality: between Pedro Point and North Sound, Grand Cayman Island, Cayman Islands.

Holotype: ANSP 22123.

Description. (1) Head rounded. (2) Rostral broad in dorsal aspect (EW/SL 0.64-0.80), oval to nearly parallel; no apical flare; no labial flare. (3) Preocular angle 100-120°, apex broadly rounded; lower portion contacting labials 2 and 3 of upper labials. (4) Ocular length about 1/2 to slightly greater in length than in height, sinuosity 0.26-0.11. (5) Rostronasal pattern divergent. (6) Postocular higher than long (rarely 2 by apical encroachment of another scale on the postocular space). (7) First parietal expanded, bladelike, spanning more than 2 rows, or standard spanning 2 scale rows. (8) Second parietal standard, spanning 2 scale rows or absent. (9) TL to 256 mm (Table 19). (10) TL/TA 29-35. (11) TL/MBD 39-45. (12) Middorsal scales 351-408. (13) Scale rows 20-20 with no reduction. (14) Coloration bicolor with dorsal pigmentation (medium brown) ending abruptly along a midlateral line by dropping out of pigmentatin from scales. (15) Rectal caecum present. (16) Hemipenes attenuate.

Distribution. Grand Cayman, Cayman Islands.
**Typhlops tasyemicris** Thomas


**Description.** (1) Head rounded. (2) Rostral broad in dorsal aspect (RW/HL 0.85), oval; not flared on apex; no labial flare. (3) Preocular without anteriad angular extension; lower portion contacting labials 2 and 3 of upper labials. (4) Ocular length less than 1/2 height, no appreciable sinuosity. (5) Rostronasal pattern divergent. (6) One cycloid postocular. (7) First parietal expanded, bladelike, width spanning more than 2 scale rows. (8) Second parietal present, narrower than first. (9) TL 181 mm. (10) TL/TA 70. (11) TL/MBD 48. (12) Middorsal scales 429. (13) Scale rows 20-20, no reduction. (14) Coloration bicolor with dorsal pigmentation fading to unpigmented venter along a lageral zone; dorsum lineate as a result of dark scale centers and light scale edges.

**Distribution.** *Typhlops tasyemicris* is known only from the island of Grenada.

**Remarks.** This species, known only from the holotype, is closely related to *Typhlops trinitatus* Richmond of Trinidad and Tobago. Both species are in turn related to *Typhlops lehneri* Roux of northern South America (Venezuela).
EVOLUTIONARY RELATIONSHIPS

Excluding Typhlops tasymicris, a species with South American affinities, at the southeastern extremity of the Antilles, there appear to be two principal groups of Antillean Typhlops. One of these, the biminiensis group, is composed of but two species (one polytypic) and occupies the area of the Cayman Islands, Cuba and parts of the Bahamas. The other group, the major Antillean radiation (MAR) contains the balance of the species and is spread over much of the Antilles.

The Typhlops biminiensis group

It is pertinent to emphasize the distinctness of the biminiensis group forms from the MAR species. The dichotomy of "preocular contacting only the 3rd of the upper labials" versus "preocular contacting upper labials 2 and 3" may at first seem trivial. However, this feature is but one easily described manifestation of a set of fairly constant differences in head scale proportions between the two groups. In the biminiensis group (in contrast to the MAR): 1) the anterior nasals are less flared (have less extent lateral to the nares); 2) the anterior nasals have less contact with the second labial; 3) the lower portion of the posterior nasal is broader (i.e., has a relatively greater surface area); 4) the preocular angle is greater, in fact the preocular tends not to be angulate but to be broadly curved; 5) the lower portion of the preocular is broader (i.e., has a greater relative surface area); 6) the third upper labial is shorter and higher; and 7) the fourth upper labial is longer with a greater, more nearly horizontal, contact with the ocular. This constellation of features is shared
with a number of non-Antillean species in both the New World and Old World tropics; the characteristics shared by members of the MAR appear to be unique to that group.

The skeletal data for *T. biminiensis* (osteological preparations were not made for *T. caymanensis*) suggest that the group may also be osteologically distinct from the MAR. The hyoid is distinctive among Antillean species but like that of at one non-Antillean species (*Typhlops* sp. from Israel). The anterior ventral region of the frontal is also peculiar. The prootic lappet and foramina show the primitive condition, found among some Antillean and some non-Antillean species. The *biminiensis* group appears to be most closely related to species inhabiting the Central American mainland (on the basis of external features).

Among the Antillean species not belonging to the *biminiensis* group, *Typhlops granti* most closely resembles the members of the *biminiensis* group in its head scale configuration, principally because of the large preocular angle and the relatively unexpanded anterior nasals. These features are almost certainly secondary acquisitions; in other respects the head scales are like the unspecialized MAR species.

*Typhlops tasymicris* is a relative of the South American species *lehneri* and *trinitatus* and is unrelated in any close fashion to any of the other Antillean species, although it has a closer common ancestry with the *biminiensis* group than with the MAR species.
The Major Antillean Radiation (MAR)

The remaining species form what I believe to be a monophyletic Antillean radiation characterized by the converse of the head scale features enumerated above for the *biminiensis* group. A fundamental head scale feature of this complex is the tendency for the preocular to form an anteriar extension. Much of the specialization within the group has involved an accentuation of this preocular extension in conjunction with other modifications of the head.

Cochran (1924), Parker (1933), and Ruthven and Gaige (1935) recognized either a species or a species group encompassing the forms now called *Typhlops jamaicensis*, *T. richardi*, and *T. monastus* on Jamaica, greater Puerto Rico, and the northern Leeward Islands, respectively (*T. richardi* has been known only very recently from the Turks and Caicos islands). The major zoogeographic anomaly has been the apparent lack of any member of this group on Hispaniola. I find it convenient to recognize a larger assemblage, which includes the old *jamaicensis* group and which I call the "primary Antillean group."

This more inclusive assemblage contains the species *T. jamaicensis* (Jamaica), *T. sulcata* (Hispaniola), *T. richardi* (greater Puerto Rico and the Turks and Caicos banks), *T. monastus* (a number of the northern Leeward Islands), and *T. dominicana* (Dominica and Guadeloupe). The features characterizing this primary Antillean group are:

- Oval rostral shape
- Divergent rostronasal pattern
- Relatively large preocular angle
- High middorsal counts (ca. 350–400+)

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Large size (Table 19)
Broad crania
Hooked and tapered septomaxillae
Unfused supraoccipitals

Except for *T. sulcata*, all members of the primary Antillean group have a high primary scale row number of 22 or 24 (one species).
The anterior head scales of these five species present a definite community of resemblance. I do not view this primary group as a cohesive evolutionary assemblage. Rather, they are the generalize (for the most part eurytopic) descendants of the initial invaders that gave rise to the major Antillean radiation. They have themselves undergone a certain amount of divergence and, in two cases, are parts of multi-species radiations on their respective island groups. In essence this is a paraphyletic group of conveience, and I do not treat it as a taxon. *Typhlops jamaicensis, T. monastus,* and *T. dominicana* occur alone on their islands or island banks without sympatric congeners. *T. sulcata* and *T. richardi,* on the other hand, share their ranges, at least in part, with other species of *Typhlops.*

*Typhlops sulcata* shares several of its primitive features with *Typhlops I* and *II* on Hisapniola and with *T. lumbricalis* on Cuba and the Bahamas. These four members of the MAR have the best development of the free bladelike anterior porcoss of the frontal (may be partly fused in *Typhlops II*). *T. sulcata* departs from more from the primary Antillean group than the other members—not surprising in light of the overall Hisapniolan *Typhlops* diversity. It is somewhat arbitrary to consider *T. sulcata* a member of the primary Antillean group and not the species I, II, and *lumbricalis.*

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But *T. sulcata*, a species with high middorsal counts, does agree more in general aspect with the other primary group members.

The other four Hispianiolan species, *T. hector*, *T. pusilla*, *T. syntherus*, and *T. capitulata*, form part of a narrow-skulled group that also includes *T. rostellata* of Puerto Rico. This group, the Hispianiolan radiation, is characterized by:

- Narrow, clavate rostrals in dorsal aspect.
- Preoculars with marked anterior projections (divided preoculars in one species).
- Calyculate rostronasal pattern.
- Tapered crania.
- Narrow premaxillae with posteroventral edges angled forward.
- Septomaxillae not hooked; broad anteriorly.
- No free bladelike process of the frontal.

Of this group, *T. capitulata* and *T. syntherus* have the most tapered crania and show reduction in the bones of the rear of the skull: reduction of the supraoccipitals or fusion with the exoccipitals (*syntherus*); fusion of the supraoccipitals, exoccipitals, and prootics (*capitulata*).

In the Greater Puerto Rico region, *Typhlops monensis* and *T. granti* are *richardi* relatives, and with *richardi* they comprise a local radiation: *T. monensis* an isolate on Isla Mona and *T. granti* confined to the xeric southwestern part of the bank. Both species have divergent rostronasal patterns (least so in *monensis*), broad crania, and attenuate hemipenes; they are otherwise unspecialized osteologically and in head scale configuration. *T. granti* is
extreme in attenuation of the body, in the low number of scale rows, and in the truncate head shape. Its head scales are relatively unmodified, although the preocular angle is large; it has high middorsal counts and a tripartite pelvis.

Fig. 37 depicts a tentative phylogeny of the Hispaniolan radiation of the MAR. I have not included all of the species of the MAR, primarily because I am unsure of the phylogeny of the species belonging to the non-Hispaniolan members of the primary group. The derivation of granti and monensis from richardi (or proto-richardi) is reasonably clear, but the phylogenetic relationships of jamaicensis, sulcata, richardi, monastus, and dominicana are not. It is easy enough to derive jamaicensis from the sulcata line before the evolution of attenuate hemipenes and to derive richardi from the line after that step (Fig. 37). But I have little confidence in that arrangement; it is not supported by other characters, and I am suspicious of making Hispaniola that much of a nexus of Antillean Typhlops evolution.

In head scale features, size, and general appearance, T. monastus resembles the proximal Virgin Islands (St. Thomas, St. John, Tortola, St. Croix) richardi; and jamaicensis resembles Puerto Rican richardi in the same features. However, hemipenial morphology does not bear out these resemblances. T. jamaicensis has expanded organs, whereas richardi has attenuate ones. T. monastus, which occurs to the east of richardi has expanded hemipenes; T. dominicana, on islands just south of monastus, has attenuate organs. It is thus difficult to postulate a sensible branching sequence without invoking a dual origin of one of the hemipenial types.
ZOOGEOGRAPHY

For a number of years ideas on the origin of the Antillean fauna, particularly the vertebrate fauna, have been tied to a stabilist conception of Antillean physiography. It has been generally assumed that the islands have remained in the positions they now occupy for a long enough period that present-day vertebrate occupancy is best accounted for by over-water dispersal (rafting or waif dispersal). More recently, stemming principally from the work of Croizat, a vicariance hypothesis has been invoked to explain the present-day distribution of forms (Rosen, 1975). This hypothesis assumes that the distribution of the species in a given group is largely accounted for by the fragmentation of the geographic range (by a variety of possible agencies) of the ancestral form (Croizat et al., 1974; Nelson, 1974; Rosen, 1975) rather than by dispersal or migration. Based on recent geological theory, the Antillean islands are assumed to have originated from a proto-Antillean archipelago located in the region of the present Panamanian isthmus and, beginning in the late Cretaceous, to have migrated to their present positions through the agency of the plate tectonics of the region (Rosen, 1975). In so doing, the proto-Antillean islands are presumed to have carried with them the populations ancestral to their present faunas. A diverse array of organisms, both invertebrate and vertebrate, marine, freshwater, and terrestrial are presented by Rosen as fitting this vicariance model of Antillean historical zoogeography. To what extent the distributions of Antillean amphibians and reptiles can
be accounted for by this model remains to be seen. The Typhlopidae, however, is with little doubt a relatively old group and on a worldwide basis shows a basically Gondwanaland distribution. (Typhlops is known from as early as the Eocene of France; on anatomical grounds the Typhlopidae and other scolecophidian families are considered to be primitive snakes.) The distribution of Antillean Typhlops may be reconcilable with the vicariance zoogeographic model; unfortunately we are hampered in dealing with most of the species by not knowing the identity of their closest mainland relatives.

The primary group species of the MAR occur in an east-west transect across the Greater Antilles, excepting Cuba and all but the southernmost Bahamas, and extend into the Lesser Antilles (with an apparent hiatus on the Anguilla bank) as far as Dominica at the southern end of the Leeward Islands. Initially, I was tempted to postulate a simple east-to-west dispersal route with Jamaica as the presumptive port-of-entry and an eastward spread through Hispaniola, the Puerto Rico region, and south into the Lesser Antilles. The variational picture does not entirely support such a sequence: Differentiation is very low on Jamaica, which is surprising if Typhlops has been there a long time. Other genera (e.g., Sphaerodactylus, Anolis, Celestus) have diversified into a number of species on Jamaica.

Another possibility, under a dispersal hypothesis, is that Hispaniola was the port-of-entry. The greatest species diversity is found on Hispaniola, implying long residence of the genus, although the very complex physiography is also a factor (perhaps an
overriding one) in the species diversity. Some very primitive features are found only among the Hispaniolan forms (including the Hispaniolan derived *T. lumbricalis*): the unfused bladelike process of the frontal and the most primitive condition of the prootic lappet and foramina.

The distribution of expanded and attenuate hemipenial types (Fig. 38) is very difficult to reconcile with a single port-of-entry and monophyletic derivation of the forms, assuming that one or the other was not evolved more than once. Despite the uncertainty about the early history of *Typhlops* in the Antilles, certain conclusions about the later history of the MAR species appear warranted:

1. *Typhlops lumbricalis* is derived from dispersals from Hispaniola to Cuba and from Cuba to the Bahamas (Fig. 39). It is the widespread, abundant species on Cuba, the Isla de Pinos, and the Great and Little Bahama banks; throughout this area it shows comparatively little diversity. The forms closest to the ancestry of *T. lumbricalis* (*Typhlops I, II, and hectus*) are relictually distributed on Hispaniola and show regional differentiation.

2. *T. rostellata* is the result of a Hispaniola to Puerto Rico dispersal.

3. Dispersal of *T. richardi* (or its ancestral populations) beyond the confines of the Puerto Rico Bank has occurred to St. Croix, the Turks and Caicos banks, and Isla Mona (giving rise to *T. monensis*). (The occurrence of *T. richardi* on the Turks and Caicos islands has a parallel in the occurrence of *Anolis scriptus*, closely related to
the Puerto Rican *Anolis cristatellus*, in the southern Bahamas.)

The origin of the Lesser Antillean MAR representatives cannot be stated with confidence. A sequential colonization southward from the Greater Antilles is intuitively the most satisfying hypothesis. However, unless the expanded hemipenes of *T. monastus* have been secondarily evolved from the attenuate condition, that hypothesis is not tenable. Other characters provide no unequivocal evidence. Rosen (1975) has suggested that elements of the Lesser Antillean fauna were derived from a now no longer emergent Aves Ridge that lay to the west of the present Lesser Antilles. This possibility provides no neat solution to the problem but at least allows for the possibility that a solution exists outside of the constraints of the present-day insular configurations.

*Typhlops tasymicris* is very clearly the result of recent dispersal into the southern Lesser Antilles (known only from Grenada). It is a very close relative of *T. trinitatus* Richmond, occurring on Trinidad and Tobago (Thomas, 1974b).

The islands inhabited by the *Typhlops biminiensis* group are positioned on the North American tectonic plate and have had a somewhat different tectonic history than the balance of the Caribbean islands, positioned on the Caribbean plate (Rosen, 1975). The level of diversification of these forms indicates a relatively long residency in this area, in contrast to the more recent occupancy of the area by only one member of the MAR. In a review of the *biminiensis* group (Thomas, 1968) I suggested that this group may have dispersed into the Antilles along a formerly more emergent Cayman
Ridge. The greatest present diversity occurs in the Caymans with relatively little diversity over much of the much greater area of Cuba plus the Bahamas. This pattern suggests that *T. biminiensis* has relatively recently expanded into the latter region without time for much differentiation. The virtual restriction of each of the two major groups of West Indian *Typhlops* to each of the tectonic plates is suggestive of a vicariant derivation of the *Typhlops* fauna. The closest relatives of the *biminiensis* group are evidently Central American forms; unfortunately the closest extra-Antillean relatives of the MAR are unknown.
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Fig. 1. Diagrammatic representation of rostral shape, rostro-nasal pattern, and head shape. Rostral shape in dorsal aspect: Q, oval; R, sagittate; S, parallel; T, waisted; U, oval with apical flare; V, clavate. Rostro-nasal pattern: Q-S, U, divergent; T, parallel; V, calyx. Head shape: Q-T, rounded; U, ogival; V, tapered; AE, truncate. Dashed line separates dorsal from ventral views. Categories of labial flaring of rostral: W, 0; X, 1; Y, 2; Z, 3. Stippling indicates extent of rostral scales.
Fig. 2. Some head scale features employed. RL is rostral length, RW is rostral width. First and second parietals are indicated by 1 and 2; the upper figure gradual reduction of succeeding scales to width of a normal body scale row. The middle figure shows abrupt transition from parietal to normal body scale row size. The lower figure shows measurement of preocular angle (curved arrow) and measurements used in determining sinuosity, calculated by B/A - 1. The two solid arrows indicate the postoculars; an is anterior nasal, pn is posterior nasal, and pr is preocular.
Fig. 3. Hemipenial shapes among the species studied. H, expanded and trumpet-shaped; I, attenuate; J, expanded; K, oblique. H is *T. jamaicensis*, I is *T. richardi*, J is *T. monastus*, and K is *T. rostellata*. The left figure in K shows a (diagrammatic) view of an approximately right angle rotation of the right figure; the dotted line demarcates the edge of the poorly defined apical region.
Fig. 5. Semidiagrammatic representations of the conditions of the anterior ventral portion of the frontal found in Antillean Typhlops. P, bladelike process (bp) free, not fused to overlying part of frontal (fr); optic foramen slitlike (sof). Q, bladelike process fused with overlying portion of frontal but line of fusion evident; optic foramen canalicular (cof). R, wedgelike process (wp) present; no line of fusion evident; optic foramen canalicular. S, no processes evident. Sp indicates rostrum of sphenoid.
Fig. 6. Condition of the prootic (pr) in the region of the trigeminal foramen among the species of Antillean Typhlops. The arrow indicates the lappet of the prootic; T denotes the tongue. Pa indicates the parietal and sp, the sphenoid. In B the lappet has fused with the tongue. In some instances the area of fusion is not evident, and the presence of a secondary foramen is the only indication that fusion rather than loss of the tongue has occurred.
Fig. 7. The mandibles of three species of Antillean Typhlops showing the conditions of the angular (arrow); in U and V the angular is normal; in W it is sliverlike. U is *T. jamaicensis*; V is *T. rostellata*; and W is *T. syntherus*.
Fig. 8. The quadrate in selected species of Antillean Typhlops (capitulata, pusilla, rostellata, sytherus, and richardi from top to bottom) showing the two categories of the dorsal process: hooked (K-M) and not hooked (N-O). To the right is anterior.
Fig. 9. Conditions of the pelvic girdle (right moieties figured) among the species of Antillean Typhlops. A is tripartite; B and C are triradiate; D is L-shaped; E is hatchet-shaped; and F is rodlike (ischium only). Il indicates ilium; pu, pubis; is, ischium; and hi, hypoischium. To the right is anterior.
Fig. 10. Configurations of the hyoid found among Antillean Typhlops. Hatching indicates bone, and stippling indicates cartilage. Bh denotes basihyal and cb, ceratobranchial. Presumed direction of evolutionary change in the hyoid is indicated in the diagram below.
Fig. 11. Line histograms of middorsal scale counts of *T. jamaicensis* (upper part). The smallest vertical unit represents a single individual. Letters are keyed to lettered samples on map (lower part).
Fig. 12. Map of western Hispaniola showing distribution of *T. sulcata*. Lettered samples are keyed to line histograms in Fig. 13. Questioned circle indicates the La Vallée specimen.
Fig. 13. Line histograms of middorsal counts for the samples of Typhlops sulcata indicated in Fig. 12. The smallest vertical unit represents a single individual.
Fig. 14. Map of Cuba and the Isla de Pinos showing localities for *Typhlops lumbricalis*. Numbered samples are keyed to line histograms in Fig. 16.
Fig. 15. Distribution of *Typhlops lumbricalis* in the Bahama Islands. Sample 10 encompasses the Little Bahama Bank: a, Water Cay; b, Grand Bahama; C, Great Abaco. Sample 11 encompasses the Great Bahama Bank: d, South Bimini; e, New Providence; f, Eleuthera; g, Cat Island; h, Great Exuma; i, Little Exuma; j, Long Island; K and L approximate locations of Staniel and Pipe cays respectively; M, Andros; N, Great Harbour I., Berry Islands.
Fig. 16 Line histograms of middorsal scale counts for *Typhlops lumbricalis*. Numbered histograms are keyed to numbered samples indicated in Figs. 14, 15. The smallest vertical unit represents a single individual.
Fig. 17. Scatter diagram of rostral width (RW) versus rostral length (RL) in three species of Typhlops (lumbricalis and the unnamed Hispaniolan species I and II). Both the eastern population (triangles) and the western population (squares) of Typhlops I are shown (see Fig. 18).
Fig. 18. Map of Hispaniola showing localities for *T. hecutus* (open circles), *T. I* (solid circles), and *T. II* (solid triangles). Hexagons indicate localities for the *hecutus*-like specimens noted in the text. The dashed line separates both the eastern and western and western samples of *T. hecutus* (Fig. 19) and the eastern and Cul de Sac samples of *T. I* (Fig. 17).
Fig. 19. Line histograms of middorsal scale counts for T. hectus. A designates the western (Tiburon Peninsula) specimens (open circles to west of dashed line in Fig. 18); B designates the eastern sample (open circles to the east of the dashed line in Fig. 18); C indicates the hectus-like specimens noted in the text (hexagons in Fig. 18).
Fig. 20. Line histograms of middorsal counts for *Typhlops* I (eastern and Cul de Sac samples are divided by dashed line in Fig. 19) and *Typhlops* II. The smallest vertical unit represents a single individual.
Fig. 21. Map of the northern part of Hispaniola showing localities for *T. pusilla*. Encircled samples are connected to line histograms of middorsal counts for that particular sample. Some localities bearing very few specimens were not included in the histograms. The smallest vertical unit represents a single individual.
Fig. 22. Southern part of Hispaniola showing localities for *Typhlops pusilla*. Encircled samples are connected to their respective line histograms of middorsal counts. The smallest vertical unit represents a single individual.
Fig. 23. Map of central Hispaniola indicating transition of pigmentation and scale row characteristics of *Typhlops pusilla* in the area. The upper portion of each "fraction" indicates number of pigmented scale rows (T=completely pigmented across ventral surface); numbers in lower part indicate scale row formulas occurring in each sample. Numbers circled or in parentheses indicate sample size either collectively or for individual character states.
Fig. 24. Map of west-central Hispaniola showing localities for *Typhlops capitulata* (triangles) and *T. syntherus* (circles).
Fig. 25. Line histograms of middorsal counts for *Typhlops syntherus*. Letters refer to samples indicated in Fig. 24. The smallest vertical unit represents a single individual.
Fig. 26. Line histograms of middorsal counts for *Typhlops capitulata*. The sample areas are shown in Fig. 24. The smallest vertical unit represents a single individual.
Fig. 27. Scatter diagram of the anterior versus posterior postnasal widths (see diagram) among the populations of *Typhlops capitulata*. Differences reflect the degree of outward curvature of the postnasals and hence the development of the calyx condition (greater with greater curvature).
Fig. 28. Map of Puerto Rico showing localities for *Typhlops rostellata* (circles) and *T. granti* (triangles). Letters refer to samples for which histograms are shown in Fig. 29.
Fig. 29. Line histograms of middorsal counts for *Typhlops rostellata*. Letters are keyed to sample areas in Fig. 28. The smallest vertical unit represents a single individual.
Fig. 30. Line histograms of middorsal scale counts for *Typhlops granti*. Sample areas are shown in Fig. 28. The smallest vertical unit represents a single individual.
Fig. 31. Map of part of the West Indies showing occurrence of *Typhlops richardi* (rectangles) and *T. monensis* (arrow). P indicates the Turks (stipple) and Caicos banks; Q indicates the area shown in Fig. 32; R indicates the area shown in Fig. 33.
Fig. 32. Map of Puerto Rico showing localities for *Typhlops richardi*. Lettered samples are keyed to Fig. 34.
Fig. 33. Map of the islands to the east of Puerto Rico showing occurrence of *Typhlops richardi* (stipple and arrows). Arrows indicate, left to right, Cayo de A fuera, Cayo Luis Pena, Isla Culebrita, and Beef I.
Fig. 34. Line histograms of middorsal counts for *Typhlops richardi*. Samples A-D are as indicated in Fig. 32; E indicates Vieques and Culebra (including satellites); F, St. Thomas; G, St. John; H, St. Croix; I, Tortola; J, Virgin Gorda; and K, Anegada. The smallest vertical unit represents a single individual.
Fig. 35. Line histograms of indicating reduction level (as percentage of TL) for *T. richardi*. Histograms to the left of dashed line indicate reduction from 22 to 20 scale rows; those to right of dashed line, reduction from 20 to 18 rows; numbers following a plus indicate specimens that do not reduce from 20 to 18 rows.

A, Turks and Caicos; B, southwestern Puerto Rico; C, the rest of Puerto Rico; D, Vieques and Culebra; E, St. John and St. Thomas; F, St. Croix; G, Tortola; H, Virgin Gorda; I, Anegada. The smallest vertical unit represents a single individual.
Fig. 36. Map showing the distribution of the biminiensis group species of Typhlops. The large coarsely stippled area is the Great Bahama Bank, and the smaller coarsely stippled area is the Cay Sal Bank. A indicates the Biminis; B, Andros (Mastic Point); C, New Providence; D, Elbow Cay; E, Rancho Luna (Cuba); F, Bahia de Guantanamo (Cuba); G, Little Ragged I. (all previous localities are for T. b. biminiensis); H, Great Inagua (T. b. paradoxus); I, Cayman Brac (T. b. epactia); J, Grand Cayman (T. caymanensis).
A - reduction in primary scale row number from 22 to 20
B - reduction in middorsal counts
C - hemipenes become attenuate
D - frontal blade fuses with adjacent part of frontal
E - preocular divides
F - acquisition of calyx rostronasal

Bracket encloses species with tapered crania.
Fig. 38. Distribution of expanded and attenuate hemipenial categories among the species of the primary group of the major Antillean radiation.
Fig. 39. Distribution of the *Typhlops biminiensis* group (cross-hatching); the area covered includes some Bahamian islands for which no group members are known but which fall within the boundaries defined by island banks of known occurrence. The branched arrow indicates the dispersal pathway hypothesized for the dispersal of *Typhlops lumbricalis*. The single arrow indicates the dispersal pathway of *Typhlops richardi*.
Fig. 40. Dorsal, lateral, and ventral views of the head of *Typhlops jamaicensis* (ASFS 11111). Bar equals 2 mm to scale.
Fig. 41. Dorsal, lateral, and ventral views of the head of *Typhlops sulcata* (ASFS V26650). Bar equals 2 mm to scale.
Fig. 42. Dorsal and lateral views of the head of *Typhlops* I. (USNM 10276). Bar equals 2 mm to scale.
Fig. 43. Ventral views of the heads of *Typhlops* I (upper; ASFS V27874) and *Typhlops hectus* (lower; ASFS V9389). Bar equals 2 mm to scale.
Fig. 44. Dorsal, lateral, and ventral views of the head of *Typhlops* II (ASFS V2604). Bar equals 2 mm to scale.
Fig. 45. Dorsal and lateral views of the head of *Typhlops hectus* (ASFS V9389); see Fig. 43 for ventral view. Bar equals 2 mm to scale.
Fig. 46. Dorsal and lateral views of the head of *Typhlops hectus* (ASFS V398); note divided right preocular and partially divided left preocular. Bar equals 2 mm to scale.
Fig. 47. Dorsal, lateral, and ventral views of the head of *Typhlops pusilla* (ASFS V38315). Bar equals 2 mm to scale.
Fig. 48. Dorsal, lateral, and ventral views of the head of *Typhlops syntherus* (MCZ 77215, dorsal and lateral views; ASFS V35546, ventral view).
Fig. 49. Dorsal, lateral, and ventral views of the head of Typhlops capitulata (ASFS V8474). Bar equals 2 mm to scale.
Fig. 50. Dorsal, lateral, and ventral views of the head of

*Typhlops rostellata* (UMMZ 76634)
Fig. 51. Dorsal, lateral, and ventral views of the head of *Typhlops richardi* (ASFS 76591) from Puerto Rico. Bar equals 2 mm to scale.
Fig. 52. Dorsal, lateral, and ventral views of the head of *Typhlops richardi* (ASFS X7501) from Puerto Rico (Virgin Islands type head scale configuration; cf. Figs. 51, 53). Bar equals 2 mm to scale.
Fig. 53. Dorsal, lateral, and ventral views of the head of *Typhlops richardi* (UMMZ 76665) from Tortola, British Virgin Islands. Bar equals 2 mm to scale.

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Fig. 54. Dorsal, lateral, and ventral views of the head of *Typhlops monensis* (ASFS 76493). Bar equals 2 mm to scale.
Fig. 55. Dorsal, lateral, and ventral views of the head of *Typhlops granti* (UMMZ 76669). Bar equals 2 mm to scale.
Fig. 56. Dorsal and lateral views of the head of *Typhlops monastus* (MCZ 81112).
Fig. 57. Ventral views of the head of *T. m. monastus* (upper figure; ASFS V6699) and *T. m. geotomus* (lower figure; ASFS V6769). Bar equals 2 mm to scale.
Fig. 58. Dorsal, lateral, and ventral views of the head of Typhlops dominicana (ASFS X6294) from Dominica. Bar equals 2 mm to scale.
Fig. 59. Dorsal and lateral views of the heads of A, *Typhlops b. bimininiensis* (ASFS V11655); B, *T. b. paradoxus* (ASFS V12067); C, *T. b. epactia* (ASFS V11673); D, *T. caymanensis*. The dark lines equal 2 mm to scale.
Fig. 60. Dorsal, lateral, and ventral views of the head of

*Typhlops tasyricris* (UF/FSM 21547). Bar equals 2 mm to scale.
Fig. 61. Dorsal view of the cranium of *Typhlops sulcata* (ASFS V2842). Bar equals 2 mm to scale.
Fig. 62. Dorsal view of the cranium of *Typhlops* I. (ASFS V26849)
Bar equals 2 mm to scale.
Fig. 63. Dorsal view of the cranium of *Typhlops* II (RT 3440).

Bar equals 2 mm to scale.
Fig. 64. Dorsal view of the cranium of *Typhlops lumbricalis* (MCZ 232606). Bar equals 2 mm to scale.
Fig. 65. Dorsal views of the crania of *Typhlops hectus* (upper figure; ASFS 726252) and *Typhlops pusilla* (lower figure; RT 3385)
Fig. 66. Dorsal view of the cranium of *Typhlops richardi* (RT 2289) from Puerto Rico. Bar equals 2 mm to scale.
Fig. 67. Dorsal view of the cranium of Typhlops monensis (ASFS V6514). Bar equals 2 mm to scale.
Fig. 68. Dorsal view of the cranium of *Typhlops granti* (RT 1249).

Bar equals 2 mm to scale.
Fig. 69. Dorsal view of the cranium of *Typhlops dominicana* (ASFS X5296). Bar equals 2 mm to scale.
Fig. 70. Dorsal view of the cranium of *Typhlops syntherus* (ASFS V26833). Bar equals 2 mm to scale.
Fig. 71. Dorsal views of the crania of *Typhlops capitulata* (upper figure; ASFS V26825) and *Typhlops rostellata* (lower figure; RT 2201). Bar equals 2 mm to scale.
Fig. 72. Anterior ventral views of the crania of G, *Typhlops jamaicensis* (ASFS 13642); H, *T. richardi* (RT 2289); I, *T. sulcata* (ASFS W26842); J, *T. dominicana* (ASFS X5296). Bar equals 2 mm to scale.

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Fig. 73. Anterior ventral view of the cranium of *Typhlops monensis* (ASFS 76514). Bar equals 2 mm to scale.
Fig. 74. Ventral view of the cranium of *Typhlops* I. (ASFS V26849). Bar equals 2 mm to scale.
Fig. 75. Anterior ventral views of the crania of S, Typhlops lumbricalis (MCZ 32606); T, Typhlops I (RT 3440); U, T. hectus (ASFS V26252); V, T. syntherus (ASFS V26833).
Fig. 76. Ventral view of the cranium of *Typhlops capitulata* (ASFS V26825). Bar equals 2 mm to scale.
Fig. 77. Ventral view of the cranium of *Typhlops rostellata* (RT 2201). Bar equals 2 mm to scale.
In the following tables I do not attempt to indicate the total range of variation in many of the characters, only the predominant conditions occurring in a species or in different populations of a species. Infrequent and weakly developed conditions are given in some instances (indicated by parentheses). Species that are not members of the major Antillean radiation (*biminiensis*, *caymanensis*, and *tasymicris*) are set off by brackets.
Table 1. Head shape in the species of Antillean *Typhlops*.

<table>
<thead>
<tr>
<th>Rounded</th>
<th>Ogival</th>
<th>Tapered</th>
<th>Truncate</th>
<th>Truncate-Ogival</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>sulcata</em></td>
<td><em>jamaicensis</em></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>II</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>lumbricalis</em></td>
<td>(syntherus)*</td>
<td>(capitulata)</td>
<td>(capitulata)</td>
<td></td>
</tr>
<tr>
<td><em>pusilla</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>rostellata</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>richardi</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>monastus</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>dominicana</em></td>
<td>[caymanensis]</td>
<td>[monensis]</td>
<td>[tasymicris]</td>
<td></td>
</tr>
</tbody>
</table>

*Parentheses indicate the condition is weakly developed and not the predominant condition.*
Table 2. Rostral shape categories among Antillean Typhlops<sup>1</sup>.

<table>
<thead>
<tr>
<th>Oval</th>
<th>Sagittate</th>
<th>Clavate</th>
<th>Parallel</th>
<th>Waisted</th>
<th>Tapered</th>
</tr>
</thead>
<tbody>
<tr>
<td>sulcata</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>lumbricalis</td>
<td>lumbricalis</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>syntherus</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>richardi</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>granti</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>monastus</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>dominicana</td>
<td>[biminiensis]</td>
<td></td>
<td></td>
<td></td>
<td>[biminiensis]</td>
</tr>
<tr>
<td></td>
<td>[caymanensis]</td>
<td></td>
<td></td>
<td></td>
<td>[caymanensis]</td>
</tr>
<tr>
<td></td>
<td>[tasymicris]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<sup>1</sup>The predominant condition and common variants are given; no attempt is made to indicate the entire spectrum of variation.
<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>jamaiicensis</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>rostellata</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>richardi</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>monensis</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>granti</em></td>
<td></td>
<td></td>
<td>I</td>
<td></td>
</tr>
<tr>
<td><em>dominicana</em></td>
<td></td>
<td></td>
<td>II</td>
<td></td>
</tr>
<tr>
<td>[biminicensis]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[caymanensis]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[tarymicris]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3. Labial flare categories among Antillean Typhlops.
Table 4. Categories of rostronasal pattern among the species of Antillean Typhlops.

<table>
<thead>
<tr>
<th>Divergent</th>
<th>Parallel</th>
<th>Calyculate</th>
</tr>
</thead>
<tbody>
<tr>
<td>jamaicensis</td>
<td>II</td>
<td></td>
</tr>
<tr>
<td>sulcata</td>
<td>hectus</td>
<td>hectus</td>
</tr>
<tr>
<td>I</td>
<td></td>
<td>pusilla</td>
</tr>
<tr>
<td>lumbricalis</td>
<td></td>
<td>syntherus</td>
</tr>
<tr>
<td>richardi</td>
<td></td>
<td>capitulata</td>
</tr>
<tr>
<td>monensis</td>
<td></td>
<td>rostellata</td>
</tr>
<tr>
<td>granti</td>
<td></td>
<td></td>
</tr>
<tr>
<td>monastus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>dominicana</td>
<td></td>
<td></td>
</tr>
<tr>
<td>biminiensis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>caymanensis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>tasymicris</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 5. Postocular condition among the species of Antillean Typhlops.

<table>
<thead>
<tr>
<th>? cycle</th>
<th>1 cycle</th>
<th>1 elongate</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>jamaicensis</em></td>
<td></td>
<td><em>sulcata</em></td>
</tr>
<tr>
<td><em>lumbricalis</em></td>
<td></td>
<td><em>[tasymicris]</em></td>
</tr>
<tr>
<td><em>hectus</em></td>
<td><em>syntherus</em></td>
<td><em>[biminiensis]</em></td>
</tr>
<tr>
<td><em>pusilla</em></td>
<td></td>
<td><em>[caymanensis]</em></td>
</tr>
<tr>
<td><em>capitulata</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>rostellata</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>richardi</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>monensis</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>granti</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>dominicana</em></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 6. Condition of first parietal among Antillean Typhlops.

<table>
<thead>
<tr>
<th>Standard Narrow</th>
<th>Narrow</th>
<th>Expanded</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>jamaicensis</em></td>
<td><em>granti</em></td>
<td><em>sulcata</em></td>
</tr>
<tr>
<td>II</td>
<td>I</td>
<td></td>
</tr>
<tr>
<td><em>lumbricalis</em></td>
<td></td>
<td><em>syntherus</em></td>
</tr>
<tr>
<td><em>hectus</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>pusilla</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>capitulata</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>rostellata</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>richardi</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>monensis</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>dominicana</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>[biminensis]</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>[caymanensis]</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>[tasymicris]</em></td>
</tr>
</tbody>
</table>
Table 7. Scale row reduction pattern in the species of Antillean *Typhlops*.

<table>
<thead>
<tr>
<th></th>
<th>24-22</th>
<th>22-22</th>
<th>22-20</th>
<th>22-20-18</th>
<th>20-20</th>
<th>20-18</th>
<th>18-16</th>
</tr>
</thead>
<tbody>
<tr>
<td>dominicana</td>
<td>[biminiensis]</td>
<td>[biminiensis]</td>
<td>richardi</td>
<td>richardi</td>
<td>sulcata</td>
<td>richardi</td>
<td>granti</td>
</tr>
<tr>
<td></td>
<td>jamaicensis</td>
<td>[biminiensis]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(pusilla)</td>
<td>pusilla</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>syntherus</td>
<td>monastus</td>
<td>monastus</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(monastus)</td>
<td>[tasymicris]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>lumbricalis</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 8. Shape categories for crania of the species of Antillean *Typhlops*.

<table>
<thead>
<tr>
<th>Broad</th>
<th>Tapered</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>jamaicensis</em></td>
<td><em>hectus</em></td>
</tr>
<tr>
<td><em>sulcata</em> I</td>
<td><em>pusilla</em></td>
</tr>
<tr>
<td><em>I</em></td>
<td><em>synthorus</em></td>
</tr>
<tr>
<td><em>II</em></td>
<td><em>capitulata</em></td>
</tr>
<tr>
<td><em>lumbricalis</em></td>
<td><em>rostellata</em></td>
</tr>
<tr>
<td><em>richardi</em></td>
<td><em>monensis</em></td>
</tr>
<tr>
<td><em>granti</em></td>
<td></td>
</tr>
<tr>
<td><em>monastus</em></td>
<td></td>
</tr>
<tr>
<td><em>dominicana</em></td>
<td></td>
</tr>
<tr>
<td>[biminiensis]</td>
<td></td>
</tr>
</tbody>
</table>
Table 9. Condition of posteroventral edge and blade of premaxilla in Antillean Typhlops.

<table>
<thead>
<tr>
<th>Posteroventral Edge</th>
<th>Blade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transverse</td>
<td>Angled forward</td>
</tr>
<tr>
<td>jamaiicensis</td>
<td>pusilla</td>
</tr>
<tr>
<td>sulcata</td>
<td>syntherus</td>
</tr>
<tr>
<td>I</td>
<td>capitulata</td>
</tr>
<tr>
<td>II</td>
<td>rostellata</td>
</tr>
<tr>
<td>hectus</td>
<td></td>
</tr>
<tr>
<td>monensis</td>
<td>monastus</td>
</tr>
<tr>
<td>richardi</td>
<td>richardi</td>
</tr>
<tr>
<td>granti</td>
<td></td>
</tr>
<tr>
<td>dominicana</td>
<td></td>
</tr>
<tr>
<td>[biminiensis]</td>
<td></td>
</tr>
</tbody>
</table>

*Juncture between posteroventral edges and blade continuous.
Table 10. Hemipenial shape categories of Antillean *Typhlops*.

<table>
<thead>
<tr>
<th>Expanded</th>
<th>Trumpet-shaped</th>
<th>Oblique</th>
<th>Attenuate</th>
</tr>
</thead>
<tbody>
<tr>
<td>(hectus)</td>
<td><em>jamaicensis</em></td>
<td>I</td>
<td><em>sulcata</em></td>
</tr>
<tr>
<td>(capitulata)</td>
<td></td>
<td>II</td>
<td><em>richardi</em></td>
</tr>
<tr>
<td>syntherus</td>
<td></td>
<td></td>
<td><em>monensis</em></td>
</tr>
<tr>
<td>monastus</td>
<td><em>lumbricalis</em></td>
<td></td>
<td><em>granti</em></td>
</tr>
<tr>
<td></td>
<td><em>pusilla</em></td>
<td></td>
<td><em>dominicana</em></td>
</tr>
<tr>
<td></td>
<td><em>rostellata</em></td>
<td></td>
<td>[biminiensis]</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>[caymanensis]</td>
</tr>
</tbody>
</table>

1Expanded but with no apical differentiation.

2Parentheses indicate species for which apical condition was not determined.
Table 11. Septomaxilla condition in Antillean Typhlops.

<table>
<thead>
<tr>
<th>Hooked, tapered</th>
<th>No hook, broad</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>jamaicensis</em></td>
<td><em>hectus</em></td>
</tr>
<tr>
<td><em>sulcata</em></td>
<td><em>pusilla</em></td>
</tr>
<tr>
<td><em>I</em></td>
<td><em>syntherus</em></td>
</tr>
<tr>
<td><em>II</em></td>
<td><em>capitulata</em></td>
</tr>
<tr>
<td><em>lumbricalis</em></td>
<td><em>rostellata</em></td>
</tr>
<tr>
<td><em>richardi</em></td>
<td></td>
</tr>
<tr>
<td><em>monensis</em></td>
<td></td>
</tr>
<tr>
<td><em>granti</em></td>
<td></td>
</tr>
<tr>
<td><em>monastus</em></td>
<td></td>
</tr>
<tr>
<td><em>dominicana</em></td>
<td></td>
</tr>
<tr>
<td>[biminiensis]</td>
<td></td>
</tr>
</tbody>
</table>
Table 12. Condition of anterior ventral portion of frontal in Antillean *Typhlops*.

<table>
<thead>
<tr>
<th>Blade unfused</th>
<th>Blade partially fused</th>
<th>Wedgelike process and line of fusion</th>
<th>Wedgelike process only</th>
<th>No blade, no wedgelike process</th>
</tr>
</thead>
<tbody>
<tr>
<td>sulcata</td>
<td>II</td>
<td>richardi</td>
<td></td>
<td>richardi</td>
</tr>
<tr>
<td>I</td>
<td>hector</td>
<td>granti</td>
<td>syntherus</td>
<td>jamaiicensis</td>
</tr>
<tr>
<td>lumbricalis</td>
<td></td>
<td></td>
<td>rostellata**</td>
<td>capitulata</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>monensis</td>
<td>monastus</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>pusilla</td>
<td>dominicana</td>
</tr>
</tbody>
</table>

[biminiensis*]

*Line of fusion present; no wedgelike process but lamina present

**Wedgelike processes variable; present or absent.
Table 13. Condition of prootic lappet among Antillean Typhlops.

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Table 14. Condition of supraoccipitals among Antillean *Typhlops*.

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<th>Unfused, contact</th>
<th>No contact</th>
<th>Complete fusion</th>
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*May be partially fused with exoccipitals.*
Table 15. Condition of hyoid among Antillean *Typhlops*.

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Table 16. Condition of pelvis among Antillean Typhlops.

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<th>Triradiate</th>
<th>Dolabriform</th>
<th>L-shaped</th>
<th>Rodlike</th>
<th>Minute</th>
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*With cartilaginous pubic and ilial extensions.
Table 17. Pigmentation categories among Antillean *Typhlops*.

<table>
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<tr>
<th>Bicolor, abrupt transition</th>
<th>Bicolor, fading transition</th>
<th>Ventrolateral transition</th>
<th>Total pigmentation</th>
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<td>[tasymicris]</td>
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Table 18. Habitat preference among Antillean *Typhlops*.

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<td><em>richardi</em></td>
<td><em>syntheus</em></td>
<td>([<em>taymicris</em>])</td>
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<td><em>capitulata</em></td>
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*Obligate occupants of the habitat; species on islands with no appreciable habitat diversity are not so considered.

Parentheses indicate evidence is scant and the category presumptive.
Table 19. Total length for species of Antillean Typhlops presented for 20 mm size classes; numbers in body of table are numbers of specimens.

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*St. Thomas, St. John, Tortola. **Anegada and Virgin Gorda.
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**Data are from three large samples or large sample clusters (Western Cibao) from widely scattered parts of the range, including one low-count sample (Grande Cayemite).**
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SPECIMENS EXAMINED

With the exception of Typhlops I and II, the species are listed in alphabetical order. A list of cleared and stained material follows the listing of all specimens by localities.
Typhlops I

HAITI. Dépt. de l'Ouest: ASFS V37361, 0.3 mi. S Terre Rouge; ASFS V37104-05, Fond Michelle; MCZ 62637, 81150, CM 38886, ASFS V8185-86, Manneville; USNM 117270-72, 117275, ASFS V24346, Trou Caiman; ASFS V36982-83, 1.7 mi. E Trou Caiman; BMNH 1948.1.6.63-.64 (2), Pont Beudet; ASFS V36216, Tarbarre, 3.2 mi. SE François Duvalier Airport; USNM 75893, 123792, MCZ 51426, 62631-33, Port au Prince; MCZ 65812, near Port au Prince; ASFS V8394-97, Château Blond, 6.4 km NE Pétionville, 160 m; ASFS V22440-44, LDO 7-6464-69, 4.8 km N Pétionville; ASFS V24346, 1.6 km NW Pétionville. REPUBLICA DOMINICANA. Azua Prov.: ASFS X8047, 2.9 km W, thence 16.4 km N, Azua. Puerto Plata Prov.: USNM 10276, Puerto Plata. Duarte Prov.: MNHNSD 165, San Pedro de Macoris, Ingenio Colón. La Vega Prov.: ASFS V14143, 4 km S La Vega; RT 3633, 2 km W Jayaco; ASFS V27860-76, V27878-81, V27884, V27888, V28023-25, V26847-51, V40807-10, V40813-15, V40907-09, 1.5 km W Jayaco; ASFS V35897-900, V35904-05, 1 km W Jayaco, 274 m. Samaná Prov.: USNM 55298, Sánchez. San Pedro de Macoris Prov.: AMNH 13630, San Pedro de Macoris. La Altagracia Prov.: RT 3601, 3 km SW Higüey.
Typhlops II

HAITI. Dépt. de l'Ouest: MCZ 68571, Colombier near (22 km E) Saltrou. REPUBLICA DOMINICANA. Pedernales Prov.: ASFS V2604, 11 km SW Los Arroyos, 443 m; ASFS V2708, 21 km N Pedernales, 243 m; ASFS V42015, Mencia, 1300'; RT 3440-44, 3569, 18 km N Pedernales, El Mulito on Río El Mulito, 500'.

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Typhlops biminiensis biminiensis


Typhlops biminiensis paradoxus

BAHAMA ISLANDS. Great Inagua: MCZ 92993, 7.5 mi. N Mathew Town; ASFS V12067, 6.1 mi. N Mathew Town.

Typhlops biminiensis epactia

CAYMAN ISLANDS. Cayman Brac: MCZ 92048 (holotype), ASFS V11669, 5.4 mi. E West End, southern coastal platform; ASFS 16973, V11673-74, West End, south shore.

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Typhlops capitulata

HAITI. Dépt. du Sud: ASFS V26133, 4 mi. NE Paillant, 500'.


Typhlops caymanensis

CAYMAN ISLANDS. Grand Cayman: ANSP 22123 (holotype), between Pedro Point and North Sound; ASFS 17112-13, V11723, Red Bay; MCZ 79177, ASFS V11780, V11707, V11712, Prospect Point; UF/FSM (uncatalogued), ridge 0.9 mi. S North Side Village.
**Typhlops dominicana dominicana**

DOMINICA. BMNH 89.8.14.1-4, 91.5.11.2, 65.5.4.177 (syntypes), YPM R-10, ASFS 19033; MCZ 57815, Woodford Hill, St. Andrew Parish; ASFS X6294-97, RT 283, Soufriere Estate, 400', St. Mark Parish; UMMZ 83329, road between Roseau and Grand Bay, south central Dominica.

**Typhlops dominicana guadeloupensis**

GUADELOUPE. Basse-Terre: ASFS V15047, SC (1 unnumbered), Ste.-Rose; ASFS V15048, La Boucan; SC (1 unnumbered), St.-Sauveur; MCZ 10694-96, Capesterre. Grande-Terre: MCZ 1103398, Raizet, Abymes; USNM 198924, Pointe à Pitre, vicinity of airport.
Typhlops granti

PUERTO RICO. UMMZ 76671, 1 mi. N Parguera; ASFS V5716-19, RT 1249, 7.0 km E Guánica; ASFS V5648, 7.5 km E Guánica; ASFS V5715, 7.4 km E Guánica. Isla Caja de Muertos: MCZ 38301-02, UMMZ 76669-71.
Typhlops heatus

HAITI. Dépt. du Sud: ASFS V9276-77, ca. 10 km WSW Moron, 475 m; MCZ 74907-14, Marfranc near Jérémie; MCZ 64779, Carrefour Sanon near Jérémie; MCZ 81149 (holotype), Martineau, ca. 9 km (airline) W Jérémie; ASFS V9147, V9495, V9601-12, Jérémie; ASFS V25284, beach area within 1 km E Jérémie; ASFS V9389, 2 km SE Jérémie; MCZ 64773-78, Place Nègre near Jérémie; MCZ 70044, La Source near Jérémie; MCZ 64780, Laye near Jérémie; MCZ 70045, Tosia near (about 33 km SW) Jérémie; ASFS V9348, ca. 5 km (airline) SE Marché Léon, 670 m; ASFS V9514-16, ca. 7.5 km (airline) SSE Roseaux, est. 2 km W La Bastille; ASFS V9519, ca. 3 km (airline) SW Corail; ASFS X3070, X3141-52, USNM 157928-29, Camp Perrin; MCZ R-128373-74, Marcelline; ASFS V26251-53, Fond des Nègres; ASFS V26223, Paillant, 548 m; MCZ 66323-24, CM 37953, Butete near Miragoâne; MCZ 66325, Mingrette near Miragoâne; MCZ 66326-28, CM 37921-22, Femel near Miragoâne. Dépt. de l'Ouest: ASFS V9821, ca. 2.4 km S Trouin, 243 m; ASFS V8370-71, ca. 7 km (airline) W Pétonville, N versant Morne l'Hôpital, ca. 609 m; ASFS V8375, 9.6 km (road) W Pétonville, N versant Morne l'Hôpital, 822 m; ASFS V8295-96, ca. 7 km SE Mirebalais; ASFS V26542-48, V26577, V37321, V37325-26, Couline, 2.2 km SW Lascahobas, 900'; ASFS V37340, 5.2 mi. SW Lascahobas; ASFS V26593, 5.4 km SW Lascahobas. REPUBLICA DOMINICANA. San Juan Prov.: ASFS V512-15, Rio Arriba del Norte; FGT 2045, 15 km NW Juan de Herrera, 690 m; ASFS V21567, 4 km N Sabaneta; ASFS V396-98, 7 km W Vallejuelo, 792 m. La Estrelleta Prov.: FGT 2057, 6 km S Elias Pina; ASFS V21570-71, 1 km E Hondo Valle. Independencia Prov.: FGT 1991, 5 km SW El Limón; ASFS V20924, 15 km W Puerto Escondido; AMNH 41265-66, Duvergé; JRD 21633, 21718, La Descubierta; ASFS V41855, V42218-19,

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Los Pinos, 1700'. **Barahona Prov.**: ASFS V30493, El Iguito, 2.6 km NE Fondo Negro; ASFS V35641, El Iguito, 3.1 km NE Fondo Negro; AMNH 51496, above Delmonte's Finca (near Barahona); RT 3516, 3 km N Enriquillo.

**Ile Grande Cayemite**: MCZ 25552; ASFS V26459, vicinity of Anse a Maçon.
Typhlops jamaicensis

Typhlops lumbricalis

BAHAMA ISLANDS. ANSP 3282 (no other data). Little Bahama Bank: MCZ 83053, Freeport, Grand Bahama; MCZ 42343, Water Cay; MCZ 6970, USNM 14579, Great Abaco. Great Bahama Bank: ASFS V2447, AMNH 73499, LDO 6-3047, South Bimini; CM 32575-76, east end, South Bimini ("Black Land"); ASFS V22211-12, between airstrip and north coast, South Bimini; MCZ 8770, Nassau, New Providence; ASFS V6958, ca. 0.5 km NW Yamacraw Beach, New Providence; ASFS 17428, 17430, 17537-38, 17545-48, 17567-68, Alicetown, Eleuthera; ASFS V6955, 4 mi. N, less than 2 mi. E Rock Sound, Eleuthera; ASFS V6898-19, 4 mi. N, 0.5 mi. E Rock Sound, Eleuthera; ASFS V6823-32, ca. 4 mi. NW Rock Sound, Eleuthera; ASFS V6809, 5 mi. NW Southeast Point, Eleuthera; ASFS V20286-87, Fresh Creek, Andros; ASFS V22036-37, 1 mi. S Pleasant Bay, Andros; ASFS V22282, west side of Great Harbour Cay, Berry Islands; ASFS V11107-08, 4 mi. NE Arthur's Town, Cat I.; ASFS V11118-19, V11148-19, 0.5 mi. N Port Howe; MCZ 42270, Long I.; ASFS V10816-17, 4.2 mi. S Adderlys, Long I.; ASFS V10862, 2 mi. E Simms, Long I.; ASFS V22065-66, Staniel Cay, Exuma Cays; ASFS V22067-68, Pipe Cay, Exuma Cays; ASFS V6982-83, 4.2 mi. SE Rolleville, Great Exuma; ASFS V7017-18, 3.2 mi. NW George Town, Great Exuma; ASFS V7019, ca. 2 mi. NW George Town, Great Exuma; ASFS V7082, 0.8 mi. SE Moss Town, Great Exuma; ASFS V7085, 1.0 mi. NW Moss Town, Great Exuma; ASFS V7052, 5.7 mi. SSE The Ferry, Little Exuma.

CUBA. AMNH 7714, L6657-68, USNM 36813, 12357, ANSP 3263, MNHN 3218, 3218a (no other locality data; MNHN specimens are syntypes of T. cubae).

Pinar del Rio Prov.: USNM 56229-301 (no other data); AMNH 32300, UMMZ 116962-63, "Pinar del Rio"; BMNH 1907.4.27.9, "Canas"; AMNH 77803,
1 km N La Coloma; AMNH 77793-802, 81139-42, DRP 562, San Vicente; MCZ 10911, Guane; Iz 1061, Vinales; USNM 51863, mogote No. 1 W kilometer 14; USNM 27847, San Diego de los Banos; USNM 54406, Río Santa Cruz.

Habana Prov.: USNM 56297-98 (no other data); AMNH 65576, near Ceiba del Agua; AMNH 12815-16, 12819-20, MCZ 13710-12, Caimito de Guyabal; MCZ 10854-55, San Antonio de los Banos; USNM 31162, 56296, MCZ 7928, Habana; Iz 1062, Habana, Marianao; AMNH 6846-48, Habana University Hill; AMNH 46669-77, Habana, El Cotorro; Iz 1063-72, Habana, El Laguito; USNM 101061, Habana, Vibora; MBZH 95, Habana, Vedado (Highway 13); MCZ 84960, Habana; USNM 56295, Habana, Cerro. Matanzas Prov.: USNM 103623-25, UMMZ 78492, Matanzas. Las Villas Prov.: AMNH 6528-29, 7382-83, Banos del Ciego Montero; AMNH 77804, USNM 134358-61, MCZ 10824-32, 18113-16, 19924-25, 21826-27, 22279-85, 22676-82, 32601-02, 32604-45, 7927, 84953-59, UMMZ 72415 (11 specimens) 92253-64, 65042, BMNH 1932.11.11.23-.30, ANSP 26032, Soledad; USNM 138507, Trinidad; MCZ 35519, Sancti Spiritus. Camagüey Prov.: ANSP 15906, Majagua; MCZ 59353, 9 km W Camagüey; MCZ 57944, Finca San Pablo, about 15 km SW Camagüey; AMNH 77807, Finca El Porvenir, Loma de la Tagua, 24 km SW Camagüey; AMNH 77805-06, 5.5 mi. NE Bonao; AMNH 96471, Los Paredones; AMNH 77808, 3.8 mi. S, 5.1 mi. W Ecuador; AMNH 77809, Ecuador; UMMZ 70880-83, Martí; MCZ 59354, 19 km S Santa Lucía. Oriente Prov.: KU 47456-71 (type and paratypes of T. silus), Banes; UMMZ 90734 (2), south of Puerto Belie; USNM 138506, Ocujal; ANSP 15206, Santiago de Cuba; USNM 63216, San Carlos Estate, Guantánamo; AMNH 17729, costa sur Baracoa; MCZ 13290, San Lucas, Maisí. Isla de Pinos: MCZ 13939-50, 84922-52, UF/FSM 21917-18, Santa Barbara; AMNH 78584, Sierra de las.
Casas, just west of Nueva Gerona; AMNH 81136-37, Jacksonville.

EXTRALIMITAL SPECIMENS. UF 8995, "South of Miami, Florida."

AMNH 67881, "Kartabo, Guyana."
Typhlops monastus monastus

MONTSERRAT. BMNH 1931.10.18.158-59, 1934.4.1.2 (no other data). St. Peter's Parish: ASFS V6674-78, Cassava Ghaut; ASFS V6698-701, V6793-95, MCZ 81112 (holotype), 81113, USNM 157905-96, UF/FSM 21510-11, RT 1337, between Lawyer's River and Cassava Ghaut; CM 40591, Sweeneys (SE Carr's Bay); UIMNH 61659-60, 0.6 mi. N Salem Village. St. Anthony's Parish: BMNH 1924.2.19.9-11, Richmond (Estate?); MCZ 81114, from stomach of Falco sparverius, collected west slope, South Soufriere, 1400'; CM 40592, approx. 3/4 mi. NE Upper Galway's Estate; ASFS V6720, south side Belham River near mouth; AMNH 94165-66, approx. 1/2 mi. N Roche's Estate.

Typhlops monastus geotomus


BARBUDA. USNM 137827, UF/FSM 11376 (no other data). ST. CHRISTOPHER. ASFS 19789, Christ Church Nicola Town Parish, 3 mi. SW Molyneux; UF/FSM 11395, St. Thomas Middle Island Parish, 3.5 mi. N, 8 mi. W Basseterre. NEVIS. ASFS 19783, St. George Gingerland Parish, White Bay.
**Typhlops monensis**

ISLA MONA. UMMZ 76637 (6), 76638, MCZ 38303-05, 38307-08 (no other data); UPRM T-10, Playa de Pajaros; ASFS V5421, V6493, V6512-14, Anclaje Sardinero.
Typhlops pusilla


**REPUBLICA DOMINICANA.** **Azua Prov.**: ASFS V4080-09, 5 km S Padre Las Casas; FGT 2041, 8 km SSE Padre Las Casas, 480 m; ASFS V7334, 1 km S Yayas de Viajama; ASFS V21109, V21383, V21431-32, V21540, V31051-56, V31257-63, Barreras, 10 km SW Puerto Viejo; ASFS X8044-46, V21136-38, V21166-67, 4 km W, thence 6 km N Azua; ASFS X8102, V19358, 15.2-15.5 km E Azua; ASFS V21092-98, 17 km E Azua. **Barahona Prov.**: MCZ 57991-92, Cabral; ASFS V40631, 8 km S Cabral, 1300'; ASFS V20544, ca. 3 km E Cabral; ASFS X9607-14, RT 730, 4.7 mi. E Cabral; ASFS V35679-83, 1 km NE Fondo Negro; ASFS V30469-92, V30494, El Iguito, 1.6 mi. NE Fondo Negro; ASFS V39763-81, V39783-94, El Iguito, 1.8 mi. NE Fondo Negro; ASFS V30529, 2.6 mi. NW Palo Alto, 100'; ASFS V30981, Barahona, southern outskirts; ASFS V40761, 1 km NE Paraíso, Río Nizaito. **Dajabón Prov.**: ASFS V17625, 16 km S Loma de Cabrera, 2000'; ASFS V1435-42, DRP 2908, 15 km S Loma de Cabrera, 2400'; ASFS V17793, 6 km NE Restauración, 1900'; ASFS V17898-973, V18024, Restauración. **Distrito Nacional**: ASFS V2034, Santo Domingo; ASFS V14469-70, 2 km N Guerra. **Duarte Prov.**: MCZ 44392, Loma Quita Espuela; AMNH 41238-39, 41245-50, 41252-61, 41264, "La Bracita" (Loma Quita Espuela); ASFS V2952, 6 km NE San Francisco de Macoris; ASFS V2958, 8 km NE Pontón; MCZ 92009, ca. 4 km NE Pontón (on Río Cuaba); ASFS V33485, 4.5 mi. E Cruce de Pimentel, 400'. **El Seibo Prov.**: ASFS V3148, Bahía de San Lorenzo, less than 1 km inland along old railway at southeastern corner of bay. **Esplugat Prov.**: ASFS V1885, 2 km SW Jose Contreras. **Independencia Prov.**: FGT 2030, 4 km SSE Los Pinos, 490 m; FGT 2020-23, 6 km NW La
Descubierta, 250 m; JRD 21719, La Descubierta. La Altagracia Prov.: ASFS V21659-31, V29074, V29102-06, V35233-34, V35242-43, Juanillo.
La Estrelleta Prov.: MCZ 57989-90, Bánica; ASFS V31513, 1.4 mi. SE El Llano, 1400'; ASFS V21570-71, 1 km E Hondo Valle. La Romana Prov.: ASFS V13842, Buenos Aires at Río Chavón; ASFS V13809, 0.7 mi. NW Boca de Yuma; ASFS V16186, 2 km NW Mano Juan, Isla Saona. La Vega Prov.: ASFS V4330, 8 km S Moca; ASFS V16108-10, 4 km S La Vega; ASFS V33526, 3 mi. S La Vega, Guaguái, 300'; ASFS V14151, 10 km SE La Vega; SMF 25683 Oberhalb von Jarabacoa; ASFS V1744, V1776, V1865, V1941, V2028-29, V4305, V4319, 12 km NE Jarabacoa, 2000'; ASFS V4217, 10 km NE Jaraba­

coa, 2000'; ASFS V35901-03, V35906, 1 km W Jayaco, 900'; ASFS V40811-12, 1.5 km W Jayaco, 600'; ASFS V35868, 1 mi. NE Bonao; ASFS X8129-30, 1.2 mi. SE Monsenor Noulé, 700'. Maria Trinidad Sánchez Prov.: ASFS V34131-33, V34925. Monte Cristi Prov.: ASFS V17630-31, 4 km SE Monte Cristi; ASFS V1358, V1616-17, 5 km SE Pepillo Salcedo; ASFS V17622, 7 km SE Pepillo Salcedo; ASFS V1347, V1511, 1 km S Palo Verde;

ASFS V1512-13, 4 km E Los Comucos; ASFS V1522-25, 3 km E Los Comucos;
ASFS V1610-13, 5 km W Guayuhín; ASFS V33446-54, Cerro Gordo, 17.3 mi. NW Mao, 275'; ASFS V32152-59, V33314-44, Cana, 14.4 mi. NW Mao, 300'. Peravia Prov.: ASFS V28739, 11.3 mi. NE Sabana Larga, 2000'; ASFS V35825-31, 3 km N San José de Ocoa, 1340'; ASFS V34094, 1.3 mi. S San José de Ocoa, 1400'; ASFS V35824, 14 km N Cruce de Ocoa, 1200'; ASFS V35794-809, 3 km N Cruce de Ocoa, 500'; ASFS V34119, 1.9 mi. N Cruce de Ocoa, 700'; FGT 2349, 17 km N Baní, 280 m. Puerto Plata Prov.: ASFS V1711, 9 km SE Sosúa. Samaná Prov.: AMNH 43826, "probably province of Samaná"; ASFS V34835, Sánchez; ASFS V34127, 3.3 mi. NE Sánchez, 1000'; ASFS V34285-87, V34433-37, V34788-834, V34937,
7.6 mi. NE Sánchez, 1000'; FGT 1851, 10 km SW Las Terrenas, 330 m; USNM 74944, Río San Juan; AMNH 50353-56, ASFS V21898, Samaná. San Cristóbal Prov.: ASFS V3140, 10 km NE Gonzalo, 600'; ASFS V29532-38, V29695, 5.0 mi. NE Gonzalo, 1000'; MCZ 44391, Villa Altagracia; ASFS V14438, V28495-97, 6 km NW Cambita Garabitas, 1600-1800'; FGT 1983-84, 1 km E El Tablazo, 190 m; JRD 22472-77, E. bank of Río Nizao, near Nizao; 75'. San Juan Prov.: ASFS V511, Río Arriba del Norte; FGT 2046, 15 km NNW Juan Herrera, 690 m; ASFS V21567, 4 km N Sabaneta; ASFS V21563, 9 km N El Cercado; FGT 2053, 6 km N El Cercado, 700 m; ASFS V21561, 6 km NW Vallejuelo; FGT 2051, 4 km E Vallejuelo, 710 m; ASFS V21580-82, V21614, V21627-33, V31344-60, Barranca; FGT 2052, 1 km SSW Cardón, 450 m; ASFS V413, 15 km SE San Juan; ASFS V21549, 15 km E San Juan; ASFS V31334, 0.8 mi. SE Sabana Alta, 1100'; ASFS V403-06, 5.4 mi. NNE Guanito. Santiago Prov.: ASFS V18215-16, 1 km S La Cumbre, 2000'; ASFS V18135-42, 4 km S La Cumbre, 1700'; USNM 64271, Mao-Yaqui Valley; SMF 32245, Río Yaque del Norte; MCZ 57993, Santiago; MCZ 75019-20, Licey al Medio. Santiago Rodríguez Prov.: ASFS V32022, V32032-64, V32295-V33250, 9.1 mi. E Santiago Rodríguez, 800'. Valverde Prov.: ASFS V32250, 5.9 mi. N La Cruz de Guyacanes, 1400'; ASFS V14154, 2 km SE Pontón. ADDENDUM: Puerto Plata Prov.: USNM (field number) 41349, 1.0 km W Yaroa, trail to Loma Indio Viejo, 500-600 m.
Typhlops richardi

CAICOS ISLANDS. North Caicos: ASFS V23670, LDO 8-7701-05, Kew. TURKS ISLANDS. Pear Cay: ASFS V27343. PUERTO RICO. UPRM T-09, Carretera a Poncito, Isabela; UPRM T-03, Barrio Jocha, Isabela; ASFS V3244, 4 km SE Isabela; ASFS 12136, 5 mi. NW Mayagüez; UMMZ 55823, 76647, TU 18547, Mayagüez; UPRM T-11, km 4, km 4, Miradero road, Mayagüez; UPRM T-01, Barrio Miradero, km 4, Mayagüez; UPRM T-07, Barrio Miradero, Mayagüez; UPRM T-05, T-06, T-13, University of Puerto Rico campus, Mayagüez; TU 18550, Cerro Las Mesas, 1000'; ASFS V5678, 8 mi. NW Yáuco, 600'; RT 2235, ca. 5 km airline NW Yáuco; UMMZ 76660, hillside west of pass to Parguera; UPRM T-02, Bahía de Guajino, Ensenada; ASFS V5720, 7.0 km E Guánica; ASFS V5660, V5714, 7.1 km E Guánica; RT 3644-45, 9 km SE Guánica; ASFS 12509, UMMZ 76664, Isla Caja de Muertos; ASFS V6591-92, 3.6 km S Juana Díaz; UMMZ 76650-52, Cayey; ASFS X4062, 2.5 mi. SW Yabucoa; ASFS X7501-02, 0.7 mi. E Palmas Altas; ASFS V5941-58, 2.5 mi. W Playa de Vega Baja; UMMZ 76648, Camp Buchanan; UMMZ 76659, San Juan; UMMZ 76646, 76661, El Morro, San Juan; UMMZ 53260, 76649 (2), 125101, Río Piedras; UMMZ 76653 (2), 76654 (2), 76656 (8), 76657-58, 76662-63, near Canóvanas; UMMZ 76655 (2), 20 km S Canóvanas; ASFS 11899, 7 mi. NW Sabana Abajo; ASFS X653, X4126-28, X4938-39, X7399-402, V4147, V4999, RT 112, Isla Verde; ASFS X7496; Playa de Luquillo; UMMZ 76643-44, 76645 (5), Humacao; RT 2271-72, 2289, cocal just north of Playa de Humacao. Isla Vieques: ASFS V1072, Cayo de A fuera; UMMZ 76639, USNM 162505, no other data. Isla Culebra: UMMZ 76641 (4), 76642, no other data; UMMZ 80787, Isla Culebrita; UMMZ 76640, Cayo Luís Peña. U. S. VIRGIN ISLANDS. St.
Thomas: UMMZ 76667-68, no other data; UMMZ 80633, 80634 (5), West End; ASFS V7330, Dorothea; ASFS V7988, 1 mi. SE Water Bay; ASFS V8034, 2.7 mi. NW Charlotte Amalie. St. John: UMMZ 76666, no other data; ASFS 80676-69, Frederickdal ruins. St. Croix: UMMZ 80782, no other data; UMMZ 80632, West End; UMMZ 80630, Little La Grange; UMMZ 80631, Anguilla; ASFS V4153, Estate Clairmont. BRITISH VIRGIN ISLANDS.

Tortola: UMMZ 76665 (15), no other data; ASFS 7979-83, Jackass Gut; ASFS V7900, 7916-20, RT 976, Baugher's Bay; ASFS V7978, Lloyd's Pond.

Virgin Gorda: UMMH 55629-30, AMNH 92829, southwestern slope of Gorda Peak; CM 39612, north of Pond Bay; MCZ 77221, hillside above Pond Bay; KU 79857, RT 948, inland margin of Salt Pond behind St. Thomas Bay; USNM 152449, ASFS V3789-90, just N Garden Rock. Anegada: ASFS V3938, V3940-41, CM 39611, MCZ 77220, USNM 152448, vicinity of The Settlement; ASFS V14197-98, Low Key; ASFS V14257, Citron Bush.
Typhlops rostellata

PUERTO RICO. ASFS V5151, V5347, 7.0 km S Mora, 800'; RT 2160, ca. 3 mi. S Mora; RT 2181-82, Bosque de Guajataca, 800'; ASFS V3240, 2 mi. S Pueblito de Ponce; ASFS V5261, 5.6 mi. N Lares, 1100'; ASFS V919, 7 km E Lares, 1200'; ASFS V4525, 21.3 km E Lares, 1400'; ASFS V925, 11.2 km NW Utuado, 1300'; RT 2200-01, 10 km W Utuado; ASFS V4547, 8 mi. NW Utuado, 1500'; ASFS V5863, RT 1261, 10.2 km E Dos Bocas; RT 2203, Bosque de Río Abajo; ASFS V5881, 4 mi. W Las Llanadas; RT 2226-27, 5 km airline NW Yauco; UMMZ 76631, Cayey; UMMZ 76630, Camp Buchanan; UMMZ 76629, Río Piedras; UMMZ 76632 (3), 3 km S Canovanas; UMMZ 76623, 76624 (2), 76625 (3), 76626 (2), 76627 (2), 76633 (5), 76634 (10), 76635 (4), 76636 (5), 10 km S Canóvanas; UMMZ 76655 (2), 20 km S Canóvanas; UMMZ 90165, km 9 on road from Mameyes to Mt. Britton; UMMZ 76628, El Yunque; ASFS X4514, 2.2 km SW Sabana, 1000'; ASFS X4513, 6.2 km S Sabana, 1300'.
Typhlops sulcata

Typhlops symherus

REPUBLICA DOMINICANA. Pedernales Prov.: ASFS V2597-600; ASFS V21543, V35718, V35721-22, V35725, V35727-28, V35730, V35736-37, V35739-43, 7 km N Pedernales; ASFS V21520-25, 6 km N Pedernales; ASFS V2549, MCZ 77215 (holotype), 77216, 5 km N Pedernales; FGT 1792-94, 1799, 2 km E Las Mercedes, 250 m; ASFS V21512, 18 km N Cabo Rojo; FGT 1807-08, 17 km N Cabo Rojo; ASFS V40499, V29833-34, V29830-31, 17 km NW Oviedo Nuevo; AMNH 92825-26, CM 39609-10, ASFS X9986, 13.1 mi. SW Enriquillo; ASFS V23321, V23323-24, Oviedo Nuevo; USNM 142450-51, 5 mi. NE Oviedo Viejo; FGT 2334-37, 8 km NW Oviedo, 110 m; ASFS V29801-02, V29805, V29807, V29811, V29813, V30150, V39702-04, V35541, V35542-45, V35549-50, V35559-60, V35562-64, V35566-67, V35570, V35574, V35581, Oviedo Viejo; FGT 1727-30, 4 km E Oviedo; FGT 2341, 1 km S Oviedo Viejo.

ADDENDUM. ASFS V42261-67, RT 3540-43, 3 km NW Oviedo Nuevo, Pedernales Prov., República Dominicana.

Typhlops tasymicris

GRÉNADE. UF/FSM (holotype), 1 mi. E Vincennes, St. David Parish.
SKELETAL MATERIAL (CLEARED AND STAINED SPECIMENS)

Typhlops I. ASFS V26847, V26849, V22641, RT 3633.

Typhlops II. RT 3440.

Typhlops biminiensis. ASFS V23946.

Typhlops capitulata. ASFS V26777, V26825, V26832, RT 3649.

Typhlops dominicana. ASFS V6296.

Typhlops granti. RT 1249.

Typhlops hec tus. ASFS V9605, V26252, V26577.

Typhlops jamaicensis. ASFS 13612, 14519, 14926, USNM (field number) 040361.

Typhlops lumbricalis. MCZ 22279, 32606, ASFS V6902, V23913, V26899.

Typhlops monestus. RT 1337.

Typhlops monensis. ASFS V6514.

Typhlops pusilla. ASFS V26823, V26824, V26826, V26827, RT 3384-87, 3646, 3648, USNM 66887.

Typhlops richardi. MCZ 38337, 38350, ASFS V5943, V7979, RT 2289, 3644.

Typhlops rostellata. MCZ 38370, RT 2201.

Typhlops sulcata. ASFS V26831, V26838, V26842, RT 3647.

Typhlops syntherus. ASFS V26829, V26830, V26833, V26840, V26841.
VITA

Richard Thomas was born John Paul Richard Thomas on 2 May 1938 in Jacksonville, Florida. Prior to beginning High School in Cheraw, South Carolina, he lived in a variety of places in Florida (Jacksonville, Tallahassee, Tampa, Miami, Fort Lauderdale), spend two years in Colombia, and lived in New York for a time. He attended the University of South Carolina, the University of Maryland (in France, while stationed there in the Army), Miami-Dade Community College, and the University of South Florida, where he received the B. A. degree in 1969. He spent 1963 to 1967 engaged in field work and systematic research on Antillean amphibians and reptiles, which he continued along with systematic field work in Peru, after coming to Louisiana State University in 1969. In 1972 he married Kim Rutherford of Shreveport, also a graduate student in zoology at LSU.
EXAMINATION AND THESIS REPORT

Candidate: John Paul Richard Thomas

Major Field: Zoology

Title of Thesis: Systematics of the Antillean blind snakes of the genus Typhlops
(Serpentes: Typhlopidae)

Approved:

[Signatures]

Major Professor and Chairman

Dean of the Graduate School

EXAMINING COMMITTEE:

[Signatures]

Date of Examination:

May 7, 1976