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The Snakes of the Genus Storeria

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Introduction

The snakes of the genus *Storeria* are widespread in North America east of the Great Plains, ranging through Mexico to Honduras and in the northeast to southern Canada. In urban areas one species, *Storeria dekayi,* may thrive after most other snakes have long been exterminated. While considerable number of specimens have found their way into the collections of museums, no revision of *Storeria* has heretofore been attempted. The present paper presents the results of a comprehensive study of existing museum collections of this group of snakes. My principal emphasis has been on the study of variation within the species, the interpretation in taxonomic (and geographic) terms of such variation, and its bearing on the probable phylogeny within the genus. Several thousand specimens have been examined and the scale and coloration data tabulated. The scope of the work and the numbers of specimens entered in the tabulations have been limited by unforeseen circumstances; it is hoped that these studies together with obsrvation and experiment on the biology of some of the species may be resumed at a later date.

During the course of this study numerous individuals and institutions have been obliging in making loans of specimens and providing facilities for study. For such courtesies I am indebted to the following: E. Ross Allen, Silver Springs, Florida; Paul Anderson, Independence, Missouri; Dr. Reeve M. Bailey, Iowa State College; Roger Barbour, Morehead, Kentucky; Dr. Thomas Barbour, Arthur Loveridge and Benjamin Shreve, Museum of Comparative Zoology; Dr. S. C. Bishop, Arnold Grobman, and J. A. Tihen, University of Rochester; Br. Alexander Blouin, Mont-Saint-Louis College; Charles M. Bogert and Dr. James Oliver, American Museum of Natural History; Dr. G. D. Bunker and Dr. Clyde Hibbard, University of Kansas; Dr. Archie E. Carr and Coleman Goin, University of Florida; E. B. Chamberlain, Charleston

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Abbreviations of museum or private collection names which have been used in the text are as follows:

AMNH—American Museum of Natural History, New York, New York.
ANS—Academy of Natural Sciences of Philadelphia, Philadelphia, Pennsylvania.
CA—Chicago Academy of Sciences, Chicago, Illinois.
CAS—California Academy of Sciences, San Francisco, California.
CFK—Collection of Carl F. Kauffeld, Staten Island Zoo, New York, New York.
CHM—Charleston Museum, Charleston, South Carolina.
CLEM—Clemson College, Clemson College, South Carolina.
CM—Carnegie Museum, Pittsburgh, Pennsylvania.
CNM—Canadian National Museum, Ottawa, Ontario.
CORNELL—Cornell University, Ithaca, New York.
EHT-HMS—Collection of Edward H. Taylor and Hobart M. Smith, Lawrence, Kans.
ERA—Collection of E. Ross Allen, Silver Springs, Florida.
FMNH—Field Museum of Natural History, Chicago, Illinois.
FNB—Collection of Frank N. Blanchard (now in the Chicago Academy of Sciences, Chicago, Illinois).
INHS—Illinois State Natural History Survey Collection, Urbana, Illinois.
ISC—Iowa State College, Ames, Iowa.
JBH—Collection of J. B. Hollis, Henderson, Tennessee.
KU—University of Kansas Museum, Lawrence, Kansas.
LMK—Collection of Lawrence M. Klauber, San Diego, California.
MCZ—Museum of Comparative Zoology, Cambridge, Massachusetts.
OAM—Oklahoma Agricultural and Mechanical College, Stillwater, Oklahoma.
OUMZ—Ohio University Museum of Zoology, Athens, Ohio.
PA—Collection of Paul Anderson, Independence, Missouri.
RB—Collection of Roger Barbour, Morehead, Kentucky.
ROMZ—Royal Ontario Museum of Zoology, Toronto, Ontario.
S-M—Starr-Malnate collection of Edmund Malnate, Philadelphia Zoological Garden, Philadelphia, Pennsylvania.
SUMNH—Stanford University Museum of Natural History, Palo Alto, California.
UFC—University of Florida collection, Gainesville, Florida.
UMMZ—University of Michigan Museum of Zoology, Ann Arbor, Michigan.

UOMZ—University of Oklahoma Museum of Zoology, Norman, Oklahoma.
URMNH—University of Rochester Museum of Natural History, Rochester, New York.
USNM—United States National Museum, Washington, D.C.
ZSP—Zoological Society of Philadelphia, Philadelphia, Pennsylvania.

Complete synonymies for only the less well known forms are included, such as those from Mexico and Central America, and *S. d. obscura* from Florida.

In the tabulation of variation in head plates, the variations are given in per cent, and the symbols R and L refer respectively to right and left sides of the head. The tables showing variation in measurements and in numbers of body scales are greatly condensed. These data for the more abundant and wide ranging species may be analyzed in more detail in further studies on *Storeria*. The original data are available in a manuscript in the Cornell University Library submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy at Cornell University. In these tabulations the data for males and females are recorded separately with the exception of the figures for the sum of the ventrals and subcaudals in which the data for the two sexes are combined since there is no sexual variation.

A difficulty in the study of the snakes of the genus *Storeria* is that these, like many other snakes and lizards, become darkened and finally almost totally black upon preservation in formalin. The markings of the back and those about the head which show significant geographical variation are either partially or completely obscured in many specimens, so that it is not possible to designate their subspecies with certainty. Specimens of *Storeria* should be transferred to alcohol a short time after their fixation in formalin.

The working definition of species used here is that of a population having a distinctive combination of characters and exhibiting no overlap with related populations in these characters. This definition is used only since breeding experiments have not yet been made. It is understood that this is taken merely as an empirical measure of the more fundamental criterion, that of incompatibility in breeding. Subspecies are populations with distinctive combinations of characters occupying particular areas to the exclusion of other subspecies, but showing overlap in characters with other subspecies in the regions between the populations.

Storeria Baird and Girard

Storeria Baird and Girard, Cat. N. Amer. Rept., pt. 1, Serpents, p. 135, January 1853; Garman, N. Amer. Rept., pt. 1, Ophidia, p. 29, 1883; Cope, Rept. U. S. Nat. Mus., p. 1000, 1900.
Ischnognathus Duméril, Prodrome des Ophidiens, p. 468, May 1853; Duméril and Bibron, Erp. Gén., vol. 8, p. 506, 1854; Boulenger, Cat. Snakes Brit. Mus., vol. 1, p. 285, 1893.
Tropidoclonium Cope, Proc. Acad. Nat. Sci. Phila., p. 190, 1865, (partim).
Hemigenius Dugès, Proc. Amer. Philos. Soc., vol. 25, p. 182-3, 1888.
Natrix Cope, Proc. U. S. Nat. Mus., vol. 11, p. 391, 1889, (partim).

The "Catalogue of North American Reptiles" by Baird and Girard, in which the name *Storeria* is first used and defined, bears the date January 1853. The preface is dated January 5, 1853. Duméril's "Prodrome des Ophi-

diens," in which the name *Ischnognathus* is proposed for *Tropidonotus dekayi* appeared in the same year. Bocourt (1894: 742) indicates that Duméril's work was published in May; *Storeria* therefore has priority over *Ischnognathus*.

Garman in his "Reptiles of North America" (1883) modified the description of *Storeria* to include snakes with the loreal present or absent, and the anal entire or divided. He included the species *S. storerioides, S. occipito-maculata,* and *S. dekayi,* as well as *Microps lineatus* (=*Tropidoclonion lineatum*); this last with the anal plate entire.

Boulenger (1893) used *Ischnognathus* as the generic designation for this group and included *Regina kirtlandii* (*Natrix kirtlandii*) in addition to the forms treated under *Storeria* by Garman. The primary characters given for the genus were the number of maxillary teeth, 14 to 18, the equal maxillary and mandibular teeth, the keeled scales, the arrangement of the scales in 15 to 19 rows, and the presence of hypapophyses throughout the vertebral column.

Cope (1900) gave essentially the same diagnosis of the genus as Baird and Girard, mentioning in addition only the character of the teeth, "small, numerous, of equal length, and ungrooved." He referred to *Storeria* the species mentioned by Baird and Girard with the addition of his own *S. tropica,* described in 1885. *Storeria storerioides,* described in 1865 as *Tropidoclonium,* he here referred to *Natrix,* as this last genus has the loreal plate present.

There remains still the question as to how this group of snakes should be delimited. *Storeria dekayi, S. occipito-maculata, S. victa* and *S. storerioides* are very similar in appearance — size, proportions, scalation, and type of coloration. The presence of the loreal in *S. storerioides* sets it apart from the other forms, but in the large series of *S. dekayi* and *S. occipito-maculata* examined occasional specimens were found with the loreal present on one or both sides. The summation of the characters of *storerioides* indicates that this species is closest to the genus *Storeria. S. storerioides,* furthermore, does not fit elsewhere among related genera. It lacks the apical scale pits which are present in both genera to which Cope at different times assigned it — *Tropidoclonion* and *Natrix.* It further differs from *Tropidoclonion* in possessing a divided anal plate.

Taylor (1942) points out that *Adelophis copei* which Garman, Boulenger, and others included in the genus *Storeria,* properly has no place there. The chin shields are differently arranged, the prefrontals are enlarged to reach the upper labials, the anal plate is undivided, the upper labials are reduced to five, and the pattern is lineate.

We may characterize the genus *Storeria* as: colubrid serpents, with all teeth solid; teeth on the entire entire length of the maxillary and dentary bones; dentary bone hardly movable on the articular; hypapophyses present throughout the vertebral column; nostrils lateral; scales keeled, in fifteen to seventeen rows, without apical pits; head somewhat distinct from body; anal plate divided; subcaudals paired.

The scutellation of the head is of the normal colubrid type. The nostrils are within the limits of the nasal plates, which may be entire or divided to

form an anterior and a posterior nasal. The loreal may be present (regularly in *S. storerioides*, and as an anomaly in other species) or absent. The preoculars are normally one or two. The supraocular is single. The postoculars normally two or three in number. The anterior temporals are normally one, the posterior temporals generally two or three. The upper labials are normally six or seven; the lower labials normally seven. The chin shields are in two or three pairs, the anterior parallel and in contact medially, the posterior subparallel to divergent, in contact medially or separated by small scales.

This genus occurs in eastern North America from Quebec to Manitoba and south to Honduras.

KEY TO THE SNAKES OF THE GENUS STORERIA

A. Body scales in fifteen rows
  B. Loreal present ..... *S. storerioides*, p. 5
  BB. Loreal absent
    C. Supralabials seven, preoculars one ..... *S. victa*, p. 39
    CC. Supralabials six, preoculars two ..... *S. occipito-maculata*
      D. Venter whitish, head dark with a dark fork behind, fifth labial often obscured with black (Mexico) ..... *S. o. hidalgoensis*, p. 14
      DD. Venter red or pink (United States)
        E. Three occipital light marks ..... *S. o. occipito-maculata*, p. 20
        EE. Occiput with light ring about two scales wide ..... *S. o. obscura*, p. 33
AA. Body scales in seventeen rows ..... *S. dekayi*
  F. Anterior temporal with a horizontal dark mark.
    G. Chin shields in three pairs ..... *S. d. anomala*, p. 73
    GG. Chin shields in two pairs
      H. Posterior temporals often three, sum of ventrals and subcaudals higher—av. 187 (Gulf Coastal Plain in Mexico) ..... *S. d. temporalineata*, p. 70
      HH. Posterior temporals two, sum of ventrals and subcaudals lower—av. 181 (Guatemala and Honduras) ..... *S. d. tropica*, p. 77
  FF. Anterior temporal otherwise
    I. Anterior temporal with a vertical or diagonal dark bar (occasionally interrupted); dorsal spots separate ..... *S. d. dekayi*, p. 47
    II. Anterior temporal with a vertical dark bar (occasionally interrupted); dorsal spots fused to short crossbars ..... *S. d. wrightorum*, p. 57
    III. Anterior temporal not marked with black, or with black only along margin; dorsal spots separate ..... *S. d. texana*, p. 63

STORERIA STORERIOIDES (Cope)

Figs. 1-6

Tropidoclonium storerioides Cope, Proc. Acad. Nat. Sci. Phila., vol. 17, p. 190 and 197, 1865; Bull. U. S. Nat. Mus., vol. 1, p. 42, 1875; Yarrow, Bull. U. S. Nat. Mus., vol. 24, p. 18, 1883; Garman, Bull. Essex Inst., vol. 16, p. 24, 1884; Cope, Bull. U. S. Nat. Mus., vol. 32, p. 60 and 75, 1887; Proc. U. S. Nat. Mus., vol. 11, p. 392, 1888; Amaral, Mem. Inst. Butantan, vol. 4, p. 251, 1929.

Ischnognathus occipito-maculatus Fischer, Arch. Naturg., vol. 48, p. 284, 1882.

Hemigenius variabilis Dugès, Prcc. Amer. Philos. Soc., vol. 25, p. 182-3, fig. 2, 1888; Dugès, La Naturaleza, (2), vol. 1, p. 403, pl. 27, fig. 14, 1890; Bocourt, Miss. Sci. Mex., vol. 13, p. 741-2, pl. 53, fig. 5, 1893; Cope, Amer. Nat., vol. 30, p. 1021 and 1025, 1896; Dugès, La Naturaleza, (2), vol. 2, p. 482-485, 1896; Taylor, Copeia, 1933, p. 97, 1933.

Natrix storerioides Cope, Proc. U. S. Nat. Mus., vol. 11, p. 392, 1889; Proc. U.S. Nat. Mus., vol. 14, p. 674, 1892; Amer. Nat., vol. 30, p. 1021 and 1025, 1896; Ann. Rep. U. S. Nat. Mus., p. 997-8, 1900; Dunn, Copeia, 1931, p. 163, 1931.

Ischnognathus storerioides Boulenger, Cat. Snakes Brit. Mus., ed. 2, vol. 1, p. 288-9, 1893; Günther, Biol. Cent. Amer., Rept., p. 136, 1894; Boettger, Nat. Rept. Senck. Mus., pt. 2, p. 31, 1898; Boulenger, Cat. Snakes Brit. Mus., ed. 2, vol. 3, p. 611, 1896; Werner, Zool. Jahrb., vol. 57, p. 38, 1929.

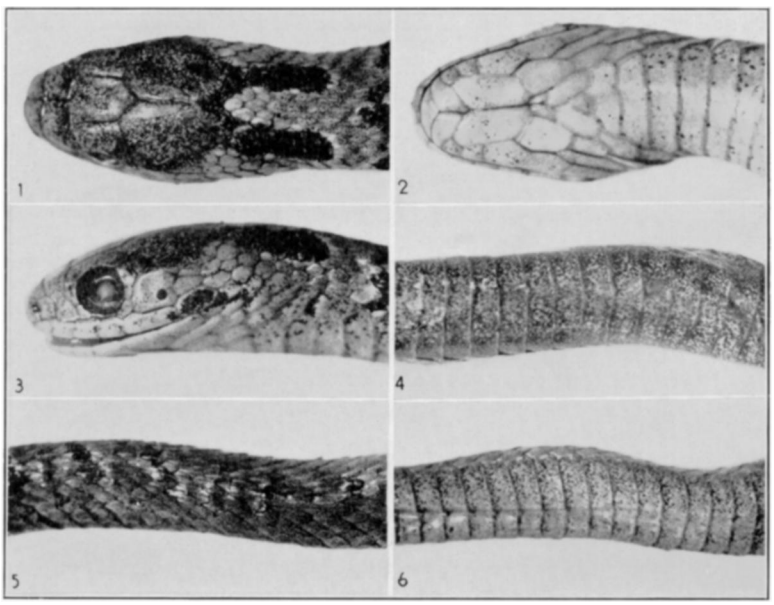
Tropidonotus storerioides Bocourt, Miss. Sci. Mex., vol. 13, p. 750, 1893.

Tropidonotus variabilis Günther, Biol. Cent. Amer., Rept., p. 133, 1894; Gadow, Proc. Zool. Soc. Lond., p. 231, 1905.

Thamnophis variabilis Amaral, Mem. Inst. Butantan, vol. 4, p. 147, 1929.

Storeria storerioides Garman, Mem. Mus. Comp. Zool., vol. 8, p. 29-30 and 143, 1883; Mertens, Abh. Ber. Mus. Magdeburg, vol. 6, p. 150, 1930; Taylor and Smith, Univ. Kans. Sci. Bull, vol. 25, p. 249-251, fig. 3, 1938; Taylor, Herpetologica, vol. 2, p. 79, 1942.

This is the one species of *Storeria* whose generic status has been questioned in recent times. Cope originally described the species in 1865 in the genus *Tropidoclonium* (=*Tropidoclonion*). Garman (1883) broadened the definition of *Storeria* to include this species (with a loreal). Dugès (1888) described the species *variabilis* for specimens from Guadalajara and Guanajuato, erecting the genus *Hemigenius* for it, since the specimens had the posterior chin shields somewhat reduced, so that he considered only one pair of chin shields to be present. Cope, in the following year, decided that his *storerioides* did not belong in the genus *Tropidoclonion* as originally described, since the anal



Figs. 1-6.—*Storeria storerioides*. All figures exceeding life size. Fig. 1. USNM 24989, Cotype, dorsal view of head and neck. Fig. 2. USNM 24989, Cotype, ventral view of head and neck. Fig. 3. USNM 24989, Cotype, lateral view of head and neck. Fig. 4. USNM 24987, Cotype, ventral view of body showing extent of dark punctulation. Fig. 5. USNM 24989, Cotype, dorsal view of body. Fig. 6. USNM 24989, Cotype, ventral view of body.

was not entire. He therefore placed it in *Natrix,* which has the anal divided. Boulenger (1893), and several European workers following him, included *storerioides* in their equivalent of *Storeria,* i.e. *Ischnognathus.* Bocourt (1893), not recognizing the identity of the *variabilis* of Dugès and the *storerioides* of Cope, included both in his treatment of the Mexican snakes, but placed *storerioides* in *Tropidonotus.* Günther (1894), like Bocourt, not only treated *variabilis* and *storerioides* as distinct species but placed them in different genera; *storerioides* in *Ischnognathus,* and *variabilis* in *Tropidonotus.* In 1929 Amaral added to this confusion by placing *variabilis* in *Thamnophis* despite the fact that the anal of that genus is entire, while in *variabilis* it is divided. He also listed *storerioides* in *Tropidoclonion,* which is also characterized by the entire anal. E. H. Taylor (1942) and H. M. Smith consider *storerioides* and *variabilis* to be congeneric and conspecific. In this I concur.

In the original description of this species the ventral and subcaudal scale counts, and the measurements of but one specimen are given, although as variations in the head plates are mentioned, it is evident that Cope had several specimens before him. No types were designated but the "habitat" of the species is given as the "Mexican plateau between the eastern ranges and the valley of Mexico." The specimens were sent to Cope by Dr. Charles Sartorius. In Cope (1900) the original description is merely transcribed with the exception that variation in the ventrals and subcaudals is noted, and the measurements, now in millimeters, not inches as before, are slightly different. Six specimens (USNM 9055-60) from Sartorius are listed. There are now four specimens in the U. S. National Museum designated as cotypes, and undoubtedly correctly so, although renumbered USNM 24987-90. In scalation these fall within the limits of variation given by Cope in 1900, but the extremes of ventral and subcaudal counts of the four specimens do not reach those given by Cope. These extremes are evidently those of the series of fifteen specimens cited by Boulenger (1893).

Hemigenius variabilis is apparently based on a specimen from Barranca de Portillo, Guadalajara, and a second individual from Guanajuato. Taylor (1933) has located these types in the Alfredo Dugès Museo at the Colegio del Estado de Guanajuato.

DESCRIPTION

Diagnosis.—This is the only *Storeria* with a loreal normally present, and with the posterior chin shields normally separated from each other by small scales interposed between them. The occipital marks are also diagnostic, as they consist of a pair of elongate narrow dark marks, extending parallel to the body axis, behind the parietals. These are usually four or more scales in length. The dorsal scales are in lfteen rows with the lowermost normally smooth. The preoculars are normally two, postoculars two or three, the upper labials six or seven, the lower labials seven.

Scutellation.—Dorsal head scales normal; nostril opening at posterior margin of anterior nasal, anterior nasal separated from posterior nasal below nostril, and sometimes above; loreal present, variable in shape and extent,

sometimes entering the orbit between the preoculars; proculars normally two, the upper slightly larger; postoculars two or three, when two, the upper larger; anterior temporal single; posterior temporals normally two; upper labials normally seven, the third and fourth entering the orbit; lower labials normally seven, the fifth generally the largest; mental deltoid; chin shields in two pairs, the anterior pair slightly larger, or the two pairs subequal, the posterior pair separated by small scales; dorsal body scales in fifteen rows, keeled, except for the first row which has the scales smooth or very weakly keeled and twice as wide as those of the upper scale rows; second scale row more weakly keeled than rows above it and also slightly wider; scales emarginate behind, apical pits not apparent.

Ventrals in males 120 to 133 (nineteen specimens), in females 123 to 136 (twenty-one specimens); anal plate divided; subcaudals divided, in males 42 to 53 pairs (nineteen specimens), in females in 37 to 48 pairs (twenty-one specimens).

Coloration.—Head brownish with minute black punctulations aggregated to form dark areas of varying shapes, but always forming, toward the rear of the parietals, a pair of occipital marks extending from one to seven scales behind the parietals. These punctulations scattered along the side of the head, tending to be aggregated along the sutures of the labials and across the angle of the mouth. Dark markings weak or absent on the mental and chin shields. Body brownish above with a pattern of variously pronounced dorsal spots on the fifth and sixth scale rows; these spots fused to form crossbars on the body; alternating with the crossbars are faint lateral spots usually most pronounced on the fourth scale row. Body pattern, faint posteriorly, finally disappearing on the tail, formed by black margins of scales and black pigment on the skin between the scales. Lateral margins of ventrals and subcaudals with punctulations of varying intensity; their extent is quite variable, some specimens being so faintly marked that the belly appears clear, while others have an intensification of these fine spots so that the belly appears black laterally, with a narrow midventral light stripe only a millimeter wide.

Hemipenis.—The retractor penis muscle inserts at the level of nineteenth subcaudal scale. The penis itself apparently extends as far as the eighth subcaudal. There are small fine spines distally; the spines become larger proximally, the longest being about two millimeters from the base of the organ, which bears smooth spineless folds. The spines of the basal half of the organ are larger than in other species of *Storeria,* but there is no single much enlarged spine as in *S. dekayi.* The distal half of the organ has its dorsal surface thrown into a large fold so that when everted it is probably expanded as in *S. occipito-maculata.* The sulcus spermaticus could not be made out in the dissected hemipenis.

The hemipenis is more similar to that of *S. occipito-maculata* than to that of *S. dekayi.* The hemipenis of *S. storerioides* differs from that of *S. occipito-maculata* in its relatively larger proximal spines.

Dentition.—The maxillary teeth are thirteen to fifteen, the last of the

series enlarged; the dentary is provided with approximately eleven teeth, subequal in length, but with a trend toward a reduction in size posteriorly.

Size.—The largest male examined is 328 mm. long (EHT-HMS 21423 from Rio Frio, Mexico) and the largest female is one recorded by Boulenger (1893), 340 mm. in total length. The ratio of tail to total length in males is 21 to 25 per cent (average 22 per cent) in females 19 to 21 per cent (average 20 per cent).

DESCRIPTION OF COTYPES

The scutellation of the four cotypes in the United States National Museum may be summarized as follows:

No.	Sex	Ventrals	Subcaudals	Supralabials	Infralabials	Postoculars	Posterior temporals	Total Length	Tail Length
24987	♀	123	43	6/6	7/7	3/2	3/2	320	63
24988	♂	126	47	7/7	7/7	2/3	3/2	309	69
24989	♂	125	49	7/6	7/7	3/3	2/3	271	61
24990	♂	127	47	6/6	7/6	3/3	3/2	260	56

The preoculars are invariably 2/2, the anterior temporals 1/1, the dorsal scales in 15 rows, and the posterior chin shields separated. The loreal is invariably present, entering the orbit between the preoculars in No. 24987, excluded from the orbit in the remaining three.

Coloration in cotypes.—USNM 24988 is a brown specimen like *S. dekayi,* while the other three are grayer, 24987 being decidedly dark gray. The dorsal markings are prominent, except in 24988.

The top of the head is brownish or tan peppered with black. The sides of the head are less heavily peppered, but with specific areas of intense pigmentation. The dark color of the top of the head ends about the middle of the upper postocular, and extends along the upper margin of the anterior temporal. The occipital marks are darker than the head. The markings of the upper labials are variable, but in general there is a small dark spot below the eye, on the third labial (in six labial specimens) or fourth labial (in seven labial specimens). This condition is most pronounced in 24988, in which there is also a dark spot on the rear of the fourth upper labial. The ventral half or three-fourths of the last labial is dark and the mark extends forward to involve the rear lower corner of the penultimate labial. The lower labials, mental, and chin shields are almost unspotted or very weakly flecked. The dorsal crossbars extend down to the fifth scale row and vary in width from a fourth to a whole scale.

There are fifty-two to sixty-two cross bands on the body. No. 24988 has five pairs of spots on the neck not fused to form crossbars. There are smaller, faint marks on the third scale row.

The black flecks which darken the back become more scattered on the venter but in 24987 the belly is blackish except for a narrow central area one-third of the width of the ventrals. Nos. 24989 and 24990 have less pigmentation of the belly while 24988 has the belly about as unmarked as most *S. dekayi,* i.e., with only a few scattered flecks along the side of the ventrals.

VARIATION

Scutellation.—Variation in numbers of ventrals and subcaudals is shown in Table 1. The portions of the table summarizing the data on the ventrals and the subcaudals include all the specimens seen by the writer, and the counts given by Boulenger (1893: 288-9, 1896: 611) on the series of specimens in the British Museum. In the part of the table dealing with the ventrals minus the subcaudals the counts of Boulenger (1893: 288-9) are omitted since he lists ventral and subcaudal counts separately and the two may not be related with certainty.

There is a slightly higher number of ventrals and a somewhat more decidedly lower number of subcaudals in females.

It is difficult to correlate trends in scale variation with the geographic or ecological factors, since the material now available often has vague locality data, and since variation in altitude is great over relatively short distances in the terrain occupied by this species in central Mexico. Altitudinal data, much less ecological data, are woefully lacking in other than recently collected material. There is, however, some indication that specimens from lower altitudes at the periphery of the range of this species tend to have lower numbers of ventrals.

The specimens with the low subcaudal counts (i.e., 42 to 46 in the males and 37 and 38 in the females) are from the northern and northwestern periphery of the range of the species, and from low altitudes (4500'-6000'). Thus the female with 37 subcaudals is from Autlan, Jalisco, those with 38 are from Talpa and Mascota in Jalisco and from Jesus Maria in San Luis Potosi. The male with 42 subcaudals is from Talpa, Jalisco, the ones with 45 are from

TABLE 1.—Variation in Certain Characters of *Storeria storerioides*.

Ventrals

No. of scales	120	'1	'2	'3	'4	'5	'6	'7	'8	'9	130	'1	'2	'3	'4	'5	'6
♂	1	1				2	2	3	1	2	3	4		2			
♀				1			1	1	1	2	5	4	2	1	2		2
total	1	1	0	1	0	2	3	4	2	4	8	8	2	3	2	0	2

Subcaudals

Scales	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53
♂						1			2	1	4	2	2	3	3	2	1
♀	1	4		5	5		1	1	2	1	1	1					
total	1	4	0	5	5	1	1	1	4	2	5	3	2	3	3	2	1

Ventrals — Subcaudals

No. of scales	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92
♂	1	1	1	2	3	4	2	1										
♀						1		2			2	1		1	1	2	3	1
total	1	1	1	2	3	5	2	3	0	0	2	1	0	1	1	2	3	1

Talpa, and north of the Rio de Santiago, Jalisco, and the one with 46 subcaudals is from Autlan, Jalisco. Thus there is some evidence of reduced subcaudal numbers in specimens from Jalisco and San Luis Potosi but any subspecific distinction must await the collection of more ample data.

The variations in head plates in the twenty-six specimens examined are summarized in Table 2. The labials are exceedingly variable, with the fusion in the supralabials either before or to the rear of the orbit. The reduced number of infralabials is mostly due to the fusion of what are normally the second and third, although the last two may be fused. When there is reduction in the labials on both sides, the fusions are bilaterally symmetrical, i.e., the variations on each side involve the same scales. When the loreal enters the eye it is not quadrilateral, but elongate and acute posteriorly, wedged between the two preoculars.

In the variability of its head plates *storerioides* must be considered the most plastic of the species of *Storeria*.

Coloration.—The dark occipital marks are usually diagnostic of this species, being longer than broad in contrast to *S. dekayi* in which they are

TABLE 2.—Summary of Variation in Head Plates in 26 Specimens of *Storeria storerioides* Cope.

Supralabials	5–R	6–R	6–L	6/6	7/7			
Frequency in Per Cent	3.8	3.8	7.6	26.6	normal			
Infralabials	5–L	6–R	6–L	6/6	7/7	8–R		
Frequency in Per Cent	3.8	7.6	7.6	7.6	normal	3.8		
Preoculars				1–R	2/2	3–L		
Frequency in Per Cent				3.8	normal	3.8		
Postoculars					2/2	3–R	3–L	3/3
Frequency in Per Cent					normal	3.8	7.6	15.2
Posterior Temporals				1–L	2/2	3–R	3–L	3/3
Frequency in Per Cent				3.8	normal	26.6	11.4	7.6
Loreal Enters Orbit		Rt. Side		Left Side		Both Sides		
Frequency in Per Cent		3.8		3.8		7.6		

broader than long or reduced to small spots. These occipital marks are variable in length, but one specimen (EHT-HMS 5404 from Zitacuaro, Michoacan) has no occipital marks other than the anteriormost of the paired body spots. The occipital paired marks may be equal or of different lengths. Thus one specimen has the occipital marks extending five scales posterior of the parietals on one side, seven on the other. Most frequently these marks extend four scales behind the parietals.

Taylor and Smith (1938) record an irregular narrow reddish-brown band on the middorsal line and Boulenger (1893) says the species is gray or reddish beneath. Dugès (1888) states that, "La couleur général varie du brun jaunâtre au rouge brique sur les parties superieures. . . ." He also notes that the throat is white, and the venter brick red to yellowish white. These colors are lost in preserved material.

A specimen from Guadalajara, Jalisco, USNM 29125, is melanistic. The head coloration is normal, but with an intensification of the punctulations. The chin and first several ventrals are likewise normal, but the dorsum of the body and tail have the pattern obscured with black, while ventrally the punctulations are concentrated and similarly appear black, with a faint light midventral area for the first third of the body. Some of the body scales, on

close examination, are white margined, as is some of the skin between the scales, so that the normal pattern may be made out vaguely when the specimen is submerged in liquid.

Other specimens from Guerrero are also very dark, but possibly as a result of poor preservation. There may be a distinct geographic race in lower altitudes in Guerrero but the material now available is not sufficient to define it.

DISTRIBUTION

This species is known only from the southern part of the Mexican plateau and the adjoining Sierra Madre Occidentale and Sierra Madre del Sur, where it occurs at altitudes of 4500 to 10,500 feet. It ranges from Morelos north to southern San Luis Potosi on the Plateau, and north to central and western Jalisco in the west. An isolated record from far to the northwest at "Ciudad in Durango" (Günther, 1894) is open to question until further specimens are found. Specimens from the region of the Sierra Madre del Sur are probably separated from direct contact with the central population by the low valley of the Rio Balsas. There is the possibility that the range of these snakes is connected through the highlands of northwestern Oaxaca and Puebla, around the Balsas basin, but specimens to confirm this are lacking.

In terms of the biotic provinces of Mexico as recently outlined by Smith (1939, 1940), *Storeria storerioides* is confined to the southern nearctic provinces; the Guerreran, Austro-central, and Austro-oriental.

AFFINITIES

Storeria storerioides seems in all regards to be closest to the stock from which the genus *Storeria* arose. Of the existing species in the genus it is most closely related to *Storeria occipito-maculata* through its southern race, *hidalgoensis*. It agrees with *occipito-maculata* in having fifteen scale rows and two preoculars as well as certain salient features of coloration such as the stippling of the lateral edges of the ventrals. While the upper labials are normally seven in *S. storerioides,* they are reduced to six on each side, the normal number for *S. occipito-maculata,* in no less than twenty-seven per cent of the specimens examined. The high percentage of variability in the head plates of this species suggests a plasticity that includes the genetic potentialities found in the other members of the genus.

The limitation of this species to the relatively humid and temperate uplands in the southern part of the Mexican plateau, and its faunal relations along the Sierra Madre Orientale are easily understood. To the northwest the arid northern Mexican plateau forms a barrier for snakes with the mesic environmental requirements of this genus (especially as to cover and food). To the west and south the limits of the species are established by the rapid drop in altitude to tropical conditions. The competition of the large number of neotropical species reaching the northern limits of their range in the region of the Isthmus of Tehuantepec forms a part of the southern ecological barrier.

Storeria occipito-maculata is principally an upland species like *S. storerioides,* and as the southern limits of its range (in the subspecies *hidalgoensis*)

coincide with the northern periphery of the range of *S. storerioides,* it is the logical derivative of that form. *Storeria occipito-maculata,* like *S. storerioides,* is conspicuously absent in the lowlands of the eastern Mexican coastal plain. *Storeria dekayi* is also thought to be derived from the *S. storerioides* line (see below, page 80).

LOCALITY RECORDS

Specimens examined as follows:

DISTRITO FEDERAL: Desierto de los Leones, 10,000 feet, EHT-HMS 5354-5.

GUERRERO: Omilteme, Sierra de Burro Mountains, MCZ 42663; Chilpancingo, FMNH 38346-7.

JALISCO: Guadalajara, USNM 29125.

MEXICO: Llano Grande, five miles west of Rio Frio, USNM 110325-6; Nevada de Volcán Toluca, EHT-HMS 16141; Rio Frio, 9,500 feet, EHT-HMS 5403, 21422-23; Km. 57 on road to Puebla, near Rio Frio, 9,500 feet, EHT-HMS 5352; Km. 66 on road to Puebla, near Rio Frio, 9,500 feet, EHT-HMS 5353; Ten miles west of Villa Victoria, USNM 110327.

MICHOACAN: Two miles south of San Martin near Zitacuaro, EHT-HMS 5404.

MORELOS: Lake Zempoala near Tres Cumbres, 10,500 feet, EHT-HMS 5351, 5594-5; Tres Cumbres (Tres Marias), EHT-HMS 4665.

SAN LUIS POTOSI: Mountains near Jesus Maria, USNM 46428.

NOT ASSIGNABLE TO STATES: "Mexico," MCZ 25879; "Mexican Plateau between eastern range and valley of Mexico," USNM 24987-90, COTYPES; "Uncertain Locality, perhaps Zempoala," Morelos, EHT-HMS 5356.

Also recorded as follows: (general localities like "Mexico" omitted).

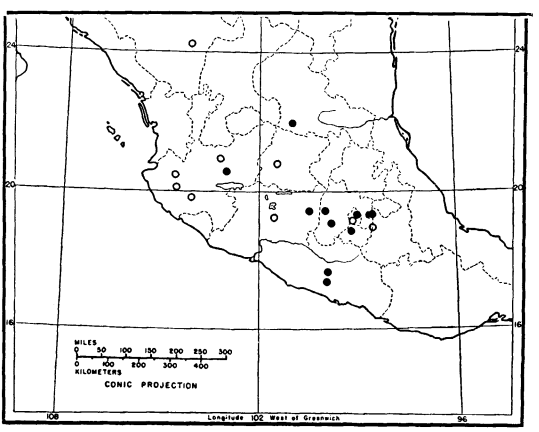
DISTRITO FEDERAL: Mexico City (Günther, 1894).

DURANGO: "Ciudad in Durango" (Günther, 1894).

GUERRERO: Amula (Boulenger, 1896).

GUANAJUATO: Guanajuato (Dugès, 1888; Dugès 1890; Bocourt, 1893; Günther 1894; Dugès 1896; Amaral, 1929).

JALISCO: Autlan, Colonia Brizuela, Hacienda el Rosario (Boulenger, 1893); Guadalajara, Barranca de Portillo (Dugès, 1888; Dugès, 1890); Guadalajara (Günther, 1894); Mascota, Hacienda Sta Gertrudio (Boulenger, 1893); North of Rio de



Map 1. Distribution of *Storeria storerioides.* Black spots represent specimens examined, circles records from the literature. (Based on Field Museum Outline Map No. 1.)

Santiago (Boulenger, 1895); Talpa, La Cumbre de los Arrastrados (Boulenger, 1893); "Jalisco" (Dugès, 1896); "Jalisco," 8500 feet (Boettger, 1898).

MEXICO: "Mexico State" (Mertens, 1930).

MICHOACAN: Morelia (Dugès, 1896).

NOT ASSIGNABLE TO STATES: "en el Valle de Mexico" (Dugès, 1890); Plateau of Mexico (Boulenger, 1893); Popocatepetl, 9000 feet (Boulenger, 1896); the high plateau, 6000-8000 feet (Gadow, 1905).

STORERIA OCCIPITO-MACULATA HIDALGOENSIS Taylor

Mexican Red-bellied Snake

Figs. 7-10

Ischnognathus occipitomaculata Müller, Reisen Ver. Staat. Can. Mex., p. 611 *fide* H. M. Smith *in litt.*, 1865; Dugès, La Naturaleza, vol. 1, p. 144, 1870.

Storeria occipitomaculata Cope, Proc. Amer. Philos. Soc., vol. 22, p. 386, 1885; Bull. U. S. Nat. Mus., vol. 32, p. 75, 1887; Proc. U. S. Nat. Mus., vol. 14, (882), p. 675 (partim), 1891; Amer. Nat., vol. 30, p. 1023 (partim), 1896; Ann. Rept. Smithsonian Inst., p. 1003-5 (partim), 1900; Stejneger and Barbour, Check List N. Amer. Amph. Rept., ed. 4, p. 131 (partim), 1939.

Storeria occipito-maculata Bocourt, Miss. Sci. Mex., vol. 13, p. 745-6, pl. 53, fig. 6 (partim), 1893; Stejneger and Barbour, Check List N. Amer. Amph. Rept., ed. 1, p. 98 (partim); Dunn, Proc. Acad. Nat. Sci. Philad., vol. 88, p. 477, 1936.

Ischnognathus occipito-maculatus Günther, Biol. Cent. Amer., Rept., p. 136 (partim), 1894.

Storeria sp., Taylor, Univ. Kans. Sci. Bull, vol. 27, p. 113, 1941.

Storeria hidalgoensis Taylor, Herpetologica, vol. 2, p. 78, 1942.

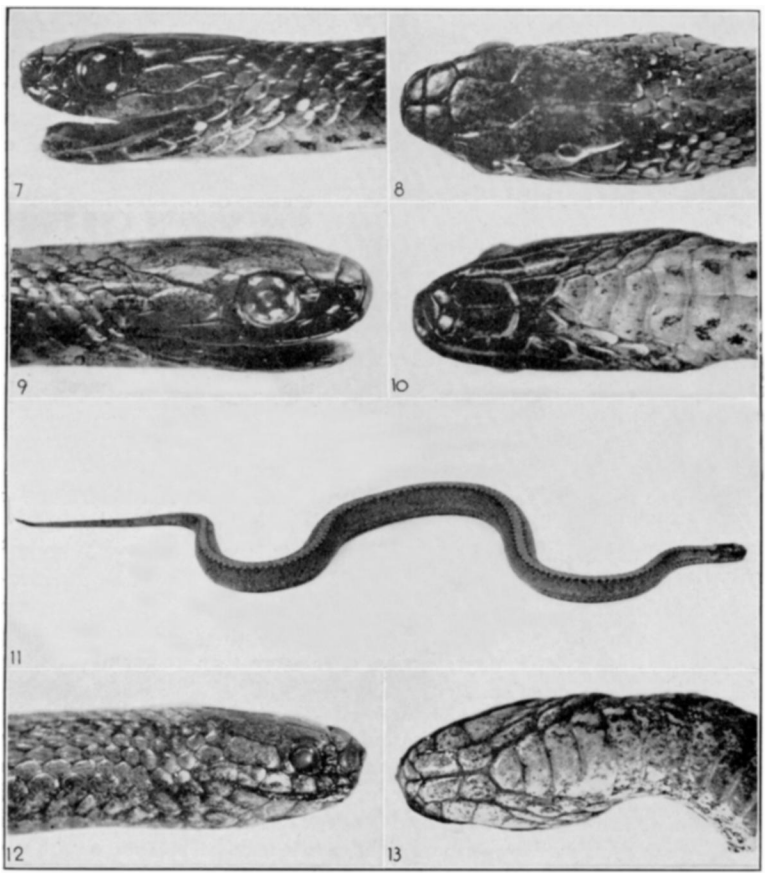
This race from the Sierra Madre Orientale of northeastern Mexico has not been distinguished from *Storeria occipito-maculata* until recently, although Dunn (1936) recognized that it might represent a new "color race." Taylor (1942) regards it as a full species, but from examination of the series of three dozen specimens available to me it is now apparent that it should be regarded as a race of *S. occipito-maculata*. The holotype is in the Edward H. Taylor-Hobart M. Smith collection at Lawrence, Kansas.

DESCRIPTION

Diagnosis.—Characters mostly as for *Storeria o. occipito-maculata*, differing as follows: head darkened, and with a black wedge-shaped mark extending behind each parietal; fifth labial often obscured with black; belly usually white or gray, size large, ventrals high (males 124 to 134, females 128 to 136); posterior nasal enlarged.

Scutellation.—The head plates are in general similar to those of *S. o. occipito-maculata*. Dorsal head plates normal; nostril opening with posterior border along suture between nasals; posterior nasal two or more times the area of the anterior nasal; loreal absent; two preoculars subequal in area; postoculars two, the upper larger; temporals normally 1-2, the anterior usually larger than the combined area of the posterior; upper labials normally six, the third and fourth entering the orbit, the fifth largest, the sixth somewhat smaller and those anterior smallest; lower labials normally seven, the fourth and fifth

largest, the first pair in contact between the mental and the anterior chin shields; mental triangular, broader than long; chin shields in two pairs, the anterior in contact throughout their length, a little less than twice as long as broad, laterally in contact with the first to fourth infralabials; posterior chin shields slightly shorter than anterior, truncate anteriorly and rounded posteriorly, in contact for three-fourths or more of their length, laterally in contact with the fourth and fifth infralabials; dorsal body scales in 15 rows, all keeled, the first row about twice as broad as the others and very weakly keeled, scales



Figs. 7-10. *Storeria occipito-maculata hidalgoensis*. Views of head and neck of specimen from Alvarez, San Luis Potosi, in the collection of the Museum of Comparative Zoology (several times life size). Fig. 11. *S. o. occipito-maculata*, photographed in life from a specimen from Ithaca, New York, less than life size. Fig. 12. *S. o. occipito-maculata*, lateral view of head several times enlarged, specimen from Ithaca, New York. Fig. 13. *S. o. occipito-maculata*, ventral view of head several times enlarged, specimen from Ithaca, New York.

truncate or weakly emarginate posteriorly, scales of first row not emarginate, apical pits not apparent.

Ventrals in males 124 to 134 (fourteen specimens), in females 128 to 136 (twenty-three specimens); anal plate divided; subcaudals divided, in males 52 to 63 (fourteen specimens); in females 47 to 53 (twenty specimens).

Coloration.—The general features of the color pattern of *Storeria occipito-maculata* are described in the account of the typical subspecies.

The dorsal color on the body in *S. o. hidalgoensis* varies from light brown or tan to reddish or grayish. The ground color is usually brown flecked with variable amounts of gray so that the snakes are "brownish" or "grayish," depending on the amount of flecking, just as in subspecies *occipito-maculata*. The dark flecking on the first and sixth scale rows is usually faint or absent, but such flecks, as well as some white, may be present. In some specimens from Alvarez the marks on the sixth scale row are joined to form small spots somewhat in the fashion of the marks on the dorsum of *S. dekayi*.

In specimens from Hidalgo the dorsal coloration extends as faint and diffuse markings on the edges of the ventrals, but certain of those from Alvarez, San Luis Potosi, have three-fifths of the ventrals obscured with black. Others from the same locality, however, have the belly almost clear and unmarked. Unfortunately, any red on the ventrals fades with time on preservation, so that it is impossible to determine the color in life in most of the material of this race. According to Taylor, in the description of this snake, the type had the belly ivory-white with no trace of red. Dunn (1936), who had recently collected material at his disposal, found the bellies gray in all but one of five specimens from Pablillo, Nuevo Leon, and Alvarez, San Luis Potosi. As the pink-bellied Pablillo specimen is from the north and may represent an approach to subspecies *occipito-maculata,* the normal belly color in life for *hidalgoensis* may be white or grayish. W. W. Brown, the collector of the large series from Alvarez deposited in the Museum of Comparative Zoology, informs me that to the best of his memory these snakes were reddish below in life; but this is a recollection after more than fourteen years, and accordingly open to question.

In this race, as in the subspecies *obscura,* there is a constant pronounced blackening of the head, particularly toward the rear. The black is prolonged behind the parietals, forming a pair of wedge-shaped marks two scales in length. These markings are interposed between the light occipital marks, when the latter are present. The occipital light marks may be present, or the neck may be about the same color as the dorsum. The condition of the side of the head and the lower jaw is variable. In some specimens from Alvarez, black obscures the labials, mental, and chin shields completely, while others, from Alvarez and elsewhere have the fifth labial lighter or even white, and the mental also unmarked. According to Taylor (1942) the fifth supralabial is lighter than the others in the type. The fifth supralabial may be black on one side and light on the other in individual specimens. Those with the fifth

supralabial light have the rear and labial margin of the scale dark as in subspecies *occipito-maculata* and unlike *obscura*. Specimens which have been preserved a long time, (such as ANS 11680 and 14754-5) have the dark pigment of the labials faded. The lower jaw may be light and only stippled with black.

Size.—The largest male examined was 337 mm. in total length (eleven specimens), the largest female 333 mm. (twenty-two specimens). A summary of the average total length and tail/total length ratio is given in Table 3. If the average total length of subspecies *hidalgoensis* as determined in the sample now available is a true representation of the natural population it will be seen that the snakes of this race are considerably larger than those of the other subspecies. The tail/total length ratio does not differ from subspecies *occipito-maculata*.

VARIATION

Scutellation.—The variation in ventrals and subcaudals is summarized in Table 3. It will be seen that while there is a slight difference in the average number of ventrals in males and females (the females having the greater number), there is great overlap in the extremes. The number of ventrals is greatest to the south (in Hidalgo) and lower in the north (in Nuevo León). The number of ventrals in subspecies *hidalgoensis* exceeds that of most *S. o. occipito-maculata*. This species is uncommon at the western edge of its range, so that an adequate sample from the westernmost area occupied by *occipito-maculata* in the United States is not available to determine if there is a gradual transition from the one race to the other.

The sexual difference in number of subcaudals is somewhat more pronounced than is the difference in number of ventrals. The number of subcaudals is higher in the males. As with the ventrals, the number is higher to the south and lower to the north. It will be pointed out that in *S. o. occipito-maculata* there is an increase in number of subcaudal scales from the northeast southward to the lower Mississippi Valley. The subcaudals in the Mexican *hidalgoensis* show the continuation of this clinal trend.

The cline within subspecies *hidalgoensis* is best shown by the figures for ventrals plus subcaudals, disregarding sex:

	Number	Extremes	Average
Nuevo Léon	3	176-179	177.3
San Luis Potosi	25	178-190	183.2
Hidalgo	4	186-195	191.0

The variation in head plates in this race is relatively slight. There are two preoculars, two postoculars and two anterior temporals in all specimens examined. The supralabials may be reduced to five or increased to seven (see Table 4). The infralabials are less variable, the only abnormality observed being the increase to eight on one side. The posterior temporals are occasionally one or three instead of the normal two. The posterior nasal which is variable in size in subspecies *occipito-maculata* here seems to be consistently about twice the

TABLE 3.—Summary of Regional Variation in Certain Characters of *Storeria occipito-maculata hidalgoensis*.

	Males			Females		
	No.	Extremes	Average	No.	Extremes	Average
Ventrals						
Nuevo Léon	2	124-125	124.5	1	128-128	128.0
S. L. P.	9	125-134	129.2	19	130-136	132.7
Hidalgo	3	130-133	131.3	3	131-135	132.7
Subcaudals						
Nuevo Léon	2	52-52	52.0	1	51-51	51.0
S. L. P.	7	54-62	56.9	18	47-53	49.8
Hidalgo	3	59-63	61.3	1	51-51	51.0
Ventrals—Subcaudals						
Nuevo Léon	2	72-73	72.5	1	77-77	77.0
S. L. P.	7	66-76	71.4	18	79-86	82.9
Hidalgo	3	68-71	70.0	1	84-84	84.0
Total Length						
Nuevo Léon	2	218	217	1	240	240
S. L. P.	7	313	275	18	333	303
Hidalgo	2	337	310	3	332	301
Tail/Total Length Ratio						
Nuevo Léon	2	24.3-25.1	24.7	1	22.5-22.5	22.5
S. L. P.	7	24.0-27.2	25.2	18	20.1-24.0	21.8
Hidalgo	3	23.5-26.0	24.9	1	20.8-20.8	20.8

area of the anterior nasal. This condition is sometimes matched in subspecies *occipito-maculata* but it is nowhere as constant as in the series of *S. o. hidalgoensis*.

HABITAT

According to Taylor (1941) and Cope (1885) the characteristic plants of the region inhabited by this snake in Hidalgo are pines, firs, and alders, as well as brake fern and shrubs of the genera *Andromeda* and *Vaccinium*. At the high altitudes in which this race occurs the climate is humid and many damp situations are available.

DISTRIBUTION

Storeria occipito-maculata hidalgoensis is known from high altitudes in the Sierra Madre Orientale from Hidalgo north through eastern San Luis Potosi to Pablillo, Nuevo León. The altitude range is from about 6000 feet to about 8000 feet. In a list of the vertebrate animals of Mexico, Dugès (1870) has also recorded its from Guanajuato and Guadalajara, but these records are doubtful. Cope (1900) gives the range of this snake as south to Vera Cruz, and he has been followed in this by Stejneger and Barbour (Check List, ed. 1, 1917, and subsequent editions), but there do not appear to be any authentic records from that state.

AFFINITIES

This snake is obviously most closely related to *Storeria o. occipito-maculata*. The scalation is the same except that the ventrals are higher in number, and the subcaudals somewhat so. The distinctive coloration is a modification of the fundamental color pattern of *S. o. occipito-maculata*, or perhaps

TABLE 4.—Summary of Variation in Head Plates in 35 Specimens of *Storeria occipito-maculata hidalgoensis.*

Supralabials	5–R	5–L	6/6	7–R	7–L
Frequency in per cent	2.9	5.7	normal	2.9	2.9
Infralabials			7/7	8–L	
Frequency in per cent			normal	5.9	
Posterior Temporals	1/1		2/2	3–R	3/3
Frequency in per cent	2.9		normal	8.6	2.9

more correctly, the pattern in subspecies *occipito-maculata* is modified from *hidalgoensis*. To the north, the high mountains which provide the humid habitat for this race, give way to the semiarid southern Great Plains where these mesic snakes find no congenial habitat. In consequence, *S. occipito-maculata* barely reaches Texas and Oklahoma, and this area is, in effect, a barrier separating the population of subspecies *hidalgoensis* in the northeastern Mexican mountains from that of *occipito-maculata* in the moist Ozark Plateau and the Mississippi valley. While there are reservoirs of suitable habitats for this species in the river valleys of Texas, the drainage from northwest to southeast lies athwart the path of migration which the species would have to follow. A further discussion of the relations of these two subspecies will be found in the account of *S. o. occipito-maculata.*

To the south and west of the area occupied by *S. o. hidalgoensis, S. storerioides* occurs in similar high country. The scale rows in these two are the same, fifteen. *Storeria storerioides* is distinctive in the possession of a loreal, but the enlarged posterior nasal of *hidalgoensis* suggests that the loreal of *storerioides* has been lost in evolution by a fusion with the posterior nasal resulting in the large plate found in *hidalgoensis*. There are frequently six supralabials in *storerioides,* the normal number in *hidalgoensis*. The dark wedge marks to the rear of the parietals in *hidalgoensis* resemble the pair of elongate dark markings behind the parietals in *storerioides*. It is significant that the belly in *hidalgoensis* is white or gray, just as in *storerioides*. The only definitely red-bellied specimen of *hidalgoensis* is from the northern edge of the range of this race in Nuevo León, where I believe the red-bellied race, *occipito-maculata,* to have influenced the southern form. While the hemipenis in *S. o. hidalgoensis* has not been available for dissection, it is to be presumed that it is similar to that of *S. o. occipito-maculata* and to that of *S. storerioides*. On the basis of these various data it seems evident that *S. o. hidalgoensis* is derived from *S. storerioides,* though now more closely related to *S. o. occipito-maculata.*

LOCALITY RECORDS

Specimens examined as follows:

HIDALGO: Zacualtipán, ANS 11680, 14754-5; near Zacualtipán, EHT-HMS 23624; near Durango, EHT-HMS 23625.

NUEVO LEON: Hills above Pablillo, ANS 20025-7.

SAN LUIS POTOSI: Vicinity of Alvarez, alt. 8000 feet, MCZ 19016-8, 19020, 25006-19, 25020 (eight specimens), ANS 20098, 20100.

STORERIA OCCIPITO-MACULATA OCCIPITO-MACULATA (Storer)

Red-bellied Snake

Figs. 11-13, 20

Coluber occipito-maculatus Storer, Rept. of Mass., p. 230, 1839; Boston Journ. Nat. Hist., vol. 3, (1-2), p. 33-34, 1840.

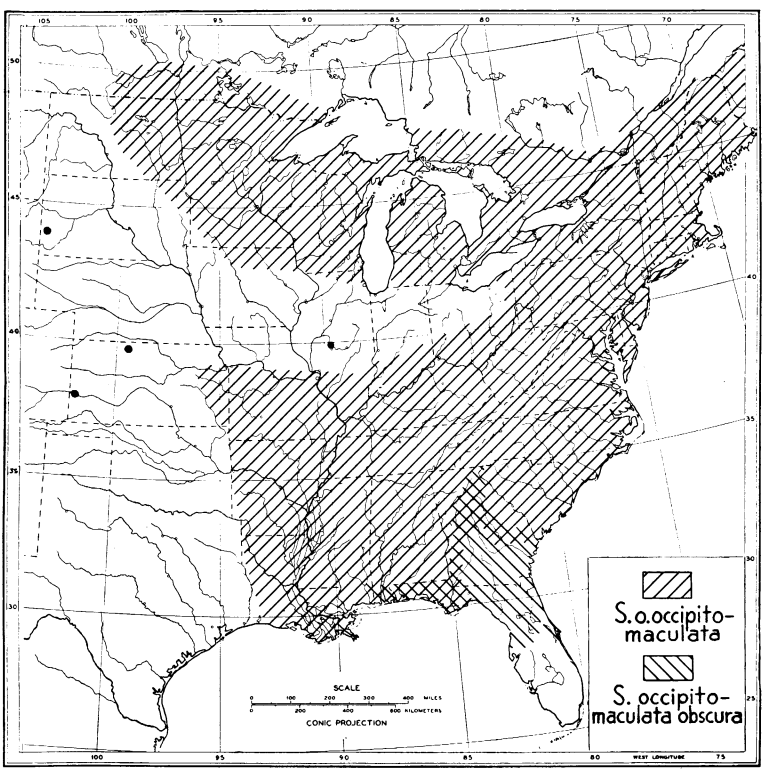
Coluber venustus Hallowell, Proc. Acad. Nat. Sci. Phila., vol. 3, p. 278-280, pl. 3, 1848.

Storeria occipito-maculata Baird and Girard, Cat. N. Amer. Rept., pt. 1, Serpents, p. 137, 1853.

Ischnognathus occipitomaculatus Günther, Cat. Snakes Brit. Mus., p. 81, 1858.

Storeria occipitomaculata Stejneger and Barbour, Check List N. Amer. Amph. Rept., ed. 4, p. 131, 1939.

Storeria occipito-maculata was described from a preserved specimen, and the most obvious character in life, the red belly, was not apparent. The type, from Amherst, Massachusetts, had six upper labials, seven lower labials, one



Map 2. Distribution of *Storeria occipito-maculata*. The black spots represent isolated records, presumably outside the general range of the species. (Based on Goode Base Map No. 109. By permission of the University of Chicago Press.)

hundred and twenty-four ventrals and thirty-eight subcaudals. It was ten and one-half inches in total length. The upper part of the body was gray, with a faintly lighter stripe down the back which was bordered on each side with a row of dark colored scales; the belly was yellowish white, with black markings on the edges of the plates, which anteriorly appeared like black dots; there were "three large white irregularly formed blotches directly back of the occipital plates; one above, and one on each side of the first."

Hallowell's *Coluber venustus* is based on a specimen of *S. occipito-maculata* from Copper Harbor, Lake Superior, Michigan, in the collection of the Academy of Natural Sciences of Philadelphia (ANS 5907). It is still in good condition.

The type of *S. o. occipito-maculata* is presumably no longer in existence.

DESCRIPTION

Diagnosis.—The subspecies *occipito-maculata* is characterized by the three light spots on the occiput, the light mark on the fifth labial scale interrupted by black on the lower margin of the scale, the moderate amount of black pigment over much of the dorsum and rear of the head, and the red belly. The dorsal scales are keeled, and in fifteen rows. The loreal is absent, the preoculars normally two, the postoculars normally two, the upper labials normally six, and the lower labials seven.

Scutellation.—Dorsal head scales normal; anterior nasal slightly smaller than posterior nasal, or subequal, approximately equilateral, frequently fused with the latter; posterior nasal approximately equilateral; loreal normally absent; two preoculars usually about equal; supraocular about twice as long as wide; two postoculars, the upper usually slightly larger; temporals normally 1-2, the anterior usually slightly larger than the posterior temporals combined; upper labials normally six, the third and fourth entering the orbit, the fifth and sixth about equal, and larger than the others; lower labials normally seven, the fourth and fifth largest, first pair in contact between the mental and anterior chin shields; mental triangular, broader than long; chin shields in two pairs, the anterior twice as long as broad, normally in contact throughout their length along the median line, in contact with the first to the fourth infralabials laterally; posterior chin shields normally shorter than anterior, truncate anteriorly and gently tapering to a rounded apex posteriorly, normally in contact for the anterior third of their length, but divergent and separated posteriorly by small scales, laterally in contact with the fourth and fifth infralabials; dorsal body scales in fifteen rows (sometimes seventeen to twenty-two rows on the occiput), all keeled except a few on the occiput, first scale row broader than others, scales becoming gradually narrower dorsally, scales emarginate behind, apical pits not apparent.

Ventrals in males 110 to 132 (three hundred and forty-six specimens), in females 115 to 133 (three hundred and eighty-four specimens); anal plate divided; subcaudals divided, in males 42 to 61 (three hundred and thirty-

seven specimens), in females 35 to 54 (three hundred and sixty-three specimens).

Coloration.—This is a species with exceedingly variable coloration. In general appearance these snakes are grayish, or brownish above, red or deep pink below, with three light marks on the occiput, and a light mark on the upper lip behind the eye.

The dorsal scales are uniformly pigmented with brownish or grayish and marked to varying degrees with chromatophore-like flecks of black. Specimens which seem grayish brown, on close examination are seen to have the brown ground color marked with blackish flecks; variation from "brown" to "gray" lies in the extent to which the blackish pigment flecks obscure the brown. Very dark gray specimens usually have the scales actually gray and much flecked with black. The skin between the scales is always black, but this is seldom apparent since the skin between the scales is not seen unless the body is distended as in females heavy with young. The dark flecks described above are usually not uniformly distributed over the dorsal scales, but tend to be aggregated on the scales of the first and sixth rows, resulting in dark longitudinal stripes of variable intensity. The skin between the fist and second scale rows is dotted with white, and the adjoining upper edge of the first scale row and the lower edge of the second scale row are narrowly tipped with white. Similar white flecks sometimes appear on the anterio-lateral edges of the more dorsal scale rows, particularly between the fifth and sixth rows and between the sixth and seventh rows. They are also sometimes present along the lower margin of the first scale row and the lateral edges of the ventrals. The white flecks are more frequent and somewhat larger on the lower scale rows and anteriorly. The posterior third of the body, the tail, and the median three dorsal scale rows usually do not have such white spots. The white is not superficially apparent, but in distended specimens, the white shows as stippled longitudinal lines.

This species is distinguished by the extension of the dorsal color onto the ventral plates. The dark coloration of the lateral margins of the ventrals is primarily due to the flecked, chromatophore-like black, rather than the uniform brown or gray ground color of the dorsal scales. Snakes that are brown above have the edges of the ventrals not brown but gray; those that are gray above have the change in coloratiion less obvious. In a few specimens, however, the only pigment edging the venter is the uniform ground color. In these there is a diffuse transition from the dorsal color to the clear red of the venter, rather than the sharp demarkation apparent in most. The gray of the edges of ventrals is often mixed with white, and this becomes particularly evident anteriorly, where white borders the margins of the ventrals, and the black pigment spots sometimes become confluent medially. As much as three-fifths of the belly may be obscured with dark leaving only a narrow central red band. The middle of the venter is normally bright red fading to white on the neck and chin shields, although some specimens from New York, New England, Pennsylvania, and elsewhere have the belly completely black. Since the red of the belly fades on preservation, most museum material has the belly white,

and it is impossible to say how much variation there is in this character. Corrington (1931) has reported a white bellied individual from Syracuse, New York.

The top of the head, like the scales of the body, is brown with a variable amount of black stippling, that generally begins at the level of the frontal plate and is sometimes so intense on the rear of the frontal and parietals that they appear black. The anterior portion of the head is lighter and brownish, lacking the dark speckling. The rostral is sometimes whitish. The sides of the head are similar, the plates before the orbit usually light brown, and those behind often heavily stippled and blackish. The upper labials, with the exception of the fifth, are similarly brown or whitish with variable amounts of black stippling mostly aggregated toward the rear of each scale. The last labial is often uniformly darkly pigmented. The greater part of the fifth labial is white, cream or pinkish. Most frequently the labial margin of the scale is stippled with black and there is a vertical black mark at the rear of the scale. The light color of this scale may reach the labial margin between these two dark marks, or it may be confined to the anterio-dorsal corner of the scale. In general, however, the mark is longer than high, and it never reaches the labial margin anteriorly. This marking thus differs from that of *S. occipito-maculata obscura*. The ventral part of the head, including the lower labials, mental and chin shields, is whitish, stippled with black.

The three occipital light spots, from which the species takes its name, are always present though with some variation in size and intensity. The lateral ones appear to be an anterior enlargement of the white stripe between the second and third scale rows, and are located directly behind the corner of the mouth. The median mark covers the occipital scales directly behind the suture between the two parietals. These spots may be reddish, orange, or whitish; they may be distinct, or only a little lighter than the ground color. The three spots are occasionally fused with one another to form a light bar on the neck. There is always some dark pigmentation on the lower scale rows or the edges of the ventrals separating the spots (or the light bar) from the clear venter, so that there is never a neck ring completely joined with the light venter as in *S. occipito-maculata obscura*.

Hemipenis.—The retractor penis muscle inserts at the level of the fourteenth to the nineteenth subcaudal. In dissecting the hemipenis the small distal spines are so fine that they cannot readily be distinguished from the severed muscle fibers. Thus the length of the penis itself could not be determined accurately. The insertion of the penis retractor muscle is abrupt and thus provides a convenient reference point.

The everted hemipenis is short and undivided, with the distal end expanded. The distal end is flattened and smooth, apparently without spines, but with densely placed fine spines around its edge. These become larger and more widely spaced proximally, but there are no much enlarged basal spines as in *S. dekayi*. The sulcus spermaticus arises medially, passes around the rear of the organ to the lateral side where it ascends to the tip in a relatively straight line.

Occasional specimens have a slightly enlarged basal spine, but these are from scattered parts of the range of this race, and the slight enlargement of this spine is of no apparent significance.

Dentition.—The dentition, determined from skulls of specimens from Ithaca, New York, and from maxillary and dentary bones of a few specimens from other localities, is as follows. The maxillary teeth are fourteen or fifteen in number. They are slender, slightly recurved, and subequal in length, except for the last two or three, which are about twice as heavy as the others. The dentary bears about seventeen teeth, gradually decreasing in length posteriorly, the anteriormost being the largest. The palato-pterygoid has thirty to thirty-three slender teeth that gradually decrease in length posteriorly.

Size.—The largest male examined was 359 mm. in total length (CM 17402 from Randolph County, West Virginia) and the largest female 383 mm., from Ithaca, New York. A summary by geographic regions, showing average length of mature individuals, maximum lengths, and tail/total length ratio is given in Table 5.

VARIATION

Scutellation.—The variation in ventrals and subcaudals is shown in Table 5. It is evident from this table that in any particular region the number of ventrals in the females exceeds that in the males, and that conversely the number of subcaudals in the males exceeds that of the females. The summary of the ventrals minus the subcaudals emphasizes the sexual difference in the ventrals and subcaudals.

An examination of Table 5 also shows that the number of ventrals tends to be less at lower altitudes, and toward the south. Specimens from New Jersey, Maryland, Virginia, and the Carolinas (where most of the specimens are from the coastal plain) and those from the Mississippi Valley and the Gulf Coastal Plain have lower counts than specimens from the north, and those from relatively high altitudes in the Appalachian area.

The highest subcaudal counts are found in the specimens from the lower Mississippi Valley, although as there are relatively few specimens available from that area it is not certain that this would hold for larger samples. The counts are also high in specimens from the northwestern periphery of the range of this subspecies. The lowest number of subcaudals is found in the north and east.

The ventrals are normally entire and the subcaudals divided, though with occasional abnormalities. A half scale may be interposed between the last ventral and the anal plate. Less frequently the last ventral plate is divided, or there is a half scale before the last ventral. A half scale may be interposed among the ventrals anywhere along the length of the belly. Entire subcaudals are rare, and usually less than half a dozen scutes near the base of the tail. A single specimen has the anal plate entire instead of divided, PA 1310, from St. Clair County, Missouri.

The variation in the plates of the head are summarized in Table 6. Variation from the normal six upper labials was found in 9.3 per cent of the specimens examined. The increase in labials from six to seven is accomplished by the splitting of the second labial, the last, or the next to the last. In those cases where the number of supralabials was reduced to five, the fusion was anterior to the orbit, that is, the second and the third labials fused to form a single plate. The lower labials are more variable than the upper, more than a quarter of all specimens examined (26.1 per cent) having an abnormality of one sort or another. The reduction in number of infralabials from seven to six is usually either the result of the fusion of the second and third, or the sixth and seventh. The reduction to five infralabials may be due to both these fusions occurring at once, or the fusion of the fifth, sixth, and seventh infralabials to form a single plate. Table 6 shows that fusions of this sort are much more frequent than splitting to form higher numbers of labials. Increase in number of infralabials is usually the result of splitting of the second or third labial.

Variation in number of preoculars and postoculars is also summarized in Table 6. It will be seen that there is great uniformity in the number of preoculars (only 4.3 per cent varying from the normal two) and a little more variation in the number of postoculars (6.6 per cent varying from the normal two). The posterior temporals show the greatest variation of all the head plates as they are other than 2/2 in 33.9 per cent of the specimens tabulated.

A loreal scale is present as an abnormality in several specimens. ROMZ 13 from Sudbury, Ontario, is provided with a loreal on each side and three other specimens, two from Ontario, and one from New York, had a loreal on one side only.

A single specimen, CLEM 225, from Clemson, South Carolina, has seventeen scale rows throughout the length of the body.

Coloration.—The normal range of color variation in this species is great. Many of the color forms have already been mentioned, and their composition discussed above (p. 22).

So-called melanistic specimens have been mentioned in the literature. Such specimens are not truly melanistic, but are merely blackish above, with the red of the belly replaced by black. These snakes have the prominent light occipital spots, and the fifth labial spot, and the chin is white and only flecked with black. The white flecks on the sides, forming longitudinal lines, are often unusually prominent. I have examined specimens from New York, New England and Pennsylvania, and various writers have reported them from elsewhere. M. Graham Netting, in an unpublished paper read at the April 1942 meetings of the American Society of Ichthyologists and Herpetologists, associates a greater frequency of snakes of this color phase with higher altitudes in West Virginia. In central New York they are found in certain localities while they are absent in other ecologically similar areas.

The black, chromatophore-like flecks that cover the dorsal scales to a greater or lesser degree are often wanting on the three median dorsal scale rows, so that while the sides are gray or even black, there may be a middorsal

TABLE 5.—Summary of Regional Variation in Certain Characters of *Storeria occipito-maculata occipito-maculata*.

	Northeast			North Central			Atlantic Coast			Upper Mississippi Valley			Gulf Coast		
		Extremes	Av.		Extremes	Av.		Extremes	Av.		Extremes	Av.		Extremes	Av.
Ventrals															
Males	(183)	114–129	119.1	(126)	112–132	120.5	(43)	110–124	116.2	(6)	110–115	113.0	(4)	117–122	118.8
Females	(197)	116–133	125.4	(142)	121–133	125.4	(32)	115–133	120.7	(7)	117–123	119.7	(14)	115–129	122.7
Subcaudals															
Males	(172)	43–58	48.9	(121)	42–55	49.3	(41)	42–59	48.7	(5)	46–54	48.8	(4)	51–61	56.2
Females	(187)	35–49	41.8	(135)	37–51	42.2	(30)	38–48	41.6	(7)	40–46	42.3	(12)	40–54	47.0
Ventrals + Subcaudals															
Sexes Combined	(359)	155–187	169.7	(255)	157–186	168.9	(71)	156–178	163.6	(12)	156–176	161.8	(16)	158–179	170.9
Ventrals — Subcaudals															
Males	(172)	64–82	72.8	(120)	61–82	71.2	(41)	60–74	67.4	(5)	57–67	63.8	(4)	57–71	62.5
Females	(187)	74–95	83.5	(135)	74–91	82.6	(30)	68–89	79.0	(7)	64–67	77.4	(12)	64–82	75.4
Total Length															
Males	(145)	359	242	(95)	347	238	(25)	281	215	(3)	214	202	(4)	278	182
Females	(139)	380	253	(105)	322	255	(26)	345	227	(5)	250	224	(10)	256	211
Tail/Total Length Ratio															
Males	(167)	21.1–26.6	22.8	(119)	21.0–27.7	23.6	(39)	24.2–27.0	24.5	(5)	20.8–28.6	24.8	(4)	25.3–29.8	26.6
Females	(183)	17.2–25.1	20.0	(131)	17.8–22.6	20.3	(30)	19.4–22.5	20.6	(7)	18.0–23.0	20.9	(11)	19.5–25.1	22.1

Figures contained in parentheses indicate number of specimens examined. For "Extremes" under "Total Length" only maxima are given. The average total length is derived from specimens over 175 mm. in length. (These are assumed to be mature.) Regions used may be outlined as follows: NORTHEAST—Quebec, New England, New York, Pennsylvania, and West Virginia; NORTH CENTRAL—Manitoba to Ontario south to Kentucky and Kansas; ATLANTIC COAST—New Jersey to Florida; UPPER MISSISSIPPI VALLEY—Arkansas, Missouri, and Tennessee; GULF COAST—Alabama to Texas.

TABLE 6.—Summary of Variation in Number of Head Plates in 730 Specimens of *S. o. occipito-maculata.*

Supralabials					5–R	5–L	5/5	6/6	7–R	7–L	7/7	
Frequency in per cent					1.4	1.5	1.2	normal	1.8	1.6	1.8	
Infralabials	3–R	4–R	5–L	5/5	6–R	6–L	6/6	7/7	8–R	8–L	8/8	
Frequency in per cent	0.6	0.1	1.0	0.1	5.1	7.4	7.5	normal	2.5	1.4	0.4	
Preoculars					1–R	1–L	1/1	2/2	3–R	3–L	3/3	
Frequency in per cent					0.4	0.7	0.6	normal	0.8	0.8	1.0	
Postoculars					1–R	1–L	1/1	2/2	3–R	3–L	3/3	
Frequency in per cent					1.5	1.4	0.7	normal	2.1	0.6	0.3	
Anterior Temporals								1/1	2–R	2–L	2/2	
Frequency in per cent								normal	0.1	0.1	0.1	
Posterior Temporals					1–R	1–L	1/1	2/2	3–R	3–L	3/2	4–L
Frequency in per cent					4.7	4.3	5.3	normal	8.8	6.3	4.4	0.1

band of brown, chestnut, or red. Occasionally the dark fleckings are absent from the first scale row as well as the median dorsal ones. Many specimens have the flecking much reduced or almost absent so that they appear brown or reddish since the ground color is not masked.

The shade of the belly color normally varies from pale pink to an intense bright red. There is no way of determining the shade of color in preserved specimens for in all the belly color fades to white with time, as is mentioned above. In my own experience with living specimens I have found no geographical correlation in this character.

HABITAT

This snake is found under logs and leaf mold in wooded areas, as well as under stones and boards in open fields. It is usually absent in densely populated areas, where *S. dekayi dekayi* and *S. d. wrightorum* are found in such abundance. At Ithaca, New York, they are not uncommon in the vicinity of buildings, providing good cover is available. The species has been thought to be nocturnal as its food is principally slugs, which feed at night. None of the writer's attempts to erect a distinction between the habitat of this species and that of *S. dekayi* have been successful. The two species have been found under adjoining stones. The general impression remains that *S. o. occipito-maculata* is a snake of more open places and greater altitudes.

DISTRIBUTION

Storeria o. occipito-maculata occurs from the Maritime Provinces and Quebec west to Manitoba, and south to Texas and central Georgia. The distribution over this vast area is characterized by a striking "spottiness." These snakes are locally common in many areas and surprisingly absent in other adjoining ones which seem similar in every respect. In central Georgia, extreme northwestern Florida, and adjoining portions of Alabama and Mississippi, this race intergrades with *S. occipito-maculata obscura*. There are but few reliable records from Texas where this must be accounted an exceedingly uncommon snake.

AFFINITIES

This race seems to be derived from *S. occipito-maculata hidalgoensis* which occurs to the south in Mexico. The coloration differences between the two races are distinctive but not profound, and it has been demonstrated that there is a gradual decrease in numbers of ventrals and subcaudals from *hidalgoensis* in the south to *occipito-maculata* in the north. The transition from subspecies *hidalgoensis* to *occipito-maculata* is not bridged by known intergrades, the area from which the transitional specimens might be expected being largely unsuited to these snakes, and the species here apparently persists in but small colonies. Were the differences between these two snakes more pronounced they might be considered specifically distinct.

LOCALITY RECORDS

Specimens examined as follows:

CANADA

MANITOBA: *Neepawa County*—Carberry, AMNH 9570; Douglas, CNM 960. *McDonald County*—Treesbank, CNM 1075, ROMZ 5306-09.

NOVA SCOTIA: *Annapolis County*—Annapolis Valley, North Mountain Road, CNM 1577; Spa Springs, CNM 1729. *Kings County*—Garland, CNM 1903. *Halifax County*—Hubbards on St. Margaret's Bay, CNM 1640. *Lunenburg County*—La Have Island, CNM 140. *Richmond County*—Cape Breton Island, St. Peters, CNM 1942. *Victoria County*—Cape Breton Island, Neil Hb., CNM 709.*Yarmouth County*—MCZ 6434; Central Argyle, AMNH 61585; Yarmouth, CNM 135.

NEW BRUNSWICK: *Charlotte County*—St. George, Lake Utopia, CORNELL 3413; near Grand Harbor, Grand Manan, MCZ 12668. *Northumberland County*—Chatham, CNM 1562. *York County*—Fredericton, ROMZ 4611-12. "Scotch Lake," CNM 1606, 1653, 1654; "New Brunswick," MCZ 317.

ONTARIO: *Algoma District*—Laird and vicinity, ROMZ 2905, 2909, 2904, 2907, 2899, 2902, 2903, 2895, 2893, 2906, 2896; Little Rapids, ROMZ 5377; MacLennan, ROMZ 2890, 2897-98, 2900-01, 2908, 3285-92; Sudbury, ROMZ 13; Georgian Bay, Tamarack Cove, Manitoba Island, UMMZ 74238; Georgian Bay, Cockburn, UMMZ 74240; Georgian Bay, Gore Bay, UMMZ 74239. *Bruce County*—Dorcas Bay, ROMZ 3825; Kinloss, ROMZ 4233. *Carleton County*—Ottawa, CNM 116, 150, 687, 781, 887, 895, 1033-34, 1133, 1135, 1285, 1737, 1777; Woodlawn, Constant Bay, Ottawa River, CNM 855. *Frontenac County*—ROMZ 2788, 3261; Arden, ROMZ 3395-96, 3819; Camp Oconto, ROMZ 3234-35; Buckshot Lake near Pierna, ROMZ 5347; Hartington, ROMZ 5044. *Haliburton County*—ROMZ 4020, 4030. *Huron County*—Clinton, ROMZ 2772; Lucknow, ANS 19714-16, 19718. *Muskoka District*—Sparrow Lake Camp, ROMZ 3090, 5305; Bracebridge, CNM 65, 73; Lake Rosseau, ROMZ 4752; Muskoka, Muldrew Lakes, ROMZ 5489; Port Sydney, ROMZ 5069. *Nipissing District*—North Bay, ROMZ 3895; Lake Timagami, ROMZ 2189; High Rock, Timagami, ROMZ 2369; Camp Otter, CORNELL 6686. *Ontario County*—ROMZ 3478, 3770, 2701-02, 2762; Gordon Bay, ROMZ 2799; Parry Sound, ROMZ 5364, 2790, 2859, 4983; Lake Nipissing, ROMZ 4679; Sequin Falls, Parry Sound, ROMZ 3478, 3770, 2701-02, 2762; Gordon Bay, ROMZ 2799; Parry Sound, ROMZ 4807-08. *Peterboro County*—Oak Lake, ROMZ 4680. *Renfrew County*—Arnprior, CNM 811. *Simcoe County*—Egbert, ROMZ 4728; Minesing, ROMZ 2807. *Timiskaming County*—New Liskeard, ROMZ 4581. *Victoria County*—ROMZ 3704; Cameron, ROMZ 5079; Coboconk, CNM 161, ROMZ 2616-17, 3719, 3720-22; Sturgeon Lake, ROMZ 4793. *York County*—Kelly Lake, ROMZ 4037; King Township, ROMZ 2239; Pottageville, ROMZ 96, 124, 182; Richmond Hill, ROMZ 5065; Toronto, ROMZ 20, 2320. "Lake Simcoe," ROMZ, 5082; "Ontario," ROMZ 2908.

QUEBEC: *Pontiac County*—Norway Bay, CNM 1151. *Quebec County*—Valcartier, Conway Lake, CNM 1991-92. *Sherebrooke County*—3 miles northeast of Sherebrooke, CORNELL 2367. *Wright County*—Aylmer, CNM 114, 786; Chelsea, CNM 82, 1469; Maniwaki, ROMZ 1818; Masham Mills, ROMZ 5434-35; Pink Lake near Hull, CNM 1435; Hull, CNM 685, 1132, 1564; Wakefield, CNM 948; Meach Lake, CNM 1426; Big Island, Blue Sea Lake, CNM 1662; Burbridge, CNM 1540, 1437; Whitefish Lake, near Lucerne in Quebec, CNM 1735.

UNITED STATES

ALABAMA: *Jackson County*—Woodville, CM 7148-49. *Lee County*—near Auburn, UMMZ 83197, USNM 102586-87. *Mobile County*—Mobile, USNM 55790-91. *Sumter County*—near Bellamy, CM 9910.

ARKANSAS: *Garland County*—Hot Springs, Hot Springs National Park, FMNH 30873. *Lawrence County*—Imboden, KU 17162.

CONNECTICUT: Fairfield County—Stamford, AMNH 3388. *Litchfield County*—Norfolk, USNM 19972. *Tolland County*—Storrs, CORNELL 3499.

GEORGIA: *Rabun County*—Clayton, CORNELL 1392; Tallulah Falls, MCZ 9071. *Richmond County*—Augusta, USNM 8793. "Georgia," USNM 1912.

ILLINOIS: *Cook County*—CA 122; Braeside, FMNH 15698; Chicago, CORNELL 3408, USNM 6388; Evanston, MCZ 3274; Niles Center, FMNH 19317; Palos Park, FMNH 2972-73; Thatcher Woods, River Forest, FMNH 3289, CA 6106-08,

6176, 6725-88, 7923; Willow Springs, FMNH 19399. *DuPage County*—Forest Preserves, CA 6950-53, 6963-65. *Menard County*—Athens, MCZ 5523. *Richland County*—Olney, USNM 37973, 38415-18. *Saint Clair County*—Belleville, USNM 8772, 8775-76, 8990. *Union County*—7 miles west of Jonesboro, State Forest, FMNH 23716. *Wabash County*—Mt. Carmel, USNM 12022. "Bird Haven," USNM 49716; "Southern Illinois," USNM 7284; "Illinois," AMNH 2788; *Lake-Cook County* Line, west of Braeside, FMNH 22837.

INDIANA: *Brown County*—Game Reserve CM 9751, 9799-9800. *Knox County*—Wheatland, USNM 13359. *Lawrence County*—Twin Cave, Mitchell, UMMZ 61013. *Martin County*—Brown Township, CM 9738.

IOWA: *Clayton County*—Vicinity of Garnauillo, ISC 571-2, 577. *Dickinson County*—Lake Okoboji, UMMZ 52200. *Humboldt County*—three miles west of Ottosen, ISC 576.

KANSAS: *Douglas County*—Seven and a half miles southwest of Lawrence, KU 3581; Northwest of Lawrence, KU 7661. *Franklin County*—UMMZ 66982. *Hamilton County*—KU 2355. *Miami County*—CA 5277. *Phillips County*—Long Island, AMNH 3380. "Kansas," USNM 4657.

KENTUCKY: *Edmonson County*—USNM 55789; Jim Lee Ridge, KU 20098; near Mammoth Cave, USNM 1964, 79392; McBee Spring, MCZ 3512. "St. James," USNM 29643; *Hart* or *Edmonson County*, Mammoth Cave, AMNH 9631.

LOUISIANA: *Nachitoches Parish*—Creston, CORNELL, 7157, 7368, 7396; *Livingston Parish*—"Camp Wilson, Indiana Mound," FMNH 4809-10.

MAINE: *Androscoggin County*—Auburn, USNM 13716. *Cumberland County*—Portland, USNM 1935; Steep Falls, CORNELL 2667; Westbrook, USNM 17834. *Hancock County*—Brooklin, USNM 24065-93; Castine, USNM 17424; East Orland, SU 7778; Trenton, MCZ 719. *Kennebec County*—Vassalboro, MCZ 2351. *Oxford County*—Bethel, MCZ 723; Gilead, CORNELL 2548; Norway, MCZ 722, 2479. *Penobscot County*—Bangor, MCZ 332. *Waldo County*—Isleboro, ANS 3952, 3955, 5894. *Washington County*—twelve miles south of Calais, CORNELL 3178. "Lake Richardson," MCZ 716. *Piscataquis* or *Somerset County*, Moosehead Lake, AMNH 60025.

MARYLAND: *Calvert County*—Prince Frederick, USNM 76972. *Garrett County*—three miles east of Grantsville near Little Meadows, UMMZ 78247-48; near Lakewood M. E. Church, CORNELL 2809. *Montgomery County*—USNM 17562. *Queen Annes County*—Centerville, USNM 1937. *Worcester County*—Pocomoke State Park, CORNELL 3028; Old Furnace. CORNELL, 3029. "Maryland," MCZ 5907.

MASSACHUSETTS: *Barnstable County*—Woods Hole, USNM 37854, CM 16758, AMNH 2703. *Berkshire County*—Mount Washington, OUMZ R-487-1-5, R-487-7, 8, R-478, AMNH 58064. *Essex County*—USNM 55786. *Hampden County*—Chicopee, MCZ 5590. *Hampshire County*—Goshen, Road to Mt. Rest, CORNELL 469; Lake Norwich, OUMZ R-393; Worthington, MCZ 2358, 4792. *Plymouth County*—East Marshfield, OUMZ R-112. *Middlesex County*—Bedford, MCZ 2482; Cambridge, MCZ 724; Lexington, MCZ 17739; Sherborn, MCZ 2385; Waltham, MCZ 373, 380. *Worcester County*—Berlin, MCZ 744; Oxford, USNM 39287. "Massachusetts," ANS 5916.

MICHIGAN: *Baraga County*—Pequaming, ANS 19858. *Cheboygan County*—Douglas Lake, EMNH 26770, UMMZ 50125. *Chippewa County*—Brimley, OUMZ R-401; Whitefish Point, USNM 59733. *Clare County*—Tobaco River, UMMZ 74488. *Crawford County*—Higgins Lake, State Forest, UMMZ 72579. *Delta County*—Hunter's Creek, four miles north of Cornell, UMMZ 83762. *Emmet County*—Carplake, USNM 79332. *Grand Traverse County*—Arbutus Lake, UMMZ 64395. *Gogebic County*—Wakefield, USNM 51921-22; Bass Lake near Watersmeet, UMMZ 83766. *Houghton County*—USNM 55787. *Huron County*—Sand Point, UMMZ 37727-28, 74521. *Iosco County*—Van Etten Lake, UMMZ 82111-12. *Kalamazoo County*—ANS 12311. *Kalkaska County*—UMMZ 68830. *Keweenaw County*—Copper Harbor, ANS 5903-06,

5908-09, 5907 (TYPE Coluber venustus); Isle Royale, UMMZ 33408-17, 33475-76, 33478, 33493-94, 68838, 83875; Keweenaw Point, UMMZ 70198. *Livingston County*—Plainsfield, UMMZ 36159. *Luce County*—Pike Lake, UMMZ 61771. *Mackinac County*—St. Ignace, UMMZ 56324-25. *Macomb County*—Utica, UMMZ 72443. *Marquette County*—Huron Mountains, UMMZ 54061; Ishpeming, UMMZ 56691. *Mason County*—Bass Lake, UMMZ 56744. *Montmorency County*—UMMZ 62604. *Oakland County*—Franklin, UMMZ 66981; Lake Angelus near Pontiac, UMMZ 73218. *Otsego County*—Sturgeon River, UMMZ 64839. *Schoolcraft County*—Floodwood, UMMZ 47335. *Shiawassee County*—UMMZ 74536. *Washtenaw County*—Ann Arbor, UMMZ 74682; one mile east of Milford Road, UMMZ 82089. "Michigan," MCZ 720; "Northern Michigan," MCZ 5704.

MINNESOTA: *Clearwater County*—Itasca State Park near Lake Itasca, CM 20528. *Hennepin County*—Minneapolis, UMMZ 52511. *Rice County*—Northfield, CORNELL 3496. "Minnesota," MCZ 718; "Red River of the North," USNM 2133.

MISSISSIPPI: *Harrison County*—Biloxi, FMNH 21576, AMNH 46758, UMMZ 76824-25. *Wayne County*—seven miles north Waynesboro, USNM 99337.

MISSOURI: *Barry County*—Roaring River State Park, seven miles south of Cassville, CA 8643; Washburn, USNM 80987. *Carter County*—Current River, Big Spring State Park, UMMZ 68910. *Crawford County*—In USNM 55778-85 series. *Franklin County*—Meramec State Park, CA 8904. *Gasconade County*—Cooper Hill, CA 8513. *Jefferson County*—In USNM 55778-85 series. *Montgomery County*—In USNM 55778-85 series. *Oregon County*—In USNM 55778-85 series. *Ozark County*—In USNM 55778-85 series; CAS 17753. *St. Clair County*—seven miles northeast of Osceola, PA 950, 1310, 1348-49. *St. Louis County*—In USNM 55778-85 series. *Stone County*—Marble Cave, USNM 44293; vicinity of Marble Cave, AMNH 46820; in USNM 55778-85 series. *Wayne County*—Taskee Station, CA 8512.

NEBRASKA: "Eighty miles below Sargent's Bluffs," MCZ 135.

NEW HAMPSHIRE: *Carroll County*—Ossipee, USNM 44335. *Cheshire County*—Munsonville, AMNH 8689, 8789, 8933. *Grafton County*—Hanover, USNM 36012. *Merrimack County*—Franklin, MCZ 13799, 14158. *Hillsboro County*—Monadnock Mountain, altitude 2000 feet, USNM 52470, 52411. "Two miles from Upper Baker Pond," AMNH 49226.

NEW JERSEY: Burlington County—Atsion near route 39, CFK 89; Bear Swamp, ANS 15847; Friendship near Tabernacle, CFK 62; Mount Misery, CFK—. *Camden County*—West Berlin, ANS 21505. *Cumberland County*—Vineland, CFK 122, 128, 142, 143. *Middlesex County*—Spottswood, AMNH 43917. *Ocean County*—Lakehurst, AMNH 38177; Lakewood, Lake Carosaljo, UMMZ 78946; Lakewood, CORNELL 1274; West Lakewood, CORNELL 1273; Stafford's Forge, ANS 18647. *Passaic County*—Moe, AMNH 43916.

NEW YORK: *Cattaraugus County*—Allegany State Park, URMNH 4186, 6616; Olean, AMNH 46081, 46104-5, 60204-16, 60218-21. *Chautauqua County*—one mile from Chautauqua, URMNH 5657-5666; one-half mile north of Panama, URMNH 4140. *Clinton County*—six miles southwest of Peasleeville, USNM 82548-49. *Cortland County*—McLean, CORNELL 1039, 1870, 2531; just northeast of Chicago Bog, CORNELL 2192. Delaware County—two miles northeast of Downsville, UMMZ 78947. *Erie County*—Eden, CORNELL 3205; Hamburg, CORNELL 1391. *Essex County*—ANS 18970-71; Keene Valley, USNM 16690; near Severance, AMNH 32894-97. *Genessee County*—Bergen Swamp, URMNH 3146-47, CORNELL 2187. *Hamilton County*—ANS 5920; Blue Mountain, URMNH 6596. *Herkimer County*—one-half mile southeast of Poland Center, URMNH 4139; Poland Center URMNH 4144. *Jefferson County*—Philadelphia, CORNELL 3505; Watertown, URMNH 2016. *Madison County*—Peterboro, USNM 28361-63. *Monroe County*—Rochester, URMNH 2176, 2729-30, 3142-45, 3593, 4193; Union Hill, URMNH 3431. *Onondaga County*—Syracuse, USNM 76135. *Orange County*—FMNH 2030; Palisades Interstate Park, Lake Tiorati, CORNELL 923; Greenwood Lake, AMNH 6715-18; West Point, AMNH 3390. *Orleans County*—Quarry near Albion, URMNH 1173. *Otsego*

County—Oneonta, ANS 5901-02. *Queens County*—Long Island, Flushing, AMNH 59712-13, 59720. *Rennselaer County*—Berlin, USNM 82550. *St. Lawrence County*—Madrid, USNM 1939. *Schuyler County*—Cayuta Gorge, CORNELL 1922. *Steuben County*—Addison, URMNH 6661; two miles west of Kanona, CORNELL 2196; one mile west of North Cohocton, CORNELL 2254. *Suffolk County*—Lake Grove, USNM 44360; Long Island, Mt. Sinai, AMNH 20631, 4157; Long Island, Wading River, Camp Wauwepex, CM 2689-90. *Sullivan County*—ANS 5895; seven miles north of Monticello, UMMZ 78945; Neversink, URMNH 2157. *Tioga County*—ANS 5915; Berkshire, MCZ 254, 374; three-fourth of a mile southeast of Lockwood, CORNELL 2386; Prospect Valley near Willseyville, CORNELL 3241, 2375, 1306; Spencer, CORNELL 1850. *Tompkins County*—Ithaca, CORNELL 1123, 1204, 1319, 1378, 1908, 2278, 2282, 3030, 3123, 6094, 6999, 7012, 7061, 7069-73, 7075, 7082, 7550, 7045, 2289; McLean, CORNELL 1856; above Taughannock Falls, CORNELL 3210; Turkey Hill near Varna, CORNELL 3239; Cortland Road north of Varna, CORNELL 1293; West Danby, CORNELL 3232. *Warren County*—two miles west Creek Center Post Office, USNM 82547; Lake George, USNM 80318. "Long Island," AMNH 3391-95; "Catskill Mountains, Slide Mountain," CORNELL 3280; "*Ulster* or *Greene County*, Catskills," USNM 23143-45.

NORTH CAROLINA: *Avery County*—Cranberry, ANS 4779-80, 4789-90, USNM 16264; Pineola, AMNH 8416. *Buncombe County*—Swannanoa, UMMZ 76427. *Catawba County*—Catawba, MCZ 4313. *Harnett County*—Summerville, USNM 2146. *Haywood County*—Sunburst, ZSP 387. *Henderson County*—Hendersonville, CHM—. *New Hanover County*—Wilmington, SUMNH. *Wake County*—Raleigh, SUMNH 1739, CM 5584, FMNH 2031, 22758-59. "Chubb Gap, Pisgah Forest," UMMZ 52680; "Natahala National Forest, near Ravenel Lake," USNM 104526.

NORTH DAKOTA: *McHenry County*—Towner, MCZ 37195. "*Bottineau* or *Rolette County*, Turtle Mountains," UMMZ 54473.

OHIO: *Butler County*—Hughes, USNM 10089. *Franklin County*—Columbus, ANS 6463. *Lake County*—Madison, USNM 6473. *Mahoning County*—Yellow Creek, Poland, USNM 2151.

PENNSYLVANIA: *Allegheny County*—Pittsburgh, USNM 1938; Wilkinsburg, CM 4769. *Bedford County*—near Everett, CM 5387. *Blair County*—CM 14585. *Bradford County*—near Troy, CM 6171. *Bucks County*—Near Langhorne, Meshaming Creek, ANS 21507. *Butler County*—Near Forestville, LMK 21474; Slippery Rock, near Wolf Creek, CM 8096. *Cambria County*—Flynton, CM 1285; Lloydsville, CM 2050. *Carbon County*—Hickory Run Recreation Area, AMNH 62906. *Center County*—MCZ 2396; ten miles west of Milroy, Seven Mountains, CM 5267-69; Ingleby, CORNELL 2195; Osceola Mills, CM 6681. *Clarion County*—Strattonville, CM 1115. *Clearfield County*—Clearfield, CM 8847. *Clinton County*—Honeyville to Williamsport, CM 1348; Henryville, CM 1354; Keating, CM 8843; Round Island, ANS 4614; Sproul Forest plateau south of Keating, CM 12719-21. *Crawford County*—Near Linesville, Hemlock Island, CM 7643, 11465. *Elk County*—Clover Hill Farm, CM 13497-99, 19983-84; Johnsonburg, ANS 14536; two miles south of Wilcox along Clarion River, CM 19250. *Fayette County*—Ohiopyle, ANS 17720. *Forest County*—Brookston, CM 12999; near Cooksburg between Cook Forest and National Forest, CM 5360; Cook Forest, CM 17318. *Fulton County*—Amaranth, CM 8834. *Huntington County*—Diamond Valley, ANS 16599. *Jefferson County*—Near Brookville, Baxter, CM 6643. *Lackawanna County*—Moscow, ANS 18968-69. *Lycoming County*—Cammal, ANS 22023. *McKean County*—Bradford, CORNELL 1393-94. *Mercer County*—one mile north of Mercer, CORNELL 3422. *Mifflin County*—Near Milroy, CM 6188. *Monroe County*—Near Cresco, ANS 3950-51; Mt. Pocono, ANS 15966; Pocono Lake, ANS 17706. *Philadelphia County*—Chestnut Hill, ANS 14728. *Pike County*—Six miles south of Porter's Lake, CM 9704-06. *Potter County*—Near Inez, CM 5123; Stewardson Township, ANS 13992. *Somerset County*—Laurel Ridge near Jennerstown, CM 780; three miles east of Stoystown near Lincoln Highway, CM 10592. *Sullivan County*—Ganoga Lake, ANS 12418-19; three miles east of Lopez, CM 6257; Shady Nook, ANS 20867. *Warren County*—Near Pine Valley, Tamarack Sw., near Sulphur Spring, CM 7086-93, 7734; near Scandia, UMMZ 68669. *Westmoreland County*—Near Waterford, Pine Hill, CM 4881-82, CM 4884; near New Florence, three miles from

Twin Echo, CM 5199. *Wyoming County*—Bella Sylva, ANS 14970. "Camel," ANS 19603.

SOUTH CAROLINA: *Anderson County*—Anderson, USNM 1917, 2144, MCZ 5906. *Beaufort County*—three miles northwest of Sheldon, CA 10872. *Berkeley County*—Alvin, S-M 194-105, 201-106, 202-107. *Charleston County*—Charleston, MCZ 27-28, 114. *Darlington County*—Society Hill, USNM 2147. *Lexington County*—Five miles southeast of Leesville, CM 9530. *Oconee County*—Clemson College, CLEM 215, 225. *Pickens County*—Rocky Bottom, CLEM 174, 211, CHM 30-173-3. *Richland County*—Columbia, CHM 31-219-16. "South Carolina," CLEM 216.

SOUTH DAKOTA: *Pennington County*—Hill City, USNM 17640.

TENNESSEE: *Decatur County*—Perryville, KU 2471.

TEXAS: "Texas," MCZ 299, 715. Obviously E. Texas.

VERMONT: *Addison County*—Granville, AMNH 63528-29; Hancock, AMNH 60217, 63510-12, 63514-18, 63623. *Caledonia County*—St. Johnsbury, USNM 40100. *Essex County*—Lunenberg, MCZ 2304 (one hundred and six specimens); Miles Pond, AMNH 7757. *Lamoille County*—Stowe, AMNH 38178, USNM 103304-6; two and one-half miles west southwest Stowe, USNM 108705; four miles northeast Stowe, USNM 108715. *Washington County*—Nichols Pond, CORNELL 2555; Northfield, AMNH 46249; Roxbury, CA 339-44.

VIRGINIA: *Augusta County*—O'Connell's Farm, USNM 36737. *Fairfax County*—Near Burke Station, USNM 110953; Mt. Vernon, USNM 29622. *Henry County*—Spencer, CM 13962; *New Kent County*—Near Lanexa, CM 18581. *Pittsylvania County*—Danville, MCZ 13061-62.

WEST VIRGINIA: *Grant County*—Near Dorcas, CM 5382. *Hampshire County*—Near Romney, CM 6130. *Lincoln County*—Branchland, CM 18071. *McDowell County*—two miles south of Panther, CM 15946. *Nicholas County*—Near Richwood, CM 12000. *Pocahontas County*—Cranberry Glades, CM 11981, 12037. *Preston County*—Snaggy Mountain, CM 15570; near Terra Alta, CM 6079, 6137, 6946. *Randolph County*—Near Elkins, CM 15612, 15649; one mile above Elkwater, CM 9588; Gardineer Knob, CM 17401-03; near Huttonsville, CM 8441. *Tucker County*—Canaan Valley, CM 6966-67; Coketon, CM 9945. *Webster County*—near Dyer, CM 12010. *Wyoming County*—One and one-half miles south of Pineville, CM 15891. "West Virginia," CM 15611.

WISCONSIN: *Ashland County*—Bear Lake, FMNH 18434. *Bayfield County*—Twin Lake Camp Iron River, UMMZ 74552-54. *Clark County*—Dewhurst Township, FMNH 14596-99, 14601; Thorp Township, FMNH 14605; Hewett Township, FMNH 13046-48; Mentor Township, FMNH 14602-3; Worden Township, FMNH 5533, 8079, 8257-58, 8296-97, 12680-83, 14594-95, 14600, 14604, 14606-09, 14795-97. *Iron County*—UMMZ 58589. Jackson County—Millston, FMNH 19214. *Langlade County*—Ainsworth Township, Mosquito Lake, CA 3834-43, 5478. *Marathon County*—Trapp River, UMMZ 64745. *Marinette County*—Coleman Lake, FMNH 3312. *Oconto County*—Bear Paw Lake near Little James Mountain, FMNH 29370. *Oneida County*—Big Fork Lake, Three Lakes, FMNH 26045; twelve miles northwest of Rhinelander, CA 6821-7; four miles southeast of Rhinelander, CA 6828. *Racine County*—Racine, USNM 7281. *Sauk County*—Baraboo, USNM 10715. *Shawano County*—Red River, CA 6829-33, 6837, 6838-52. *Taylor County*—seven miles north of Medford, UMMZ 69625. *Vilas County*—USNM 55788, OUMZ R-226, 227, 228; Lake Mishishe, FMNH 22892-93. "Upper Wisconsin," USNM 7280.

Storeria occipito-maculata obscura Trapido, subsp. nov.

Florida Red-bellied Snake

Figs. 14-20

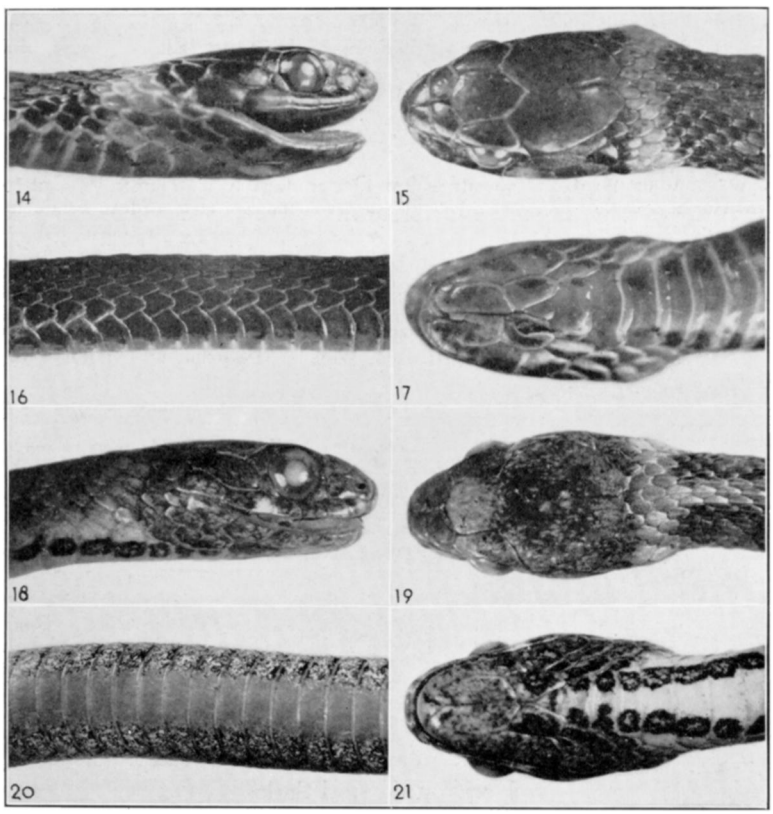
Storeria occipitomaculata Cope, Proc. Amer. Philos. Soc., vol. 17, p. 64, 1878.

Storeria occipito-maculata Cope, Proc. U. S. Nat. Mus., vol. 11, p. 391, 1888; Loennberg, Proc. U. S. Nat. Mus., vol. 17, p. 333, 1894; Wright and Bishop, Proc. Acad. Nat. Sci. Phila., vol. LXVII, p. 178, 1915; Van Hyning, Copeia (1), p. 6, 1933; Stejneger and Barbour, Check List N. Amer. Amph. Rept., Ed. 4, p. 131 (partim), 1939; Carr, Univ. Fla. Pub. Biol., Sci. Ser., vol. 3, p. 91, 1940.

The citations above appear to be the only ones definitely referable to *S. occipito-maculata obscura*. This new race is apparently not common, and it is only after the examination of relatively recent collections that diagnosis is possible.

DESCRIPTION

Diagnosis.—Characters of *S. o. occipito-maculata* but differing as follows: the top and sides of the head are black, with the occasional exception of the portion before the eyes and the anterior portion of the fifth supralabial which is white to the lower margin of the scale. The anterior tip of the first labial is also sometimes white. The occiput is marked with a light ring about two scales



Figs. 14-21. All figures somewhat enlarged. *Storeria occipito-maculata obscura*, FMNH 8561, Holotype, from Gainesville, Florida. Fig. 14. Lateral view of head and neck. Fig. 15. Dorsal view of head and neck. Fig. 16. Lateral view of body. Fig. 17. Ventral view of head and neck. *Storeria occipito-maculata obscura*. Fig. 18. Lateral view of head and neck. Fig. 19. Dorsal view of head and neck. Fig. 20. Ventral view of body. Fig. 21. Ventral view of head and neck. *Storeria o. occipito-maculata* from Ithaca, New York.

in width, joining the light color of the venter laterally. The dorsal body color varies from light tan to black. Ventrals fewer, and subcaudals more numerous than in *S. o. occipito-maculata.*

Holotype. — FMNH 8561, adult female, Florida, Alachua County, Gainesville, October 1922. Collected by T. Van Hyning.

Scutellation of Holotype.—Dorsal head plates normal, prefrontals a little larger than the internasals; nostril contained within anterior nasal; posterior nasal slightly larger than anterior, separated from the anterior nasal below, but not above the nostrils; preoculars two, the upper larger; postoculars two, the upper larger; anterior temporal single, about twice as long as high; posterior temporals two, the lower larger; supralabials six, the fifth and sixth largest, others in descending order of size, four, three, one, two; most of the fourth and the rear of the third entering the orbit; infralabials seven, the fifth largest, others in descending order of size, four, six, one, seven, three, two, the first labial of each side meeting its mate of the opposite side behind the mental; chin shields in two pairs, the anterior longer than the posterior, both pairs somewhat torn in the holotype, a single scale separating the rear two-thirds of the posterior chin shields; dorsal scales in fifteen rows throughout, keeled, emarginate posteriorly, apical pores not apparent, first scale row about half again as wide as others, somewhat more weakly keeled; ventral scales 116; anal plate divided; subcaudal scales in 42 pairs; total length 260 mm., tail 54 mm.

Coloration of Holotype.—The specimen was probably somewhat darkened in preservation, but the coloration is as follows: head black above to the rear of the parietals, a little lighter on the internasals; black laterally except for the anterior two-thirds of the fifth supralabial which is white, with some weak, faint dark stippling, and the anterior portions of the first and second supralabials which are somewhat lighter; black extending posterior to the first scales behind the posterior temporals, and extending ventrally to cover the last two infralabials, and portions of the others; white neck ring two scales wide at the level of the rear of the parietals, but not extending onto the parietals; all dorsal body scales black, with no evidence of any marks; venter white in alcohol (probably red or pink in life), with the black of the dorsum extending onto the lateral edges of the ventrals for a distance about equal to the width of the first scale row.

Hemipenis.—The description of the hemipenis is based on an examination of several specimens other than the holotype, which is a female. The penis retractor muscle inserts at the level of the seventeenth subcaudal scale. In general features, such as the somewhat expanded distal end, the location of the sulcus spermaticus, and the nature of the spines, the hemipenis of subspecies *obscura* is like that of *S. o. occipito-maculata.* One of the specimens examined had a somewhat enlarged spine at the base of the organ and to one side of the sulcus, but such an enlarged spine is not constantly present. This spine is not so pronouncedly enlarged as is the case with the basal spine in the hemipenis of *S. dekayi,* but it is noticeably larger than its fellows.

Dentition.—The teeth are largest anteriorly, and become gradually shorter toward the rear. A specimen from the Okefinokee Swamp, apparently has twelve teeth on the dentary, but the jaw is broken.

Size.—The largest male from Florida is 215 mm. in total length (four specimens), the largest female 260 mm. (five specimens). The largest male from Georgia is 197 mm. in total length (three specimens), the largest female 231 mm. (five specimens). A summary of the average total length and the tail/total length ratio is given in Table 7.

VARIATION

Scutellation.—Variation in scutellation is summarized in Tables 7 and 8. A comparison of the average number of ventrals with those of *S. o. occipito-maculata* (Table 5) shows that subspecies *obscura* has a lower number of ventrals. The sexual dimorphism in subcaudal counts is pronounced. Since the increase in subcaudals balances the decrease in number of ventrals, the sum of the ventrals and subcaudals in *S. o. obscura* approximates that of *o. occipito-maculata* from localities to the north. The average for seventeen specimens, males and females combined, is 165.9. The high number of subcaudals and the low number of ventrals is reflected in the figures given for the ventrals minus the subcaudals, which average lower in *obscura* than in *occipito-maculata* from the north.

The variation in head plates is shown in Table 8. There are no abnormalities recorded for the infralabials, preoculars, or anterior temporals. The number of posterior temporals may be increased from two to three. The head scutellation in this subspecies seems remarkably stable.

All specimens examined had fifteen scale rows. The first scale row may be as strongly keeled as the others, or the keels may be somewhat weaker. The margination at the rear of the scales of the first row is lacking in some specimens.

Coloration.—Most of the specimens have the body scales a light brown, tan, or reddish, with the head, in striking contrast, black. Other specimens, like the holotype and CORNELL 7189, have the body fully as dark as the head. In body coloration the range of variation will probably be found to be as great as in subspecies *occipito-maculata.* On lighter specimens there is usually a series of fine dots along the sixth scale row, tending to form a longitudinal line. Similar flecks of pigment are also sometimes present on the first scale row. Subspecies *obscura* has the dorsal color extending onto the edges of the ventrals for a distance equal or a little greater than the width of the first scale row. In the specimens with the dorsum blackish, the pigment is of the same intensity on edges of the ventrals, as above, and there is a rather sharp line of demarkation between it and the clear belly. The snakes with the lighter colored back may have only this tan pigment bordering the outer edge of the ventrals (UMMZ 58549, 79577), or there may be an intensification of the pigment due to the accumulation of flecks of dark grey or black, so that there appears to be a black line on each side adjoining the outer edge of the ventrals (CORNELL 6238, 7190). These black lines are not along the edges of the

TABLE 7.—Summary of Regional Variation in Certain Characters of *Storeria occipito-maculata obscura.*

	Males			Females		
	No.	Extremes	Average	No.	Extremes	Average
Ventrals						
Florida	4	114-116	114.7	7	111-126	119.1
Georgia	3	113-116	115.0	6	116-124	120.1
Subcaudals						
Florida	4	46-56	50.8	5	42-48	44.6
Georgia	3	49-57	52.5	5	44-49	46.6
Ventrals-Subcaudals						
Florida	4	62-68	64.0	5	63-84	75.0
Georgia	1	59-67	62.6	5	70-80	74.4
Total Length						
Florida	3	215	199.7	5	260	212.8
Georgia	1	197	197.0	3	231	203.6
Tail/Total Length Ratio						
Florida	4	25.1-27.2	26 2	5	20.8-21.8	21.5
Georgia	3	24.8-26.4	25.7	5	21 2-23 7	22 6

TABLE 8.—Summary of Variation in Head Plates in 19 Specimens of *S. occipito-maculata obscura.*

Supralabials		5–L	6/6
Frequency in per cent		5.3	normal
Preoculars		3/3	2/2
Frequency in per cent		5.3	normal
Posterior Temporals	3–R	3–L	2/2
Frequency in per cent	5.3	21.0	normal

ventrals, but set in a short distance from the margins, which are tan like the back. The latero-ventral black stripes become faint posteriorly and are wanting on the tail, but anteriorly they are well defined and run into the dark pigment of the posterior lower labials and adjoining scales. It may be presumed that the belly is pink or reddish in life.

The occipital light ring of this race is a modification of the three light occipital spots of typical *occipito-maculata.* Some specimens have the ring uniformly one and a half or two scales wide, while others have broader areas laterally and medially, in the position of the light occipital spots of subspecies *occipito-maculata,* narrowing to one scale in width at the level of the sixth scale row, where typical *occipito-maculata* would have the ring interrupted by the darker ground color. In the specimens examined, the light neck ring is either directly behind the parietals, or separated from them by only one scale. Typical *occipito-maculata* may very rarely have the three occipital spots fused with each other, but the resulting light bar does not reach the light ventrals.

The blackening of the head, characteristic of *obscura,* is subject to some variation on the underside. The material from Okefinokee Swamp (CORNELL 7189-90, 6328) has the chin shields and infralabials, and the scales directly behind them completely black, while specimens from north central Florida have the chin shields and infralabials anterior to the fifth merely spotted with black. These agree with the Okefinokee material in having the

infralabials posterior to the middle of the fifth, and the scales behind, completely black. In all specimens the tip of the snout is lightened. Thus the rostral itself is not black, and the mental is either whitish, or with only a black posterior margin. Some specimens (AMNH 7463, 8334, 38353) are light posteriorly to the level of the middle of the frontal.

The light mark on the fifth labial, characteristic of the several races of *occipito-maculata,* differs in *obscura* in that it is not interrupted along the lower margin, as in typical *occipito-maculata.* Specimens from southern Georgia and two from Florida (AMNH 7463 and 8334), have black obscuring all but the anterior fourth of the scale, and a little of the posterior margin of the preceding scale, while snakes from Florida have three-fourths of the scale whitish. The anterior tip of the first supralabial may also be light.

These coloration characteristics, when taken together provide a ready means of distinguishing the red-bellied snake of peninsular Florida and the adjoining portions of northern Florida and the coastal plain of Georgia.

At the periphery of the range of *obscura,* i.e., in the panhandle of Florida and in western Georgia, specimens are found with the head coloration as described above, but with the occipital spots not fused to form a neck ring. Such snakes are regarded as intergrades between the typical subspecies *occipito-maculata* and subspecies *obscura.* Similarly modified specimens have also been seen from further west along the Gulf.

HABITAT

Very little has been written on this snake. We do know that it is decidedly uncommon. Carr (1940) found it fossorial, burrowing in leaf mold, and under bark and logs. He found two in piles of debris at the bases of magnolia trees.

DISTRIBUTION

S. occipito-maculata obscura ranges from Pasco and Volusia counties in Florida north and west to Jefferson Country, Florida, and Monroe County, Georgia; i.e., from central Florida north onto the coastal plain of Georgia. Mr. E. Ross Allen records red-bellied snakes from Sarasota and Charlotte counties in southern Florida, but these records require confirmation. The specimen from Monroe County, Georgia, is at the edge of the coastal plain, but is undoubtedly of this race.

AFFFINITIES

The Florida red-bellied snake is obviously closely related to the widespread northern form. The genus *Storeria* has two endemic forms in the Floridian region, *S. victa* and *S. occipito-maculata. obscura. S. victa* presumably developed during the period of isolation of a *Storeria* on a tertiary Floridian island or group of islands, and *S. occipito-maculata obscura* evolved during the recent invasion of the reunited area by *S. occipito-maculata.* Whatever forces have produced the tendency toward differentiation in the recent herpetofauna of Florida, have molded subspecies *obscura* from *S. occipito-maculata.* The differences between subspecies *obscura* and *occipito-maculata* are of the same

order as those in *Lampropeltis getulus, Natrix cyclopion, Tantilla coronata, Micrurus fulvius,* and others in this same area.

LOCALITY RECORDS

Specimens examined as follows:

FLORIDA: *Alachua County*—UMMZ 58549; Gainesville, UMMZ 79577, AMNH 3397, FMNH 8561 HOLOTYPE; Waldo, FMNH 8562; San Pulaski (San Felasco) Hammock, UFC 348. *Jefferson County*—Monticello, ERA 47-A. *Marion County*—Eureka, AMNH 7463, 8334; Silver Springs, CORNELL 3432; Hull Lake, ERA 47-B. *Pasco County*—Argo, ANS 12308. "Florida," ANSP 12305.

GEORGIA: *Charlton County*—Billy's Island, Okefinokee Swamp, CORNELL 6238, 7189-90; Floyd's Island, Okefinokee Swamp, AMNH 38353. *Grady County*—Sherwood Plantation, fifteen miles west of Thomasville, CA 9221-2. *McIntosh County*—two miles east of Eulonia, CM 15340, 16614. *Monroe County*—four miles north of Culloden, CM 17881.

Also recorded as follows:

Escambia County—(Carr, 1940).

Marion County—Oklawaha River, ten miles southeast from Ocala (Loennberg, 1894).

VOLUSIA: "Volusia" (Cope, 1888).

Intergrades between *Storeria occipito-maculata occipito-maculata* and *obscura* examined as follows:

FLORIDA: *Gadsden County*—three miles southeast of River Junction, UMMZ 86468. *Jefferson County*—near Monticello, UFC 630.

GEORGIA: *Baldwin County*—Milledgeville, MCZ 285. *DeKalb County*—MCZ 31854. *Fulton County*—Roswell, MCZ 12787. *Grady County*—15 miles west of Thomasville, Sherwood Plantation, CA 5186. *Rabun County*—Mountain City, near Wilson Gap, CORNELL 6359. "Georgia," MCZ 275.

MISSISSIPPI: *Greene County*—Gaine's Creek, URMNH 4206.

SOUTH CAROLINA: *Oconee County*—five miles west of Jocassee, CM 17733.

STORERIA VICTA Hay

Florida Brown Snake

Figs. 22-25

Storeria dekayi Loennberg, Proc. U. S. Nat. Mus., vol. 17, p. 332, 333, 1894; Brimley, Proc. Biol. Soc. Wash., vol. 23, p. 15 (partim), 1910; Wright and Bishop, Proc. Acad. Nat. Sci. Phila., p. 177, 1915; Deckert, Copeia, No. 54, p. 32, 1918.

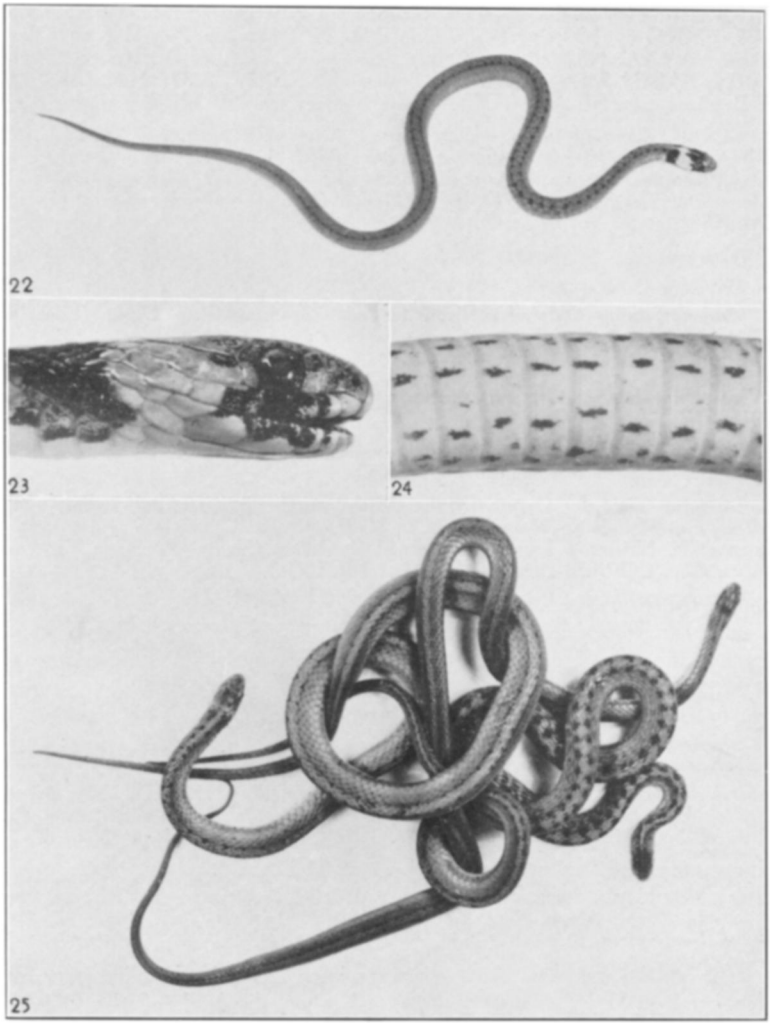
Ischnognathus victa Boulenger, Cat. Snakes Brit. Mus., vol. 3, p. 611, 1896.

Storeria victa Hay, Science, vol. 19 (479), p. 199, 1892; Stejneger and Barbour, Check List N. Amer. Amph. Rept. Ed. 4, p. 131, 1939; Carr, Univ. Fla. Pub. Biol., Sci. Ser., vol. 3, p. 90, 91, 1940.

This species was described from a specimen found in the alimentary canal of a coral snake (*Micrurus fulvius*) taken on the bank of the Oklawaha River "some distance north of Kissimee, Florida." *Storeria victa* was distinguished from *S. dekayi* by the number of dorsal scale rows (fifteen instead of seventeen), the greater proportional width of the scales, the greater number of ventrals (146) and the presence of two rows of spots on the ventral scales. Loennberg (1894) identified a snake of this species from Kissimee as *S.*

dekayi. As recently as 1940, Carr implied that *victa* will be found to intergrade with *dekayi* in northern Florida and southern Georgia, so that *victa* would become a race of *S. dekayi*. I find no evidence, however, that *S. victa* intergrades with any of the forms of *dekayi*.

While Hays (1892) stated that he intended to place the type of this



Figs. 22-25.—*Storeria victa*. Fig. 22. Specimen from Paine's Prairie, Alachua County, Florida, photographed in life, slightly reduced. Fig. 23. Lateral view of head, specimen from Alachua County, Florida, several times enlarged. Fig. 24. Ventral view of body, specimen from Alachua County, Florida, several times enlarged. Fig. 25. Specimens from Dade County, Florida, photographed in life, slightly reduced.

species in the United States National Museum, the specimen is not now there, and Dr. Stejneger informs me he has no recollection of its having ever been deposited.

DESCRIPTION

Diagnosis.—Scales in fifteen rows, head plates normally as in *S. dekayi.* Ventrals and subcaudals high in number. Dorsal color brown with dark spots of varying intensity on the sixth scale row. Belly whitish, variously marked with dark flecks laterally, or almost unmarked. Head characteristically with a light band posteriorly, followed by a dark band on the occiput, labials below the orbit dark.

Scutellation.—Dorsal head plates normal; anterior nasal usually subequal to posterior, higher than long, fused or separate from the latter; posterior nasal about equilateral, or slightly higher than long; preocular normally entire, twice as high as broad; supraocular twice as long as wide; postoculars normally two, narrow, the upper usually slightly the larger; anterior temporal single; posterior temporals normally two; upper labials seven, the third and fourth entering the orbit, the seventh largest; lower labials normally seven, the fourth and fifth much larger than the others, the first pair in contact between the mental and the anterior chin shields; mental triangular, broader than long; chin shields in two pairs, subequal in size, in contact medially, the rear third of the posterior pair separated by a small scale.

Ventrals in males 131 to 142 (sixteen specimens), in females 130 to 148 (thirty-three specimens); anal plate divided; subcaudals divided, in males 52 to 69 (fourteen specimens), in females 46 to 64 (twenty-two specimens).

Coloration.—The head and body brown; scales of the top of the head peppered with black to varying degrees. The labials lighter, straw to whitish, except the third to fifth supralabials and the adjoining margins of the lower labials, which are usually black and always somewhat darkened. Usually some black on the postoculars and the forward portion of the anterior temporal. A light band, actually white in some specimens, usually present on the rear of the head, from the rear of the anterior temporal to a little behind the angle of the mouth. Behind this, on the occiput, a dark band, usually three scales wide, narrowing or interrupted on the middorsal line, extending laterally and ventrally to the margins of ventrals. Body scales brown or tan with a variable amount of black flecking on the scales of the sixth row. Occasional specimens with this flecking intensified and involving the adjoining scale rows, and occasional joining of the spots across the back to form short bars as in *S. dekayi wrightorum.* Usually some slight encroachment of the dorsal ground color onto the tips of the ventrals. A light vertebral band on the median three scale rows sometimes evident. Belly whitish, and often with a spot on each end of each ventral; markings often scattered on the ventrals as in *S. dekayi;* occasional specimens almost unmarked on the belly.

Hemipenis.—The penis retractor muscle inserts at about the level of the twentieth subcaudal, the organ itself reaching to about the eighth subcaudal. In the organ dissected *in situ,* the sulcus spermaticus is straight, unforked, and

laterally placed. The distal end of the hemipenis is shallowly forked and provided with fine spines which become enlarged proximally. Two millimeters from the base, on the medial side of the sulcus, is a moderately enlarged recurved spine with a slightly smaller spine beside it.

Dentition.—Maxillary teeth about fifteen, slender and gently recurved, subequal in length, except the last two, which are reduced to about one-half the length of the others. Mandibular teeth fifteen, largest anteriorly, and gradually reduced posteriorly.

Size.—The largest male of this species examined was 320 mm. in total length (fifteen specimens), the largest female 412 mm. (thirty-one specimens). A summary of the average total length and the tail/total length ratio is given in Table 9. These snakes appear to be more slender in proportion to body length than *S. dekayi* or *S. occipito-maculata.*

VARIATION

Scutellation.—Variation in scutellation is summarized in Table 9. The population has been arbitrarily treated in two sections, the one north of a line through Florida at the latitude of Orlando, the other south. It is evident that there is an increase in numbers of both ventrals and subcaudals to the south. The sum of the ventrals and subcaudals averages 190.9 in the north and 203.1 in the south. It is usually possible to tell whether a given specimen is from northern or southern Florida on the basis of ventral and subcaudal counts alone. The amount of sexual dimorphism in numbers of ventrals and subcaudals is apparent on consulting Table 9. Variation in numbers of the various plates of the head is shown in Table 10. The supralabials are always seven, the anterior temporal always single. The dorsal scales are uniformly in fifteen rows. There is no evidence of intergradation of this species with *S. dekayi.*

TABLE 9.—Summary of Regional Variation in Certain Characters of *Storeria victa* Hay.

	Males			Females		
	No.	Extremes	Average	No.	Extremes	Average
Ventrals						
North	12	131-140	134.4	22	130-148	139.8
South	4	134-142	138.9	11	140-148	143.6
Subcaudals						
North	10	52-62	57.5	22	46-56	51.2
South	4	65-69	66.7	10	48-64	59.5
Ventrals — Subcaudals						
North	10	73-80	77.0	22	77-96	88.1
South	4	65-75	72.0	10	79-92	84.1
Total Length						
North	11	296	252.0	22	412	287.4
South	4	320	259.8	9	402	332.0
Tail/Total Length Ratio						
North	10	21.4-25.6	23.9	17	18.0-23.2	20.7
South	4	25.6-28.9	26.9	10	18.0-25.2	22.2

TABLE 10.—Summary of Variation in Head Plates in 48 Specimens of *Storeria victa* Hay.

Infralabials			6/6	7/7	8–R	8–L	8/8
Frequency in per cent			2.1	normal	2.1	8.3	2.1
Preoculars				1/1	2–R	2–L	2/2
Frequency in per cent				normal	8.3	2.1	4.2
Postoculars			1–L	2/2	3–L	3/3	
Frequency in per cent			2.1	normal	6.2	2.1	
Posterior Temporals	1–R	1–L	1/1	2/2	3–R	3–L	3/3
Frequency in per cent	6.2	6.2	6.2	normal	8.3	6.2	8.3

Coloration.—There is much variation in the intensity of the markings on the head and belly. The light band across the rear of the head may be white, or hardly lighter than the dorsal ground color. The dark occipital marks may be black, or lightened to a point where they are hardly darker than the ground color of the body. The dark markings on the side of the head are relatively dull and obscure in specimens from southern Florida, while they are prominent in those from northern Florida. The light band on the occiput in adults of this species is similar to the juvenile coloration of *S. dekayi*. Occasional specimens from northern Florida have the head markings relatively obscure, while ones from as far south as Sarasota may have prominent head markings.

The dark mark on the side of the head typically covers the third to fifth supralabials and the adjoining portions of the lower labials; it may be confined to the fourth supralabial and involve only the adjoining margins of the third and fiifth. The lower labials are sometimes completely unmarked.

The anterior temporal frequently bears a dark horizontal stripe on the upper half of the scale, but sometimes only on the anterior margin.

Variation in the intensity of the spots on the sixth scale row is almost as great as in *S. dekayi*.

There is a tendency for each ventral to be provided with a single prominent spot a short distance from its lateral edge, as noted in the description of the type. These spots are often mixed with the smaller spots, and are frequently indiscriminately scattered over the belly; the spots tend to be elongate, and arranged in rows.

HABITAT

This species appears to inhabit moister localities than any other *Storeria*. Carr (1940) records it from near ponds, sloughs, and marshes, under logs and among floating water hyacinths. It is found under logs along the canals in the Everglades but the best known locality is Payne's Prairie south of Gainesville, where it has been taken among the water hyacinths, and under debris along the margin of the Prairie.

DISTRIBUTION

This species is known from the entire length of the Florida peninsula, north to southeastern Georgia. There are no records from the panhandle of Florida. The northernmost station known is the Okefinokee Swamp in Georgia.

AFFINITIES

The derivation of *Storeria victa* is not clear. In number of scale rows, it agrees with *S. occipito-maculata;* in other characters, i.e., the number of preoculars, the number of supralabials, and the general coloration, it seems more closely allied to *S. dekayi.* In its high number of ventrals and subcaudals it is more closely approached by *S. dekayi* than by *S. occipito-maculata* in this region (compare Tables). These characters seems to indicate *S. dekayi* to be the most closely relater form. A point against this interpretation lies in the fact that *S. dekayi* is probably derived from *S. storerioides* (or a *storerioides* ancestor) which has fifteen scale rows. I am reluctant to assume that in the course of evolution the scale rows would be increased and subsequently again reduced. On the evidence available, however, *S. dekayi* must be accepted as the form from which *S. victa* has evolved.

The order of difference between this species and other species of *Storeria* is much greater than that distinguishing *S. occipito-maculata obscura,* the other endemic form of the Floridian region. *Storeria victa* is probably a form that evolved during the insulation of a portion of Florida, and from a population of *S. dekayi* thus isolated.

The reunion of the Floridian island with the mainland must have occurred after a period of isolation sufficiently long for the development of intersterility so that interbreeding with *S. dekayi* was no longer possible. *S. victa* continues its specific integrity, though the northern limit of its range now overlaps that of *S. dekayi.*

LOCALITY RECORDS

Specimens examined as follows:

FLORIDA: *Alachua County*—UMMZ 65318, 79578; Coclough's Hill, UFC 1655; Gainesville, CORNELL 1939, FMNH 8560, OUMZ R-294, UFC 703; Payne's Prairie, south of Gainesville, AMNH 50490, CM 20115, CORNELL 1736, ERA Cape Sable, CM 20076; Royal Palm Park, CORNELL 1690; eight miles north of (six specimens), UFC—, 80, 1858, URMNH 6720. *Dade County*—CORNELL 3518; Cape Sable, CM 20076; Royal Palm Park, CORNELL 1690; eight miles north of Homestead, ZSP 506; Miami, UFC 286, CM 19834; Paradise Key, MCZ 12752, 13886, CAS 54668. *Duval County*—Jacksonville, MCZ 15718. *Indian River County*—Sebastian, MCZ 13952, 16199, 16200, 38578, 56990. *Lake County*—Leesburg, CM 19858. *Madison County*—Indian Reservation, Lee City, AMNH 21239. *Sarasota County*—Sarasota, FNB—. *Seminole County*—Sanford, CM 386. "North Florida," ERA 45A; "Seven Oaks," AMNH 2335.

GEORGIA: *Charleston County*—Okefinokee Swamp, Billy's Island, CORNELL 6237, 6239.

Introduction to Storeria dekayi

Pattern characters useful in working out the races of *Storeria dekayi* are found in the arrangement of the dark spots along the back, on either side of the middorsal line. These may be minute flecks or prominent spots, as much of the black pigment composing the spots is not on the scales themselves, but on the skin between the scales. Thus females that have the body distended with developing embryos during the early summer will have the scales spread, more of the skin between the scales showing, and in consequence have more

prominent dorsal spots. This is not always the explanation of the variation in the intensity of the spots — there actually is a graded series from those with less dark pigment, to those with more. There is, however, no geographic correlation in the intensity of dorsal marks. In certain specimens the marks of each side, whether light flecks or heavy spots, do not form discrete pairs, but fuse medially to form short mid-dorsal transverse bars. The marks about one-third of the way back on the body are the first to fuse, and individual specimens are found with the anterior dorsal spots in separate pairs, those behind fused to form crossbars and those toward the rear of the body again separate. Specimens from the Mississippi Valley, particularly the lower and eastern parts of this vast area, and those from the southern portion of the Atlantic coastal plain in the United States, show the fused condition of the dorsal spots. In New England, and in the northeast generally, as well as along the northern Atlantic coastal plain, the spots are separate. They are also separate in the snakes from Honduras through Guatemala and Mexico, into Texas, Oklahoma, Kansas, and to the north, as well as east along the Gulf coastal strip to Louisiana. Thus we find the separate condition in the east and northeast separated from the similar condition to the west and south, by the crossbar condition in the Mississippi Valley.

The markings of the head of *Storeria dekayi* also vary geographically. Over all of the eastern United States, the anterior temporal scale is marked through its center or rear with a vertical or oblique dark bar. Specimens from eastern localities may occasionally have this bar interrupted. In the west, from Texas to Iowa, the temporal lacks the bar, and is either completely unmarked, or with a little dark pigment along one of its margins. Occasional specimens are found as far east as Illinois or Indiana with the temporal unmarked. Along the eastern Mexican coastal plain snakes are found in which the temporal scale bears a horizontal dark stripe. This usually obscures the upper half of the scale, but it is sometimes darkest along the middle of the scale and lighter above. The transition from this condition to that of the unmarked temporal is seen in specimens from the Texas coastal strip, although occasional specimens from as far east as Louisiana, and one from western Florida show a horizontal stripe. To the south as far as Puebla, there is a well developed stripe in all specimens seen. Snakes from south of the Isthmus of Tehuantepec have the stripe faint and incomplete posteriorly.

The supralabials in this species are marked to a varying degree. The pigment is usually accumulated along the sutures between the scales and forms wedge-shaped marks broad above and narrow below. The most prominent of these are the one below the orbit on the fourth supralabial, and that on the suture between the last two supralabials. The mark below the eye is best developed in snakes from the interior of Texas and from Oklahoma. In these it obscures almost all of the fourth supralabial, sometimes leaving a narrow light area along the labial margin. To the north and northeast this mark becomes reduced to a dark wedge with its apex at the point where the fourth and fifth supralabials meet the labial margin, and with its base along the upper margin of the scale bordering the orbit. To the south, along the Mexican coastal strip, it is absent or persists as a faint dusting of pigment in the

upper rear corner of the scale. The mark across the suture between the last two supralabials is a continuation of the vertical temporal stripe of specimens from the east, persisting in western snakes though the temporal mark is absent. In the snakes from the Mexican coastal strip and south, it is completely absent as are all labial marks.

The dark paired marks on the occiput also vary. In the Texas region they are elongate, sometimes as long as broad. To the north and northeast they become narrower, and in the northeastern states are reduced to narrow crescents. South of Texas they are reduced until they are hardly larger than the paired dorsal spots that follow them on the back.

Juvenile specimens of all the races of *Storeria dekayi* have distinctive head coloration as follows. There is a whitish area on the side of the head in the region of the forward portion of the anterior temporal and the fifth supralabial. There is another strong white patch of larger size behind this involving the posterior temporals, and the row of scales immediately behind these. This patch is continuous with the white of the venter. Dorsally the white extends as a narrow band across the back just behind the parietals and just anterior to the dark occipital markings. The white band is here about one scale in width. The light condition of the rear of the head, anterior to the paired dark markings of the occiput is pronounced in all young and persists until the snakes have reached a length of 135 to 145 mm. Some specimens of 150 mm. have the lightening of the rear of the head almost as pronounced as the newly-born young, but mostly between 150 and 160 mm. there is a decided dimming of the white. Snakes as large as 200 or 225 mm. will sometimes have the rear of the head slightly lighter than the remainder of the body, but beyond this size the adult coloration is reached.

The number of ventrals and of subcaudals show similar clinal trends — low in the northeast, increasing to the south. As the ventrals are high in the females and low in the males, and the subcaudals low in the females and high in the males, summation of the ventrals plus subcaudals roughly balances the differences between the sexes and the figure which represents the sum of the ventrals and subcaudals is about the same for both sexes in any one region; it thus lends itself to the examination of clinal variation in these characters.

The chin shields in this species are in two pairs, usually subequal in length, with the exception of the form from the vicinity of Mt. Orizaba in Mexico, in which they are in three pairs.

The combinations of characters in any one area are striking, and by close attention to them it is possible to determine the region from which any individual snake has come. The transitions from one to the other do not always coincide geographically, so that much consideration has been necessary to determine which of two characters shall be the decisive one in delimiting two subspecies, and further how the characterization of each race should be stated to most closely approximate the natural subspecies with the smallest areas of intergradation.

STORERIA DEKAYI DEKAYI (Holbrook)
Dekay's Brown Snake

Figs. 26-37

Tropidonotus dekayi Holbrook, N. Amer. Herp., vol. 4, p. 53 (partim), 1842; Dekay, New York Fauna, Rept., p. 46 (partim), 1842.

Tropidonotus occipito-maculatus Holbrook. N. Amer. Herp., vol. 4, p. 55 (partim), 1842.

Ischnognathus dekayi Duméril and Bibron, Erp. Gen., vol. 8, pt. 1, p. 507, 1854; Boulenger, Cat. Snakes Brit. Mus., vol. 1, p. 286 (partim), 1893.

Storeria dekayi Baird and Girard, Cat. N. Amer. Rept., pt. 1, Serpents, p. 135 (partim), 1853; Cope, Rept. U. S. Nat. Mus., p. 1000 (partim), 1900; Stejneger and Barbour, Check List N. Amer. Amph. Rept., ed. 4, p. 131 (partim), 1939.

The description of *Tropidonotus dekayi* was based on specimens from Massachusetts, New York, Michigan, and Louisiana. Apparently only one of the types is now in existence, a female, number 5832, in the collection of the Academy of Natural Sciences of Philadelphia. This individual, from the Holbrook collection at the Academy bears the locality data, "Massachusetts" (see Figs. 32-37).

The ventral and subcaudal counts are given by Holbrook for only one specimen, total 185, indicating a specimen from the south. The specimen he illustrates (Pl. 14) shows the characters of what is here designated as subspecies *texana,* i.e., with separate dorsal spots and a clear temporal. But the description of the coloration is too general to be linked with any of the races recognized here. Furthermore, it is evident from the widespread localities given for the cotypes, that the description is a composite. I choose the first mentioned locality, Massachusetts, as the type locality, and select ANS 5832 as the lectotype. This choice makes for the least disturbance of the nomenclature.

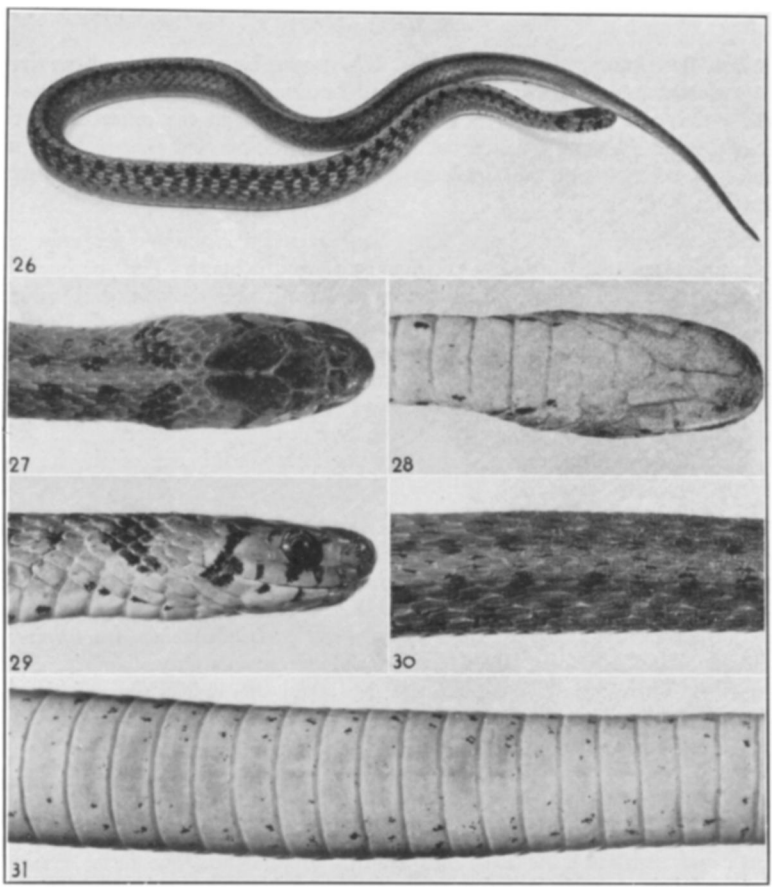
The lectotype is in good condition. The head plates are normal with the exception of the right upper postocular, which is fused with the supraocular. The preoculars are one on each side, the left postoculars two, the temporals 1-3 on each side. The chin shields are in two pairs, subequal in length, the anterior somewhat damaged. Both supralabials and infralabials are seven on each side. The body scales are all keeled, posteriorly emarginate, and in seventeen rows. There are 129 ventrals, and 44 paired subcaudals, thus within the range of numbers in subspecies *dekayi.* The total length is 382 mm., of which the tail comprises 20.0 per cent.

The top of the head is heavily peppered with black excepting the outer margins of the parietals. The upper half of the fourth supralabial is marked with black as are the areas about the sutures between the third and fourth, the fourth and fifth, and the sixth and seventh supralabials. The latter mark is continued below to darken the suture between the sixth and seventh infralabials, and above to darken more than half of the width of the rear portion of the anterior temporal. In this the specimen is somewhat abnormal, as a complete vertical bar across the temporal proves to be characteristic of this race. The occipital marks are crescentic and separate on the middorsal line.

The dorsal spots on the sixth and seventh scale rows of the body are pronounced. There are weak lateral rows of spots alternating with the dorsal spots. The belly is laterally flecked with black, particularly on the anterior portion of the body. There are no flecks evident on the tail, or on the posterior portion of the body.

DESCRIPTION

Diagnosis.—The subspecies *dekayi* is characterized by the low number of ventrals and subcaudals (their sum equalling 175 or less in 94 per cent of specimens examined), by the discrete paired spots along the back, and by the vertical or diagonal dark bar across the rear of the anterior temporal.



Figs. 26-31.—*Storeria dekayi dekayi*. All figures of specimen from near Auburn, New York, photographed in life. Fig. 26. Dorso-lateral view of entire snake, slightly reduced. Fig. 27. Dorsal view of head, slightly enlarged. Fig. 28. Ventral view of head, slightly enlarged. Fig. 29. Lateral view of head, slightly enlarged. Fig. 30. Dorsal view of body, slightly enlarged. Fig. 31. Ventral view of body, slightly enlarged.

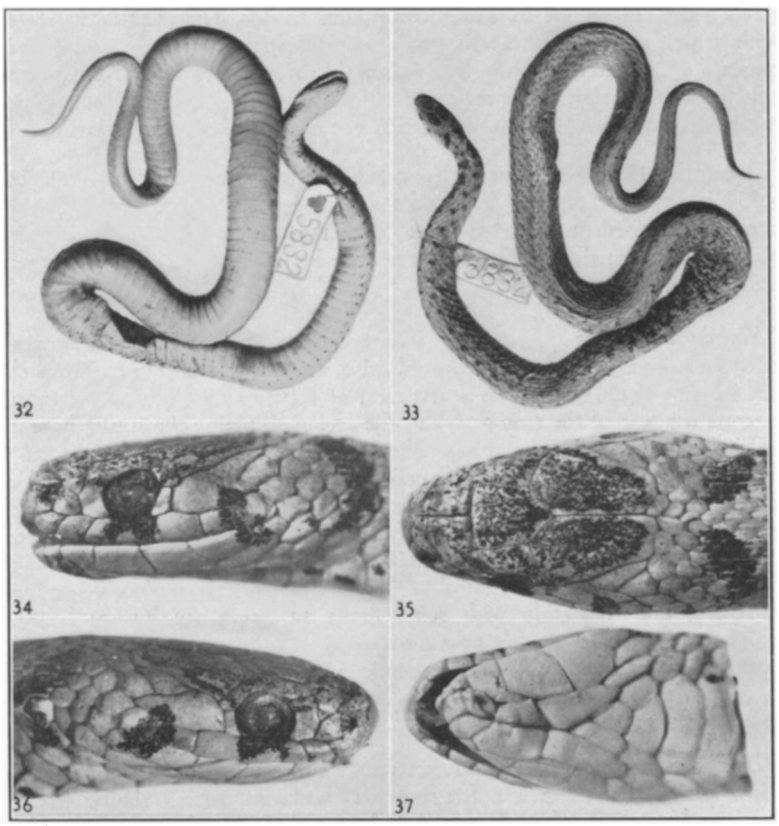
Scutellation.—Dorsal head plates normal for the genus; anterior nasal slightly smaller than posterior, higher than long, frequently fused with the latter, particularly above the nostril; posterior nasal approximately equilateral; preocular entire, half again as high as broad; supraocular twice as long as wide; postoculars normally two, the upper usually slightly larger; temporals normally 1-2, the anterior larger than the two posterior combined; upper labials normally seven, the third and fourth entering the orbit, the seventh largest; lower labials normally seven, the fourth and fifth each not less than twice the area of the others, first pair in contact between the mental and the anterior chin shields; mental triangular, broader than long; chin shields in two pairs, the anterior pair in contact throughout their length along the median line; posterior chin shields normally approximately equal in length to the anterior chin shields, but slightly narrower, truncate anteriorly, gently tapering to a rounded apex posteriorly, normally in contact for the anterior third of their length, divergent and separated posteriorly by small scales; body scales in seventeen rows, all keeled, emarginate posteriorly, first row broadest, apical pits not apparent.

Ventrals 112 to 125 in males (one hundred and forty-six specimens), 119 to 134 in females (one hundred and seventy-seven specimens); anal divided; subcaudals divided, in males in 43 to 57 pairs (one hundred and thirty-nine specimens), in females in 36 to 49 pairs (one hundred and seventy-three specimens).

Coloration.—This species is brown or sometimes grayish in general appearance. The head is normally peppered with dark brown or black. From the dark dorsum of the head there is a vertical or oblique stripe extending ventrally across the rear of the temporal, and the region adjoining the suture between the sixth and seventh infralabials. The mark across the anterior temporal is characteristic of this subspecies, sometimes obscuring the entire rear half of the temporal. The markings of the supralabials are variable, but there is usually some dark pigment at the rear of each labial except the seventh. Most constant is the mark on the fourth labial, below the orbit. This mark is usually wedge-shaped, broadest dorsally. The infralabials are often clear and unmarked, but frequently with some flecks adjoining the sutures between the scales. The chin shields and mental are usually clear whitish. On the occiput there is a pair of dark crescentic marks two scales in width. These are most often separate on the median dorsal line, and extend laterally to the ventrals or a scale or two above.

The markings on the body are exceedingly variable. With the skin stretched it is apparent that there is a fundamental checkered pattern similar to that found in the garter snakes (*Thamnophis*), dark markings being more evident on skin between the scales, and along the margins of the scales than on the scales themselves. On the sixth and seventh rows of scales there is a series of squarish dark marks, usually alternating with similar but smaller ones below on the third and fourth scale rows. There are often darkened areas bordering the scales of the first row, alternating with the second series of

marks. Except for these dark areas, the skin between the scales is whitish or yellowish. The dark markings may be prominent, or scarcely apparent. It is characteristic of this subspecies that the dark markings of the sixth and seventh scale rows are not fused across the back to form short crossbars as in the subspecies *wrightorum*, though occasional specimens may have a few such spots. The middorsal three scale rows are frequently uniform with the remainder of the dorsum; they may be lighter in color to form a light dorsal stripe, bordered by the uppermost of the series of spots described above. This stripe varies from a light clay color to a shade of brown or gray only faintly distinguishable from the ground color. The dorsal spots become smaller posteriorly so that they cannot be made out on the tail and are frequently obscure on



Figs. 32-37.—*Storeria dekayi dekayi*. All figures of Lectotype, ANS 5832, from "Massachusetts," Fig. 32. Ventral view of whole specimen, slightly reduced. Fig. 33. Dorsal view of whole specimen, slightly reduced. Fig. 34. Lateral view of head and neck several times life size. Fig. 35. Dorsal view of head and neck, several times life size. Fig. 36. Lateral view of head and neck, several times life size. Fig. 37. Ventral view of head and neck, several times life size.

the rear of the body. The number of spots in that portion of the body included in the first fifty ventrals varies from eighteen to twenty-nine.

The venter is clear and whitish, often washed with pale pink or brownish. It is usually flecked with black laterally. These flecks are more pronounced anteriorly and become fewer posteriorly, often being completely absent on the rear of the body and tail. The lateral edges of the ventrals are often a little darkened by invasion of some of the dorsal ground color.

Hemipenis.—The retractor penis muscle inserts at the level of the twentieth to the twenty-fifth subcaudal. The hemipenis itself reaches the region of the eighth subcaudal. Tht organ is finely spinose distally, the spines becoming gradually larger proximally, and culminating in one much enlarged spine on the median side of the base of the sulcus. There are two or three lesser but enlarged spines just distad of this enlarged spine. The sulcus spermaticus is straight. The hemipenis is not expanded distally as in *S. occipito-maculata.*

Dentition.—The maxillary teeth are fifteen in number, slender, and gently recurved. They are subequal in length, except the last several which are very slightly reduced. The dentary is provided with sixteen to eighteen teeth, largest anteriorly and decreasing gradually posteriorly.

Size.—The largest male of this species measured was 324 mm. in total length, the largest female 436 mm. A summary showing geographic variation in maximum size and average length of adults as well as the tail/total length ratio is given in Table 11.

VARIATION

Scutellation.—The data on the numbers of ventrals and subcaudals are summarized in Table 11. The ventrals are higher in females and lower in males, and the subcaudals higher in males and lower in females, though with some overlap of the extremes. Geographic variation in numbers of ventrals and subcaudals is not pronounced in this race. The largest series from a single state, all subspecies *dekayi,* is from New York; 26 males and 36 females have ventrals 117-125, average 121.6 and 123-132, average 127.4; subcaudals in 24 males and 29 females are 46-54, average 49.5, and 36-48, average 42.5.

The variation in number of head plates is shown in Table 12. The variation in number of infralabials is much greater than that of the supralabials and the number of postoculars is more variable than the number of preoculars. The normal two posterior temporals may be reduced by fusion to one, or may be increased to five.

A single male specimen from Mt. Washington, Berkshire County, Massachusetts, OUMZ R-484-11, has more than seventeen scale rows. Its scale formula is 17-18-19-20-19-17. A single female specimen from Ferry Landing, Virginia, USNM 8951, has the anal plate entire.

Coloration.—The amount of pigmentation on the labials varies greatly. The top of the head is sometimes almost completely black and it may be rarely almost a clear brown. The vertical temporal bar characteristic of this

TABLE 11.—Summary of Regional Variation in Certain Characters of *Storeria dekayi dekayi*.

	Northeast			Eastern Upland			North Central			Atlantic Coastal Plain		
	No.	Extremes	Av.	No.	Extremes	Av.	No.	Extremes	Av.	No.	Extremes	Av.
Ventrals												
Males	31	115-125	121.0	49	116-125	120.6	17	115-125	121.2	49	112-125	118.8
Females	39	124-130	126.3	62	123-132	126.6	34	124-134	127.5	42	120-132	125.4
Subcaudals												
Males	30	47-55	50.2	46	46-55	49.9	16	48-55	51.3	47	43-57	50.8
Females	38	37-49	42.9	60	36-48	42.6	34	40-49	45.2	43	38-48	43.7
Ventral + Subcaudals												
Sexes combined	70	163-178	170.2	106	161-178	170.0	50	164-175	172.6	89	158-177	169.2
Ventrals — Subcaudals												
Males	30	64-76	70.7	46	64-77	70.8	17	65-75	69.7	47	55-75	68.0
Females	39	75-90	83.2	60	75-91	83.9	33	77-94	82.7	42	75-89	82.0
Total Length												
Males	26	331	266.9	39	336	262.6	14	306	252.6	34	324	250.4
Females	33	392	300.2	49	436	296.4	29	409	314.6	29	368	284.2
Tail/Total Length Ratio												
Males	31	21.2-31.6	23.4	45	20.0-26.3	23.6	18	20.0-25.5	23.6	47	19.1-26.9	24.0
Females	39	16.7-23.0	19.6	60	17.4-22.2	19.5	32	18.4-22.5	20.1	39	17.9-22.6	20.4

For "Extremes" under "Total Length" only the maxima are given. The average total length is derived from specimens over 175 mm. in length. (These are assumed to be mature.) Regions used may be outlined as follows: Northeast — Quebec and New England; Eastern Upland — New York, Pennsylvania, West Virginia, Kentucky, Tennessee; North Central — Ohio, Ontario, Michigan; Atlantic Coastal Plain — New Jersey to South Carolina.

subspecies is rarely interrupted. The dorsal spots may be prominent or almost entirely wanting. The flecking of the belly may be very prominent, almost as in *S. victa,* or the flecks of pigment may be almost totally lacking. An albino specimen from Washington, D. C., is white, with a very faint indication of the dorsal body spots.

HABITAT

In my experience this is a snake of relatively dry, well-drained situations where it secretes itself under flat stones. In eastern cities it is often abundant in vacant lots where it may be found under bits of trash as tarpaper, tin, cardboard, boards, or under stones. This is somewhat at variance with DeKay's statement (1842) that all specimens he had seen were either in or near water. DeKay reports that the specimen he figures was taken swimming across a large saltwater bay on the northern shore of Long Island. At Flushing, Long Island, these snakes are abundant along hillsides and embankments above a freshwater marsh, but absent from an adjoining saltwater marsh.

TABLE 12.—Summary of Variation in Head Plates in 323 Specimens of *Storeria dekayi dekayi.*

Supralabials				6–R	6–L	7/7	8–R	8–L		
Frequency in per cent				1.9	0.9	normal	1.2	1.2		
Infralabials	5–R	5/5	6/6	6–R	6–L	7/7	8–R	8–L	9–R	9–L
Frequency in per cent	0.3	0.3	0.3	2.0	3.1	normal	3.7	4.0	0.6	0.3
Preoculars						1/1	2/2			
Frequency in per cent						normal	0.3			
Postoculars			1/1	1–R	1–L	2/2	3–R	3–L	3/3	
Frequency in per cent			0.9	2.5	2.2	normal	5.3	5.9	2.8	
Posterior Temporals			1/1	1–R	1–L	2/2	3–R	3–L	3/3	4–L	5–L
Frequency in per cent			13.0	8.0	9.3	normal	7.7	5.3	6.9	0.3	0.3

The evolutionary success of *Storeria dekayi dekayi* is attested by its survival even within the limits of such large eastern cities as Boston, New York, Philadelphia, and Washington. Individuals are rarely seen on the surface except perhaps at dusk when they seem most actively on the prowl for food. That the successful survival of this form in the urban situation is not alone due to their secretive habits is evident from the fact that similarly secretive snakes like *Diadophis punctatus, Carphophis amoena, Tantilla coronata* and *Storeria occipito-maculata,* have not survived in such areas.

DISTRIBUTION

The typical race of *Storeria dekayi* occurs from southern Quebec through New England and New York to western South Carolina and eastern Tennessee in the uplands. It intergrades to the south and west with *S. dekayi wrightorum.* Intergrading specimens are found along the Atlantic coastal plain from Virginia south to South Carolina, around the southern end of the Applachians and north along the western border of the interior low plateau to Illinois and Ontario.

LOCALITY RECORDS

Specimens examined as follows:

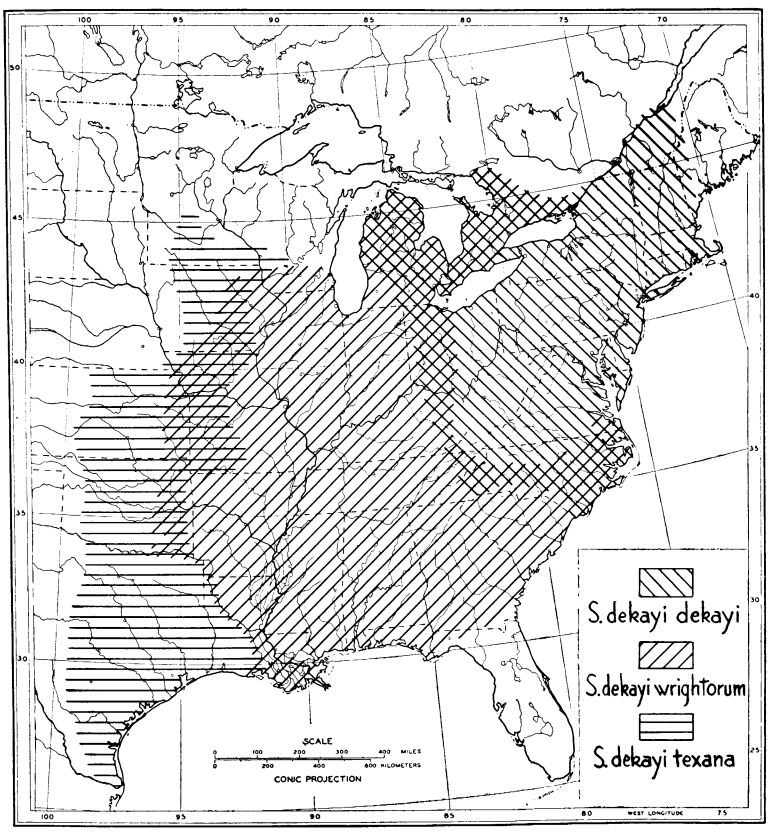
CANADA

ONTARIO: *Essex County*—Point Pelee, ROMZ 87. *Kent County*—Rondeau Park, ROMZ 2048. *Middlesex County*—Kerrwood, ROMZ 170. *Norfolk County*—Lake Erie, Turkey Point, CM 21021; Long Point ROMZ 1997-98, 1994, 2000, 2046, 2051. *Parry Sound County*—Parry Sound, ROMZ 2094; Point Au Baril, CM 6357. *Prince Edward County*—Garrett's Island, ROMZ 2433. *Waterloo County*—near Rockton, ROMZ 2803. *Wentworth County*—Aldershot, CNM 1099; Hamilton CNM 1078, 1178, 1314. *York County*—Toronto (Don Valley), CNM 108, USNM 25343; Humber River, Toronto, ROMZ 3708.

QUEBEC: *Jacques Cartier County*—Montreal, CORNELL 3429. *Portneuf County*—St. Catherine's, USNM 4986.

UNITED STATES

CONNECTICUT: *Fairfield County*—Saugatuck, AMNH 7707. *Hartford County*—three miles west of Hartford, CM 12526.



Map 3. Distribution of *Storeria dekayi*. See text for discussion of intergradient areas (p. 82). (Based on Goode Base Map No. 109. By permission of the University of Chicago Press.)

DELAWARE: *New Castle County*—two miles south of Newark, ZSP 669.

DISTRICT OF COLUMBIA: Washington, USNM 1949, 4900, 17282-86, 17447-54, 17563-64, 44160, 44924, 44337, 80316, 37505, 75117, 17288, 67456, 66998-67000, 5891.

KENTUCKY: *McCreary County*—Cumberland Falls, CA 7442. *Rowan County*—Morehead, RB—.

MAINE: *Cumberland County*—Westbrook, USNM 17834. *Oxford County*—Upton, MCZ 2390. *York County*—York Harbor, FMNH 33752.

MARYLAND: *Baltimore County*—Baltimore, USNM 27466, 27492-94, 29352-53. *Dorchester County*—Cambridge, MCZ 29781; two miles southeast of Golden Hill, ZSP 2121-22. *Montgomery County*—near Glen Echo, USNM 53391; Cabin John, USNM 54326; Plummer's Island, USNM 65147. *Prince George County*—Berwyn, USNM 36867.

MASSACHUSETTS: *Berkshire County*—Mt. Washington, OUMZ R478, R484, R484-1-3, R484-5, R484-11, R484-15. *Dukes County*—Cuttyhunk, Elizabeth Ids., AMNH 6411, 6415-16. *Essex County*—Wenham, MCZ 737. *Franklin County*—Warwick, MCZ 2366. *Hampden County*—Chicopee, MCZ 733; Springfield, MCZ 2258, 2291. *Hampshire County*—Northampton, ANS 12304, 12310. *Middlesex County*—Arlington, UMMZ 65951; Newton Center, MCZ 18976; Sherborn MCZ 726, 2385; Cambridge, MCZ 166-67, 738, 2329, 2343, 2470, 4484; Waltham, MCZ 375; Framingham, USNM 1960; Feltonville, Hudson, MCZ 2376; Woburn MCZ 729. *Suffolk County*—Brookline, MCZ 730; West Roxbury, MCZ 2492. *Worcester County*—Berlin, MCZ 732; near Auburn, USNM 1944. "Massachusetts," ANS 5832, USNM 55920, UMMZ 71412.

MICHIGAN: *Benzie County*—Crystal Lake, UMMZ 70509. *Calhoun County*—Battle Creek, UMMZ 79132. *Crawford County*—Near Lovells, UMMZ 76180. *Huron County*—Caseville, UMMZ 37952; Sand Point, UMMZ 37731. *Jackson County*—Crass Lake Twp., FNB—; three miles north Jackson UMMZ 65288. *Manistree County*—East Lake, UMMZ 46024-26. *Mason County*—Bass Lake, UMMZ 56745. *Mecosta County*—UMMZ 63385. *Muskegon County*—North Muskegon, UMMZ 78531. *Oakland County*—Pontiac, UMMZ 35864. *Roscommon County*—UMMZ 47448. *Shiawassee County*—UMMZ 74548. *Washenau County*—Ann Arbor, FNB—, UMMZ 32778, AMNH 37359; Ypsilanti, UMMZ 32499. *Wayne County*—Grosse Is., UMMZ 42496.

NEW HAMPSHIRE: *Cheshire County*—Dublin, USNM 24128; Fitzwilliam, USNM 52428; one mile southwest Rindge, UMMZ 86336. *Hillsboro County*—Amherst, MCZ 725; Peterborough FNB—. *Merrimack County*—UMMZ 84639. *Rockingham County*—Northampton, MCZ 5598. *Sullivan County*—UMMZ 86337.

NEW JERSEY: *Atlantic County*—two and one-half miles north of Weymouth, CFK 111. *Bergen County*—Fort Lee, AMNH 3386, 31852; *Rutherford*, AMNH 24692-93. *Camden County*—Camden, ZSP 208. *Cumberland County*—Vineland, CFK 84, 121, USNM 66658-59. *Essex County*—Newark, CORNELL 1869; Caldwell, AMNH 3375. *Hudson County*—Secaucus, AMNH 7543-46. *Monmouth County*—Allaire, UMMZ 74463, 77143; Long Beach UMMZ 76576; Spring Lake, USNM 100828. *Morris County*—Near Dover, CM 6194; Newfoundland, AMNH 43903. *Ocean County*—Lakewood, CORNELL 1989; East Lakewood, CORNELL 1275. *Somerset County*—Watchung, AMNH 43890, 43946. *Union County*—Plainfield, AMNH 43932, 43958. "New Jersey," AMNH 6713, 6710-11, UMMZ 77141.

NEW YORK: *Albany County*—near Rafts Pond, URMNH 3590. *Bronx County*—New York City, AMNH 61794, 61797-99, 61801, MCZ 6861, OUMZ R-486. *Cattaraugus County*—Olean, AMNH 60203. *Chautauqua County*—Clymer, URMNH 4138. *Chemung County*—Van Etten, CORNELL 1873. *Cortland County*—south end Skaneateles, Grout Brook, CORNELL 2614. *Kings County*—Bergen Beach, AMNH 4174-75, 2378-79, 2090-92, LMK 33453. *Monroe County*—University of Rochester River Campus, URMNH 2144, Rochester URMNH 3594, 3139-41; North Greece, URMNH 3428. *Nassau County*—Glen Cove City, Long Island, AMNH 28371;

Freeport, Long Island, URMNH 2548-49. *New York County*—New York City, AMNH 3379, 9612, 24736, 61800, 61784-86, 61792-93, 61795-96. *Onondaga County*—Near Campus Syracuse University, FNB—. *Ontario County*—Near Honeoye Lake, SUMNH. *Orange County*—Goshen, URMNH 1448. *Putnam County*—Cold Spring, ANS 20875. *Queens County*—OUMZ R-145, R-68-69; Flushing, CORNELL 1095, AMNH 24951, 59708-11, 59714-19, 59721; Lynbrook, AMNH 19446; Jamaica, AMNH 4150; Elmhurst, Long Island, AMNH 22418. *Rensselaer County*—Berlin, USNM 82551. *Richmond County*—Staten Island, OUMZ R65, CORNELL 2478. *Rockland County*—AMNH 3382; Palisades Interstate Park, CORNELL 1452. *Saratoga County*—Fortsville, URMNH 2567. *Tompkins County*—Camp Barton, CORNELL 1372. *Warren County*—Lake George, USNM 80317. *Wayne County*—North Rose, USNM 49634. "Long Island," USNM 55427.

NORTH CAROLINA: *Brunswick County*—four miles south Supply, CM 17993. *Buncombe County*—Asheville, USNM 44177. *Cabarrus County*—Concord, AMNH 12590. *Craven County*—New Bern. MCZ 2489, USNM 6427. *Gates County*—Winton, AMNH 39847. *Harnett County*—Buies Creek, OUMZ R-433. *Hyde County*—Lake Landing, CM 15107. *New Hanover*—Wilmington, UFC 119; Cape Fear River, Wilmington, USNM 37058. *Wake County*—Raleigh, SUMNR 1725, CM 5583.

OHIO: *Ashtabula County*—five miles north of Geneva, CM 13084, 14033. *Erie County*—Sandusky, UMMZ 32784-85. *Franklin County*—near Columbus ROMZ 3761. USNM 1957. *Lucas County*—Toledo, UMMZ 75622. *Ottawa County*—CM 9485.

PENNSYLVANIA: *Allegheny County*—near Wilkinsburg, CM 19267. *Bedford County*—Bedford, MCZ 2411. *Bucks County*—Tinicum, ANS 20874. *Butler County*—near Slippery Rock, Wolf Creek, CORNELL 9060. *Dauphin County*—Harrisburg, MCZ 5908, CM 7591. *Delaware County*—Addingham ANS 21510; Clifton Heights, ANS 22025; Darby Creek above Addingham, ANS 22026; Tinicum, ANS 19062; Drexel Hill, ZSP 1321, 652, 528-30, 533-34. *Forest County*—twelve miles northeast of Tionesta, CM 9499. *Mercer County*—Greenville, CM 7750. *Montgomery County*—Camp Delmont, Sumneytown, ZSP 2305; Penn Lynne, ZSP 549-50. *Philadelphia County*—Torresdale, ANS 17676; West Philadelphia, ANS 21528; Philadelphia, UMMZ 46791, ANS 23001, 21479; Germantown, ANS 4011-13, 21953; Holmsburg, ANS 19047, 18344, 18347, 18592-93, 18670, 18710, 18941-42, 19040-41; in a quarry at Wingahocking Terrace, ANS 20919; Jones Neck, ANS 16625; League Island, ANS 15253-4. *Pike County*—AMNH 60668. *Somerset County*—three miles east of Stoystown, CM 10593. *Westmoreland County*—Mt. Lebanon, CM 19227.

RHODE ISLAND: *Newport County*—Newport, USNM 28651, 28666, 2874-84, 30051. *Washington County*—Narragansett Bay, USNM 28646-50. "Dutch Island," USNM 28667-8, 28652-65, 44172.

SOUTH CAROLINA: *Lexington County*—Batesburg, UMMZ 72241; Clemson, CLEM 207, 265. "South Carolina," AMNH 3387.

TENNESSEE: *Clairborne County*—Cumberland Gap, USNM 17966.

VERMONT: *Chittendon County*—Burlington, MCZ 2344. *Windham County*—West Wardsboro, AMNH 20411.

VIRGINIA: *Arlington County*—Arlington, USNM 25149. *Fairfax County*—Vienna, USNM 109701-3; Potomac Valley, one mile above Great Falls, UMMZ 36083; Little Hunting Creek, Mt. Vernon, UMMZ 63919. *Nansemond County*—Cypress Chapel, UMMZ 78201. *Norfolk County*—Dismal Swamp, Lake Drummond, USNM 44290. "Alexandria, Jackson City," USNM 24379-80; "Ferry Landing," USNM 8951; "Fort Humphries," LMK 108005-6; "Great Falls," AMNH 24972.

WEST VIRGINIA: *Mineral County*—Gerstell, CM 9575. *Preston County*—Snaggy Mountain, CM 15569. *Randolph County*—vicinity of Elkins, CM 6038, 6174-77, 9405, 9587, 12967, 12970-74, 12976, 20267, 15595, 15622, 15641, 15644-46, 15653-54, 15657, 15662, 15667-68, 15678, 15686, 15788-91, 15793. "West Virginia," CM 12977, 15665; "Elk River," USNM 33733.

Storeria dekayi wrightorum Trapido, subsp. nov.
Wrights' Brown Snake

Figs. 38-44

Tropidonotus dekayi Holbrook, N. Amer. Herpt., vol. 4, p. 53 (partim), 1842.

Ischnognathus dekayi Duméril and Bibron, Erp. Gén., vol. 8, pt. 1, p. 507 (partim), 1854; Boulenger, Cat. Snakes Brit. Mus., vol. 1, p. 286 (partim), 1893.

Storeria dekayi Baird and Girard, Cat. N. Amer. Rept., pt. 1, Serpents, p. 135 (partim), 1853; Cope, Rept. U. S. Nat. Mus., p. 1000-1003 (partim), 1900; Parker, Journ. Tenn. Acad. Sci., vol. 3, p. 85, 1939; Stejneger and Barbour, Check List N. Amer. Amph. Rept., ed. 4, p. 131 (partim), 1939.

No writer has seriously questioned the homogeneity of the population of *S. dekayi* inhabiting the United States up to the present time. The descriptions of this snake in the writings of eastern United States authors make no mention of the dorsal crossbars, and this has led to some question in the identification of specimens from the Mississippi Valley and the lower Atlantic coastal plain. The correlation of the cross-bar condition with a high number of ventrals and subcaudals in the same region provides a ready means of defining a population which seems worthy of nomenclatorial recognition.

DESCRIPTION

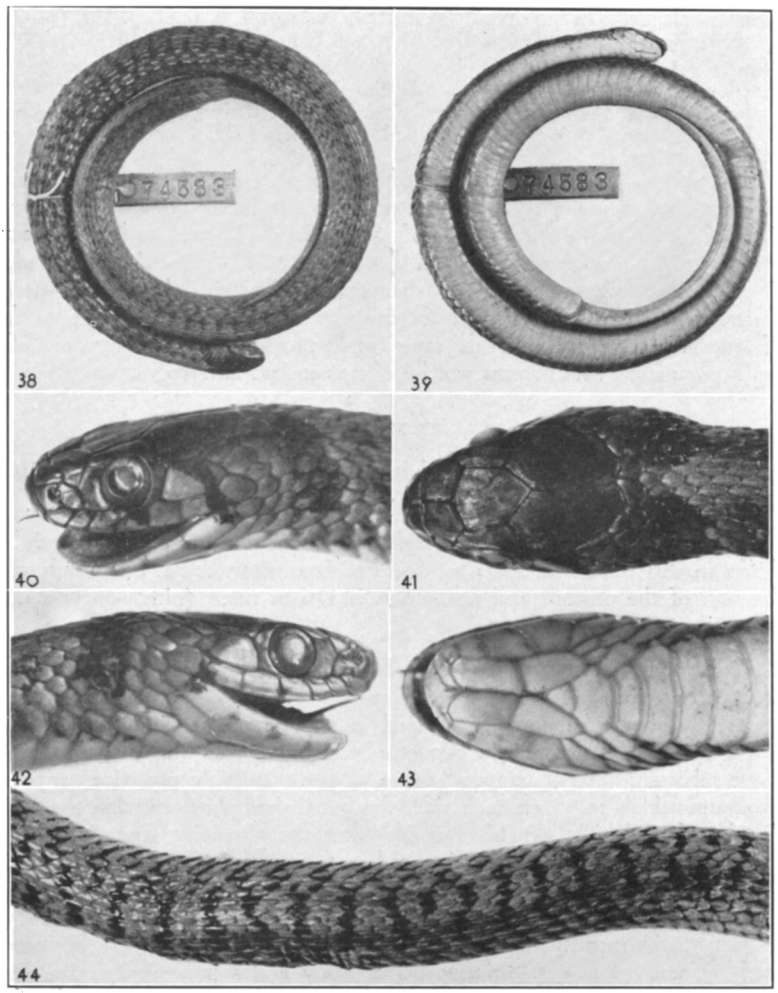
Holotype.—UMMZ 78583, adult female, taken at Reelfoot Lake, Tennessee, on April 9, 1933, by Norman Hartweg and Wesley Clanton.

Diagnosis.—*Storeria dekayi wrightorum* is similar to *S. d. dekayi* but differs in that the dorsal spots are fused to form short dorsal crossbands, and the sum of the ventrals and subcaudals is 176 or more (ninety-one per cent of specimens examined).

Scutellation of Holotype.—Dorsal head plates normal; nostril opening between anterior and posterior nasals, nasals separated by suture below and apparently above the nostril, sub-equal in size; preocular single, about twice as high as broad; postoculars two on the right, one on the left, upper and lower subequal; anterior temporal single, longer than high; posterior temporals two; supralabials seven on each side, the fourth and third entering the orbit, the first three labials somewhat smaller than the remaining four; infralabials seven on each side, in descending order of size, five, four, six, three, one, seven, two, the first pair in contact on the median line behind the mental; mental triangular; chin shields in two pairs, subequal, the anterior pair in contact on the median line, the posterior pair in contact anteriorly, but separated by small scales posteriorly; dorsal body scales in seventeen rows, all keeled, scale rows narrowest medially, becoming broader laterally, the first scale row the broadest; all scales except those of the first row emarginate posteriorly; apical pits not apparent; ventrals 136 and subcaudals 51.

Coloration of Holotype.—Head brownish, spotted with black anterior to the parietals, the parietals mostly black; sides of head brownish, with the upper half of the superior postocular black. A black vertical bar through the

rear half of the anterior temporal, this bar continuing ventrally across the suture between the sixth and seventh supralabials, and terminating on the posterior end of the sixth infralabial; wedge-shaped black mark on the posterior half of the fourth supralabial, with its apex on the labial margin and its base at the orbit; little black pigmentation on the rear upper corners of the



Figs. 38-44.—*Storeria dekayi wrightorum*. Figs. 38-43 of Holotype, UMMZ 74583, from Reelfoot Lake, Tennessee. Fig. 38. Dorsal view of whole specimen, slightly reduced. Fig. 39. Ventral view of whole specimen, slightly reduced. Fig. 40. Lateral view of head and neck, several times life size. Fig. 41. Dorsal view of head and neck several times enlarged. Fig. 42. Lateral view of head and neck several times enlarged. Fig. 43. Ventral view of head and neck several times enlarged. Fig. 44. Dorsal view of body about twice life size, showing characteristic cross bars of this race.

first, second, and third supralabials. Infralabials, mental, and chin shields whitish, unmarked, except as noted above. A pair of black occipital marks behind the parietals, two and a half scales long and seven scales high, separated on the median dorsal line by two scale rows, extending laterally to the level of the last infralabial.

Body brownish above with a pattern of seventy-six black crossbars about one-half scale wide, extending to the sixth scale row, becoming progressively fainter posteriorly. First three pairs of spots not fused to form crossbars. Diffuse lateral spots alternating with the dorsal crossbars, principally on the third and fourth scale rows; some of these joined with the dorsal crossbars. The black pigment forming these spots is on the skin between the scales and on the edges of the scales. The black markings obscure on the uniform brownish tail. The venter whitish, with the brown ground color of the dorsum tinting the edges of the ventars for a little less than the width of the first scale row; a very few faint small flecks of black along the lateral edges of the ventrals.

The hemipenis and dentition vary in no significant respect from *S. d. dekayi.*

Size.—The largest male specimen examined measures 350 mm., the largest female, 405 mm. The summary showing the geographic variation in maximum size, the average of adult specimens (those over 175 mm.) and the tail/total length ratio is given in Table 13.

VARIATION

Scutellation.—Sexual dimorphism in this race is like that of *S. d. dekayi.* The ventrals average slightly higher in the Mississippi Valley and there is a more pronounced trend toward a high number of subcaudals to the south as may be seen in Table 13. The sum of the ventrals and subcaudals exhibits this trend, the average exceeding 185 in the Florida panhandle. The extremes of ventrals in males are 119 to 133 (one hundred and fifty-three specimens), in females 125 to 140 (one hundred and fifty-two specimens). The extremes of subcaudals in males are 50 to 62 (one hundred and fifty specimens), in females 42 to 56 (one hundred and forty-seven specimens). The largest series from a single state, without other subspecies, is from Illinois. Ventrals in 43 males and 39 females range 121-131, average 126.3, and 127-140, average 132.7; in subcaudals, 43 males and 38 females range 50-61, average 55.4, and 42-51, average 47.4.

Variation in head plates is shown in Table 14.

Coloration.—Variation in coloration in this race is very much like that in *S. d. dekayi.* To the west this race intergrades with *S. d. texana,* which lacks the vertical dark bar on the temporal. While the temporal bar is highly constant over the wide range *S. d. wrightorum,* some specimens from northern Illinois and Indiana do not have it. These are included with subspecies *wrightorum* as they form only a minor portion of the population. The fusion of the dorsal spots to form short crossbars is somewhat variable in the north,

TABLE 13.—Summary of Regional Variation in Certain Characters of *Storeria dekayi wrightorum*.

	North Central			South Central			South Atlantic Coastal Plain		
	No.	Extremes	Av.	No.	Extremes	Av.	No.	Extremes	Av.
Ventrals									
Males	118	119-133	125.4	19	120-130	124.7	16	122-130	124.8
Females	105	125-140	132.0	34	126-138	131.9	13	127-134	130.7
Subcaudals									
Males	116	50-61	54.9	18	50-62	57.3	16	52-61	56.6
Females	103	42-53	47.6	31	44-56	49.3	13	43-56	48.6
Ventrals + Subcaudals									
Sexes combined	218	171-189	179.9	49	172-192	181.6	29	175-190	181.0
Ventrals — Subcaudals									
Males	115	62-79	70.5	18	60-76	67.5	16	63-75	68.2
Females	103	70-92	84.1	31	76-94	82.7	13	78-89	82.5
Total Length									
Males	99	350	268.5	10	313	247.4	10	311	262.0
Females	87	405	312.1	27	399	290.6	13	378	282.5
Tail/Total Length Ratio									
Males	116	18.1-25.8	23.9	17	18.6-26.8	25.0	14	23.1-26.0	24.7
Females	100	17.6-23.1	20.2	30	18 7-23.8	21.3	12	19.3-23.7	20.9

For "Extremes" under "Total Length" only the maxima are given. The average total length is derived from specimens over 175 mm. in length. (These are assumed to be mature.) Regions used may be outline as follows: North Central—Ontario to West Virginia and west to Iowa and Oklahoma; South Central — Tennessee and Alabama west to Arkansas and Louisiana; South Atlantic Coastal Plain — Virginia to Florida.

i.e., Ontario, Michigan, Ohio, Indiana and Illinois. Intermediate specimens with the fusion complete in varying degrees are characteristic of this area.

HABITAT

Storeria dekayi wrightorum is found in much the same habitat as *S. d. dekayi,* but there is frequent reference in the literature to aquatic or semi-aquatic habits. At Reelsfoot Lake, Tennessee, specimens were taken by myself in the relatively dry higher portion of an extensive swampy area. In urban situations it appears that its habitat is precisely like that of *S. d. dekayi* in the east.

TABLE 14.—Summary of Variation in Head Plates in 305 Specimens of *Storeria dekayi wrightorum.*

Supralabials	6/6	6–R	6–L	7/7	8–R	8/8	
Frequency in per cent	0.7	0.3	1.6	normal	0.7	0.7	
Infralabials	6/6	6–R	6–L	7/7	8–R	8–L	8/8
Frequency in per cent	1.6	1.0	0.3	normal	4.9	3.6	0.7
Preoculars				1/1	2–R	2–L	2/2
Frequency in per cent				normal	0.7	1.0	0.7
Postoculars	1/1	1–R	1–L	2/2	3–R	3–L	3/3
Frequency in per cent	1.3	2.3	1.6	normal	6.6	6.2	5.2
Anterior Temporals				1/1	2–R	2–L	2/2
Frequency in per cent				normal	3.6	0.3	0.3
Posterior Temporals	1/1	1–R	1–L	2/2	3–R	3–L	3/3
Frequency in per cent	2.3	4.6	3.6	normal	11.5	9.2	11.1

DISTRIBUTION

Storeria dekayi wrightorum ranges in the Atlantic coastal plain from southeastern Virginia and North Carolina south around the Appalachian highlands and north in the Mississippi basin. To the west it intergrades with *S. d. texana* from western Louisiana north to Nebraska. It intergrades with *S. d. dekayi* from Ontario to Illinois and south along the fringe of the Appalachian region and the interior low plateau.

LOCALITY RECORDS

Specimens examined as follows:

CANADA

ONTARIO: *Elgin County*—Southwold Tp., Talbotville Royal, ROMZ 2188. *Frontenac County*—Abbey Dawn, Kingston, ROMZ 2379. *Kent County*—Mitchell's Bay, ROMZ 4322. *Leeds County*—Wallace Island, Lansdowne, ROMZ 5115. *Middlesex County*—London, ROMZ 2077; Hyde Park, CNM 916. *Muskola County*—Lake Rosseau, ROMZ 4749. *Norfolk County*—Long Point, ROMZ 1999, 2001-2, 2049; Turkey Point, CM 21020, ROMZ 3799-3801. *Parry Sound County*—Pointe au Baril, MCZ 22806. *Peel County*—Georgetown, ROMZ 213. *Wentworth County*—Oaklands, Aldershot, CNM 1059; Hamilton, CNM 1383. *York County*—Toronto, ROMZ 2316-17, 2381, 2522, 2622, 2625, 2627, 2661, 4713, 4894, 5023; Highland Creek, ROMZ 3901; Etobicoke Tp., Lambton Mills, ROMZ 3891, 5043, 3676; Long Branch, ROMZ 3662-63.

UNITED STATES

ALABAMA: *Lee County*—Auburn, USNM 102589-90. *Mobile County*—FNB—, USNM 42542, 55925, 55927; near Mobile, UMMZ 84435. "Alabama," USNM 55926.

ARKANSAS: *Benton County*—Sulphur Springs, UMMZ 60108. *Carroll County*—USNM 55922. *Greene County*—three and one-half miles southeast of Paragould, UMMZ 71985. *Hempstead County*—UMMZ 84170. *Lawrence County*—Imboden, FMNH 12551. *Pulaski County*—Little Rock, USNM 55924. *Washington County*—Chert Hill, east of Springdale, CA 4760.

FLORIDA: *Escambia County*—Pensacola, MCZ 15713, USNM 2222, FNB—. *Gadsden County*—Chattahoochee, ERA 46B. *Liberty County*—Appalachicola River Bottom, UFC 561; five-six miles north Rock Bluff, UMMZ 72809.

GEORGIA: *Berrien County*—Nashville, USNM 10711. *Chatham County*—Savannah, ANS 5892. *Elbert County*—Huguenot, USNM 29606. *Fulton County*—MCZ 31843; near Atlanta, UMMZ 67818-22. *Hall County*—Gainesville, URMNH 6693. *Lincoln County*—Island above Price Island, USNM 92062. *Rabun County*—ERA 46A. *Warren County*—thirteen miles south of Thompson, FNB—. "Georgia," MCZ 275.

ILLINOIS: *Alexander County*—Cairo, FMNH 2129. *Calhoun County*—INHS 1741-42. *Champaign County*—Urbana, FMNH 13205. *Cook County*—Chicago, FMNH 717, 14813, 22770, USNM 6388, CA 1364; Elmwood Park, CA 5077; Evanston, MCZ 3269, 3272; Homewood, FMNH 22857, 17648, 7839, 8788, 12537, 13198; Lemont, FMNH 27700; Willow Springs, FMNH 22771-73, 19400; Braeside, FMNH 15699-15702, 15761; Beverley Hills, Longwood, FMNH 2495, 22774, 1930; Summit, FMNH 804; Berwyn FMNH 822; Riverside, FMNH 17132; Lambert, FMNH 27281; Pullman FMNH 2672; Edgebrooke, FMNH 3527, 2787. *DuPage County*—Downer's Grove, FMNH 12540; Ingalton, FMNH 22736-37. *Jackson County*—Murphrysboro, FMNH 18617, FNB—. *Jersey County*—four miles north of Grafton, INHS 1731-34. *Kankakee County*—Pembroke Tp., FMNH 19220. *Lake County*—Pistakee Lake, FMNH 13185. *McLean County*—Bloomington, UMMZ 32332. *Morgan County*—Meredosia, FMNH 27858-59, 3261. *St. Clair County*—CAS 13033; Belleville, USNM 8983, 8770. *Wabash County*—Mt. Carmel, USNM 12028. *Will County*—New Lenox, FMNH 2976. "*Lake-Cook*" *County* line, FMNH 22831-36; "Southern Illinois," USNM 4814.

INDIANA: *Boone County*—Lebanon, USNM 2137. *Carroll County*—Delphi, MCZ 360. *Kosciusko County*—Winona Lake, FMNH 747, 22764. *Knox County*—Wheatland, USNM 10653-55, 13358-59. *Lake County*—Clark Junction, FMNH 22761; Pine, FMNH 22762-63; just south of Pine, FMNH 2837; Clark Junction, FMNH 2194; Hesseville, FMNH 21707-11; Dunes Park, LMK 24530-34. *Marion County*—Irvington, USNM 17967; Indianapolis, FMNH 21572. *Porter County*—Tremont, CA 1982-83, 907-08; near Dune Park, FMNH 3440. *Posey County*—New Harmony, MCZ 125. *Starke County*—northwest corner of county, LMK 24536. *Jasper-Pulaski Counties*—Jasper Pulaski Park, LMK 24529, 24537-39. "two miles west of Woodville, LMK 24535; "Lake Maxintuckee," USNM 42589, 33529.

IOWA: *Blackhawk County*—Dunkerton, ISC 573. *Boone County*—Boone, ISC 2821. *Butler County*—one-half mile west Shell Rock, ISC 575. *Clayton County*—two miles southwest Garnaville, ISC 570. *Des Moines County*—Burlington, MCZ 80. *Lee County*—five miles north of Montrose, ISC 574.

KANSAS: *Miami County*—CA 5274. *Riley County*—CA 5275. "Fort Riley to Pike's Peak," ANS 5833-39.

LOUISIANA: *East Baton Rouge Parish*—Baton Rouge, FNB—. *Livingston Parish*—Colyell, CORNELL 8443. *Natchitoches Parish*—Creston, CORNELL 7361, 7370, 7377, 7387, 7355. *Orleans Parish*—New Orleans, USNM 4798b, 1120, 12904. *St. James Parish*—USNM 10211; near Gramercy, AMNH 53893. *St. Tammany Parish*—Bush, FMNH 25622. *West Baton Rouge Parish*—Lobdell, USNM 31666. "Louisiana," ANS 5886.

MICHIGAN: *Genesee County*—UMMZ 63435. *Gladwin County*—UMMZ 78163. *Iosco County*—Cooke Dam, UMMZ 59168. *Kalamazoo County*—Kalamazoo, PA 1252. *Lenawee County*—Morenci, UMMZ 40483. *Livingston County*—Portage Lake, UMMZ 74507. *Mecosta County*—UMMZ 63385. *Saint Clair County*—Port Huron,

USNM 2215. *Washtenaw County*—CM 5003, 5004; Ann Arbor, AMNH 36896, UMMZ 30382, 38919, 57069.

MISSISSIPPI: *Bolivar County*—Rosedale, CA 7375; two and one-half miles southeast Rosedale, CA 7079. *Coahoma County*—Moon Lake, AMNH 6555. *Coctaw County*—Ackerman, UMMZ 90109. *Hancock County*—Bay St. Louis, FMNH 2028. *Harrison County*—Biloxi, AMNH 46757. *Hinds County*—Jackson, UMMZ 86695. *Lawrence County*—Monticello, USNM 2226. *Madison County*—four miles east of Canton, CA 6137, 6719, 6810-19. *Rankin County*—two miles south of East Jackson, CM 19019. *Webster County*—Mathiston, FNB—.

MISSOURI: *Butler County*—near Keenar (near Poplar Bluff), UMMZ 77435-36. *Carter County*—Big Springs State Park, UMMZ 68957. *Crawford County*—USNM 33939. *Johnson County*—Montserrat, PA 2660. *Lincoln County*—Sheepscott Bay, Isle of Springs, USNM 31953. *St. Francis County*—USNM 55935. *St. Louis County*—USNM 55928, KU 1731; Creve Coeur Lake, CA 8511. *Stoddard County*—USNM 55932; four miles northwest of Advance, CA 8530-31. *Stone County*—USNM 44294. "St. Louis," USNM 7278.

NORTH CAROLINA: *Guilford County*—Greensboro, FMNH 37899. *Hyde County*—Lake Landing, CM 15140. *Jackson County*—Dillsboro, UMMZ 80997, 80999-81000. *New Hanover County*—Wilmington, USNM 26077, ZSP 593. *Swain County*—Cherokee, USNM 15577. *Wake County*—Raleigh, FMNH 2029, 22766.

OHIO: *Erie County*—Castalia, UMMZ 62658; Huron Tp., FMNH 2545; Sandusky, UMMZ 32782. *Lucas County*—Little Cedar Point, ISC 578; Toledo, CM 5276, UMMZ 75622. *Warren County*—Monroe, USNM 10665-66.

OKLAHOMA: *Bryan County*—UMMZ 86539. *LeFlore County*—Wister, CM 720, AMNH 4213. *McCurtain County*—UOMZ 2094. *Ottawa County*—Vicinity of Kansas, UMMZ 81327. *Tulsa County*—Tulsa, AMNH 43458. "Indian Territory, Neutral Strip," AMNH 3381.

PENNSYLVANIA: *Allegheny County*—Pittsburgh, USNM 1945; Wexford, CM 8874. *Lawrence County*—Newcastle, Big Run, CM 10576.

SOUTH CAROLINA: *Anderson County*—Portman Shoals, CLEM 108. *Beaufort County*—Hiltonhead, ANS 5889. *Charleston County*—Santee River, Hampton Plantation, CHM 37-74-10, 36-74-11. *Lexington County*—two miles southeast of Leesville, CM 9520. *Oconee County*—Clemson, CLEM 56. *Richland County*—Wateree River along US 76 about twenty-one miles east of Columbia, ZSP 594. "South Carolina," CLEM—.

TENNESSEE: *Chester County*—F. O. Bottom, Henderson, JBH—. *Decatur County*—Kelley's Island, Ohio River, MCZ 5717. *Hardeman County*—fourteen miles northeast of Bolivar, CA 7681. *Knox County*—Knoxville, UMMZ 66725. *Lake County*—Horse Island, CORNELL 2222; Hunting Club road to Hickman, CORNELL 2350. *Madison County*—five miles north of Jackson, UMMZ 72256. *Obion County*—Reelfoot Lake, UMMZ 74583.

VIRGINIA: *New Kent County*—near Lanexa, CM 13263.

WEST VIRGINIA: *Randolph County*—Elkins, CM 15642-43, 15652, 15655, 15666, 15792.

WISCONSIN: *Dane County*—Madison, UMMZ 57862. *Grant County*—near Potosi, UMMZ 69642. *Racine County*—Racine, USNM 1958-59.

Storeria dekayi texana Trapido, subsp. nov.

Texas Brown Snake

Figs. 45-50

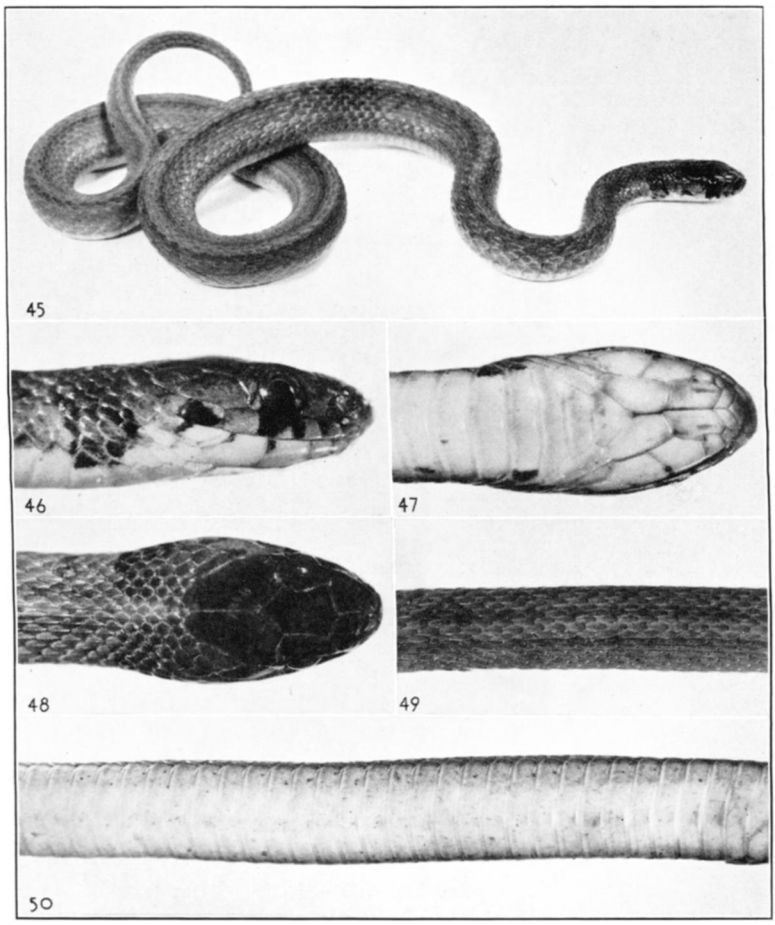
Storeria dekayi Baird and Girard, Cat. N. Amer. Rept. pt. 1, Serpents, p. 135 (partim), 1853; Cope, Rept. U. S. Nat. Mus., p. 1000 (partim), 1900; Ortenburger and Freeman, Pub. Univ. Okla. Biol. Surv., vol. 2, p. 185, 1930; Stejneger and Barbour, Check List N. Amer. Amph. Rept., ed. 4, p. 131 (partim), 1939.

Ischnognathus dekayi Boulenger, Cat. Snakes Brit. Mus., Vol. 1, p. 286 (partim), 1893.

DESCRIPTION

Holotype.—CORNELL 3530, adult female, taken at Edge Falls, four miles south of Kendalia, Kendall County, Texas, on June 16, 1942, by Albert J. Kirn. This is deposited in the collection of the Carnegie Museum at Pittsburgh, Pennsylvania.

Diagnosis.—This subspecies is characterized by the coloration of the anterior temporal which is not marked with a black vertical bar, nor with a longi-



Figs. 45-50.—*Storeria dekayi texana.* All figures of Holotype, CORNELL 3530, photographed in life. Specimen from Kendall County, Texas. Fig. 45. Dorso-lateral view of whole animal, slightly reduced. Fig. 46. Lateral view of head and neck, several times life size. Fig. 47. Ventral view of head and neck, several times life size. Fig. 48. Dorsal view of head and neck, several times life size. Fig. 49. Dorsal view of body, slightly enlarged. Fig. 50. Ventral view of body, about twice life size.

tudinal stripe. The dark occipital blotches are broader than in other subspecies and the fourth labial is usually more extensively darkened.

Scutellation of Holotype.—Dorsal head plates normal; nostril opening in the anterior nasal, anterior and posterior nasals completely separated, subequal in size; preoculars single, higher than broad; postoculars two, the upper larger; anterior temporal single, longer than high; posterior temporals two on the right and three on the left; supralabials seven on each side, the fourth and part of the third entering the orbit; infralabials seven on each side, the fourth and the fifth are largest and subequal in size, others in descending order of size, six, three, one, seven, two, the first pair in contact on the median line behind the mental; mental triangular; chin shields in two pairs, subequal, the anterior pair in contact medially, the posterior with their rear half divergent and separated by a small scale; dorsal scales in seventeen rows, all keeled, the first row broadest, all except those of the first row emarginate posteriorly; apical pits not apparent. Ventrals 136, anal plate divided, subcaudals in 49 pairs.

Coloration of Holotype.—Head reddish brown, flecked with black above; right temporal clear, grading from reddish brown above to light brown below; left temporal similar, but with a black spot in upper rear corner. Nasals and oculars reddish brown flecked with black. Supralabials light brown marked with black as follows: the first with some dark in upper rear corner, second with black flecking along posterior margin, third with the posterior third black, fourth (below orbit) all black except anterior lower corner, fifth with anterior fifth black, sixth almost completely dark except for the anterior upper corner, seventh tipped with black anteriorly. Underside of head whitish except for a little dark pigment along the sutures of the infralabials.

A pair of dark occipital blotches uniformly three scales in width, separated on the median dorsal line by three scale rows and extending laterally to the edges of the ventrals.

Body brown above (with a faint cast of reddish in life), with faint black spots along the seventh scale row; these spots fainter posteriorly disappearing on the rear of the body and tail. No other lateral markings. Middorsal three scale rows slightly paler than the remainder of the dorsum. Venter whitish, tending to yellowish medially and to pinkish laterally. Brown dorsal pigment invading the lateral edges of the ventrals for a distance equaling about half the width of the lower scale row. Lateral edges of the ventrals very faintly flecked with black on the anterior part of the body.

Hemipenis.—The retractor penis muscle inserts in the region of the twenty-third subcaudal. The organ itself reaches the level of the eighth or ninth subcaudal. The spines and sulcus are like those in *S. d. dekayi.*

Dentition.—There are fourteen or fifteen teeth on the maxillary, as in *S. d. dekayi.* The dentary bears seventeen or eighteen teeth which gradually decrease in size posteriorly, the teeth somewhat more elongate than in *S. d. dekayi.*

TABLE 15.—Summary of Variation in Certain Characters of *Storeria dekayi texana*.

	Northern			Southern			Mexican		
	No.	Extremes	Av.	No.	Extremes	Av.	No.	Extremes	Av.
Ventrals									
Males	48	121-131	125.4	34	121-136	129.7	3	136-141	139.0
Females	44	125-140	131.1	58	123-143	134.5	2	138-141	139.5
Subcaudals									
Males	47	53-61	56.0	30	50-63	56.0	3	57-60	58.0
Females	44	41-51	45.5	58	38-52	46.8	2	48-49	48.5
Ventrals + Subcaudals									
Sexes combined	89	167-190	179.2	28	170-194	182.8	5	187-201	193.4
Ventrals — Subcaudals									
Males	46	62-74	69.1	28	64-82	73.6	3	79-83	81.0
Females	44	79-98	85.4	54	76-98	87.5	2	89-94	91.5
Total Length									
Males	42	341	251.0	25	316	246.0	1	313	313.0
Females	38	455	260.8	43	386	279.8	1	190	190.0
Tail/Total Length Ratio									
Males	46	23.4-26.9	25.1	28	22.8-26.9	24.7	3	23.2-23.6	23.3
Females	44	17.6-21.6	19.9	53	17.4-23.4	20.6	2	20.0-21.0	20.5

For "Extremes" under "Total Length" only the maxima are given. The average total length is derived from specimens over 175 mm. in length. (These are assumed to be mature.) Regions used may be outlined as follows: Northern—Iowa and Nebraska to Arkansas and Oklahoma; Southern—Mississippi, Louisiana and Texas; Mexican—San Luis Potosi and Hidalgo.

Size.—The largest male specimen measures 341 mm., the largest female 455 mm. The geographic variation in maximum length, the average length of adults (those over 175 mm.), and the tail/total length ratio are shown in Table 15.

VARIATION

Scutellation.—As in other members of the genus the ventrals are high in females, and the subcaudals high in the males. The number of ventrals in this subspecies increases toward the south, and is highest in Hidalgo and San Luis Potosi. While the counts in the Mexican specimens are high, they overlap the counts in specimens from Texas (see Table 15), so that with no supporting coloration differences, there is no reason for separating a further geographic race. There is less geographic variation in numbers of subcaudals, but also a slight trend toward an increase in the south. The figures for the sum of the ventrals and subcaudals (Table 15) also demonstrates the increase of linear elements toward the south. The summary of ventrals minus subcaudals in Table 15 emphasizes sexual dimorphism, while also showing the geographic trend expressed above. The largest series from a single state where no intergrades or specimens of other subspecies occur is from Texas. In 34 males and 56 females the range in ventrals is 121-136, average 129.7, and 123-143, average 134.5; in 30 males and 56 females subcaudals are 50-63, average 56.0, and 38-52, average 46.7.

Variation in the head plates is summarized in Table 16.

A somewhat obscure but none the less distinctive feature of this subspecies is the relative acuteness of the snout, especially in specimens from Texas. The internasals and prefrontals are slightly reduced, and the head when viewed from above is more pointed than in the relatively truncate snouted specimens from the north and east. In the ventral view the rostral projects beyond the lower jaw.

TABLE 16.—Summary of Variation in Head Plates in 189 Specimens of *Storeria dekayi texana.*

Supralabials		6–R	6–L	7/7	8–L				
Frequency in per cent		2.1	3.2	normal	1.1				
Infralabials	6/6	6–R	6–L	7/7	8–R	8–L	8/8		
Frequency in per cent	2.1	1.1	2.1	normal	0.5	2.1	1.1		
Preoculars				1/1	2–R	2/2			
Frequency in per cent				normal	0.5	1.6			
Postoculars	1/1	1–R	1–L	2/2	3–R	3–L	3/3	4–R	4–L
Frequency in per cent	1.6	2.1	4.8	normal	4.8	1.1	2.1	0.5	0.5
Anterior Temporal				1/1					
Frequency in per cent				all normal					
Posterior Temporals	1/1	1–R	1–L	2/2	3–R	3–L	3/3		
Frequency in per cent	2.6	3.7	4.2	normal	10.0	9.5	9.5		

Coloration.—The dorsal spots are discrete in *texana,* but from the eastern portion of the range (western Louisiana to Iowa) specimens are found with the unmarked temporal characteristic of this race, but with the dorsal spots

fused to crossbars. These are regarded as intergrades between *S. d. texana* and *wrightorum*.

While the temporal is typically clear and unmarked in *texana*, some individuals have a little black pigment along one of the margins of this plate, but neither the vertical dark bar of *wrightorum* or the longitudinal stripe of *temporalineata* is present. In other color features of the head, variation is like that of the races of *S. dekayi* already discussed, with the exception of the marking of the fourth supralabial (below the eye). Specimens of *texana* from Texas are almost invariably characterized by a black spot obscuring this scale, except for a narrow, light, labial margin. This is an extension of the wedge-shaped mark found on the fourth labial in *wrightorum* and *S. d. dekayi*. Along the southern Texas coastal strip this race intergrades with subspecies *temporalineata*, which characteristically has the labials unmarked except for a little dark powdering of the upper rear corner of the fourth supralabial. These intergrades are characterized by a reduction of the labial marks.

HABITAT

In Texas this race has been found under logs, boats, boards, and drift near lakes and streams.

DISTRIBUTION

S. d. texana occurs from Hidalgo in Mexico north through Texas to Minnesota. Its western limit coincides in general with the eastern edge of the Great Plains. On the east it intergrades with *S. d. wrightorum* from Iowa and western Wisconsin to western Louisiana. To the south it intergrades with *S. d. temporalineata* in the Mexican Gulf coastal plain.

The Mexican specimens are from the eastern border of the Sierra Madre Orientale, while in Texas this race occupies the coastal plain. To the north it occurs in the western portion of the central lowland.

LOCALITY RECORDS

Specimens examined as follows:

ARKANSAS: *Lafayette County*—Lewisville, KU 2489.

IOWA: *Boone County*—Ledges State Park, ISC 569. *Lee County*—five miles north Montrose, ISC 574.

KANSAS: *Barber County*—four miles north Lake City, USNM 94153-4. *Doniphon County*—UMMZ 59104. *Douglas County*—Lawrence, KU 1814. *Greenwood County*—eight miles southwest Toronto, KU 18016. *Kiowa County*—Rezeau Ranch, KU 21423. *Miami County*—UMMZ 66987. *Saline County*—Salina, CORNELL 3412. *Sumner County*—two miles northeast of Caford, FMNH 23370. *Wilson County*—Benedict, KU 18127.

LOUISIANA: *Cameron Parish*—UMMZ 86510. *Orleans Parish*—New Orleans, USNM 13090, 12922.

MINNESOTA: *McLeod County*—Winsted, USNM 65894.

MISSISSIPPI: *Harrison County*—Biloxi, UMMZ 76822.

NEBRASKA: "Fort McPherson," MCZ 3815.

OKLAHOMA: *Adair County*—four miles northwest of Watts, UOMZ 7215; vicinity of Kansas, UMMZ 81327. *Bryan County*—UOMZ 9912-14, 10037. *Caddo County*—Old Fort Cobb, USNM 11820, 11823. *Canadian County*—Devil's Canyon, UOMZ 13658. *Cleveland County*—UOMZ 12523, 12591, 12626, 13352-3, 13362, 77112;

near Norman, UOMZ 561, 3900, 8022, 8866, 9798, 19103, 20167, 22880-83, 22887, 22968. *Comanche County*—UOMZ 1722, 13129; Wichita National Forest, UOMZ 4015, 4385; W. Cache Creek, UOMZ 8215. *Craig County*—Vinita, Indian Territory, ANS 15516. *Garvin County*—Mayesville, UOMZ 10469-70. *Kay County*—Ark. River near Ponca City, OAM 190. *Latimer County*—near Wilburton, OAM 112, UOMZ 10106. *LeFlore County*—Wister, CM 718-19, 721-22. *Logan County*—Guthrie, UOMZ 11028; five miles north Edmond, UOMZ 18979. *McClain County*—five miles south Norman, UOMZ 10052. *McCurtain County*—UOMZ 17275; fourteen miles east Broken Bow, UOMZ 17562. *Murray County*—Arbuckle Mountains, UOMZ 12631. *Okmulgee County*—UMMZ 64573-75; Okmulgee, UOMZ 12412. *Osage County*—Ark. River region, ten miles east of Ponca City, UOMZ 22780. *Pawnee County*—near Quay UOMZ 7998-99. *Payne County*—Stillwater, OAM 48-328, 116, 310. *Pottawatomie County*—Shawnee, UOMZ 13566, 13797-99, 13801-03, 13567-77, 18806. *Seminole County*—Bowlegs, UOMZ 10166-67. *Sequoya County*—two miles northeast Gore, UOMZ 9005. *Tulsa County*—Tulsa, LMK 8115.

TEXAS: *Aransas County*—St. Joseph Island, off Rockport, UMMZ 72355. *Atascosa County*—FNB—, Benton, CM 18373, KU 8489. *Bee County*—Beeville, CA—. *Bexar County*—Helotes, ANS 12312; VonOrmy, CORNELL 1588; San Antonio, Medina River bottom near Blue Wing Lake, CORNELL 478; San Antonio, Brackenridge Park, FNB—; Leon Springs, CAS 31108. *Bosque County*—Clifton, CM 740; "Clifton?" CM 1028-32. *Callahan County*—Putnam, USNM 71754. *Cameron County*—EHT-HMS A481: Boco Chica near Rio Grande Mouth, CORNELL 630; Harlingen, USNM 103741; Brownsville, USNM 52281, 52284, FMNH 39610, EHT-HMS A480. *Comal County*—New Braunfels, USNM 17699. *Dallas County*—Dallas, ANS 12309, 10703, MCZ 2434. *Ellis County*—Waxahachie, FMNH 11866. *Falls County*—USNM 55912. *Frio County*—near Pearsall, EHT-HMS A479. *Gonzales County*—Ottine, CORNELL 3409. *Harris County*—Houston, ANS 10706, 12313. *Hidalgo County*—Edinburg, CORNELL 1602, CA 6534-54; FNB—, CORNELL 1602. *Kerr County*—four miles east of Kerrville, FMNH 30585. *Kleberg County*—FMNH 35920-21; Kingsville, CORNELL 3531, FMNH 38052-53. *LaSalle County*—near Cotulla, CORNELL 1761. *Matogorda County*—Bay City, CM 870-71; Deming's Bridge, MCZ 19896. *McLennan County*—Waco, USNM 55914, 14646, KU 11933; south of Waco, UMMZ 70130. *Medina County*—North Castroville, CORNELL 3411, 3532; Chican Lake, CORNELL 3533. *Nacogdoches County*—Nacogdoches FMNH 35046. *Palo Pinto County*—Palo Pinto, CORNELL 3430-31. *Travis County*—Austin, KU 13715. *Victoria County*—USNM 42286, 42290; Victoria, USNM 78611-18; Black Bayou, CM 784-93. *Walker County*—eight miles northeast New Waverly, CA 6290. *Williamson County*—Georgetown, MCZ 43917. "Wichita River," ANS 12306; "Texas?" ANS 12314; "Barnard Creek, west of Columbia," USNM 32802; "Texas," MCZ 306; "Brazos River," USNM 2095; "Seley," CM 770.

HIDALGO: Near Tianguistengo, EHT-HMS 16142-44, 16258.

SAN LUIS POTOSI: five miles south of Valles, District Ciudad de Valles, EHT-HMS 4662, 4664.

TAMAULIPAS: Metamoras, USNM 7279.

STORERIA DEKAYI TEXANA X WRIGHTORUM

IOWA: *Lee County*—five miles north of Montrose, ISC 574.

KANSAS: *Bourbon County*—UMMZ 66983. Cherokee County—KU 1733. *Chautauqua County*—Spring Creek, KU 1745. *Donphan County*—Donphan Lake, KU 2342. *Douglas County*—Lawrence, EHT-HMS A482-500; Twin Mounds, KU 2339. *Franklin County*—Ottawa, USNM 89175. *Graham County*—KU 1744. *Johnson County*—CM 5504. *Marshall County*—UMMZ 66986. *Miami County*—UMMZ 66987; Pigeon Lake, USNM 89177. *Pottawattomie County*—Flush, UMMZ 75621. *Riley County*—UMMZ 66984-5, URMNH 1168, FNB—, FMNH 18134; Manhattan, FMNH 18133, FNB—. USNM 89176; Junction Blue, Kansas River, UMMZ 64415. "Kansas," USNM 4653.

LOUISIANA: *Natchitoches County*—Natchitoches, UMMZ 71387; Creston, CORNELL 7367.

MISSOURI: *Cass County*—Freeman, PA 2663. *Carter County*—Big Spring State Park, PA 2312. *Jackson County*—USNM 55937-38; Sugar Creek, PA 2661, CA 10696; three miles east of Independence, CA 10697. *Jefferson County*—Wickes, USNM 55930. *Miller County*—USNM 55936. *Oregon County*—USNM 55931. *Stone County*—USNM 55933; Galena ANS 5883; Marble Cave, USNM 55934. *Vernon County*—Nevada, UMMZ 32330. *Warren County*—USNM 55929. "St. Louis," USNM 7278.

OKLAHOMA: *Cleveland County*—Norman, UOMZ 13756. *Latimer County*—near Wilburton, UOMZ 11314, 11360, 11397, 10104, 10105, 11084, 11684-85. *LeFlore County*—one and one-half miles east of Zoe, UOMZ 16789. *McClain County*—one-fourth mile south of Norman, UOMZ 18980. *Murray County*—Arbuckle Mountains, UOMZ 8915. *Okmulgee County*—UOMZ 1360, 64572, 64576-77, 22779. *Pottawatomie County*—Shawnee, UOMZ 13800, UMMZ 77538. *Tulsa County*—UOMZ 13564; Tulsa, UOMZ 13565, FNB (eight specimens).

WISCONSIN: *Dane County*—Madison, FMNH 12679, UMMZ 57861.

Storeria dekayi temporalineata Trapido, subsp. nov.

Mexican Brown Snake

PLATE 9, Figs. 51, 52

Storeria dekayi Garman, Mem. Mus. Comp. Zool., vol. 8, p. 31, 143 (partim), 1883; Yarrow, Bull. U. S. Nat. Mus., vol. 24, p. 130 (partim), 1883; Cope, Proc. Amer. Philos. Soc., vol. 22, p. 282, 1885; Ferrari-Perez, Proc. U. S. Nat. Mus., vol. 9, p. 187, 1887; Cope, Bull. U. S. Nat. Mus., vol. 32, p. 75 (partim), 1887; Cope, Proc. U. S. Nat. Mus., vol. 14 (883), p. 675 (partim), 1891; Cope, Ann. Rep. U. S. Nat. Mus., p. 1000-1003 (partim), 1900; Amaral, Mem. Inst. Butantan, vol. 4, p. 150 (partim), 1929; Stejneger and Barbour, Check List N. Amer. Amph. Rept., ed. 4, p. 131 (partim), 1939; Taylor and Smith, Univ. Kans. Sci. Bull., vol. 25, p. 249 (partim), 1939; Taylor, Herpetologica, vol. 2, p. 79, 1942.

Tropidonotus dekayi Garman, Bull. Essex Inst., vol. 16, p. 25 (partim), 1884.

Ischnognathus dekayi Boulenger, Cat. Snakes Brit. Mus., ed. 2, vol. 1, p. 286-287 (partim), 1893; Günther, Biol. Cent. Amer., Rept., p. 136 (partim), 1894; Werner, Zool. Jahrb., vol. 57, p. 38 (partim), 1929.

DESCRIPTION

Diagnosis.—Similar to *S. d. texana* but with a higher number of ventrals and subcaudals, the labials completely or almost completely unmarked, anteriot temporal with a horizontal dark mark.

Holotype.—USNM 32148, adult female, San Rafael, Jicaltepec, Vera Cruz, Mexico, alt. circa 100 feet, collected July 2, 1896, by C. H. T. Townsend.

Scutellation of Holotype.—Dorsal head scales normal; rostral nearly twice as broad as high; nostril opening in the anterior nasal and with its posterior edge bordering the suture between the anterior and posterior nasals; nasals divided below the nostril, but no suture apparent above the nostril; preocular single, much higher than broad; postoculars two, upper twice as large as the lower; anterior temporal single, three times as long as broad; posterior temporals three; supralabials seven, two-thirds of the third and all of the fourth entering the orbit, the fifth and sixth largest; lower labials seven, the first two in contact behind the mental, the fourth and fifth largest; mental triangular; chin shields in two pairs, the anterior and posterior of equal length, in contact

except rear half of the posterior pair separated by a small scale; dorsal body scales emarginate posteriorly, apical pits not apparent, scales in seventeen rows except for the occiput where there are nineteen rows to a point opposite the sixth ventral, the second row on each side being dropped; first scale row about twice as broad as the others; all scales keeled; ventrals 138; anal plate divided; subcaudals in 47 pairs; tail terminating in a soft spine 2.5 mm. long.

Coloration of Holotype.—In alcohol the specimen is brownish gray. The dorsum of the head is irregularly spotted with black, this concentrated somewhat near the margins of the parietals, at the rear of the frontal, and medially on the prefrontals. The rostral, nasals, and internasals are unmarked. The anterior temporal bears a longitudinal black stripe covering its upper half. The upper labials are clear straw colored except for a faint dusting of dark on the upper rear corners of the third and fourth supralabials. The ventral portion of the head is whitish and unmarked. The occiput has faint paired spots, followed on the body by prominent paired black spots on the sixth and seventh scale rows, with faint smaller spots alternating on the third and fourth scale rows. The pattern becomes obscure posteriorly, but approximately eighty-two pairs of spots are distinguishable on the body. Ventrals clear and whitish medially, and diffuse pale gray laterally, exhibiting small black flecks toward the side of each ventral. These flecks are mostly arranged as a single pair on each ventral, but posteriorly become scattered or absent.

Dentition in Holotype.—Maxillary teeth apparently sixteen in number, recurved, and subequal in length. Dentary with about sixteen teeth decreasing in size posteriorly.

Size.—The total length of the holotype is 408 mm. of which the tail comprises 18.9 per cent. This is the largest female examined. The average length and average tail/total length ratio for this race are given in Table 17.

VARIATION

Scutellation.—In the only male of this species available for study, the subcaudals exceed those of all the females examined. The sum of the ventrals and subcaudals in the male specimen much exceeds that in the females. The sum of ventrals and subcaudals in this race is high, and represents the extreme in the clinal trend toward an increase in these elements toward the south. The variation in the head plates of this race is slight. The upper labials are usually 7/7, 7/6 in two specimens; lower labials 7/7 except in one with ?/8; preocular uniformly 1/1; postoculars 2/2 except in one with 1/2; anterior temporals 1/1 except in one specimen with 1/3. The posterior temporals are more often three than two: 2/2 in two, 2/3 or 3/2 in three, and 3/3 in four.

Coloration.—Typical specimens of *S. d. temporalineata* have the temporal dark stripe covering the entire upper half of the anterior temporal scale and lack the intense dark markings on the labials that are characteristic of the more northern races of *S. dekayi,* although there may be some faint suffusion of gray along the upper margins of the supralabials in this race. *S. d. temporalineata* has the dark occipital markings restricted to small spots only slightly

larger than those along the back. These characters are found in all specimens of *S. dekayi* from the Gulf coastal plain in Mexico. Certain of these distinctive characters are found in specimens from the Gulf coastal strip in the United

TABLE 17.—Summary of Variation in Certain Characters in *Storeriay dekayi temporalineata.*

	Males			Females		
	No.	Extremes	Average	No.	Extremes	Average
Ventrals	1	138	138	8	132-143	138.6
Subcaudals	1	56	56	8	42-52	47.1
Ventrals + Subcaudals	1	194	194	8	179-191	185.8
Ventrals — Subcaudals	1	82	82	8	80-101	91.4
Total Length	1	207	207	8	408	339.8
Tail/Total Length	1	23.2	23.2	8	18.7-21.5	19.7

States even so far north and east as Louisiana, with one such from the panhandle of Florida; such specimens are thought to represent intergradation with *S. d. texana* along the Gulf strip of Texas and Louisiana.

The characters of the subspecies *texana* contrasted with *temporalineata* are: a clear usually unmarked anterior temporal, a prominent black mark below the orbit covering almost all of the fourth, and adjacent portions of the third and fifth supralabials, a black mark on either side of the suture between the sixth and seventh labials, and irregular wedge-shaped black marks bordering the sutures of the other supralabials, as well as an extension of the occipital marks into heavy blotches. Where *texana* and *temporalineata* intergrade along the Texas coastal strip there is a mixing of characters. There is fortunately an adequate series of specimens from this region to show this transition from one condition to the other. Snakes from this area have a varying amount of black pigment along the upper edge of the anterior temporal, and some have this as well developed as pure *temporalineata* from far to the south in Vera Cruz. Specimens from the Texas coastal plain with the temporal stripe well developed may always be recognized as the supralabials are not unmarked as in pure *temporalineata.* It is quite probable that specimens meeting all the requirements of subspecies *temporalineata* will be found in southeastern Texas and the range of this race probably includes this area. Those of an intermediate nature as outlined above are best designated as intergrades between the two races.

HABITAT

No accounts of the habitat of this race is Tamaulipas and Vera Cruz are available although it is probable that it is found in much the same sort of place as *S. d. texana.* Taylor and Smith (1938), who record collecting three specimens of *S. dekayi* five miles south of Valles, San Luis Potosi, one of which has proved to be this race, report that the snakes were found in piles of driftwood near a river bank.

DISTRIBUTION

Storeria d. temporalineata occurs along the Gulf coast in Tamaulipas and

Vera Cruz. It probably extends inland to the base of the Sierra Madre Orientale and north to extreme southern Texas, and has been recorded from over five thousand feet in Puebla. It is probably principally a species of low elevations.

LOCALITY RECORDS

Specimens examined as follows:

TEXAS: "Texas," MCZ 15717.

PUEBLA: Puebla, UMMZ 85966.

SAN LUIS POTOSI: Five miles south of Valles, EHT-HMS 4663.

VERA CRUZ: La Palmilla, Canton of Jalacingo, AMNH 4292; San Rafael, Jacaltepec, USNM 32148 (HOLOTYPE); Jalapa, ANS 5885, MCZ 2843, 15990; "Vera Cruz," ANS 11675.

STORERIA DEKAYI TEMPORALINEATA X TEXANA

LOUISIANA: *Iberia Parish*—Avery Island, FMNH 34816. *Jefferson Davis County*—Jennings, CORNELL 7298-99. *Orleans Parish*—New Orleans, USNM 4798a; Gr. Coteau, New Orleans, USNM 5199. *Saint Mary Parish*—Morgan City, USNM 73828.

TEXAS: *Bee County*—Medio Creek near Beeville, OAM 809. *Brazoria County*—USNM 55913. *Cameron County*—USNM 17058-59; Brownsville, USNM 52300. *Hardin County*—Sour Lake, USNM 36389. *Harris County*—Houston, ANS 10705. *Matagorda County*—Bay City, CM 872.

TAMAULIPAS: Metamoras, USNM 7279.

STORERIA DEKAYI TEMPORALINEATA X WRIGHTORUM

LOUISIANA: *Orleans Parish*—New Orleans, USNM 15377. *Natchitoches Parish*—Creston, CORNELL 7364. "Louisiana," USNM 12923.

MISSISSIPPI: *Hancock County*—Bay St. Louis, FMNH 22768. *Harrison County*—Biloxi UMMZ 76823, 76821.

STORERIA DEKAYI ANOMALA Dugès
Orizaba Brown Snake

PLATE 9, Figs. 53-55

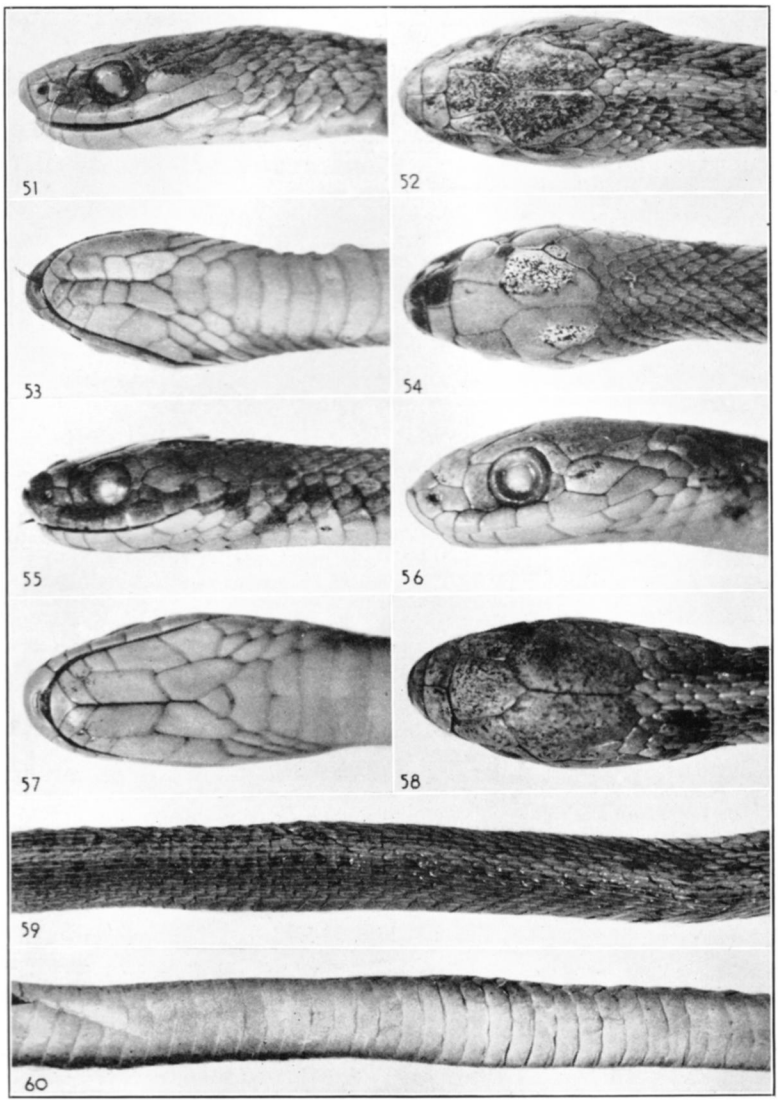
Storeria dekayi var. *anomala* Dugès, Proc. U. S. Nat. Mus., vol. 11, p. 9-10, figs., 1888; Dugès, La Naturaleza, (2), vol. 1, p. 401-2, figs., 1890; Bocourt, Miss. Sci. Mex., vol. 13, p. 744-745, 1893.

Storeria dekayi Yarrow, Bull. U. S. Nat. Mus., vol. 24, p. 130 (partim), 1883; Cope, Bull. U. S. Nat. Mus., vol. 32, p. 75 (partim), 1887; Dugès, La Naturaleza, (2), vol. 2, p. 481, 1896; Cope, Ann. Rept. U. S. Nat. Mus., pp. 1000-1003 (partim), 1900.

Ischnognathus dekayi Boulenger, Cat. Snakes Brit. Mus., ed. 2, vol. 1, p. 286-7, (partim), 1893; Günther, Biol. Cent. Amer., Rept. p. 136 (partim), 1894; Boulenger, Cat. Snakes Brit. Mus., ed. 2, vol. 3, p. 611, 1896.

Storeria dekayi anomala Taylor, Copeia, 1933, p. 97, 1933.

This subspecies was described as a "variety" of *Storeria dekayi*, with three pairs of chin shields instead of two. Cope (1900) considered this of no signifi-



Figs. 51-60.—All views slightly enlarged. *Storeria dekayi temporalineata*, Holotype, USNM 32148 from Jicaltepec, Vera Cruz. Fig. 51. Lateral view of head and neck. Fig. 52. Dorsal view of head and neck. *Storeria dekayi anomala*, Holotype, in Alfredo Dugès Museo, from Orizaba, Vera Cruz. From photograph by H. M. Smith. (The specimen was about to shed when preserved, scales are peeling off.) Fig. 53. Ventral view of head and neck. Fig. 54. Dorsal view of head and neck. Fig. 55. Lateral view of head and neck. *Storeria dekayi tropica*, Holotype, USNM 6759, from Peten, Guatemala. Fig. 56. Lateral view of head and neck. Fig. 57. Ventral view of head and neck. Fig. 58. Dorsal view of head and neck. Fig. 59. Dorsal view of body. Fig. 60. Ventral view of body.

cance as he had observed a partial splitting of the chin shields in specimens from the United States and Canada. The three chin shields, however, prove to be constant in specimens from the vicinity of Orizaba, and I have observed it in but one other of the hundreds of *S. dekayi* examined (a specimen from Louisiana, FMNH 34815). While the race has a restricted range, there seems no reason to question its validity.

Taylor (1933) found the type of *S. d. anomala* in the Alfredo Dugès Museo at the Colegio del Estado de Guanajuato, and Dr. H. M. Smith has kindly made available to me a redescription of the holotype from a manuscript on the Dugès types in the Guanajuato Museum by himself and Mr. Walter Necker, as well as photographs of the holotype.

DESCRIPTION

Diagnosis.—Similar to *S. d. temporalineata,* from which it differs in having three chin shields instead of two, as result of the transverse splitting of the anterior pairs; and in the somewhat more extensive occipital markings.

Scutellation of Holotype.—(From the manuscript of H. M. Smith and Walter Necker).

Head thick, not flattened; length of portion of rostral visible from above about half length of an internasal; median internasal suture somewhat less than median pre-frontal suture; maximum length of internasal about four-fifths that of pre-frontals; frontal pentagonal, its anterior edge somewhat curved, lateral edges somewhat convergent posteriorly, the angle posteriorly nearly a right angle (about 75 degrees); frontal longer (3 mm.) than wide (2.2 mm.), longer than its distance from tip of snout (2.4 mm.), shorter than parietal (4 mm.), equal to length of parietal suture; greatest width of a supraocular (0.9 mm.) somewhat less than half the width of frontal.

Nasal large, naris pierced nearer upper than lower edge, about in the middle anteroposteriorly; nasal suture complete below, but not above naris (a groove above, but definitely no suture); posterior section of nasal slightly larger than anterior; no loreal; one large preocular, about twice as high as long; pupil round; diameter of eye (1.7 mm.) less than its distance from tip of snout (2.6 mm.); two postoculars on one side, three on other, the upper largest; a small flat temporal, subequal in size to upper postocular, wedged between a single large anterior temporal and the fifth supraocular, narrowly in contact also with lower postocular (two lower, on one side) and sixth supralabial; excluding this small scale, the temporal formula on one side is 1-3-3, on the other 1-2-2; seven supralabials, third and fourth (also fifth, on side with two postoculars) entering orbit; fifth supraocular the largest and highest.

Mental triangular, with a labial border four-fifth that of rostral; seven infralabials, scales of the first pair in contact medially, fourth and fifth considerably larger than others, subequal; three pairs of chinshields, the anterior in contact with four supralabials, the middle with one (fourth), the posterior with two (fourth and fifth); posterior pair of chinshields largest, longest, somewhat divergent, divided posteriorly by a single small scale, broadly in contact anteriorly; median pair of chinshields narrower and shorter than others, nearly square; anterior pair of chinshields very slightly narrower than posterior, about two-thirds as long (anterior pair, 1.5 mm.; posterior pair, 2.2 mm.); two broad median scales between chinshields and first ventral.

Dorsal scales in 17-17-17 rows, all keeled, without apical pits, all distinctly although slightly notched at apex; scales of median row of dorsals smallest, the scales gradually increasing in size to the first (outer) row; the scales of this row are one and one-half times as large as the scales of the adjacent (second) row; ventrals 143 (a half ventral immediately precedes anal; this with another half ventral on the other side between the

12th and 13th ventrals are counted together as one)*; anal divided; subcaudals 45, divided; a terminal spine; female.

Coloration of Holotype.—(From the manuscript of H. M. Smith and Walter Necker).

The color of the specimen is obscured by the translucency of the old epidermis, which was apparently about to be shed when the snake was killed. The general ground color is a brownish slate; a series of very small, indistinctly outlined spots on each side, following the seventh scale row; these spots are most frequently placed on alternate scales; the anterior spot of each series, immediately posterior to the parietals and temporals, is considerably enlarged, covering parts of nine scales on one side, five on the other; the area between these series of spots, at least on the anterior third of the body, seems perceptibly lighter than the sides of the body.

The supralabials (except the upper edges of the first four) and the lower half of the large anterior temporal are lighter than the dorsal and the rest of the lateral surfaces of the head; the gular and lower labial regions are distinctly yellowish, with a slight orange tinge; the dorsal color encroaches slightly upon the ends of the ventrals and subcaudals; a series of very small black spots on each side, placed near the ends of the ventrals; this series extends from the gular region to the anus, the spots becoming indistinct near the anus; on some ventrals there are two small spots on a side, instead of one; otherwise the ventral surfaces of the belly and tail are pale yellow.

Hemipenis.—The penis retractor muscle inserts at the level of the twenty-second or the twenty-third subcaudal scale. The hemipenis itself is finely spinose as in other races of *S. dekayi* with one much enlarged basal spine, and two to several lesser ones clustered about it distally.

Dentition.—The maxillary is provided with fifteen slender recurved teeth, subequal in length. The dentary, in one specimen examined, bears sixteen teeth, decreasing in length posteriorly.

Size.—According to the manuscript of Smith and Necker the holotype measures 278 mm., of which the tail comprises 19.1 per cent. The total length and tail/total length ratio of other specimens examined are given in Table 18.

VARIATION

The variation in scalation in this race is shown in Table 18. The upper labials are uniformly 7/7; lower labials 7/7 in four specimens, 7/8 in USNM 110328; preocular uniformly single.

While the specimens available are few, it is apparent that there is a trend in this race toward the breaking up of the temporal plate anteriorly. The numbers of ventrals and subcaudals are about the same as in *S. d. temporalineata.* A specimen from Jalapa, Vera Cruz (MCZ 2843) has one of the anterior chin shields divided, the other entire. This intergrading specimen is included with *S. d. temporalineata.*

The coloration of *S. d. anomala* is similar to that of *S. d. temporalineata,* but the occipital spots are somewhat larger than in that race. All specimens examined had the horizontal dark stripe on the temporal, and the labials almost completely unmarked.

* Dugès' count is 145; he evidently counted with the ventrals the two scales between the chinshields and the scale I consider the first ventral (the first of full width).

HABITAT

Dugès (1888) found the type of this race, "sous une pierre, au bord d'un ruisseau, dans un endroit, extremement humide et d'une vegetation tropicale." Dr. H. M. Smith informs me that the specimen he took at Tequeyutepec was on a grassy hillside in a region of broken, hilly country.

DISTRIBUTION

Storeria d. anomala is known in a rather restricted area from Orizaba to Jalapa in west central Vera Cruz. Here it occurs in the foothill zone intermediate between the coastal plain to the east and the mountains bordering the central Mexican plateau to the west. One specimen bears the locality data, "Alpine Zone, Orizaba," but other specimens come from altitudes between 4500 and 5600 feet. Along the coastal plain it intergrades with *S. d. temporalineata.*

LOCALITY RECORDS

Specimens examined as follows:

VERA CRUZ: Jalapa, alt. circa 4490 feet, USNM 5565; Tequeyutepec, alt. circa 5600 feet, USNM 110328; Orizaba, USNM 8939; Orizaba, Alpine Region, USNM 7081.

STORERIA DEKAYI TROPICA Cope

Tropical Brown Snake

PLATE 9, Figs. 56-60

Storeria tropica Cope, Proc. Amer. Philos. Soc., vol. 22, p. 175, 1885; Bull. U. S. Nat. Mus., vol. 32, p. 75, 1887; Proc. U. S. Nat. Mus., vol. 14, p. 674, 1891; Ann. Rept. U. S. Nat. Mus., p. 1000, 1900.

Storeria dekayi Bocourt, Miss. Sci. Mex., vol. 13, p. 742-744 (partim), 1893; Amaral, Mem. Inst. Butantan, vol. 4, p. 150 (partim), 1929; Schmidt, Zool. Ser. Field Mus. Nat. Hist., vol. 22, p. 480, 1941; Schmidt and Stuart, Zool. Ser. Field Mus. Nat. Hist., vol. 24, p. 237, 1941.

Ischnognathus dekayi Boulenger, Cat. Snakes Brit. Mus., vol. 1, p. 286-287 (partim), 1893; Günther, Biol. Cent. Amer., Rept., p. 136 (partim), 1894.

Cope regarded the six supralabials and the absence of the dark vertical temporal bar as the characters distinguishing *S. tropica* from *dekayi.* The head plates of *Storeria* in Guatemala and Honduras are highly variable (see Table 19), and there can be no doubt that records of *S. dekayi* from Guatemala and Honduras are to be referred to *tropica,* the southernmost form in the *S. dekayi* cline.

The holotype in the United States National Museum (No. 6759) from Peten, Guatemala, is in good condition.

DESCRIPTION

Diagnosis.—This race is similar in essential features to *S. d. temporalineata* but differs in the lower average number of ventrals plus subcaudals (*temporalineata*=187: *tropica*=181), the lower average number of posterior temporals (*temporalineata*=2.6: *tropica*=2.0), and the reduced, more pointed snout.

TABLE 18.—Variation in Certain Characters of *Storeria dekayi anomala.*

Museum	No.	Sex	Ventrals	Subcaudals	Ventrals+ Subcaudals	Ventrals— Subcaudals	Post-oculars	Anterior Temporals	Posterior Temporals	Total Length	Tail/total Length
USNM	5565	♂	136	50	186	86	2/2	1/1	2/2	360	20.8
USNM	8939	♂	140	50	190	90	2/2	1/1	2/3	382	20.8
USNM	110328	♂	137	51	188	86	2/2	1/3	4/3	228	21.5
USNM	7081	♀	144	42	186	102	3/3	2/3	2/3	312	17.9
Dugès Museo (Holotoype)		♀	143	45	188	98	2/3	2/2	3/2	278	19.1

TABLE 19.—Variation in Certain Characters in *Storeria dekayi tropica.*

		Sex	Ventrals	Subcaudals	Ventrals+ Subcaudals	Ventrals— Subcaudals	Supra-labials	Infra-labials	Post-oculars	Posterior temporals	Total Length	Tail/total Length
FMNH	411	♂	125	55	180	70	7/7	7/7	2/2	3/2	300	23.7
FMNH	21796	♂	132	53	185	79	6/5	8/7	2/2	2/2	361	23.3
USNM	6759*	♂	132	53	185	79	6/6	7/7	3/2	3/2	341	22.6
FMNH	20527	♀	141	....	....	....	7/8	7/8	2/3	2/2	368	.....
MCZ	38714	♀	134	44	178	90	7/7	7/..	1/3	2/2	348	19.3
MCZ	38715	♀	135	45	180	90	7/7	7/7	3/2	2/2	319	19.8
MCZ	38716	♀	133	....	....	....	7/7	7/7	2/2	2/2	273	.....
USNM	35921	♀	135	45	180	90	7/7	7/6	2/3	1/1	185	18.9

* Holotype.

Scutellation of Holotype.—The dorsal head plates are normal, but the internasals are somewhat reduced in size; nostril between the anterior and posterior nasals; the nasals separated by a suture below the nostril but not above, posterior nasal larger than anterior; preocular single, higher than wide, postoculars three on the right and two on the left, the lowermost larger on the right, the upper larger on the left; anterior temporal single; posterior temporals three on the right and two on the left; supralabials six on each side (the normal sixth and seventh fused), the third and fourth entering the orbit; infralabials seven on each side, the fourth and fifth largest, the first pair in contact on the median line between the mental and anterior chin shields; the mental triangular; anterior and posterior chin shields subequal in length, in contact medially except for divergent rear half of the posterior pair separated by small scales anterior to the first ventral; scale rows 17-15-17 (the third scale row on each side is dropped from the fifth to the thirteenth ventral), all keeled, emarginate posteriorly, apical pits not apparent, the first scale row wider than the others.

Ventrals 132, anal divided, subcaudals divided, in 53 pairs.

Coloration in Holotype.—The top of the head weakly peppered with black; supralabials and infralabials whitish, clear and unmarked. A dark horizontal stripe on the upper part of the anterior temporal continuing forward onto the postoculars. Occipital marks reduced to the size of those of the back, which are principally on the seventh scale row. Approximately ninety pairs of spots on the body, with no fusion of the dorsal spots to form crossbars. Median three scale rows slightly lightened. Belly whitish with an occasional dark fleck laterally, and a faint suffusion of the dorsal brown onto the lateral margins of the ventrals.

Hemipenis in Holotype.—The hemipenis is about as in other races of *S. dekayi*. The retractor muscle inserts at the level of the twentieth subcaudal. The organ itself is finely spinose distally and has one much enlarged basal spine with three lesser ones distad.

Size.—The holotype, a male, measures 341 mm., the tail comprising 22.6 per cent. The largest male examined reaches the length of 361 mm., the largest female 368 mm. (See Table 19).

VARIATION

Scutellation.—The variation in scale characters of this race are given in Table 19. Sexual dimorphism is pronounced. The average of the sum of the ventrals and subcaudals most clearly shows the decrease from that in *S. d. temporalineata,* the adjoining race to the north. Variation in the labials is common in *tropica.* Seven is the normal number of both supralabials and infralabials, and it is evident that the six supralabials of the type, represents chance variation. The preoculars and anterior temporals are uniformly single. While the series of specimens of this race and of *S. d. temporalineata* available for study is small, there are trends toward differences in the number of postoculars and posterior temporals. Subspecies *temporalineata* has the postoculars almost uniformly two, while *tropica* often has an increase to three

(sometimes four, *fide* Bocourt, 1893). Conversely the average of the posterior temporal counts in subspecies *temporalineata* is 2.6 while in *tropica* it is 2.0.

Coloration.—Several of the specimens of this race examined have been darkened in preservation so that it is difficult to make out any pattern at all. As far as can be determined, however, the horizontal temporal stripe and the clear condition of the labials are constant. The occipital dark spots also seem uniformly reduced, as in the adjacent race, *temporalineata.*

HABITAT

The following information is from Karl P. Schmidt. *Storeria d. tropica* is an inhabitant of forested regions, and is a snake of the leaf mold ground cover. Field Museum No. 20527 was abroad on a path in a coffee plantation in the early forenoon.

DISTRIBUTION

This race ranges from Peten in northern Guatemala south and east to Yoro in north central Honduras. All records are from the Atlantic drainage. The known altitude range is from 2300 to 4300 feet.

LOCALITY RECORDS

Specimens examined as follows:

GUATEMALA

ALTA VERAPAZ: Samac,* near Coban, FMNH 20527; Senahu, USNM 35921.
PETEN: USNM 6759 HOLOTYPE.
GUATEMALA: FMNH 411.

HONDURAS

YORO: Subirana Valley, Yoro, FMNH 21796; Subirana Valley, Altitude 2300 feet, MCZ 38714-6.

AFFINITIES OF STORERIA DEKAYI

The *Storeria dekayi* complex appears to the writer to be derived from *S. storerioides,* or from the ancestral line of that species. The normal number of upper labials in these two species is seven, and the dorsal spot pattern, fusing to form crossbars, is also found in both. The ventral and subcaudal counts in *storerioides* are relatively high for the genus *Storeria.* The number of ventrals and subcaudals in *dekayi* is greatest in the area adjoining the range of *storerioides* (i.e., in that occupied by *S. d. temporalineata* and *S. d. anomala*). These snakes also average somewhat larger than other *Storeria dekayi.* Thus the *dekayi* series seems best read as a reductional sequence, from *temporalineata* and *anomala* through *texana* and *wrightorum* to *dekayi dekayi.* The genetic variability of *S. storerioides* might be expected to produce the mutation resulting in the three chin shields of *S. d. anomala.* It is thus significant that this race of *S. dekayi* is closest to *S. storerioides* geographically.

A difficulty in the interpretation of *S. dekayi* as a reduction series from *S. storerioides* lies in that there is an increase in number of scale rows from fifteen in *storerioides* to seventeen in *dekayi.* Thus *dekayi* is probably not a

* Also recorded from Coban by Bocourt (1893).

direct derivative of *storerioides*. It may be reasonable to suppose that *S. dekayi* is derived from a "pre-*storerioides*" stock with seventeen scale rows.

The head markings have proved to be of much value in working out the relations within *S. dekayi*. The temporal stripe, the clear labials, and the reduced occipital marks are essentially the same in subspecies *temporalineata, anomala* and *tropica*. *Storeria d. anomala* and *temporalineata* may be considered to be the closest of the *S. dekayi* line to the "pre-*storerioides*" stock. By reduction and some modification, *tropica,* to the south, was evolved from *temporalineata*. *Storeria dekayi texana,* with its clear temporal and spotted labials, exhibits characteristics of *storerioides* that differ from those of *temporalineata*. In other important features of coloration and scalation it is, however, close to *temporalineata*. Thus in the schema of the probable evolution in the genus, *texana* is placed in a questionable position. From *texana, wrightorum* is derived by the appearance of the fused dorsal spots and the development of a new feature, the vertical temporal bar. *Storeria dekayi dekayi* retains the temporal bar, but has the dorsal spots separate, and a reduced number of ventrals and subcaudals.

The relations of the various species and races of *Storeria* are summarized in the following diagram.

The Origin of Storeria

There remains the consideration of the origin of the genus *Storeria* as a whole.

In the discussion of the affinities of *S. storerioides* it has been pointed out that that species possesses the genetic potentialities of the other members of the genus, and is probably the nearest of the living forms to the ancestral line from which the group evolved. We may now seek the group from which *S. storerioides* and thus *Storeria* as a whole is derived. Unfortunately, the evidence available is only that derived from study of living forms. There is much evidence, from a morphological point of view, that *Storeria* is a reduced Natricine tribe. In such essential features as the divided anal plate, the keeled scales, the spinose hemipenis, and the single sulcus spermaticus, *Storeria* is like *Natrix*. The presence of a loreal in *S. storerioides* represents at least one character in transition between *Natrix* and the other members of the genus *Storeria,* which lack the loreal.

The writer* has shown the chromosome complement in *Storeria occipitomaculata* to be thirty-two (2n, male). Nakamura (1928) working with Asiatic *Natrix* (*N. tigrina*) found the diploid number in males to be forty. The morphology of the individual chromosomes also differs from that found in *Storeria*. This may indicate an important distinction between *Storeria* and *Natrix;* unfortunately there are no chromosome studies yet available of North American *Natrix*. The evidence from the chromosomes is best held in abeyance until further comparative studies can be made. Until that time the question of the origin and relations of *Storeria* must be held open.

* In a paper read at the April 1942 meetings of the American Society of Ichthyologists and Herpetologists, as yet unpublished.

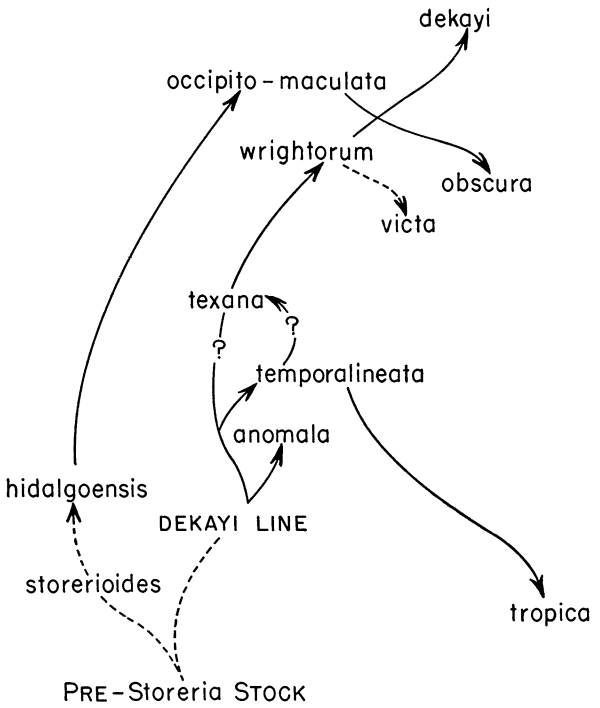


Fig. 1. A diagram of the hypothetical phylogeny in *Storeria*.

Postscript

Since the completion of this manuscript I have profited much by a discussion of the ranges of these snakes with Messrs. Karl P. Schmidt and Clifford H. Pope.

Mr. Schmidt has pointed out that the absence of records of *S. o. occipitomaculata* from what we may consider a steppe peninsula from central and southern Iowa and northern Missouri east through central Illinois and Indiana to Ohio (excepting the record from Menard Co., Illinois, whose authenticity he doubts) gives additional, though negative, evidence for the theory of the postglacial eastward extension of the steppe in North America. (See Schmidt, Ecology, 1938, 19(3):396-407.) We might then judge that the moisture and cover requirements of this species which are met in the forested eastern regions did not become established in the postglacial times in the steppe peninsula soon enough for the entry of this species, which, failing to adapt itself, has never subsequently invaded this region, though it did move into the more suitable forested country to the north in Ontario, Michigan, Wisconsin and Minnesota.

Some explanation is also desirable with reference to the areas of overlap in the ranges of the subspecies of *S. dekayi*. The broadest area of overlap is

found between *dekayi* and *wrightorum* across much of Michigan, Ontario and Ohio. This area is one with no consequential physiographic barrier and a broad area of intergradation is not, therefore, unexpected. An examination of the records of specimens cited shows that individuals from this area have been placed in one subspecies or the other. Another author might have preferred to indicate all these specimens as "intergrades," but as individual specimens may be named as one race or the other, on the basis of the diagnostic characters, each specimen was recorded as of a particular subspecies. As the transition in color characters between *wrightorum* and *texana* in the region of the 95th meridian are more gradual certain individuals were considered intermediate, and they will be found to be cited as intergrades.

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