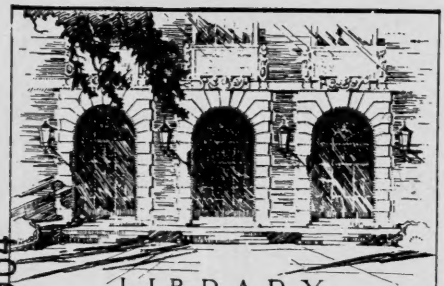

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THE AMAZONIAN CORAL SNAKE

Micrurus spixi

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The accumulation of forty-six additional specimens of the several subspecies of the Amazonian coral snake, *Micrurus spixi*, since my preliminary review of the coral snakes of South America in 1936, makes it possible to summarize our knowledge of this species, the type of the genus. The total number of specimens examined is 125, of which more than thirty are from the Bassler Peruvian collections, made available to me by Mr. C. M. Bogert, of the American Museum of Natural History. I am indebted for further loans and for examination of specimens in their charge to Messrs. H. W. Parker and J. C. Battersby, of the British Museum (Natural History); to Dr. Robert Mertens, Director of the Senckenberg Naturmuseum in Frankfort a/M; to Dr. Jean Guibé, of the Museum d'Histoire Naturelle in Paris; to Mr. Arthur Loveridge, of the Museum of Comparative Zoology; and to Mr. Neil Richmond, of the Carnegie Museum. My earlier studies on coral snakes in European museums were made as fellow of the John Simon Guggenheim Memorial Foundation.

The difficulties in the study of the coral snakes are those of any group of forms in which secretive habits make collecting and observation erratic. For *Micrurus spixi*, though the general pattern of distribution emerges, we are without specimens that might connect the several subspecies. Even more disappointing is the absence of notes as to habitat and habits. Only two living specimens of this species are known to have reached zoological gardens (one in St. Louis, Missouri, and one in Basel, Switzerland).

MATERIAL EXAMINED

Pará: [no other data], Chicago Nat. Hist. Mus. 25222, Vienna, no number; Belém, Munich 30/ 1926, Mus. Comp. Zool. 46628; Rio Capim (south of Belém), Brit. Mus. (Nat. Hist.), no number; Boim, on the Rio Tapajoz, Munich 358/1920; Santarem, Mus. Comp. Zool. 2612, 2770, Mus. Hist. Nat. Paris 5336; Campo de

Ariramba, Munich 124/1915; Marajo Island, Mus. Hist. Nat. Paris 5337; Caldeiro, Marajo Island, Brit. Mus. (Nat. Hist.) 1923–11–9–186.

AMAZONAS: [no other data], Mus. Comp. Zool. 4763; region of the Solimoes, Munich 209/0, type; Lago de Coapiranga, Senck. Nat. Mus., no number; Manaus, Munich, no number, Amer. Mus. Nat. Hist. 64913, Mus. Comp. Zool. 2976; Miriti River, Amer. Mus. Nat. Hist. 67953; Alto Amazonas, Vienna, no number; Rio Negro, Vienna, no number (2 spec.); Marabitanos, Vienna, no number (3 spec.); Manacapuru (type of *Micrurus ehrhardti* Müller), Munich 203/1925; São Gabriel, Rio Negro, Mus. Nac. Rio 440; no data, Mus. Nac. Rio 541; Munich, no number.

MATO GROSSO: Rio Tapirape, Foz com o Rio Araguaia, Chicago Nat. Hist. Mus. 48408.

BOLIVIA: [no other data], Vienna, no number (2 spec.); "Yungas," Brit. Mus. (Nat. Hist.) 1895–11–21–42; Santa Cruz de la Sierra, Carnegie Mus. 126, 2763, 2828, 2841–2842, 2952, 2961, Brit. Mus. (Nat. Hist.) 1904–10–29–62 to 66; Buenavista (80 km. northwest of Santa Cruz), Brit. Mus. (Nat. Hist.) 1927–8–1–219 to 221, Munich, no number, Chicago Nat. Hist. Mus. 37729–37734, Univ. Mich. Mus. Zool. 60733, 60776–77, 60779, 60781, 63816, 67929–67930; Rio Surutu, Prov. Sta. Cruz, Univ. Mich. Mus. Zool. 63817–63820; Sorata (upper Mapiri), Senck. Nat. Mus. 9417 (2 spec.); Trinidad, Rio Mamoré, Brit. Mus. (Nat. Hist.) 1923–11–7–81; Rio Mapiri, affluent of the Beni, 1,000 meters, Senck. Nat. Mus., 20749.

PERU: [no other data], Mus. Hist. Nat. Paris 4605, 4636, 4636a, Vienna, no number, Univ. Arequipa 91, 156, 162; Iquitos, Senck. Nat. Mus. 9420b, Amer. Mus. Nat. Hist. 52261, 52262, 52587, 52639, 53068, 53324, 54076, 54519–54520, 54910, 55869, 56064; Pucalpa, Chicago Nat. Hist. Mus. 56113–56114, 64549–64550; Loreto, Chicago Nat. Hist. Mus. 45623; Moyobamba, Brit. Mus. (Nat. Hist.) 1874–8–4–38, 42, and 43; Rio Tamaya, Rio Ucayali (above Pucalpa), Amer. Mus. Nat. Hist. 52677; Pampa Hermosa, Rio Caxabatay, Amer. Mus. Nat. Hist. 55405, 55408, 55788, 55796; Roaboya, Rio Ucayali, Amer. Mus. Nat. Hist. 52890, 53084; Monte Carmelo Requena, near Isla Cedro, Rio Ucayali, Amer. Mus. Nat. Hist. 55532, 55534; Orellana Reforma, Rio Ucayali, Amer. Mus. Nat. Hist. 54619; Rean Rean, Lago Suhaya, Contamana, Amer. Mus. Nat. Hist. 52886; Rio Ponaza, Rio Huallaga, 1,000 to 1,500 feet, Amer. Mus. Nat. Hist. 52819; Rio Tocache, Rio Huallaga (below Tingo Maria), Amer. Mus. Nat. Hist. 52093, 52392; Rio Cenipa, Rio Marañon, 52725; Rio Putumayo, 53138; Coballa Cocha, Rio Tigre, 49151; Marcapata, Chicago Nat. Hist. Mus. 59179; Sandia, 64728–64729; Peru-Brazilian frontier (Tapiche-Utoquinia), Amer. Mus. Nat. Hist. 52133.

ECUADOR: Canelos, Brit. Mus. (Nat. Hist.) 1912–11–1–44, 1880–12–8–132; Pastaza region, 1932–4–5–29; Canelos to Marañon, Mus. Comp. Zool. 36946.

COLOMBIA: Rio Putumayo, Chicago Nat. Hist. Mus. 37455; Puerto Boy, Rio Caqueta, Inst. La Salle 15.[1]

General account of the species.—The great size reached by individuals of *Micrurus spixi* (lengths up to five feet being recorded) and the boldness of its pattern give it an impressive appearance. The first living specimen to reach the zoological garden at Basel, Switzerland, was photographed in color and illustrated on a folding color plate by the Swiss popular journal DU (Schweitz. Monatschr. Du, 1949, no. 3, pl. facing p. 36).

Micrurus spixi, the type species of the genus *Micrurus*, is sharply distinct from all other species of the genus. It is characterized by having the black rings about equal in length, arranged in groups of

[1] La Tagua, also on the Caqueta, is added to the map from the record of Hermano Niceforo-Maria.

three ("triads"), each of which is separated from the next by a red ring, the separation of the outer rings of the triad from the middle ring being by yellow rings of about the same length as the outer black rings. The nuchal ring is always the middle ring of a triad, so that the number of triads is written (for example) for body plus tail $\frac{2}{3}$, $6+\frac{2}{3}$. The tail of *spixi* is short, the maximum number of caudals known being 25. Sexual dimorphism in ventrals and caudals is obscured by overlapping variation, though discoverable in the averages of larger series. The females have the greater number of ventrals, the males the greater number of caudals. Most specimens, of both sexes, have a few caudals undivided. The individuals of *M. spixi* reach a much greater length than do those of any other American coral snake; the longest specimen examined is Carnegie Museum no. 126, from Bolivia, which measures 1,600 mm. Twenty-nine specimens, out of 125, exceed a meter in length. The body is stout, the diameter being contained in the length about 60 times.

The fact that the black and yellow rings in *spixi* may be of more or less equal length, and that when the triads are numerous the red rings are shortened to about the same length (or even occasionally suppressed, producing a "quinquad" of black rings) introduces the complication in faded museum specimens that the yellow may be quite indistinguishable from the red. Fortunately, the scales in the yellow zones are always tipped with black, so that the triad nature of the pattern is still distinct.

Notes on type.—The type specimen of *spixi* in the Zoologische Sammlung des bayerischen Staates (No. 209/0), collected by the great Spix and Martius expedition of 1817–20 in the "Gebiet des Solimoens," Amazonas, was in excellent condition when I examined it in Munich in 1932. It is a male specimen, with 215 ventrals,[1] divided anal, and 22 caudals, of which 8 are entire; the labials are 7 above and below; the oculars are 1–2; the temporals are 1–2 on the left side, 1–1 on the right; the triads of black rings are $\frac{2}{3}$, 6, $\frac{2}{3}+\frac{2}{3}$. At mid-body the ventrals covered by the rings in question are:

Red	Black	Yellow	Black	Yellow	Black	Red
6	4	5	4	5	4	6

Jan's figure (Icon. gén. Ophid., Livr. 41, pl. 6, fig. 2), here reproduced, is from the type specimen in Munich.

Systematic review.—In view of the absence of isolating barriers it is somewhat remarkable to find that *spixi* falls into four rather

[1] Counted from the chin-shields, following my rule for all coral snakes.

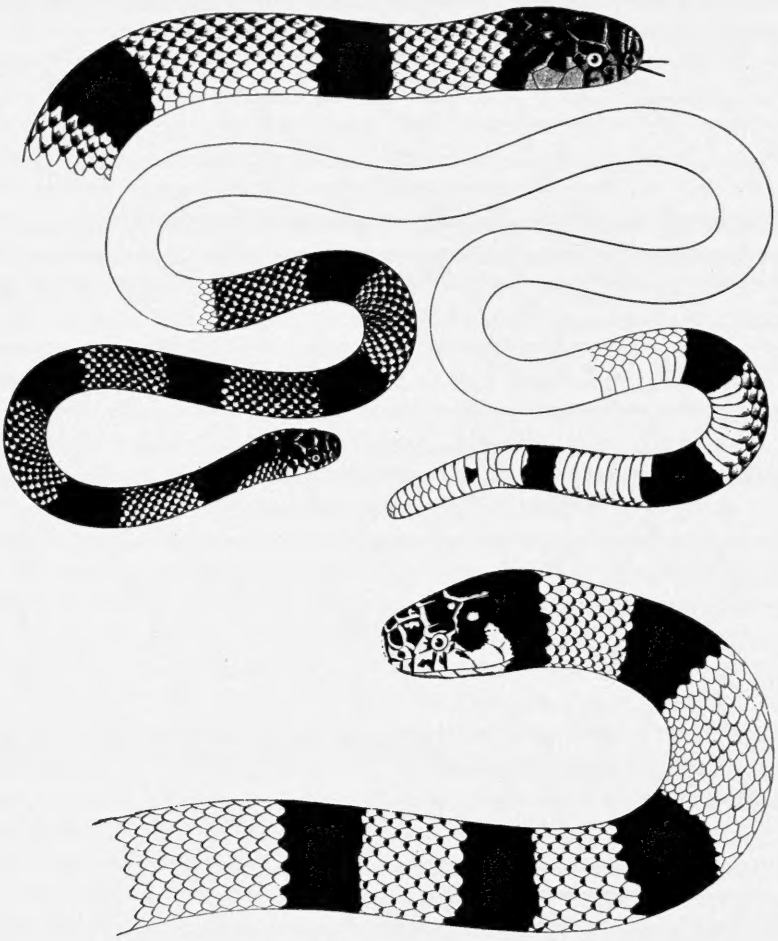

FIG. 33. Upper figure, type of *Micrurus spixi* Wagler; middle figure, type of *Elaps circinalis obscura* Jan (=*Micrurus spixi obscurus*); lower figure, *Elaps marcgravii* (not of Wied; = *Micrurus spixi martiusi*). All from Jan and Sordelli, 1872, Icon. gén. Ophid., respectively Livr. 41, pl. 6, figs. 2 and 3, and Livr. 42, pl. 3, fig. 2.

well-marked subspecies, which were ignored in my review of 1936. They may be distinguished as follows:

Triads of black rings on body ⅔, 4 to ⅔, 7, usually ⅔, 5.

Nuchal black ring (the middle ring of a triad), directly behind the head and involving the parietal shields, short (extending over three or four dorsal scales) ..... *spixi spixi*

Middle Amazon region, Amazonas

Nuchal black ring elongate, strongly produced forward (covering about nine dorsal scales) ..... *spixi obscurus*
Colombia to southern Peru, along Andean tributaries of Amazon
Triads of black rings 5/5, 6 to 5/5, 9, usually 5/5, 7.
Head light, snout mottled with dark, parietals unmarked ..... *spixi princeps*
Central to northwestern Bolivia
Head dark, parietals at least mostly black, usually solid black. *spixi martiusi*
Lower Amazon region, Pará and northeastern Mato Grosso

The synonymy of *Micrurus spixi*, ignoring some of the obscure identifications before the appearance of the third volume of Boulenger's *Catalogue of Snakes* (1896), is as follows:

Micrurus spixi Wagler

Micrurus spixi Wagler, 1824, Serp. Bras., p. 48, pl. 18—region of the Solimoens River; Schmidt, 1936, Field Mus. Nat. Hist., Zool. Ser., **20**: 198.

Micrurus spixi spixi Wagler

Elaps corallinus var. *circinalis* (not Duméril and Bibron) Jan and Sordelli, 1872, Icon. gén. Ophid., Livr. 41, pl. 6, fig. 2.

Micrurus spixii spixii Schmidt and Walker, 1943, Field Mus. Nat. Hist., Zool. Ser., **24**: 294.

Elaps erhardti Müller, 1925, Zool. Anz., **65**: 198—Manacapurú on the Solimoens.

Micrurus spixii Amaral, 1929, Mem. Inst. Butantan, **4**: 112, 232.

Micrurus spixi obscurus Jan

Elaps corallinus var. *obscura* Jan and Sordelli, 1872, Icon. gén. Ophid., Livr. 41, pl. 6, fig. 3—Lima (in error); type locality designated as Iquitos, Peru.

Micrurus spixii obscura Schmidt and Walker, 1943, Field Mus. Nat. Hist., Zool. Ser., **24**: 294.

Elaps heterozonus Peters, 1881, Sitzber. Ges. naturf. Freunde, Berlin, **1881**: 52—Sarayacu, Ecuador; Boulenger, 1896, Cat. Snakes Brit. Mus., p. 417; Amaral, 1929, Mem. Inst. Butantan, **4**: 230.

Micrurus spixi princeps Boulenger

Elaps princeps Boulenger, 1905, Ann. Mag. Nat. Hist., (7), **15**: 456—Prov. Sara, Dept. Sta. Cruz de la Sierra, Bolivia; Griffin, 1916, Mem. Carnegie Mus., **7**: 220.

Micrurus spixi martiusi subsp. nov.

Elaps spixii Boulenger, 1896, Cat. Snakes Brit. Mus., **3**: 427 (part).

Type.—Museum of Comparative Zoology no. 2612, adult male, from Santarem, Pará, Brazil, collected in 1866 by D. Bourget on the Thayer Expedition.

Diagnosis.—Distinguished by its high number of triads of black markings (6 to 9 complete triads on body); nuchal ring short, head usually solid black, parietals at least mostly black.

Description of type.—Body stout; head slightly wider than neck, with rounded, moderately high snout; tail very short; upper labials 7/7, lower labials 7/7; oculars 1–2/1–2; temporals 1–1/1–1; dorsal scale rows 15 from third widened ventral on; ventrals 226 (counted from chin-shields), anal divided; caudals 25, of which 11 are entire.

Head black above, the shields anterior to the parietals with light anterior borders; black of parietals extending three scale-lengths back and continued around neck as a complete nuchal ring; nuchal ring extending forward beneath onto the anterior chin-shields; a large light spot from the sixth upper and fifth lower labial extending forward and downward.

First ring behind the black nuchal light (yellow in life), 5½ scale-lengths wide, posterior third of each scale black; next ring black, 7 dorsal scales long above, narrowed below to 3 ventrals; following ring light, without black tips on scales (red in life), 6 dorsals in width above, widened to 9 ventrals beneath; 8 complete groups of three black rings, each group separated by red rings, the individual rings of the "triad" separated by yellow rings; the black rings of about equal width throughout; all interior rings with black-tipped scales, all the wider red rings with scales unmarked, or at most with an occasional black dot; last triad extending onto tail, producing the triad formula ⅔, 8, ⅓+⅔, i.e., the last two black rings of a triad (beginning with the nuchal and parietal one), 8 complete triads, the first black ring of a triad just before the anus, plus 2 black rings on the tail.

Measurements of type.—Total length 1,235 mm., tail 68 mm., diameter at mid-body 19 mm.

Notes on paratypes.—All of the specimens listed from Pará and the single specimen from northeastern Mato Grosso form the series of paratypes. The range of variation in ventrals, caudals, and number of triads of black rings is discussed below. Chicago Natural History Museum is indebted to the Museu Nacional, Rio de Janeiro, for the Mato Grosso specimen, which was collected by Antenor de Carvalho.

Variation within the species.—Returning to the comparison of the several subspecies, the distribution of specimens as to numbers of complete triads on the body is as follows:

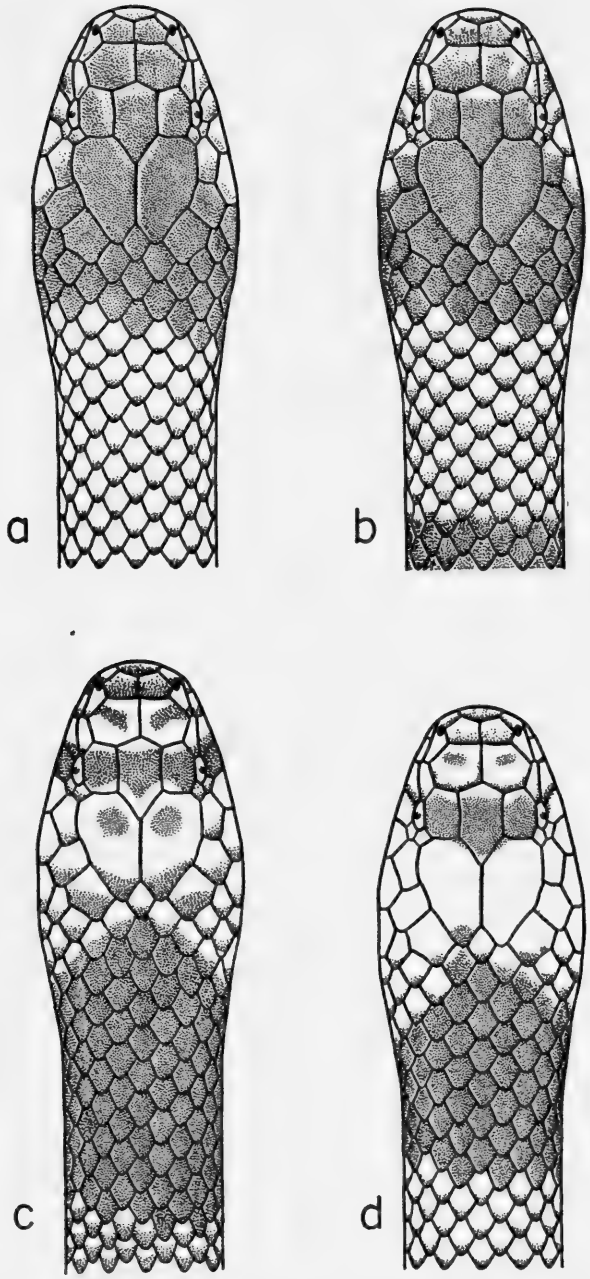

FIG. 34. Head patterns of the several subspecies of *Micrurus spixi:* a, *spixi;* b, *martiusi;* c, *obscurus;* d, *princeps.*

	Number of triads					
	4	5	6	7	8	9
	Number of specimens					
spixi	2	8	8			
obscurus	8	31	15	1		
princeps			12	26	4	
martiusi			2	7	2	2

Variation in the numbers of ventrals and caudals in the four subspecies is as follows:

	Number of specimens	Ventrals	Caudals
spixi	11♂	208–219	19–24
	7♀	212–224	19–22
obscurus	31♂	203–228	17–22
	24♀	207–275	16–22
princeps	24♂	210–227	19–24
	15♀	217–228	19–23
martiusi	12♂	211–226	21–25
	1♀	226	22

Within the subspecies *obscurus*, which ranges from southern Colombia to southeastern Peru, there are clues to significant geographic variation; in the six specimens available from Colombia and Ecuador the caudals range only from 16 to 18, average 17, whereas in the Peruvian series of 49 specimens the caudals range from 16 to 22, averaging 20 in males and 19 in females. The maximum number of ventrals in the species as a whole, 229, is reached in a female specimen of *princeps* from Buenavista, Santa Cruz, Bolivia. The specimens available from southeastern Peru tend also to have a high average number of ventrals. The specimens from the Mapiri River and from the "Yungas" (assumed to be in northwestern Bolivia) are intermediate between *princeps* and *obscurus*, with the light-colored head of *princeps* and the elongate nuchal ring of *obscurus*.

Habitat and habits.—There is no real clue to the habitat of *Micrurus spixi*, for no note is to be found with any specimen thus far on record. The only records of stomach contents are from two specimens from Sandia, southeastern Peru; one of these consists of the remains of a *Dipsas* sp., the other of an *Atractus* sp. The species of *Dipsas* are normally arboreal, and it is not likely that *Micrurus spixi* pursued it into this habitat; its capture must have been at the surface of the ground. The species of *Atractus* are subterranean or secretive, and this species is a normal coral snake food item. From the fact that *spixi obscurus* occurs so abundantly in the vicinity of Iquitos and along the Ucayali, with two subspecies con-

fined to the lower Amazon, it might be inferred that the floor of the lowland rain-forest is the principal habitat. The two specimens from Sandia, Peru, may well have come from the valley below rather than from Sandia itself, which is about 3,000 meters. The specimens of *princeps* from Sorata, Bolivia, are apparently from the head of a deep valley.

The species of *Micrurus* that occur with *spixi* in the Amazon region are mainly the smaller *hemprichi*, the more slender *lemnis-*

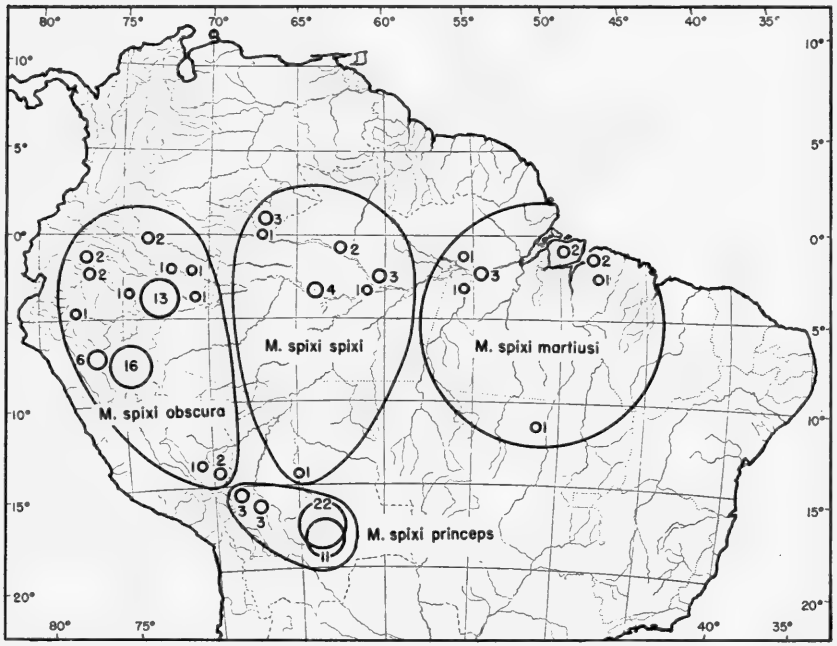

FIG. 35. Distribution of *Micrurus spixi*, with ranges of the subspecies. The figures give the number of specimens. (Erratum: for *obscura* read *obscurus*.)

catus and *filiformis*, with the almost equally large *surinamensis*, which last seems to be absent in the middle Amazon region.

Geographic distribution.—The known range of *Micrurus spixi* is limited to the Amazon and Tocantins drainages. It probably does not occur at all in the Guianas or in the middle and lower Orinoco Basin, though the Orinoco is approached via the upper Rio Negro. On the very slender basis of numbers of specimens received by museums, the center of abundance might be thought to lie in the basins of the affluents of the upper Amazon, where it presumably barely reaches the subtropical zone. There is no clue as to which of the

four subspecies might be regarded as the more primitive or as to which might be thought to be derived. Nor is there any satisfactory explanation other than unknown past dispersal patterns for the development of the four subspecies with no discernible barriers to separate them.

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