

A MONOGRAPH OF THE AMERICAN FROGS OF THE GENUS *RANA*.

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Presented by Thomas Barbour.

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I HAVE lately been able to make a thorough revision of the numerous species, about 195, constituting the genus *Rana* in the broad sense in which I take it.¹

For purposes of convenience, and also in order to facilitate its publication, I have divided the work into four parts, based on the geographical distribution. The first part, dealing with the South Asian, Papuan, Malanasian and Australian species, will be published, thanks to the kind interest of Dr. Annandale, in the Records of the Indian Museum, and is nearly entirely printed. The part dealing with America, comprising a comparatively small number of species, is now offered for publication.

The latest comprehensive accounts of the North American species are contained in the works of Cope, *Batrachia of North America*, (Bull. U. S. Nat. Mus. No. 34, 1889), and of Miss Dickerson, whose *Frog Book* (1906) is so excellently illustrated and swarms with interesting information on the life histories. The Central American species have been dealt with by Günther in the *Biologia Centrali-Americana* (1900).

From a systematic point of view, the descriptions in these works are not so precise and comparative as I should wish, and do not convey that information on individual variations in the proportions that are of essential importance in a group in which the absence of scales deprives us of so many characters which facilitate the identification and study of reptiles. That is why I have thought it desirable to prepare tables of measurements of a large number of individuals to accompany the descriptions, drawn up on a strictly comparative system and taking into consideration all departures from the normal.

These descriptions and tables will enable the student to form a correct idea of the material in the British Museum, material which, though less exhaustive than that in some institutions in the United States, is yet of great extent, especially as concerns Mexico and Central America. It has been recently increased through the gener-

¹ Cf. Bull. Soc. Zool. France (1918), p. 111.

ous help of Miss Dickerson, Dr. Stejneger and Dr. Barbour to whom I beg to express my best thanks. I have also been able to examine the types of the Central American species preserved in the Paris Museum and assign them their place in the synonymy.

A few words of explanation are necessary concerning the method of taking measurements.

The length of the head and of the snout are measured along the axis, and the posterior extremity of the head corresponds to the articulation of the skull with the vertebral column, which can be approximately ascertained, in the flesh, by feeling with the points of the compasses. The width of the head is the greatest width at the commissures of the jaws.

The tympanum, of which the greatest diameter is given, is compared with the eye, measured along the side of the head.

The limbs are measured fully stretched out, the hind limb from the middle line of the thigh where it joins the body. By foot is meant the foot without the tarsus; it is measured from the tarso-metatarsal articulation. Each finger or toe is measured from the point at which it joins its fellows, and if this is not the same on both sides of it, as in the case of the fourth toe, from the point most remote from the tip. The length of the first toe is reckoned from the distal extremity of the base of the inner metatarsal tubercle.

SYNOPSIS OF THE SPECIES.

I. Toes pointed or with slightly swollen tips.

- A. Glandular dorso-lateral fold absent or flat and ill-defined, or, if very prominent, not extending to the hip; tympanum at least $\frac{2}{3}$ diameter of eye, usually much larger, especially in males; tibia $2\frac{1}{2}$ to 4 times as long as broad; toes $\frac{3}{4}$ to entirely webbed; outer metatarsals separated nearly to the base; nasal bones in contact with each other or narrowly separated.

- 1. Male with internal vocal sacs; dorso-lateral fold absent or flat and very indistinct.

Vomerine teeth between (rarely just behind) the choanæ; first finger as long as or a little longer than second; tibio-tarsal articulation reaching tympanum or eye; heels meeting or slightly overlapping; tibia $2\frac{1}{10}$ to $2\frac{1}{2}$ times in length from snout to vent; tip of fourth toe free; no dorso-lateral fold. *R. catesbiana*, Shaw.

Vomerine teeth between the choanæ; first finger a little shorter than

second; tibia-tarsal articulation reaching tympanum or eye; heels meeting or narrowly separated; tibia $2\frac{1}{4}$ to $2\frac{1}{3}$ times in length from snout to vent; web extending to tip of fourth toe; no dorso-lateral fold.....*R. grylio*, Stejn.

Vomerine teeth on a level with posterior borders of choanæ, or just behind them; first and second fingers equal; tibio-tarsal articulation reaching eye; heels meeting or slightly overlapping; tibia 2 to $2\frac{1}{3}$ times in length from snout to vent; one or two phalanges of fourth toe free; dorso-lateral fold present or absent...*R. septentrionalis*, Baird.

2. Male with internal vocal sacs; dorso-lateral fold usually very distinct; vomerine teeth between the choanæ or just behind the level of their posterior borders; first finger as long as or a little longer than second; tibio-tarsal articulation reaching tympanum, eye, or between eye and tip of snout; heels meeting or overlapping; tibia 3 to 4 times as long as broad, $1\frac{8}{9}$ to $2\frac{1}{3}$ times in length from snout to vent; one or two phalanges of fourth toe free.

Dorso-lateral fold not extending beyond the sacral region.

R. clamitans, Daud.

Dorso-lateral fold extending beyond the sacral region. *R. onca*, Cope.

3. Male with external vocal sacs; tympanum not larger than eye; first finger as long as or slightly longer or shorter than second; heels meeting or not.

Head as long as broad; tibio-tarsal articulation reaching shoulder or tympanum; tibia $2\frac{2}{5}$ to $2\frac{2}{3}$ times in length from snout to vent; two phalanges of fourth toe free; no dorso-lateral fold. *R. virgatipes*, Cope.

Head broader than long; tibio-tarsal articulation reaching tympanum or eye; tibia 2 to $2\frac{1}{3}$ times in length from snout to vent; fourth toe webbed to the tip, or last phalanx free; usually a more or less distinct dorso-lateral fold.....*R. montezumæ*, Baird.

- B. Glandular dorso-lateral fold very distinct, extending to the hip (exceptionally interrupted posteriorly); nasal bones widely separated from each other.

1. Outer metatarsals separated nearly to the base; toes obtusely pointed, $\frac{2}{3}$ to nearly entirely webbed; tibio-tarsal articulation reaching eye, tip of snout, or a little beyond; tibia $3\frac{1}{2}$ to $5\frac{1}{2}$ times as long as broad, $1\frac{2}{3}$ to $2\frac{1}{10}$ times in length from snout to vent.

a. Male with vocal sacs.

Head as long as broad or a little broader or a little longer; interorbital space much narrower than upper eyelid; dorso-lateral folds narrow or

moderately broad, usually with interrupted folds or elongate warts between them; outer metatarsal tubercle absent or very indistinct; vocal sacs external or internal.....*R. halecina*, L.

Head as long as broad; interorbital space much narrower than upper eyelid; dorso-lateral folds very broad, with a pair of similar folds between them; outer metatarsal tubercle usually present; vocal sacs internal.....*R. palustris*, Leconte.

b. Male without vocal sacs.

Head broader than long; interorbital space as broad as or narrower than upper eyelid; tympanum $\frac{2}{3}$ to once diameter of eye; outer metatarsal tubercle absent or very indistinct.....*R. draytonii*, B. & G.

Head as long as broad or slightly broader than long; interorbital space narrower than upper eyelid; tympanum $\frac{2}{5}$ to $\frac{1}{2}$ diameter of eye; more or less distinct outer metatarsal tubercle....*R. aurora*, B. & G.

2. Web not penetrating beyond basal third or half of outer metatarsals.

a. Glandular dorso-lateral fold narrow or moderately broad; head moderately large; vomerine teeth on a level with or behind posterior borders of choanæ.

Tibio-tarsal articulation reaching tympanum or eye; tibia 3 to $4\frac{1}{2}$ times as long as broad, 2 to $2\frac{1}{5}$ times in length from snout to vent; toes $\frac{3}{4}$ to nearly entirely webbed; inner metatarsal tubercle $\frac{1}{4}$ to $\frac{3}{4}$ length of inner toe; male without vocal sacs.....*R. pretiosa*, B. & G.

Tibio-tarsal articulation reaching tympanum or eye; tibia 3 to 4 times as long as broad, 2 to $2\frac{1}{2}$ times in length from snout to vent; toes $\frac{1}{2}$ to $\frac{2}{3}$ webbed; inner metatarsal tubercle $\frac{1}{2}$ to $\frac{2}{3}$ length of inner toe; male with internal vocal sacs.....*R. cantabrigensis*, Baird.

Tibio-tarsal articulation reaching beyond eye; tibia 4 to 5 times as long as broad, $1\frac{3}{5}$ to 2 times in length from snout to vent; toes $\frac{2}{3}$ to $\frac{3}{4}$ webbed; inner metatarsal tubercle $\frac{2}{5}$ to $\frac{3}{5}$ length of inner toe; male with internal vocal sacs.....*R. silvatica*, Leconte.

b. Glandular dorso-lateral fold broad; vomerine teeth between the choanæ.

Head moderate; loreal region fully oblique; tibio-tarsal articulation reaching eye; tibia $4\frac{1}{2}$ to 5 times as long as broad, $2\frac{1}{7}$ to $2\frac{1}{5}$ times in length from snout to vent; toes $\frac{2}{3}$ webbed; male without vocal sacs.

R. godmani, Stur.

Head very large; loreal region very oblique; tibio-tarsal articulation reaching tympanum or eye, or a little beyond; tibia 3 to 4 times as long as broad, $1\frac{3}{4}$ to nearly $2\frac{1}{4}$ times in length from snout to vent; toes $\frac{1}{2}$ webbed; male with external vocal sacs....*R. areolata*, B. & S.

II. Toes ending in very small discs; outer metatarsals separated nearly to the base; interorbital space equal to or a little less the width of upper eyelid; nasal bones widely separated from each other.

A. Loreal region moderately oblique; toes entirely webbed or two phalanges of fourth free.

1. Tips of fingers swollen; vomerine teeth behind level of choanæ; tympanum $\frac{2}{5}$ to $\frac{3}{5}$ diameter of eye; tibio-tarsal articulation reaching tip of snout or beyond; head broader than long.

No dorso-lateral fold; tympanum distinct; heels not overlapping; tibia $1\frac{5}{8}$ to 2 times in length from snout to vent; no outer metatarsal tubercle; male without vocal sacs.....*R. tarahumaræ*, Blgr.

Dorso-lateral fold, if distinct, very broad and flat and restricted to the anterior half of the body; tympanum feebly distinct, ill-defined; heels overlapping; tibia $1\frac{3}{5}$ to $1\frac{4}{5}$ times in length from snout to vent; an outer metatarsal tubercle; male with internal vocal sacs.

R. boylii, Baird.

A moderately prominent dorso-lateral fold, extending to the hip, its distance from its fellow, on the back, $3\frac{1}{2}$ times in length from snout to vent; tympanum very distinct; heels overlapping; tibia $1\frac{3}{4}$ times in length from snout to vent; no outer metatarsal tubercle.

R. pustulosa, Blgr.

2. Tips of fingers obtuse or rather pointed; vomerine teeth between choanæ; tympanum $\frac{1}{2}$ to $\frac{5}{8}$ diameter of eye; tibio-tarsal articulation reaching eye or tip of snout; tibia $1\frac{3}{4}$ to $2\frac{1}{7}$ times in length from snout to vent; dorso-lateral fold prominent, its distance from its fellow, on the back, 4 to $5\frac{1}{2}$ times in length from snout to vent; no outer metatarsal tubercle; head as long as broad or a little broader than long; male with internal vocal sacs.....*R. palmipes*, Spix.

B. Loreal region vertical or nearly so; toes $\frac{2}{3}$ to $\frac{3}{4}$ webbed; tips of fingers swollen; tympanum $\frac{1}{2}$ to $\frac{2}{3}$ diameter of eye; tibio-tarsal articulation reaching eye or between eye and tip of snout; heels overlapping; tibia 5 to 6 times as long as broad, $1\frac{2}{3}$ to 2 times in length from snout to vent; dorso-lateral fold prominent, its distance from its fellow, on the back, 5 to 6 times in length from snout to vent; no outer metatarsal tubercle; head as long as broad or a little longer than broad; male without vocal sacs.....*R. cæruleopunctata*, Stdr.

The American frogs all belong to the subgenus *Rana*, agreeing with the type-species, *R. temporaria*, L., in the structure of the pectoral

arch (strong horizontal clavicles, omosternal style not forked at the base). I conceive the most primitive type as with large nasal bones in contact with each other and with the frontoparietals entirely covering the ethmoid; pointed, fully webbed toes with the outer metatarsals separated by web to the base; a distinct tympanum; no glandular dorso-lateral fold. I therefore regard the species grouped together in division I. A. of the above synopsis as nearest to this prototype; from this group I. B. 1. and II. seem to be directly and independently derived, probably also I. B. 2. *b.*; whilst I. B. 2. *a.* is obviously connected with I. B. 1. The species under Division II. are furthest removed from the prototype; I see no reason for regarding *R. boylii* as nearly allied to the *Ranæ temporariæ*, and it is connected with *R. palmipes* by *R. pustulosa*.

1. *Rana catesbiana*.

Rana boans (non Linn.), LACEP., Hist. Quadr. Ov. I, Syn. Meth., and p. 541 (1788).

Rana pipiens, part. (Daud.) LATR., Hist. Rept. II, p. 153 (1801); DAUD., Hist. Rain. Gren. Crap. (1803), p. 53,² and Hist. Rept. VIII, p. 113 (1803).

Rana grunniens, part., LATR., t. c., p. 155.

Rana catesbeiana SHAW, Gen. Zool., III, p. 103, Pl. xxxiii (1802); LECONTE, Proc. Ac. Philad., 1855, p. 423; BAIRD, Rep. U. S. Expl. Surv., XII, ii, Pl. xxix, fig. 5 (1860); BOULENG., Cat. Batr. Ecaud., p. 36 (1882); HINCKLEY, Proc. Bost. Soc. N. H. XXI, 1882, p. 311, Pl. v, fig. 1, 2, 7; H. GARM., Bull. Illin., Lab. III, 1892, p. 328; RHOADS, Proc. Ac. Philad., 1895, p. 300; STEJNEG. Proc. U. S. Nat. Mus., XXIV, 1901, p. 212; DITMARS, Amer. Mus. Journ. V, 1905, p. 203, fig. 1; DICKERSON, Frog Book, p. 227, Pls. lxxxvii-xlvi (1906); WRIGHT, Publ. Carnegie Instit. No. 197, 1914, p. 77, Pl. xix; BOULENG., Ann. and Mag. N. H. (9) III, 1919, p. 408.

Rana mugiens MERR., Tent. Syst. Amph., p. 175 (1820); DUM. AND BIBR., Exp. Gén. VIII, p. 370 (1841); GÜNTHER, Cat. Batr. Sal., p. 36 (1858); WIED, N. Acta Ac. Leop. Carol., XXII, 1865, p. 106.

Rana scapularis HARL., Am. Journ. Sc., X, 1825, p. 59, and Journ. Ac. Philad., V, 1825, p. 338.

Rana pipiens HARL., tt. cc. pp. 62, 335; HOLBR., N. Am. Herp. IV, p. 77, Pl. xviii (1842); DEKAY, N. Y. Faun., Rept., p. 60, Pl. xix, fig. 48 (1842).

Rana conspersa LECONTE, Proc. Ac. Philad., 1855, p. 425.

Rana catesbiana, part., COPE, Batr. N. Am., p. 424, fig. (1889).

² This figure is a puzzle as no aquatic American *Rana* is known ever to have a light vertebral stripe. It perhaps represents the Indian *R. hexadactyla*.

Vomerine teeth in small groups or short oblique series between the choanæ (rarely just behind them), a little nearer to each other than to the latter, or close together.

Head broader than long, much depressed; snout rounded, fully projecting beyond the mouth, as long as the eye or a little longer; canthus rostralis very indistinct; loreal region very oblique, slightly concave; nostril equidistant from the eye and from the tip of the snout or a little nearer the former; distance between the nostrils equal to or a little greater than the interorbital width, which is $\frac{1}{2}$ to nearly once that of the upper eyelid; tympanum very distinct, nearly as large as the eye in females, larger in males (up to $1\frac{2}{3}$ times the diameter of the eye), close to the eye or narrowly separated from it in males, 2 to 3 times its distance from the latter in females.

Fingers moderate or rather long, sometimes pointed, sometimes obtuse, first as long as or a little longer than the second, third longer than the snout; a narrow round fold sometimes present along the sides of the fingers; subarticular tubercles small, feebly prominent.

Hind limb moderately long, the tibio-tarsal articulation reaching the tympanum or the eye, the heels meeting or feebly overlapping when the limbs are folded at right angles to the body; tibia 3 to $3\frac{1}{2}$ times as long as broad, $2\frac{1}{10}$ to $2\frac{1}{2}$ times in length from snout to vent, shorter than the fore limb or than the foot. Toes rather long, obtuse or with slightly swollen tips, fully webbed, but the tip of the fourth free; outer metatarsals separated to the base; subarticular tubercles small; feebly prominent; no tarsal fold; inner metatarsal tubercle elliptic, feebly prominent, $\frac{1}{3}$ to $\frac{2}{3}$ the length of the inner toe; no outer tubercle.

Skin smooth on back with small warts; a strong glandular fold from the eye to the shoulder.

Brown or olive above, rarely green, uniform or spotted or marbled with dark brown or, very nearly, uniform blackish; limbs with or without dark cross-bands; hinder side of thighs often marbled black and yellow. Lower parts white, sometimes marbled with brown, or trout brown, spotted with white (females), or yellow (males); sometimes a black band along the posterior part of the thighs.

Male with internal vocal sacs and a retracting pad on the inner side of the first finger.

Skeleton very similar to that of *R. esculenta*. Nasal bones moderately large, in contact with each other or narrowly separated, separated from the ethmoid, a small part of the upper surface of which is exposed; frontoparietals grooved along the middle and compressed behind.

Rana catesbiana.*Measurements in Millimeters.*

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.
	♂	♂	♂	♀	♀	♀	♀	♂	♀	♀	♀	♂	♀	♀	♂
From snout to vent.....	132	127	103	160	120	112	95	130	157	78	125	120	122	200	158
Head.....	47	39	35	47	40	36	21	47	50	28	41	43	40	57	49
Width of head.....	54	47	39	56	44	41	36	53	59	30	47	51	49	75	59
Snout.....	16	13	12	16	13	12	11	16	17	10	13	14	13	19	16
Eye.....	15	12	12	13	13	12	11	14	15	9	12	13	13	16	15
Interorbital width.....	5	4	4	6	4	5	4	5	6	3	5	4	4	3	5
Tympanum.....	21	19	13	14	14	11	10	18	15	7	12	18	11	19	20
Fore limb.....	77	70	58	78	73	63	53	70	85	43	66	69	68	102	83
1st finger.....	18	17	16	18	16	16	12	16	20	10	17	16	17	25	20
2nd ".....	17	17	15	17	16	15	11	15	19	10	16	16	16	25	16
3rd ".....	22	21	18	23	20	18	15	20	32	13	19	20	20	29	22
4th ".....	16	15	12	17	15	12	10	14	16	8	13	14	14	20	16
Hind limb.....	192	182	153	220	190	174	149	194	232	120	181	183	179	270	217
Tibia.....	55	50	47	70	55	51	43	60	72	37	57	55	56	85	64
Foot.....	71	63	59	80	64	58	50	64	79	42	63	65	61	93	76
3rd toe.....	43	36	32	45	36	32	30	38	50	25	35	39	35	56	45
4th ".....	62	55	51	70	56	51	45	57	69	36	55	57	54	82	65
5th ".....	46	42	37	55	42	37	33	42	51	27	42	42	38	65	49

1-3. Lucknow, Ontario.—4. Oshkosh, Wisconsin.—5-7. Cambridge, Mass.—8. Ashokan, Ulster Co., N. Y.—9. New Jersey.—10. Bloomington, Indiana.—11. Marshall, N. Carolina.—12-13. N. Carolina.—14. Garnet, S. Carolina.—15. N. America.

The tadpole is also very similar to that of *R. esculenta* and reaches the size of that of *Pelobates fuscus*. Mouth small; back narrowly edged with black; having white in a long marginal upper series with a very short one (rarely 2) on each side and 3 lower series, the innermost narrowly interrupted in the middle. Upper parts often dotted with black.

The eggs are very small, as in *R. esculenta*.

Habitat.—North America east of the Rocky Mountains, from Canada (Quebec, Ontario) to Florida and Texas.

Measurements on p. 420.

2. *Rana grylio*.

Rana catesbiana, part., COPE, *Batr. N. Am.*, p. 424 (1889).

Rana grylio STEJNEG., *Proc. U. S. Nat. Mus.*, XXIV, 1901, p. 212; DICKERSON, *Frog Book*, p. 226, Pls. LXXXV, LXXXVI (1906); BOULENG., *Ann. and Mag. N. H.* (9) III, 1919, p. 409.

Vomerine teeth in small groups close together between the choanæ.

Head nearly as long as broad or a little broader than long, much depressed; snout rounded or obtusely pointed, feebly projecting beyond the mouth; canthus rostralis very indistinct; loreal region very oblique, concave; nostril equidistant from the eye and from the tip of the snout or a little nearer the latter; distance between the nostrils greater than the interorbital width, which equals $\frac{2}{3}$ to $\frac{1}{2}$ that of the upper eyelid; tympanum very distinct, as large as the eye in females, $1\frac{1}{3}$ to nearly twice its diameter in males, close to the eye in males, 3 times its distance from the eye in females.

Fingers rather long, pointed, first a little shorter than the second, third longer than the snout, second and third with a more or less distinct dermal margin; subarticular tubercles small, feebly prominent.

Hind limb moderately long, the tibiotarsal articulation reaching the tympanum or the eye, the heels meeting or narrowly separated when the limbs are folded at right angles to the body; tibia 3 to $3\frac{1}{2}$ times as long as broad, $2\frac{1}{4}$ to $2\frac{1}{3}$ times in length from snout to vent, shorter than the fore limb or than the foot. Toes long, obtuse, third longer in proportion to the fourth than in *R. catesbiana*,³ all webbed to the very tips; outer metatarsals separated nearly to the base; subarticular

³ Third meaning, according to Stejneger, 80 to 84 per cent of fourth, as against 70 to 76 (both measured from the anterior edge of the metatarsal tubercle).

tubercles small, feebly prominent; no tarsal fold; inner metatarsal tubercle elliptic, feebly prominent, $\frac{1}{3}$ to $\frac{2}{3}$ the length of the inner toe; no outer tubercle.

Skin smooth; a strong glandular fold from the eye to the shoulder. The coloration is thus described by Miss Dickerson:—"Head and shoulders usually vivid green; olive posteriorly, with many irregular black spots; the whole frog may be olive or rich dark brown; ear orange-brown, with green center; middle and posterior back may have four longitudinal bands of bright orange-brown, alternating with bands of olive; small black spots on legs; under parts light, unspotted, except posteriorly; throat of male bright yellow; under surface of legs may be mottled and reticulated in coarse pattern with black and yellow." The male from New Orleans in the Museum has a light longitudinal band between two black ones on the back of the thighs.

Male with internal vocal sacs.

Measurements in Millimeters.

	1. ♂	2. ♀	3. ♂
From snout to vent.....	83	124	126
Head.....	30	40	41
Width of head.....	31	40	46
Snout.....	9	13	13
Eye.....	9	13	11
Interorbital width.....	2	3.5	3.5
Tympanum.....	12	13	19
Fore limb.....	43	61	70
1st finger.....	9	14	16
2nd ".....	10	15	17
3rd ".....	13	19	21
4th ".....	8	14	15
Hind limb.....	115	182	183
Tibia.....	36	55	56
Foot.....	42	62	63
3rd toe.....	26	35	39
4th ".....	35	53	57
5th ".....	26	42	46

1-2. New Orleans.—3. Plaquemine, Louisiana.

3. *Rana septentrionalis*.

Rana septentrionalis BAIRD, Proc. Ac. Philad., 1855, p. 51 and Rep. U. S. Expl. Surv., XII, ii, Pl. XXIX, fig. 2 (1860); YARROW, Rep. Explor. Surv. w. of 100th Mer., Batr. Rept., p. 528 (1875); BOULENG., Cat. Batr. Ecaud., p. 37 (1882) and Ann. and Mag. N. H. (5) XI, 1883, p. 16; GARNIER, Amer. Nat., XVII, 1883, p. 945; COPE, Batr. N. Am., p. 416, Pl. LXXXVI (1889); WERNER, Jahrb. Nat. Ver. Magdeb., 1894, p. 135; DICKERSON, Frog Book, p. 224 (1906); BOULENG., Ann. and Mag. N. H. (9), III, 1919, p. 409.

Rana sinuata BAIRD, l. c.

Vomerine teeth in small groups close together, on a level with the posterior border of the choanæ or just behind the latter.

Head a little broader than long, much depressed; snout rounded, scarcely projecting beyond the mouth, as long as or slightly longer than the eye; canthus rostralis very indistinct; loreal region very oblique, slightly concave; nostril equidistant from the eye and from the tip of the snout, or a little nearer the former; distance between the nostrils greater than the interorbital width, which is about $\frac{1}{2}$ that of the upper eyelid; tympanum very distinct, $\frac{2}{3}$ to $\frac{5}{8}$ the diameter of the eye in females, as large as or larger than the eye in males, close to the eye or narrowly separated from it.

Fingers pointed, first and second equal, third much longer than the snout; subarticular tubercles small, moderately or feebly prominent.

Hind limb moderately long, the tibio-tarsal articulation reaching the eye, the heels meeting or slightly overlapping when the limbs are folded at right angles to the body; tibia 3 to 4 times as long as broad, 2 to $2\frac{1}{3}$ times in length from snout to vent, shorter than the fore limb or than the foot. Toes rather pointed, broadly webbed, the web reaching the tips of the third and fifth but leaving one or two phalanges of the fourth free; outer metatarsals separated nearly to the base; subarticular tubercles small, moderately or feebly prominent; tarsal fold absent or merely indicated; inner metatarsal tubercle elliptical, feebly prominent, $\frac{1}{3}$ to $\frac{2}{5}$ the length of the inner toe; no outer tubercle.

Skin smooth; glandular dorso-lateral fold, from above the tympanum, absent or flat and very indistinct, and not extending posteriorly beyond the sacral region; a fold from the eye to the shoulder.

Brownish olive or purplish brown above, spotted or marbled with black, or blackish with sinuous whitish lines or with light vermiculations; limbs without angular cross-bands; hinder side of thighs marbled black and white. Lower parts white, throat yellowish.

Male with internal vocal sacs; fore limbs thickened; and large pad on the inner side of the first finger.

Nasal bones moderately large, in contact with each other and with the ethmoid, which is largely uncovered in front.

Measurements in Millimeters

	1.	2.	3.	4.	5.	6.	7.	8.
	♂	♂	♂	♀	♀	♀	♀	♂
From snout to vent.....	56	55	55	76	63	63	60	58
Head.....	19	19	19	24	20	18	19	20
Width of head.....	21	21	20	27	21	19	21	21
Snout.....	6	6.5	6	7	6	6	6.5	6
Eye.....	6	6.5	7	8	7	6	6.5	6
Interorbital space.....	2.5	2	2	3	2	2	2	2
Tympanum.....	6	8	8	6	5	5	5	8
Fore limb.....	33	35	35	44	36	36	35	32
1st finger.....	6.5	7	6	8	7	7	7	7
2nd ".....	6.5	7	6	8	7	7	7	7
3rd ".....	10	10	9	13	9	9	10	9
4th ".....	6	6	5	8	6	6	6	6
Hind limb.....	91	91	91	121	94	93	98	91
Tibia.....	26	26	26	38	27	27	28	27
Foot.....	32	34	33	40	34	34	34	33
3rd toe.....	19	20	20	22	20	20	20	18
4th ".....	28	29	27	33	29	29	30	26
5th ".....	20	22	20	23	20	20	22	19

1-7. Lucknow, Ontario.— 8. Eustice, Maine.

Habitat.— Southern Canada and New York to Montana and Utah.

This species is very closely allied to *R. catesbiana*, and I have failed to find a single distinctive character that will apply to all specimens, regardless of size. The two species are thus contrasted by Cope in his key:—

Dorsal fold, size of tympanum, and extent of web variable; length not exceeding 6 centimeters; large dark spots on the back.

R. septentrionalis.

No dorso-lateral dermal fold; web generally leaving one phalange of fourth digit free; length reaching 20 centimeters. . . *R. catesbiana.*

Considering that our largest specimen of *R. septentrionalis* measures 76 mm. and that one smallest nearly adult *R. catesbiana* measures 78 mm., whilst large dark spots are frequent in the latter species, this

definition is very unsatisfactory. I trust the characters given in my synopsis will answer better for purposes of identification without regard to size, but they may fail in exceptional cases.

I cannot agree with Cope when he says, "Taking all its characters together, this species occupies a position intermediate between nearly all the American species of the genus," and he expresses this view in a diagram of the chain of affinities (p. 397); nor do I think him justified in adding that, "from such form it might be supposed that all the *Rana* of the northern hemisphere have been derived," a statement I would rather apply to *R. catesbiana* and *R. grylio*, regarding *R. septentrionalis* as connecting *R. catesbiana* with *R. clamitans*.

4. *Rana clamitans*.

Rana clamitans (DAUD.), LATR., Hist. Rept. II, p. 157 (1801); MERR., Tent. Syst. Amph., p. 175 (1820); HOLBR., N. Am. Herp., IV, p. 85, Pl. xx (1842); H. GARM., Bull. Illin. Lab., III, 1892, p. 327; DICKERSON, Frog Book, p. 198, Pl. XIII, fig. 1, and Pls. LXXV and LXXVI (1906); BOULENG., Ann. and Mag. N. H. (9), III, 1919, p. 409.

Rana clamata DAUD., Hist. Rain. Gren. Crap., p. 54, Pl. LI, fig. 2 (1802), and Hist. Rept., VIII, p. 104 (1803); HARLAN, Amer. Journ. Sc., X, 1825, p. 63, and Journ. Ac. Philad., V, 1825, p. 335; DUM. and BIBR., Exp. Gén., VIII, p. 373 (1841); GÜNT., Cat. Batr. Sal., p. 14 (1858); BOULENG., Cat. Batr. Ecaud., p. 36 (1882); COPE, Batr. N. Am., p. 419, figs. (1889); WERNER, Jahresb. Nat. Ver. Magdeb., 1894, p. 135; DITMARS, Amer. Mus. Journ., V, 1905, p. 201, fig.; WRIGHT, Publ. Carnegie Instit., No. 197, 1914, p. 70, Pl. xvii.

?*Ranaria melanota* RAFIN., Ann. of Nature, p. 5 (1820).

Rana fontinalis LECONTE, Ann. Lyc. N. Y., I, 1825, p. 282, and Proc. Ac. Philad., 1835, p. 424; HOLBR. t. c., p. 87, Pl. XXI; DEKAY, N. Y. Faun., Rept. p. 62, Pl. XXI, fig. 54 (1842); HINCKLEY, Proc. Bost. Soc. N. H., XX, 1882, p. 311, Pl. v, fig. 8.

Rana flaviviridis HARL., tt. cc., pp. 58, 338, and Med. Phys. Res. p. 103 (1835).

Rana horiconensis HOLBR., t. c., p. 83, Pl. XIX; DEKAY, op. cit., p. 61, Pl. XXII, fig. 62; GÜNT., op. cit., p. 131.

Rana nigricans AGASS., Lake Super., p. 379, Pl. VI, figs. 4, 5 (1850).

Rana nigrescens LECONTE, Proc. Ac. Philad., 1855, p. 20.

Rana clamator LECONTE, l. c.

Rana clamitans melanota RHOADS, Proc. Ac. Philad., 1895, p. 394.

Vomerine teeth in small groups close together between the choanæ or just behind the level of their posterior borders.

Head as long as broad or a little broader than long, moderately or rather strongly depressed; snout rounded, feebly projecting beyond the mouth, as long as the eye or slightly longer or shorter; canthus rostralis obtuse; loreal region oblique, concave; nostril equidistant from the eye and from the tip of the snout or a little nearer the former; distance between the nostrils greater than the interorbital width, which is about $\frac{1}{2}$ that of the upper eyelid or a little more; tympanum very distinct, $\frac{3}{4}$ to once the diameter of the eye in females, 1 to $1\frac{1}{2}$ times in males, close to the latter or separated from it by a space not exceeding $\frac{1}{3}$ its diameter.

Fingers moderate or rather long, usually pointed, sometimes rather obtuse, first as long as or a little longer than the second, third longer than the snout; a narrow dorsal fold sometimes present along the sides of the fingers; subarticular tubercles moderate or rather small, moderately prominent.

Hind limb moderately long, the tibio-tarsal articulation reaching the eye or between the eye and the tip of the snout, the heels overlapping when the limbs are folded at right angles to the body; tibia 3 to 4 times as long as broad, $1\frac{8}{9}$ to $2\frac{1}{4}$ times in length from snout to vent, shorter than the fore limb, as long as or shorter than the foot. Toes obtuse or rather pointed, $\frac{3}{4}$ to nearly entirely webbed, 1 or 2 phalanges of fourth free; outer metatarsals separated nearly to the base; subarticular tubercles rather small, feebly prominent; tarsal fold absent or very feeble; inner metatarsal tubercle elliptic, feebly prominent, $\frac{1}{4}$ to $\frac{2}{7}$ the length of the inner toe; no outer tubercle.

Skin smooth or granular above, on back with numerous small warts; a glandular dorso-lateral fold, usually narrow and prominent, sometimes broken up or very indistinct, from above the tympanum to the sacral region or, rarely, a little beyond; the distance between the folds $4\frac{1}{2}$ to $5\frac{1}{2}$ times in the length from snout to vent.

Head and anterior part of body usually bright green, and posterior part of body and limbs olive or brown; body sometimes entirely green or brown; back usually with more or less numerous black spots or marblings; tympanum often reddish brown; dark cross-bands on the limbs present or absent. Lower parts white, the throat often yellow, immaculate or marbled with gray.

Male with internal vocal sacs; fore limbs thickened; a moderately large pad on the inner side of the first finger.

Skeleton as in *R. esculenta*. Nasal bones in contact or narrowly separated from each other, sometimes in contact with the frontoparietals. No character of any importance distinguishes the tadpole from that of *R. catesbiana*, and the eggs are likewise very small.

Rana clamitans.*Measurements in Millimeters.*

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.
	♂	♂	♀	♀	♀	♀	♂	♂	♂	♂	♂	♀	♀	♀	♂	♀	♂	♀	♂	♂	♂	♀	♀
From snout to vent.....	82	74	83	77	70	66	71	77	71	76	60	98	65	65	68	73	69	71	65	70	82	58	70
Head.....	28	26	27	24	23	22	25	26	24	28	23	30	22	22	24	24	24	24	23	24	27	20	22
Width of head.....	30	29	29	25	24	23	27	28	26	28	23	33	23	22	26	24	26	25	24	26	30	22	23
Snout.....	9	8	9	8	8	7	8	8	8	8	7	11	7	7	8	8	8	9	7	8	9	6	8
Eye.....	9	8	9	8	8	7	8	8	8	8	7	10	7	8	8	8	8	7	7	8	9	7	8
Interorbital.....	3.5	2.5	3	2.5	2.5	2	3	3	2.5	3	2	3	2	3	3	3	3	3	3	2.5	3	2	3
Tympanum.....	11	12	8	7	8	7	11	12	9	11	8	9	7	6	12	7	11	7	8	10	10	6	7
Fore limb.....	45	40	47	45	40	37	39	43	38	43	34	53	36	38	38	40	44	42	37	40	45	31	37
1st finger.....	10	9	11	10	9	9	9	9	7	9	6.5	11	9	8	9	9	11	10	7	9	10	7	9
2nd ".....	10	8	10	9	9	8	8	8	6	8	6.5	11	8	7	8	8	10	9	7	8	9	6	8
3rd ".....	12.5	11	13	12	12	11	11	11	9	12	9	14	10	9	10	11	12	12	9	11	12	9	11
4th ".....	8	7	8	7	7	6	6	7	5	7	5	10	6	6	6	6	7	7	5	6	8	6	7
Hind limb.....	124	118	134	126	115	107	111	118	110	120	98	144	101	109	110	111	117	120	104	113	131	86	99
Tibia.....	39	35	43	39	36	32	35	35	33	36	31	44	32	33	34	35	37	37	32	34	42	26	33
Foot.....	42	39	43	41	38	36	38	40	35	37	32	52	34	36	35	36	40	42	35	38	46	30	33
3rd toe.....	24	20	22	22	20	19	21	21	18	21	18	29	18	20	20	20	22	22	20	20	23	16	20
4th ".....	36	33	38	37	33	30	33	33	28	33	29	46	29	30	31	32	35	36	30	32	38	25	29
5th ".....	25	24	27	25	23	20	23	23	20	24	21	32	20	21	22	22	25	25	22	22	28	17	22

1-3. Lucknow, Ontario.—4-6. Cambridge, Mass.—7. Nashawana, Elizabeth Is., Mass.—8-9. New York.—10-14. Long Is., New York.—15-16. Shokan, N. Y.—17-18. Pike Co., Penn.—19. Philadelphia, Penn.—20. Marshall, N. Carolina.—21. Providence, R. I.—22. Georgia.—23. Bloomington, Indiana.

Habitat.—North America, east of the Rocky Mountains, from Canada (Quebec and Ontario) to Florida and Louisiana.

5. *Rana onca*.

Rana onca COPE, in Yarrow, Rep. Explor. Surv. w. of 100th Mer., Batr. Rept., p. 528, Pl. XXV, figs. 1–3 (1875); DICKERSON, Frog Book, p. 196, Pl. II, fig. 6 (1906); BOULENG., Ann. and Mag. N. H. (9), III, 1919, p. 409.

Rana draytoni onca COPE, Batr. N. Am., p. 443 (1889).

Rana fischeri STEJNEG., N. Am. Faun., No. 7, p. 227, Pl. III, fig. 5 (1893).

Vomerine teeth in small groups close together between the choanæ or extending a little beyond the level of their posterior borders.

Head as long as broad or broader than long, rather strongly depressed; snout rounded, feebly projecting beyond the mouth, as long as the eye; canthus rostralis indistinct; loreal region oblique, concave; nostril nearer the eye than the tip of the snout; distance between the nostrils greater than the interorbital width, which is less than that of the upper eyelid; tympanum very distinct, $\frac{3}{4}$ to once the diameter of the eye and close to it.

Fingers moderate, obtusely pointed, first a little longer than the second, third longer than the snout; subarticular tubercles moderately large, prominent.

Hind limb moderately long or rather short, the tibio-tarsal articulation reaching the tympanum or the eye; heels meeting or overlapping when the limbs are folded at right angles to the body; tibia 3 to $3\frac{1}{2}$ times as long as broad, $2\frac{1}{5}$ to $2\frac{1}{3}$ times in length from snout to vent, a little shorter than the fore limb or than the foot. Toes obtuse, $\frac{3}{4}$ webbed, 2 phalanges of fourth free; outer metatarsals separated nearly to the base; subarticular tubercles moderate; tarsal fold absent or merely indicated; inner metatarsal tubercle oval, feebly prominent, $\frac{1}{3}$ the length of the inner toe; no outer tubercle.

Skin smooth or with small warts above; a narrow, moderately prominent glandular dorso-lateral fold, from above the tympanum to beyond the sacral region, but not reaching the tip, the distance between the folds 4 to $4\frac{1}{2}$ times in the length from snout to vent.

Pale greenish above, with oval or round dark spots, which may be light-edged; spots on the limbs not forming regular cross-bars. Lower parts white, sometimes profusely sprinkled with brown. Male without external vocal sacs.

Nasal bones large, in contact with each other and with the frontoparietals, the ethmoid nearly entirely covered.

Measurements of Females, in Millimeters.

From snout to vent.....	70	68
Head.....	22	23
Width of head.....	27	23
Snout.....	7	7
Eye.....	7	7
Interorbital width.....	3	3
Tympanum.....	7	6
Fore limb.....	38	34
1st finger.....	8	8
2nd ".....	7	7
3rd ".....	9	9
4th ".....	6	6
Hind limb.....	94	100
Tibia.....	30	31
Foot.....	31	33
3rd toe.....	18	21
4th ".....	27	30
5th ".....	19	21

Habitat.—Utah and Nevada.

This species is here described from three specimens, two females and one young, from Las Vegas, Nevada, for which I am indebted to the kindness of Dr. Stejneger and Miss Dickerson.

The affinity is very close to *R. clamitans*, the only character which may serve to distinguish *R. onca* being the somewhat greater posterior extension of the dorso-lateral fold. It is difficult to conceive the reasons which have induced Cope to place this frog as a subspecies of *R. draytoni*.

Miss Dickerson says the tympanum is larger in males than in females, and that the body is often bright green in front and brown behind, characters in which it approaches *R. clamitans*, whilst the spotting reminds one of *R. halecina*.

6. *Rana virgatipes*.

Rana virgatipes COPE, Amer. Nat. XXV, 1891, p. 1017; W. J. DAVIS, Amer. Nat. XXXVIII, 1904, p. 893, and XXXIX, 1905, p. 795; FOWLER, Proc. Ac. Philad., LVII, 1905, p. 662, Pl. XL; DICKERSON, Frog Book, p. 222, Pl. XIII, and Pl. LXXXIV, figs. 4, 5 (1906); FOWLER, Rep. N. Jers. State Mus. 1907, p. 194; BOULENG., Ann. and Mag. N. H. (9) III, 1919, p. 409.

Vomerine teeth in small groups close together, on a level with or just behind the posterior borders of the choanæ.

Head as long as broad, much depressed; snout rounded, projecting beyond the mouth, as long as or a little longer than the eye, which is large and extremely prominent; canthus rostralis very indistinct; loreal region oblique, concave; nostril equidistant from the eye and from the tip of the snout; distance between the nostrils much greater than the interorbital width, which is $\frac{1}{3}$ to $\frac{1}{2}$ that of the upper eyelid; tympanum very distinct, $\frac{3}{5}$ to $\frac{5}{8}$ the diameter of the eye in females, as large as the eye in males, 3 to 5 times its distance from the eye.

Fingers rather long and slender, pointed, first as long as or slightly longer than the second, third longer than the snout; subarticular tubercles small, feebly prominent.

Hind limb rather short, the tibio-tarsal articulation reaching the shoulder or the tympanum, the heels meeting or not when the limbs are folded at right angles to the body; tibia 3 to 4 times as long as broad, $2\frac{2}{5}$ to $2\frac{2}{3}$ times in length from snout to vent, much shorter than the fore limb, shorter than the foot. Toes rather long, obtusely pointed, $\frac{3}{4}$ webbed, 2 phalanges of fourth free; outer metatarsals separated nearly to the base; subarticular tubercles small, feebly prominent; no tarsal fold; inner metatarsal tubercles elliptic, feebly prominent, $\frac{1}{3}$ to $\frac{2}{5}$ the length of the inner toe; no outer tubercle.

Skin smooth, or with small pearl-like white horny tubercles on the back and limbs; a strong fold from the eye to the shoulder.

Chocolate brown or brownish olive above, with or without small darker spots; a yellowish brown streak from behind the eyes to the sacrum or a little beyond; a yellowish streak from below the eye to the groin; no cross-bands on the limbs. Lower parts yellowish white, or yellow on the throat and hind limbs; throat and belly uniform or more or less spotted with brown; hind limbs spotted or marbled with blackish brown, back of thighs with two blackish brown stripes enclosing a yellow one; web between the toes black.

Male with a large grayish or blackish external vocal sac on each side between the mouth and the shoulder; a feeble pad on the inner side of the first finger.

Nasal bones moderately large, narrowly separated from each other and from the frontoparietals.

Habitat.—New Jersey (Atlantic City and Lakehurst) and North Carolina (Lake Ellis).

Measurements in Millimeters

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
	♂	♂	♂	♀	♀	♀	♀	♀	♀	♀	♀
From snout to vent.	56	50	50	52	51	43	36	32	35	33	36
Head.....	20	18	18	17	17	13	12	11	12	11	11
Width of head.....	20	18	18	17	17	13	12	11	12	11	11
Snout.....	6	6	6	6	5.5	4	3.5	3.5	3	3	3
Eye.....	6	6	6	6	5.5	5	4	3.5	4	4	4
Interorbital width..	2.5	1.5	1.5	2	2	1.5	1	1.5	1	1.5	1
Tympanum.....	6	6	6	5	4	3.5	3	3	3	2.5	2.5
Fore limb.....	30	26	26	27	27	25	21	18	20	16	17
1st finger.....	6	5.5	6	6	5.5	4	3.5	3.5	3.5	3.5	3.5
2nd ".....	6	5	5.5	6	5.5	4	3.5	3.5	3.5	3	3
3rd ".....	8	7	8	8	7	5.5	5	5	5	5	5
4th ".....	6	4.5	5	5	5	3.5	3.5	3	3	3	3
Hind limb.....	80	74	70	75	73	64	55	44	51	46	46
Tibia.....	23	21	20	21	21	18	15	12	14	13	13
Foot.....	29	27	26	27	26	21	19	15	17	16	16
3rd toe.....	17	15	15	16	?	12	11	9	10	10	10
4th ".....	24	23	22	24	?	19	17	13	15	14	14
5th ".....	19	16	16	17	?	12	11	9	10	10	10

1-8. Lakehurst, New Jersey.—9-11. Lake Ellis, N. Carolina.

The species does not exceed a length of 60 millimeters from snout to vent, and may be regarded as a dwarfed form derived from the *R. catesbiana* type.

7. *Rana montezumæ*.

Rana montezumæ BAIRD, Proc. Ac. Philad., 1855, p. 61; GIRARD, Rep. U. S. Mex. Bound. Surv., Rept. p. 27, Pl. xxxvi, figs. 1-6 (1859); BROCCHI, Miss. Sc. Mex., Batr. p. 14, Pl. iv, fig. 2 (1881); BOULENG. Cat. Batr. Ecaud., p. 35 (1882); DUGÈS, Natureza (2) I, 1888, p. 137; COPE, Batr. N. Am. p. 428, figs. (1889); GÜNTHER, Biol. C.-Am., Rept. p. 197 (1900); BOULENG., Ann. and Mag. N. H. (9), III, 1919, p. 409.

Rana adtrita TROSCAL, in Müller's Reis. Ver. Stat. III, Wirbelte, p. 82 (1865).

Rana montezumæ concolor COPE, Bull. U. S. Nat. Mus., No. 32, 1887, p. 20.

Vomerine teeth in small transverse or oblique groups between or just behind the choanæ.

Head broader than long, much depressed; snout rounded, scarcely projecting beyond the mouth, as long as the eye or a little longer;

canthus rostralis indistinct; loreal region very oblique, scarcely concave; nostril equidistant from the eye and from the tip of the snout or a little nearer the former; distance between the nostrils equal to or a little greater than the interorbital width, which is less than that of the upper eyelid; tympanum moderately or very distinct, $\frac{2}{3}$ to once the diameter of the eye, $1\frac{1}{2}$ to 3 times its distance from the latter.

Fingers long and slender, pointed, first usually as long as the second sometimes slightly longer or slightly shorter, third much longer than the snout; a narrow dermal fold sometimes present along the sides of the fingers; subarticular tubercles small, feebly prominent.

Hind limb rather short or moderately long, the tibio-tarsal articulation reaching the tympanum or the eye, the heels meeting when the limbs are folded at right angles to the body; tibia $2\frac{1}{2}$ to $3\frac{1}{2}$ times as long as broad, 2 to $2\frac{1}{3}$ times in length from snout to vent, shorter than the fore limb or than the foot. Toes rather long, pointed, webbed to the tips or last phalanx of fourth free; outer metatarsals separated nearly to the base; subarticular tubercles small, feebly prominent; a feeble tarsal fold; inner metatarsal tubercle elliptic or subtriangular and prominent, $\frac{1}{4}$ to $\frac{1}{3}$ the length of the inner toe; no outer tubercle.

Skin smooth above or granulate and with small warts; a narrow or moderately broad, feebly prominent, glandular dorso-lateral fold from above the tympanum to the sacral region or a little beyond, sometimes broken up, sometimes absent; the distance between the folds, on the back, $\frac{1}{5}$ to $\frac{1}{4}$ the length from snout to vent; lower parts smooth, belly and thighs sometimes granulate.

Purplish brown or olive brown above, uniform or speckled, vermiculated, or mottled with lighter or darker, with or without large roundish dark brown spots which may be grass-green in life, and are often light-edged; limbs with or without dark cross-bands. Lower parts dirty white, uniform on throat and breast vermiculated with brown, or brown speckled with white.

Male with a large blackish external vocal sac on each side, forming loose folds from behind the angle of the mouth to the shoulder.

Nasal bones rather large, in contact with each other and narrowly separated from the frontoparietals, which are narrow, grooved along the sagittal suture, and leave but a small part of the ethmoid uncovered; zygomatic branch of squamosal long. Omosternum not forked at the base. Terminal phalanges obtusely pointed.

Larva unknown. Eggs small, measuring $1\frac{1}{2}$ millimeters in diameter in female, 100 millimeters long from snout to vent.

Habitat.—Jalisco, Guanajuato, Plateau of Mexico, Tabasco, Tehuantepec, and (*fide* Cope) Guatemala.—The types are from the City of Mexico, where the frog is common on the market.

The records of *R. montezumæ* from Shoalwater Bay, Washington Territory (3345, Col. J. D. Vaughan) and Upper Mississippi (3349, Dr. J. G. Cooper), in Yarrow's Check-list of 1882, are due to confusion with some other species.

Measurements in Millimeters

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
	♀	♀	♀	♀	♀	♂	♀	♀	♀	♀
From snout to vent.....	145	140	136	100	100	67	92	80	67	126
Head.....	40	39	38	32	31	23	29	24	22	42
Width of head.....	55	51	50	40	35	25	32	26	23	51
Snout.....	15	13	13	12	10	7	9	8	7	13
Eye.....	12	10	11	9	10	7	9	8	7	11
Interorbital width.....	6	5	5	4	3.5	2	3	2.5	2	5
Tympanum.....	9	9	9	9	9	6	7	6	5	8
Fore limb.....	88	84	80	56	54	40	52	42	36	81
1st finger.....	20	20	20	12	14	8	11	11	8	20
2nd ".....	20	20	20	12	13	8	11	11	8	20
3rd ".....	25	26	22	15	15	11	15	14	11	23
4th ".....	22	20	20	11	12	7	10	9	7	20
Hind limb.....	195	183	188	140	146	106	137	127	102	200
Tibia.....	69	65	62	46	46	33	42	37	32	63
Foot.....	72	69	68	50	51	40	50	42	38	68
3rd toe.....	43	42	40	28	29	23	28	24	23	41
4th ".....	58	56	58	42	45	35	42	37	33	59
5th ".....	44	46	46	30	34	25	31	28	25	48

1-3. Lazuna del Castillo, near Guadalajara (Paris Museum).— 4. Guanajuato (Paris Museum).— 5. City of Mexico.— 6-9. L. Texcoco.— 10. L. Zapotlan.

8. *Rana halecina*.

Rana halecina (KALM), Linn. Syst. Nat. I, p. 356⁴ (1766); DAUD., Hist. Rain. Gren. Crap., p. 63 (1803), and Hist. Rept., VIII, p. 122 (1803); HARLAN, Journ. Ac. Philad., V, 1826, p. 337; HOLBR., N. Am. Herp., I, p. 89, Pl. XIII (1836); DUM. and BIBR., Esp. Gén., VIII, p. 352 (1841); HOLBR., op. cit., IV, p. 91, Pl. XXII (1842); DEKAY, N. Y. Faun., Rept. p. 62, Pl. XX, fig. 49 (1842);

⁴ This name, latinized by Linnaeus from Kalm's "Sillhoppetossier," appears in the synonymy of *Rana ocellata*.

GÜNTH., Cat. Batr. Sal., p. 13 (1858); COOPER, Rep. U. S. Expl. Surv., XII, ii, p. 304, Pl. XXIX, fig. 1 (1860); BROCCHI, Miss. Sc. Mex., Batr., p. 10 (1881); BOULENG., Cat. Batr. Ecaud., p. 41 (1882); COPE, Proc. Am. Philos. Soc., XXIII, 1886, p. 517; DUGÈS, La Natureza (2) I, 1888, p. 136; GÜNTH., Biol. C.-Am., Rept., p. 198 (1900); BOULENG., Ann. and Mag. N. H. (9) III, 1919, p. 410.

Rana pipiens SCHREBER, Der Naturforscher, XVIII, 1782, p. 182, Pl. IV; GMEL., Syst. Nat. III, p. 1052 (1788); SHAW, Zool., III, p. 105, Pl. XXXII (1802); LECONTE, Proc. Ac. Philad., 1855, p. 424; GARMAN, Bull. Essex Inst., XX, 1888, p. 95; H. GARMAN, Bull. Illin. Lab., III, 1892, p. 322; RHOADS, Proc. Ac. Philad., 1895, p. 394; DICKERSON, Frog Book, p. 171, Pls. XI, LXIII, LXIV (1906); STRECKER, Proc. Biol. Soc. Washingt., XXI, 1908, pp. 60, 83; WRIGHT, Publ. Carnegie Inst. No. 197, 1914, p. 52, Pl. xv.

Rana utricularia HARLAN, Amer. Journ., X, 1825, p. 59, and Journ. Ac. Philad., V, 1826, p. 337; BOULENG., Cat. Batr. Ecaud., p. 49; H. GARMAN, t. c. p. 321.

Rana palustris (non Leconte), GUÉRIN, Icon. R. Anim., Rept., Pl. XXVI, fig. 1 (1844).

Rana leontii (non Baird and Gir.), GÜNTH., Cat., p. 42; BROCCHI, op. cit. p. 14, Pl. IV, fig. 1; BOULENG., Cat., p. 49; MOCQUARD, Bull. Soc. Philom. (9), I, 1899, p. 158.

Rana oxyrhynchus (non A. Smith), HALLOW., Proc. Ac. Philad., 1856, p. 142.

Rana berlandieri BAIRD, U. S. Mex. Bound. Surv., Rept. p. 27, Pl. XXXVI, figs. 7-10 (1859).

Rana halecina berlandieri COPE, Check-List N. Am. Batr. Rept., p. 32 (1875).

Rana macroglossa BROCCHI, Bull. Soc. Philom. (7) I, 1877, p. 177, and op. cit., p. 12, Pl. III, fig. 1.

Rana maculata BROCCHI, t. c., p. 178, and op. cit., p. 13, Pl. III, fig. 2.

Rana nigricans part., BROCCHI, op. cit., p. 15, Pl. IV, fig. 3.

Rana forreri BOULENG., Ann. and Mag. N. H. (5) XI, 1883, p. 343; GÜNTH. Biol. C.-Am., Rept., p. 199, Pl. LX, fig. A.

Rana virescens (Kalm), GARMAN, Bull. Essex Inst., XVI, 1884, p. 41; COPE, N. Am. Batr., p. 397 (1889); WERNER, Jahresb. Nat. Ver. Magdeb. 1894, p. 128; ATKINSON, Proc. Indiana Ac., 1895, p. 258; DITMARS, Am. Mus. Journ., V, 1905, p. 198, fig.

Rana virescens sphenoccephala, brachycephala, austriicola, COPE, N. Am. Batr., l. c.

Rana virescens, var. *austriicola* IVES, Proc. Ac. Philad., 1891, p. 461.

Rana pipiens brachycephala TEST, Bull. U. S. Fish Comm., XI, 1892, p. 57; STEJNEG., N. Am. Faun. No. 7, p. 228 (1893).

Rana trilobata MOCQUARD, Bull. Soc. Philom. (9), I, 1899, p. 158, Pl. I, fig. 1.

Rana omiltemana, GÜNTH., Biol. C.-Am., Rept., p. 200, Pl. LXI, fig. A (1900).

Rana sphenoccephala DICKERSON, op. cit., p. 186, Pls. XII, LXIX, LXX; STRECKER, Proc. Biol. Soc. Washingt., XXI, 1908, p. 83.

Rana austriicola NOBLE, Bull. Amer. Mus. N. H. XXXVIII, 1918, p. 315, pl. xv, fig. 1.

Vomerine teeth in short transverse or oblique series or groups between the choanæ or extending a little beyond the level of their posterior borders, close together or at least nearer to each other than to the choanæ.⁵

Head as long as broad, or a little broader than long, or a little longer than broad, moderately depressed; snout rounded or obtusely or acutely pointed, projecting more or less beyond the mouth, as long as the eye or longer; canthus rostralis obtuse; loreal region oblique, feebly concave; nostril equidistant from the eye and from the tip of the snout or a little nearer the former; distance between the nostrils greater than the interorbital width, which equals $\frac{1}{3}$ to $\frac{2}{3}$ that of the upper eyelid; tympanum very distinct, $\frac{1}{2}$ to once the diameter of the eye, close to the latter or separated from it by a space not more than $\frac{1}{2}$ its diameter.

Fingers obtusely pointed, sometimes bordered by a feeble lateral fold, first longer than second, or first and second rarely equal, third as long as or longer than the mouth; subarticular tubercles moderately large or rather small, moderately prominent.

Hind limb moderate or long, the tibio-tarsal articulation reaching the eye or the tip of the snout, or a little beyond, usually between the eye and the tip of the snout, tubercle strongly overlapping; tibia $3\frac{1}{2}$ to $5\frac{1}{2}$ times as long as broad, $1\frac{2}{3}$ to 2 times in length from snout to vent, as long as or shorter or longer than the fore limb or the foot. Toes obtusely pointed, $\frac{2}{3}$ to nearly entirely webbed, usually 2 phalanges of fourth free, sometimes 1 or 3; outer metatarsals separated nearly to the base; subarticular tubercles rather small, moderately prominent; tarsal fold feeble or absent; inner metatarsal tubercle narrow, more or less prominent or compressed, $\frac{1}{3}$ to $\frac{1}{2}$ the length of the inner toe; outer tubercle absent or very small and indistinct.

Skin of upper parts smooth or granular, with more or less prominent longitudinal warts or glandular longitudinal folds on the back; a prominent, narrow or moderately broad glandular dorso-lateral fold, extending from above the tympanum to the hip or not quite so far; the distance between the dorso-lateral folds, on the back, $4\frac{1}{2}$ to 6 times in length from snout to vent; a glandular fold from below the eye to the vocal sac or to above the arm; glandular ridges sometimes present along the tibia. Lower parts smooth, belly exceptionally feebly granulate, hinder half of thighs granulate.

⁵ In the type of *R. trilobata*, a young specimen which I have examined in the Paris Museum, there is a short furrow between the horns of the tongue, such as I have observed in some *R. esculenta*.

Brown, gray, olive, or bright green above, with dark brown or black spots usually disposed with great symmetry ⁶ rarely without spots; a dark central streak and a dark temporal blotch sometimes present; tympanum often reddish or bronzy, sometimes with a central and white spot; the dorso-lateral folds usually golden or bronzy; limbs with large dark spots or more or less regular cross-bands; hinder side of thighs yellow, spotted or marbled with black, or black with reddish yellow spots. Lower parts white, throat and breast sometimes spotted, marbled, or mottled with gray or brown.

Male with the vocal sacs internal or more or less developed externally, but not retractile, forming loose folds behind the angle of the mouth, above the arm; arms rather strongly thickened; a strong pad on the inner side of the first finger, covered, during the breeding season, with a wart-like gray or blackish horny layer.

Nasal bones moderately large, separated from each other and from the narrow frontoparietals; ethmoid exposed above, squarely truncate in front, not produced between the nasals; zygomatic branch of the squamosal not or but slightly longer than the posterior. Pectoral arch as in *R. esculenta*. Terminal phalanges slightly expanded at the end.

Tadpole very similar to that of *R. esculenta*, the horny teeth disposed in $\frac{1-1}{1-1}$ series, the back broadly edged with black.

Eggs very small, only $1\frac{1}{2}$ millim. in diameter. Cf. Miss Dickerson's book for a detailed and copiously illustrated account of the development.

Habitat.—North America, as far north as 52°, and not extending west of the Sierra Nevada; Mexico and Central America as far south as Costa Rica. Reaches 8000 ft. altitude in Colorado, 8500 ft. in Mexico, 5000 ft. in Costa Rica.

As is to be expected in a species of so wide a distribution, there are many variations of structure and coloration, which may be regarded as geographical; they cannot, however, be properly defined in the present state of knowledge. Cope has attempted to put order into the matter by dividing the species into four subspecies with the following definition, but he was careful to remark that they "pass into each other by occasional intermediate specimens":—

a. *sphenocephala*, Cope (*oxyrhynchus*, Leconte). Head entering

⁶ Sometimes it is quite the reverse, as shown in a female from Cuttyhunk, Mass., which has 3 large spots on one side of the upper surface (1 palpebral, 2 dorsal) and only one (dorsal) on the other.

length of head and body $2\frac{1}{2}$ or less than 3 times; males with external vesicles; muzzle more acuminate; no cross-bars on tibia, spots smaller.—Minnesota, Indiana, Georgia, Florida, Louisiana, the types being from Georgia and Florida.

b. *austriicola*, Cope. Head entering length of head and body $2\frac{1}{2}$ to nearly 3 times; no external vocal vesicles; muzzle more or less acuminate; spots less distinct; tibia generally cross-barred; no longitudinal band in front of femur.—The common Mexican form.

c. *virescens*, Kalm (*utricularia*, Harl.). Head acuminate but shorter, entering the length 3 times; males with external vocal vesicles; spots smaller, not so distinctly yellow bordered; cross-bars of tibia generally interrupted; a longitudinal band on the front of the thigh.—Eastern and southern coasts from Maine to the mouth of the Rio Grande, and up the Mississippi to southern Illinois, and the intermediate country.

d. *brachycephala*, Cope. Head shorter and more obtuse, entering the length $3\frac{1}{2}$ times; males without or with rudimental external vocal vesicles; dorsal spots larger, widely yellow bordered; tibial cross-bands complete; no longitudinal band on the front of the thigh.—The common and only form found between the eastern part of the Great Plains and the Sierra Nevada Mountains, from Lake Superior and the state of Washington to Arizona, Texas, and the Plateau of Mexico; also Quebec, Canada.

Much as I should have wished to fall in with the arrangement proposed by so experienced a herpetologist, who had access to a very large material, although I am afraid he did not make full use of it, I have been unable to follow, and Miss Dickerson observes that living material from New England, New York, Michigan, Minnesota, Wisconsin, Colorado, Texas, and Arizona has not enabled her to make a distinction between the forms *virescens* and *brachycephala*, although she raises *R. sphenoccephala* to specific rank.

In the specimens examined by me, the proportion of the head to the body does not give very satisfactory results, and the results, such as they are, do not agree with Cope's geographical scheme. In specimens from Ontario and the New England states, the head is 30 to 35 per cent. of the length from snout to vent; in those from Western Canada, Illinois, Michigan, Idaho, Indiana, Colorado, and Arizona, it is 30 to 36 per cent.; and in those from Florida, Mississippi, and Texas, 32 to 37 per cent.⁷; while it is 30 to 40 per cent., usually 33 to 38 per cent. in those from Mexico and Central America. I should have

7 29 in one specimen from Texas (No. 48 of table).

concluded, from the material studied, that the average length of the head increases from north to south, which does not answer to Cope's definitions, the specimens from Texas and some parts of Mexico being referred by him to the *brachycephala* form in which the head is stated to be $3\frac{1}{2}$ times in the length from snout to vent.

The shape of the snout varies much individually, exactly as in *R. esculenta*. The most acutely pointed snouts are in specimens from Florida (var. *sphenocephala*) Mississippi, Texas, and Minnesota, and broadly rounded snouts are to be found among specimens from Lucknow, Ont., Cuttyhunk, Mass., Ithaca, N. Y., Texas, Presidio, near Mazatlan, Jalapa, Nogales, Omilteme, La Cumbre de los Arrestados, Guatemala, and Costa Rica.

The development of external vocal vesicles does not seem to be correlated with the distribution, although the fullest development is shown in specimens from Long Island, Florida (var. *sphenocephala*) and Texas; they are large in males from Lucknow, Texas, and Nogales near Orizaba, small or absent in the others.

I cannot reconcile the presence or absence of cross-bars on the tibia with the habitat; these bars are present in two of the specimens from Lucknow and absent in the two others, and they are present or absent in the specimens from the northwestern parts of America which should, according to Cope, be referred to the subspecies *brachycephala*. The dark longitudinal band on the front of the thigh is absent in most of the specimens from Lucknow which, for the length of the head and the large external vocal sacs, answer to Cope's subspecies *virescens*; I find it more or less well marked only in single specimens from Lucknow, Cambridge, New Jersey, Eau Gallie, and Pensacola, Florida, Brownsville and Duval Co., Texas, Bloomington, Ind., Wet Mountain Valley, Colorado (8000 feet), and various localities in Mexico and Costa Rica.

In his description of the subspecies *sphenocephala*, Cope ascribes to it 3 phalanges of fourth toe free, and I find it so in specimens from Eau Gallie and Moon; but in the two male specimens from Pensacola, and in a female from Canaveral, which are surely referable to this form, only 2 phalanges are free, as in most specimens from other localities.

Miss Dickerson, who allows specific rank to *R. sphenocephala*, mentions that the dark spot on the upper surface of the snout is constantly absent whilst it is usually present in the true *R. halecina* (*pipiens*); but I note its very frequent absence in specimens from all parts of the habitat.

As a rule the yellow or pale green border to the dark spots on the

body and limbs is well marked in specimens from North America, but I find it absent in those from Florida, Texas, Arizona, Mexico, and Central America.

There is one character, not previously pointed out as geographically distinctive, which deserves attention. In nearly all specimens from Canada and the United States a well defined light streak extends on each side of the head above the dark or mottled upper lip, from near the end of the snout to the end of the glandular fold behind the mouth; this streak is absent in Arizonian, Texan, Mexican and Central American specimens, or only distinct from below the eye, as in *R. palustris*.

The tibio-tarsal articulation as a rule reaches the tip of the snout or between the eye and the tip of the snout, but sometimes only the eye (Moose Jaw and La Palma), sometimes beyond the tip of the snout (Pensacola, Moon, Hitchcock, La Cumbre de los Arrestados, Coban, Bebedero).

Miss Dickerson says *R. sphenocephala* is "peculiar in possessing a circular white spot at the center of the tympanum." I find this spot quite as sharply defined in specimens from New Jersey, Colorado, and Texas which, having an obtuse snout, do not answer to the definition of *R. sphenocephala*.

I am therefore unable to divide the species in minor groups with any precision, and must leave the matter in abeyance for the present. Probably some day it will be possible to draw up satisfactory definitions of the varieties, the principal of which would be *sphenocephala*, Cope, *forreri*, Blgr., and *austriicola*, Cope (*lecontii*, Ster., Brocchi, *nigricans*, Brocchi). Var. *austriicola* appears to differ from var. *forreri* by its smoother upper parts and its less sharply defined, often much effaced markings. A precise diagnosis of the var. *sphenocephala* is still a desideratum, as Miss Dickerson's definition, head long and pointed, with the eyes set far back, hind legs unusually long, fingers and toes long and slender, web between the toes deeply indented, and a circular, clear-cut white spot in the center of the tympanum, seems to me insufficient, in view of the variation in specimens referable to the typical form.

Rana halecina.*Measurements in Millimeters.*

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.
	♂	♂	♂	♀	♀	♂	♂	♀	♂	♂	♀	♀	♀	♂	♀	♀	♀	♀	♀	♂	♂
From snout to vent.....	70	66	57	89	50	76	76	77	74	70	83	78	86	69	75	77	60	69	68	64	76
Head.....	22	23	19	27	17	25	24	25	25	22	27	25	26	24	25	25	21	24	23	21	25
Width of head.....	23	24	20	29	17	26	26	27	27	24	28	25	28	24	25	24	21	24	24	21	28
Snout.....	8	8	7	10	7	10	10	9	9	8	9	8	9	9	10	10	7	9	8	7	8
Eye.....	8	8	7	9	6	8	8	8	8	8	9	8	8	8	8	8	7	8	8	7	8
Interorbital width.....	3	3	2.5	3.5	2.5	2	2.5	3	2.5	2	3	3	2.5	2.5	2.5	2	2	2.5	3	2	2.5
Tympanum.....	6	6	5	7	4	5	5	5	6	5.5	6	6	5	5	5	5	4.5	5.5	5	5	5
Fore limb.....	46	41	35	47	28	42	45	42	44	40	50	43	45	42	43	40	37	40	41	38	47
1st finger.....	9	7	6	11	6	9	10	9	9	8	10	9	11	8	8	10	8	8	8	8	9
2nd ".....	8	6	5	9	5	8	8	8	8	7	9	8	9	7	7	9	7	7	7	7	7
3rd ".....	11	9	9	12	8	10	11	10	11	9	11	11	11	11	11	11	9	10	11	10	11
4th ".....	6	5	5	6	4	6	6	6	6	5	7	6	6	5	6	7	6	6	5	5	6
Hind limb.....	128	107	95	147	79	124	127	125	120	115	142	120	135	132	138	136	117	121	119	105	135
Tibia.....	40	33	30	46	25	38	40	40	38	37	46	38	44	41	45	44	38	40	36	34	44
Foot.....	40	35	30	47	26	40	42	41	39	37	46	41	44	44	46	45	39	41	39	35	46
3rd toe.....	24	20	17	27	15	23	25	23	22	21	26	23	25	25	24	23	18	22	23	21	24
4th ".....	34	29	26	40	22	35	36	36	33	32	38	35	36	35	38	38	32	34	33	32	39
5th ".....	25	20	17	27	15	25	25	24	23	22	26	24	26	25	26	25	20	23	23	22	27

1-4. Lucknow, Ontario (Lataste Coll.).—5. Westbourne, Manitoba.—6-8. Moose Jaw, Assiniboia.—9-12. Swift Current, Assiniboia.—13. Calgary, Alberta.—14-15. Cambridge, Mass. (Lataste Coll.).—16-17. Cuttyhunk, Elizabeth Is., Mass.—18-19. New Jersey.—20. Long Is., N. Y.—21. Ithaca, N. Y.

Rana halecina.*Measurements in Millimeters.*

From snout to vent.....	22. ♂	23. ♀	24. ♂	25. ♂	26. ♀	27. ♂	28. ♀	29. ♂	30. ♀	31. ♂	32. ♀	33. ♂	34. ♂	35. ♂	36. ♂	37. ♀	38. ♀	39. ♂	40. ♀	41. ♀	42. ♂
Head.....	67	67	78	62	62	59	64	76	90	70	83	57	57	54	74	76	60	64	53	61	72
Width of head.....	23	23	26	20	21	19	20	24	28	25	27	20	20	20	27	28	23	25	19	21	26
Width of head.....	24	23	29	20	21	19	20	25	31	25	26	20	19	19	25	25	20	22	17	20	26
Snout.....	8	8	11	8	8	7	7	9	10	9	19	7	8	8	12	12	10	11	7.5	9	9
Eye.....	8	8	8	7	7	6	7	8	9	8	9	7	6.5	6.5	8	8	7	8	6	7	8
Interorbital width.....	3	2.5	2.5	2.5	3	2	2	2.5	3	3	3	2	2	2	2.5	3	2.5	2.5	2.5	2.5	3
Tympanum.....	5	6	7	4.5	4.5	4	5	7	7	6	6	5	4.5	4	6	6	4.5	6	4	5	6
Fore limb.....	39	40	44	34	35	34	34	44	50	41	47	34	32	32	42	43	32	37	28	37	43
1st finger.....	8	9	10	8	7	7	7	10	12	9	10	6	6	6	9	10	7	7	6	8	10
2nd ".....	7	8	9	7	6	6	6	9	10	8	9	5	5	5	7	8	6	6	5	6	9
3rd ".....	10	11	12	9	9	9	9	12	13	11	13	8	8	8	10	11	9	10	7	?	13
4th ".....	6	6	8	5	5	5	5	8	8	6	8	4	5	5	6	6	5	6	4	5	8
Hind limb.....	120	117	134	101	116	106	110	134	152	125	145	107	99	99	136	144	113	123	87	116	135
Tibia.....	38	37	45	32	36	33	35	45	50	39	48	35	31	31	44	49	36	39	29	38	45
Foot.....	39	39	43	33	37	34	37	43	50	40	47	35	33	32	45	50	37	40	29	36	43
3rd toe.....	23	21	23	20	20	20	20	23	25	22	26	17	16	16	24	27	18	21	14	19	23
4th ".....	34	33	36	27	30	28	31	36	40	34	42	30	29	27	29	43	32	35	24	30	35
5th ".....	25	23	26	20	20	20	22	26	28	23	29	20	19	17	26	29	20	23	16	?	24

22. Bay View, Michigan.—23. Oshkosh, Wisconsin.—24. Port Snelling, Minnesota.—25. Caldwell, Idaho.—26. Bloomington, Indiana.—27-28. Chicago, Illinois.—29. Douglas Co., Kansas.—30. Wray, Colorado.—31. E. of Boulder, Colorado.—32. Phoenix, Arizona.—33. Raleigh, N. Carolina.—34-38. Pensacola, Florida.—36-37. Eau Gallie, Florida.—38. Canaveral, Florida.—39. Ozone, Florida.—40. Moon, Mississippi.—41. Hitchcock, Texas.—42. Brownsville, Texas.

Rana halecina.*Measurements in Millimeters.*

	43.	44.	45.	46.	47.	48.	49.	50.	51.	52.	53.	54.	55.	56.	57.	58.	59.	60.	61.	62.	63.
	♂	♂	♀	♀	♂	♀	♀	♀	♀	♀	♀	♀	♀	♀	♂	♂	♂	♂	♀	♀	♂
From snout to vent.....	70	67	90	82	70	95	81	82	72	61	58	78	75	81	57	52	75	68	80	66	60
Head.....	24	25	29	27	24	28	26	28	26	22	21	28	26	26	20	19	26	25	28	23	22
Width of head.....	24	24	29	27	23	28	26	30	28	22	21	29	27	26	20	19	26	25	28	23	22
Snout.....	9	10	11	11	10	11	10	9	9	8	8	10	10	10	7	6.5	10	10	10	8	7
Eye.....	8	7	9	9	8	9	9	9	9	8	7	9	9	8	7	6.5	9	9	10	8	7
Interorbital width.....	3	3	3.5	3	3	3.5	3.5	2.5	2	2.5	2.5	2	3	3	2	2	3	3	3.5	3	2.5
Tympanum.....	6	6	7	6	5	7	7	7	7.5	5	5	6	6	7	5	5	6	5.5	6	5	7
Fore limb.....	45	39	49	47	43	47	45	50	43	35	33	44	42	45	34	32	43	42	51	37	38
1st finger.....	10	8	10	11	8	10	10	12	9	7	7	9	10	10	7	6	8	8	10	8	7.5
2nd ".....	9	7	9	9	7	9	9	11	9	6	6	8	8	8	6	5	7	7	8	7	6.5
3rd ".....	12	10	12	12	10	12	12	13	11	8	8	11	11	11	8	8	11	10	12	10	9
4th ".....	8	5	7	7	6	8	8	7	8	6	5	7	6	6	5	4	6	6	8	6	6
Hind limb.....	128	115	146	143	130	153	140	141	129	103	101	133	128	141	95	99	130	120	145	118	109
Tibia.....	42	39	48	47	42	54	46	43	40	32	31	42	40	45	30	31	40	39	47	37	35
Foot.....	41	38	46	45	40	50	45	48	42	33	31	44	41	45	30	31	44	39	47	39	37
3rd toe.....	22	19	24	23	21	28	24	29	24	17	16	26	25	25	17	18	26	23	27	22	21
4th ".....	35	31	40	38	34	42	40	41	37	28	26	39	34	37	24	26	39	33	39	32	31
5th ".....	25	22	28	27	25	30	27	29	27	19	18	27	25	22	18	20	27	23	30	24	23

43. Brownsville, Texas.—44-46. Duval Co., Texas.—47-49. Texas.—50. Bocoina, Sierra Tarahumari, N. W. Mexico.—51. Presidio, near Mazatlan (type of *R. forreri*).—52-53. Presidio, near Mazatlan.—54-55. Ciudad, Durango.—56. Hacienda de Abequiza, Guadalupe.—57-58. La Cumbre de los Arrestados, Jalisco.—59-62. Jalapa, Vera Cruz.—63. Omilteme, Guerrero (types of *R. omiltemana*).

Rana halecina.*Measurements in Millimeters*

	64.	65.	66.	67.	68.	69.	70.	71.	72.	73.	74.	75.	76.	77.	78.	79.	80.	81.	82.	83.	84.	85.
	♂	♂	♂	♂	♀	♀	♂	♂	♀	♀	♀	♀	♂	♂	♂	♀	♂	♂	♀	♂	♀	♀
From snout to vent.....	58	58	57	79	92	85	80	72	90	102	100	77	55	61	69	90	57	50	69	59	75	73
Head.....	23	22	22	30	32	31	29	27	30	35	35	26	20	22	23	27	20	17	25	21	26	26
Width of head.....	23	22	22	28	32	31	29	25	30	35	35	26	22	24	23	27	20	17	25	21	26	26
Snout.....	7	7	7	12	13	12	11	10	11	12	12	11	6	8	9	12	7	6	9	7	10	10
Eye.....	7	7	7	10	10	10	9	8	9	11	11	9	6	7	8	10	7	6	8	7	9	9
Interorbital width.....	3	2.5	2.5	3	4	3	3.5	3	4	4	4	3.5	3	3	3	3.5	2.5	2	2.5	2	3	3
Tympanum.....	5.5	6	5.5	6.5	7	5	6	6	6	9	9	6	4	5	5	6	5	4	6	4	5	5
Fore limb.....	35	36	32	47	50	52	46	45	46	62	60	48	39	36	44	47	35	32	41	35	44	43
1st finger.....	7.5	7.5	7	10	11	11	9	8	10	15	14	11	6	8	9	10	6	6	9	6	8	8
2nd ".....	6.5	6.5	6	8	9	9	8	7	9	11	11	9	6	7	8	8	5	5	7	5	7	7
3rd ".....	8	9	8	12	13	12	11	11	12	16	16	12	8	11	11	12	8	7	10	7	10	10
4th ".....	6	6	5	7	8	7	7	7	7	9	10	9	6	6	7	7	5	4	6	4	6	6
Hind limb.....	116	110	101	142	170	146	149	124	153	182	186	143	108	110	124	140	105	91	126	100	136	136
Tibia.....	36	33	32	47	53	47	47	41	48	62	61	47	34	35	38	46	32	27	41	32	43	42
Foot.....	40	36	33	46	52	48	47	42	48	57	59	46	34	37	42	46	36	30	41	34	45	44
3rd toe.....	21	21	19	26	28	25	26	24	26	32	33	26	18	20	22	25	19	16	24	17	26	25
4th ".....	32	31	28	40	45	38	41	36	41	48	50	40	29	32	35	40	31	25	35	27	38	37
5th ".....	23	21	20	28	31	26	31	24	29	34	35	27	20	24	25	27	21	17	26	18	26	26

64-66. Omilteme, Guerrero (types of *R. omiltemana*).—67-68. San Luis Allando.—69. Tequisixtlan, Tehuantepec.—70-72. Nogales near Orizaba.—73-74. N. of Coban, Guatemala.—75. Duenas, Guatemala.—76. Totonicapan, Guatemala (type of *R. maculata*).—77. Guatemala (type of *R. macroglossa*).—78-79. Guatemala.—80-82. Bebedero, Costa Rica.—83-85. La Palma, Costa Rica.

9. *Rana palustris*.

Rana palustris LECONTE, Ann. Lyc. N. Y., I, 1825, p. 282; HARLAN, Amer. Journ., X, 1825, p. 59, and Journ. Ac. Philad., V, 1826, p. 339; HOLBR., N. Amer. Herp., I, p. 93, Pl. XIV (1836); DUM. & BIBR., Erp. Gén., VIII, p. 356 (1841); HOLBR., op. cit. IV, p. 95, Pl. XXIII (1842); DEKAY, N. Y. Faun., Rept., p. 62, Pl. XXII, fig. 60 (1842); LECONTE, Proc. Ac. Philad., 1855, p. 424; GÜNTHER, Cat. Batr. Sal., p. 14 (1858); WEID, N. Acta Ac. Leop.-Carol., XXII, 1865, p. 114; HINCKLEY, Proc. Bost. Soc. N. H., XXI, 1881, p. 311, Pl. v, fig. 9; BOULENG., Cat. Batr. Ecaud., p. 42 (1882); COPE, Batr. N. Amer., p. 406 (1889); H. GARM., Bull. Illin. Labor., III, 1892, p. 225; WERNER, Jahresb. Nat. Ver. Magdeb., 1894, p. 133; DITMARS, Amer. Mus. Journ., V, 1905, p. 200, fig.; DICKERSON, Frog Book, p. 188, Pls. XIII and LXXII (1906); WRIGHT, Publ. Carnegie Instit. No. 1917, 1914, p. 61, Pl. XVI; BOULENG., Ann. and Mag. N. H. (9) III, 1919, p. 410.

Rana pardalis HARLAN, Amer. Journ. X, 1825, p. 59.

Vomerine teeth in oblique groups or short series between the choanæ or extending a little beyond the level of their posterior borders, close together or at least nearer to each other than to the choanæ.

Head as long as broad, moderately depressed; snout rounded or obtusely pointed, projecting beyond the mouth, as long as or a little longer than the eye; canthus rostralis obtuse; loreal region moderately oblique, feebly concave; nostril equidistant from the eye and from the tip of the snout or a little nearer the former; distance between the nostrils greater than the interorbital width, which is $\frac{1}{3}$ to $\frac{1}{2}$ that of the upper eyelid; tympanum very distinct, $\frac{3}{5}$ to $\frac{5}{8}$ the diameter of the eye, close to the latter or separated from it by a space not more than $\frac{1}{2}$ its diameter.

Fingers obtuse, first longer than second, third as long as or longer than the snout; subarticular tubercles rather large, prominent.

Tibio-tarsal articulation reaching the eye or the tip of the snout, or between these two points; heels strongly overlapping when the limbs are folded at right angle to the body; tibia 4 to 5 times as long as broad, $1\frac{2}{3}$ to 2 times in length from snout to vent, as long as or a little longer or a little shorter than the fore limb, or the foot. Toes obtuse, about $\frac{3}{4}$ webbed, 2 phalanges of fourth free; outer metatarsals separated nearly to the base; subarticular tubercles moderately large and prominent; no tarsal fold; inner metatarsal tubercle oval, $\frac{1}{3}$ to $\frac{2}{5}$ the length of the inner toe; a very small outer tubercle usually present.

Back with four broad and flat glandular longitudinal folds, the

Rana palustris*Measurements in Millimeters.*

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.
	♂	♀	♂	♂	♀	♀	♀	♀	♀	♂	♂	♂	♀	♀	♀	♂	♂	♀
From snout to vent.....	54	76	56	52	79	63	62	60	57	52	52	50	54	63	59	51	46	75
Head.....	19	24	20	20	23	20	20	19	19	17	18	18	19	22	21	19	16	25
Width of head.....	19	24	20	20	23	20	20	19	19	17	18	18	19	22	21	19	16	25
Snout.....	6	8	7	6	9	6	8	6	6	7	7	6	7	8	7	7	5.5	10
Eye.....	6	8	6	6	8	6	6	6	6	6	6	6	6	7	7	6	5.5	8
Interorbital space.....	2	3	1.5	2	3	2.5	2	2	2	2	2	2	2	2.5	2.5	2	2	3
Tympanum.....	4	6	4	4	6	5	4	4	4	4	4	3.5	4	4	4	4	3.5	6
Fore limb.....	35	44	34	32	41	34	37	33	34	30	30	29	31	36	36	30	28	43
1st finger.....	6	9	7	6	8	7	8	7	7	6	6	6	6	7	9	6	5	9
2nd ".....	5	7	6	5	7	6	6	6	6	5	5	5	5	6	8	5	4	8
3rd ".....	8	10	9	7.5	10	9	9	8	9	7	8	7	7	9	10	7	7	10
4th ".....	5	6	6	5	6.5	6	6	5	6	4	5	5	5	6	7	5	4	7
Hind limb.....	95	120	97	91	116	100	98	94	97	86	90	87	94	108	113	89	80	121
Tibia.....	30	39	32	30	43	32	33	30	31	28	29	29	30	36	36	28	25	38
Foot.....	31	40	32	28	37	31	32	31	31	28	29	29	30	36	37	30	26	39
3rd toe.....	16	20	17	17	21	18	17	18	18	14	16	15	16	20	20	16	13	21
4th ".....	26	33	27	25	30	27	27	27	27	23	25	25	25	31	32	25	20	33
5th ".....	18	24	19	18	22	19	21	19	19	17	18	16	18	21	22	19	15	24

1. Lucknow, Ontario (Latase Coll).—2. Philadelphia.—3-9. Long Island, New York.—10-12. Shokan, New York.—
 13. Pike Co., Pennsylvania.—14. Brevard, N. Carolina.—15. Pineola, N. Carolina.—16-18. N. America.

dorso-lateral extending from above the tympanum to the hip, the median pair extending from behind the eyes to the sacral region, where they are replaced by another pair closer together; the distance between the dorso-lateral folds 4 to 6 times in length from snout to vent; a few flat glands sometimes present, in addition to the folds on the back; a glandular fold from below the eye to above the arm. Lower parts smooth.

Brown above, the dorso-lateral folds usually not much lighter, bronzy; a dark brown or blackish spot on the snout and another on each upper eyelid; two series of very large, often squarish, dark brown or black spots along the back, some of them sometimes longitudinally or transversely confluent; sides with one or two series of black spots, or with black vertical base; a dark ventral streak; a light streak on the glandular fold below the eye, rarely extending to the tip of the snout; tympanum reddish or bronzy; limbs with very regular dark brown or black cross-bands; hinder side of thighs yellow or orange, with black spots or marblings. Lower parts white, rarely with pale brown spots, posterior part of belly and hind limbs yellow or orange.

Male with internal vocal sacs; fore limbs very strong, with a large pad on the inner side of the first finger.

Osteological characters as in *R. halecina*.

Tadpole also not essentially different.

Eggs very small, little over 1 millimeter in diameter.

Habitat.—North America east of the Mississippi.

R. palustris is very closely allied to *R. halecina*, and although its specific rank is unquestionable, it is by no means easy to point out constant characters for its distinction.

10. *Rana draytonii*.

Rana draytonii BAIRD AND GIR., Proc. Ac. Philad., 1852, p. 174, and U. S. Explor. Exped., Herp., p. 23, Pl. II, figs. 19–24 (1858); COPE, Proc. Am. Philos. Soc., XXIII, 1886, p. 521, and Batr. N. Am., p. 441, figs. (1889); STEJNEG., N. Am. Faun., No. 7, Pt. ii, p. 225 (1893); VAN DENBURGH, Proc. Calif. Ac. (2) V, 1896, p. 1008; DICKERSON, Frog Book, p. 213, Pls. xv, LXXX, LXXXI (1906); BOULENG., Ann. and Mag. N. H. (9) III, 1919, p. 410.

Rana lecontei BAIRD AND GIR., Proc. Ac. Philad., 1853, p. 301.

Rana nigricans (non Ag.), Hallow., Proc. Ac. Philad., 1854, p. 96; BOULENG., Bull. Soc. Zool. France, 1880, p. 207; BROCCHI, Miss. Sc. Mex., Batr., p. 15, Pl. IV, fig. 3 (1881); BOULENG., Cat. Batr. Ecaud., p. 43 (1882).

Rana longipes HALLOW., Rep. U. S. Explor. Surv., X, iv, Zool., p. 20, Pl. x, fig. 1 (1859).

Rana nigricans, part., BROCCHI, op. cit., p. 15.

Rana aurora draytonii CAMP, Univ. Calif. Publ. Zool., XVII, 1917, p. 123.

Vomerine teeth in small oblique groups between or just behind the choanæ, close together or at least nearer to each other than to the latter.

Head broader than long, rather strongly depressed; snout rounded, feebly projecting beyond the mouth, as long as or a little longer than the eye; canthus rostralis obtuse; loreal region oblique, feebly concave; nostril equidistant from the eye and from the tip of the snout; distance between the nostrils equal to or a little greater than the inter-orbital width, which is usually equal to or a little less than that of the upper eyelid, but sometimes only $\frac{2}{3}$ that width; tympanum very distinct, smooth, or, exceptionally, with a few granular asperities, $\frac{2}{3}$ to once the diameter of the eye, $1\frac{1}{3}$ to 2 times its distance from the latter.

Fingers rather long, obtuse, with a more or less distinct dermal margin, first longer than second, third much longer than the snout; sub-articular tubercles moderate.

Hind limb moderate or long, the tibio-tarsal articulation reaching the eye, the tip of the snout, or between these two points, the heels overlapping when the limbs are folded at right angles to the body; tibia $3\frac{1}{2}$ to 5 times as long as broad, $1\frac{2}{3}$ to $2\frac{1}{10}$ times in length from snout to vent, shorter than the fore limb, slightly or considerably shorter than the foot. Toes obtuse, $\frac{3}{4}$ to nearly entirely webbed, one or two phalanges of fourth free; outer metatarsals separated nearly to the base; subarticular tubercles small or rather small, moderately prominent; tarsal fold more or less distinct; inner metatarsal tubercles oval or elliptical, $\frac{1}{3}$ to $\frac{2}{5}$ the length of the inner toe; outer tubercle indistinct or absent.

Upper parts smooth or with small warts and pearl-like excrescences; a more or less prominent, moderately broad glandular dorso-lateral fold from above the tympanum to the hip or not quite so far, parallel with its fellow, from which it is separated by a space $3\frac{2}{3}$ to 5 times in the length from snout to vent; a glandular fold from below the eye to above the arm, sometimes followed by a glandule; lower parts smooth, hinder half of thighs coarsely granulate.

Olive, brown, or reddish brown above, with moderately large roundish dark spots, which may be lighter in the center; a dark central streak and sometimes a more or less distinct dark temporal spot; a light streak from below the eye to the end of the glandular fold behind

the mouth; limbs with more or less regular dark cross-bands; lumbar region and sides of thighs yellow, marbled with black, or black with round yellow spots. Lower parts uniform white or spotted or marbled with blackish. In life the sides of the body and the lower surface of the hind limbs may be bright red.

Male without vocal sacs, with a strong pad on the inner side of the first finger.

Nasal bones rather small, widely separated from each other and from the frontoparietals; ethmoid exposed and obtusely pointed in front.

Habitat.—Western North America, from British Columbia to the mountains of Lower California, up to an altitude of 4000 feet.

Measurements in Millimeters

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
	♀	♀	♀	♀	♀	♂	♀	♂	♀	♀	♀	♀
From snout to vent.....	110	106	84	72	72	70	85	63	75	68	118	115
Head.....	34	35	27	23	22	25	29	21	23	22	37	34
Width of head.....	41	40	30	26	25	27	35	23	28	24	45	42
Snout.....	13	12	10	8	8	9	11	7	7.5	7	12	12
Eye.....	10	11	8	7	6.5	8	9	7	7.5	7	12	11
Interorbital width.....	6	6	3.5	3	3	3	5	3.5	4	4	7	7
Tympanum.....	10	8	5	4	5	6	6	4	5	5	10	9
Fore limb.....	70	69	55	47	45	45	56	37	46	42	74	68
1st finger.....	17	17	13	11	11	9	13	8	10	9	18	17
2nd ".....	15	14	11	10	10	8	11	7	8	8	15	14
3rd ".....	18	18	16	15	14	13	15	11	12	11	22	20
4th ".....	13	12	10	9	8	8	9	7	7	7	14	13
Hind limb.....	171	174	145	127	125	120	159	105	124	113	190	182
Tibia.....	52	52	45	41	40	38	52	34	41	37	60	58
Foot.....	59	58	49	43	42	42	52	36	42	39	61	61
3rd toe.....	34	32	20	23	22	23	29	20	23	22	33	34
4th ".....	50	50	42	36	36	35	46	30	35	33	53	53
5th ".....	36	37	30	28	26	25	32	22	25	23	40	39

1-5. San Francisco.—6. San Diego.—7. Tia Juana, San Diego Co.—8-10. Riverside, Cal.—10-12. Pacific Region of N. America.

11. *Rana aurora*.

Rana aurora BAIRD AND GIR., Proc. Ac. Philad., 1852, p. 174, and U. S. Explor. Exped., Herp., p. 18, Pl. II, figs. 1-6 (1858); STEJNEG., N. Am. Faun. No. 7, pt. II, p. 225 (1893); DICKERSON, Frog Book, p. 216, Pls. XIV and LXXXII

(1906); CAMP, Univ. Calif. Publ. Zool., XVII, 1917, p. 123; BOULENG., Ann. and Mag. N. H. (9) III, 1919, p. 410.

Rana temporaria aurora COPE, Proc. Ac. Philad., 1883, pp. 27, 28.

Rana agilis aurora COPE, Proc. Am. Philos. Soc. XXIII, 1886, p. 521, and Batr. N. Am., p. 441, figs. (1889); MEEK, Field Col. Mus., Zool. I, 1899, p. 332.

Vomerine teeth in oblique groups close together just behind the level of the choanæ.

Head as long as broad or slightly broader than long, much depressed; snout rounded, feebly projecting beyond the mouth, as long as or slightly longer than the eye; canthus rostralis obtuse; loreal region very oblique, scarcely concave; nostril a little nearer the eye than the tip of the snout; distance between the nostrils greater than the inter-orbital width, which is $\frac{1}{2}$ to $\frac{2}{3}$ that of the upper eyelid; tympanum very distinct, about $\frac{3}{5}$ the diameter of the eye, $1\frac{1}{3}$ to 2 times its distance from the latter.

Fingers rather long, obtuse, first as long as or a little longer than the second, third much longer than the snout; subarticular tubercles moderate.

Hind limb long, the tibio-tarsal articulation reaching the nostril, the tip of the snout, or a little beyond, the heels overlapping where the limbs are folded at right angles to the body; tibia 4 to $4\frac{1}{2}$ times as long as broad, $1\frac{3}{4}$ to $1\frac{7}{8}$ times in length from snout to vent, shorter than the fore limb, a little shorter than the foot. Toes obtuse, $\frac{2}{3}$ webbed, two phalanges of fourth free, outer metatarsals separated nearly to the base; subarticular tubercles small or rather small, moderately prominent; no distinct tarsal fold; inner metatarsal tubercle oval, prominent, $\frac{1}{4}$ to $\frac{1}{3}$ the length of the inner toe; a more or less distinct outer tubercle.

Upper parts smooth; a rather broad, more or less prominent glandular dorso-lateral fold from above the tympanum to the hip or not quite so far, parallel with its fellow, from which it is separated by a space 6 times in the length from snout to vent; a glandular fold from below the eye to above the arm, followed by a glandule. Lower parts smooth, hinder half of thighs, and sometimes posterior part of belly, granulate.

The specimens in the British Museum, for which I am indebted to the kindness of Miss Dickerson, are brown above with small dark spots, a dark temporal blotch, a light streak from below the eye to the shoulder, and dark cross-bands on the limbs, in fact very similar to ordinary specimens of *R. temporaria* except for the absence of the Λ -shaped marking between the shoulders. According to Miss

Dickerson, the upper parts are brown, yellowish, or olive; there may be small spots or specks of dark brown or black on head, back, and sides; much red on the parts of the legs and feet which are concealed when folded, or the sides of the body, and at the base of the arms; reticulations of yellow and black on the body and thighs where they lie against each other. Throat and belly white, mottled with dark.

Male without vocal sacs; fore limbs strong; a thick pad on the inner side of the first finger.

Nasal bones small, transverse, with concave posterior border, separated from each other and from the ethmoid, which is obtusely pointed in front.

The tadpoles of *R. draytoni* and *R. aurora* have not been described.

Habitat.—Washington, Oregon, and California.

Measurements in Millimeters

	♂	♀	♀
From snout to vent.....	54	76	73
Head.....	18	26	25
Width of head.....	19	26	25
Snout.....	6	9	8
Eye.....	6	8	8
Interorbital width.....	2.5	3	3
Tympanum.....	3.5	5	5
Fore limb.....	35	48	47
1st finger.....	7	9	10
2nd ".....	7	9	9
3rd ".....	11	13	14
4th ".....	7	10	10
Hind limb.....	101	136	128
Tibia.....	31	42	39
Foot.....	34	43	41
3rd toe.....	16	22	21
4th ".....	28	35	34
5th ".....	18	26	26

Specimens from Seattle, Washington.

This frog is very closely related to *R. draytonii*, with which I had previously united it (Ann. & Mag. N. H. [6] VIII, 1891, p. 453), but it appears to be distinguishable, in addition to minor points, by the smaller tympanum, as pointed out by Baird & Girard in the original

description. However, according to Camp, specimens from Mendocino City, Coast of California, "are intergrades between *aurora* and *draytonii*" and he accordingly regards the latter as a subspecies of the former; but he does not state in what respects they intergrade. I therefore provisionally maintain the two as species.

I regard *R. aurora* as intermediate between *R. draytonii* and *R. pretiosa*, but nearer the former. Until I was able to examine authentic specimens of this frog, which has unaccountably been referred as a subspecies to the European *R. agilis*, I felt somewhat doubtful as to the validity of this species.

The description of Baird and Girard and of Cope do not afford convincing characters for the separation from *R. draytoni*, and Miss Dickerson makes the following statement:—

"*Rana aurora* is easily confused with *R. draytonii*, because of the likeness, both in coloring and proportions. The former frog can be distinguished by the following characteristics: It has a longer leg, the greater length especially noticeable in the tibia.⁸ Its skin is very smooth, while that of *R. draytonii*, especially in the full-grown frogs is always tubercular,⁹ and may be extremely so (even on the ear).¹⁰ *R. aurora* has a longer foot with a broader web, but with a much smaller inner sole tubercle."¹¹ It is said not to exceed 90 millimeters from snout to vent.

Cope says the two last phalanges of the fourth toe are free from the web in *R. aurora*, instead of only the last in *R. draytonii*, but the figures in his book show absolute identity between the two species in this respect. He adds that the tongue is "small and narrow" in the former and "not large" in the latter, but the tongue is decidedly small and narrow in our specimens from Riverside, remarkably so in the male,¹² which I cannot otherwise distinguish from *R. draytonii*.

According to Cope's measurements (in percentages) the differences in the proportions between the two species are:—

⁸ Tibio-tarsal articulation reaching beyond end of snout; tibia much longer than femur.—Meek, probably guided by Cope's description, refers to this species a specimen in which the heel only reaches the center of the eye.

⁹ Some of my largest *R. draytonii* have the upper parts smooth.

¹⁰ This statement is interesting in connection with Stejneger's comments on my suggestion that *R. boylei* might be a variety of *R. draytoni*.

¹¹ One third the length of the inner toe, according to Miss Dickerson's figure.

¹² I also find a remarkably small tongue in some males of *R. japonica* from Satsuma, and of *R. temporaria* from the Alps.

Measurements in Millimeters.

	<i>R. draytonii</i>	<i>R. aurora.</i>
Snout to vent.....	100	100
Head.....	34	36
Width of head.....	36	35
Eye.....	12	11
Tympanum.....	8	7
Fore limb.....	75	66
Hind limb.....	173	170
Femur.....	50	48
Tibia.....	51	52
Foot.....	56	53

There is not much light to be derived from these measurements ¹³ considering the individual variation shown by the specimens tabulated by me under *R. draytonii*, all of which, I am convinced, belong to one species only.

12. *Rana pretiosa.*

Rana pretiosa BAIRD AND GIR., Proc. Ac. Philad., 1853, p. 378; BAIRD, Proc. Ac. Philad., 1854, p. 62; GIRARD, U. S. Explor. Exped., Herp., p. 20, Pl. II, figs. 13-18 (1858); COOPER, Rep. U. S. Explor. Surv., XII, part 2, p. 304 (1860); COPE, in Hayden's Rep. U. S. Geol. Surv. Montana, p. 469 (1872); BOULENG., Bull. Soc. Zool. France, 1880, p. 208, and Cat. Batr. Ecaud., p. 43 (1882); COPE, Proc. Ac. Philad., 1883, pp. 16, 20; TEST, Bull. U. S. Fish Comm. XI, 1892, p. 58; STEJNEG., N. Am. Faun. No. 7, part 2, p. 225 (1893); DICKERSON, Frog Book, p. 218, Pls. XVI, LXXXIII (1906); CAMP, Univ. Calif. Publ. Zool., XVII, 1917, p. 123; BOULENG., Ann. and Mag. N. H. (9) III, 1919, p. 410.

Rana temporaria pretiosa COPE, Batr. N. Am., p. 432, figs. (1889); MEEK, Field Col. Mus., Zool. I, 1899, p. 232.

Rana pretiosa luteiventris H. B. THOMPSON, Proc. Biol. Soc. Washingt., XXVI, 1913, p. 53; CAMP, t. c., p. 123.

Vomerine teeth in oblique groups close together just behind the level of the choanæ.

Head a little broader than long, rather strongly depressed; snout rounded, feebly projecting beyond the mouth, as long as or a little longer than the eye; canthus rostralis obtuse; loreal region oblique, feebly concave; nostril equidistant from the eye and from the tip

¹³ Which, contrary to Miss Dickerson's definition, shows a slightly shorter hind limb in *R. aurora* as compared with *R. draytonii*.

of the snout; distance between the nostrils usually greater than the interorbital width, which equals $\frac{2}{3}$ to $\frac{3}{4}$ that of the upper eyelid; tympanum more or less distinct, $\frac{2}{5}$ to $\frac{2}{3}$ the diameter of the eye, $1\frac{1}{2}$ to 2 times its distance from the latter.

Fingers moderate, obtuse or rather pointed, first longer than second, third usually longer than the snout; subarticular tubercles moderate.

Hind limb moderately long, the tibio-tarsal articulation reaching the tympanum or the eye, the heels meeting or slightly overlapping where the limbs are folded at right angles to the body; tibia 3 to $4\frac{1}{2}$ times as long as broad, 2 to $2\frac{1}{5}$ times in length from snout to vent, shorter than the fore limb, shorter than the foot. Toes obtuse, $\frac{3}{4}$ to nearly entirely webbed, one or two phalanges of fourth free, the web thicker and with convex border in the breeding male; the web extending about half way between the outer metatarsals; subarticular tubercles small, moderately prominent; no tarsal fold; inner metatarsal tubercle oval, $\frac{1}{4}$ to $\frac{1}{3}$ the length of the inner toe; a small, round, or conical outer tubercle usually present.

Upper parts smooth or with small warts; pearl-like horny tubercles often present on the body and hind limbs; a moderately broad and moderately prominent glandular dorso-lateral fold from above the tympanum to the hip; the dorso-lateral folds parallel or slightly converging towards each other on the scapular region, where they are separated from each other by a space contained $4\frac{1}{2}$ to 6 times in the length from snout to vent. Lower parts smooth.

Brown, yellowish, or reddish above, with small darker spots which may have light centers and often with more or less profusely scattered ink-black spots on the back; flanks with large dark spots or marblings; a dark streak from the tip of the snout to the eye and a more or less marked dark temporal spot; a light streak from below the nostril to above the arm; limbs usually with more or less regular dark cross-bands. Lower parts white, uniform or mottled or marbled with gray; in life salmon-red on hind limbs and in a more or less conspicuous U-shaped marking on the belly.

Male without vocal sacs, with very strong fore limbs and a large pad on the inner side of the first finger.

Skeleton similar to that of *R. temporaria*.

The tadpole has not been described, but the eggs are known to be very similar to those of *R. temporaria*, nearly entirely black and nearing 2 to $2\frac{1}{2}$ millimeters in diameter.

Habitat.—North America, from the Rocky Mountains westwards, from British Columbia to California.

Rana pretiosa.*Measurements in Millimeters.*

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.
	♂	♀	♀	♀	♀	♀	♀	♂	♀	♀	♂	♀	♀	♀	♀	♀	♀	♂	♀	♂	♀	♀	♀
From snout to vent..	55	78	78	75	72	63	62	51	66	65	53	69	64	70	73	66	70	56	60	53	65	62	67
Head.....	20	26	25	23	24	22	20	18	20	20	18	20	20	21	21	20	21	19	20	17	21	20	22
Width of head.....	21	30	27	24	26	25	21	19	22	22	19	22	22	23	22	21	23	21	21	20	23	21	24
Snout.....	7	8	8	8	8	7	7	6	7	7	6.5	7	8	7	7	7	7	6.5	7	6	7	7	7
Eye.....	6	7	7	7	7	6	6	6	7	7	6.5	7	7	7	6	7	7	6.5	7	5.5	6	6	7
Interorbital width....	2.5	3	3	3	3	3	3	3	3	3	2	2.5	3	3	2.5	3	3	2.5	3	2	3.5	3	3
Tympanum.....	3	4	4	4	4	3.5	3	3	4	4	3	4	4	4	4	4	4	3.5	4	3	4	4	4
Fore limb.....	35	46	44	43	43	40	37	31	41	42	32	40	37	39	41	39	40	38	39	33	38	35	42
1st finger.....	6	10	10	9	9	8	7.5	6	8	8	6	8	8	8	8	8	8	7	8	6	8	8	10
2nd ".....	5	8	8	8	8	7	7	5	7	7	5	7	7	7	7	7	7	6	7	5	7	7	9
3rd ".....	7	11	11	10	10	9	8	7	10	10	7	10	10	10	10	10	10	9	9	8	10	10	11
4th ".....	5	7	7	7	7	5	5	4	7	7	4.5	6	6	6	6	6	6	6	6	5	7	6	8
Hind limb.....	87	124	119	115	111	108	102	85	107	108	78	106	98	103	108	104	100	91	97	86	103	98	110
Tibia.....	26	38	36	35	33	32	31	26	32	32	24	32	30	33	33	31	32	27	28	26	31	30	34
Foot.....	30	42	40	38	38	37	35	30	37	36	26	36	33	35	37	36	34	32	33	30	36	34	39
3rd toe.....	18	21	21	20	21	19	18	17	20	20	15	18	17	18	20	19	18	17	19	16	19	18	23
4th ".....	24	32	32	30	30	28	27	25	29	28	21	29	26	27	29	29	27	25	27	23	28	27	31
5th ".....	18	23	23	22	21	20	19	17	20	20	15	20	18	20	21	21	19	18	20	17	22	20	23

1-7. Banff, Alberta.—8. L. Louise, Alberta.—9-10. Rocky Mts., B. N. A.—11-13. Field, Brit. Columbia.—14. Kicking Horse R., Mt. Field.—15-16. Revalstoke, Brit. Columbia.—17. Ice R. valley, Brit. Columbia.—18-19. Suman Prairies, Brit. Columbia.—20-22. Le Grande, Oregon.—23. Seattle, Washington.

Although this frog bears a general resemblance to *R. temporaria*, it is difficult to understand how a herpetologist of Cope's standing should have regarded it as only subspecifically distinct from that species. It is true the subordination of *R. aurora* to *R. agilis* is an even more inconceivable example of laxity in his treatment of the subject. *R. pretiosa* differs from *R. temporaria* in the more oblique loreal region, the usually narrower interorbital space, the frequent presence of a very distinct outer metatarsal tubercle, and, above all, in the absence of vocal sacs in the male. It is further to be observed that the Λ -shaped glandular ridge, accompanied by a dark marking, which is frequent in *R. temporaria* and in the European and Asiatic species that cluster round it, is constantly absent in *R. pretiosa* as well as in the other American species.

For measurements of *Rana pretiosa* see p. 454.

13. *Rana cantabrigensis*.

Rana cantabrigensis BAIRD, Proc. Ac. Philad., 1854, p. 62; BOULENG., Bull. Soc. Zool. France, 1880, p. 209, and Cat. Batr. Ecaud., p. 45 (1882); COPE, Proc. Amer. Philos. Soc., XXIII, 1886, p. 519, and Batr. N. Am., p. 435 (1889); BOULENG., Ann. and Mag. N. H. (6) VIII, 1891, p. 453; HOWE, Proc. Bost. Soc. XXVIII, 1899, p. 369; DICKERSON, Frog Book, p. 211 (1906); BOULENG., Ann. and Mag. N. H. (9) III, 1919, p. 410.

Rana temporaria, var. *silvatica*, part., GÜNTHER, Cat. Batr. Sal., p. 17 (1858).

Rana sylvatica BOULENG., Bull. Soc. Zool. France, 1879, p. 174.

Rana cantabrigensis latiremis COPE, t. c., p. 520, and op. c., p. 435; HOWE, t. c. p. 373.

Rana cantabrigensis evittata COPE, op. c., p. 435.

Vomerine teeth in small oblique groups just behind the level of the choanæ, close together or at least nearer to each other than to the latter.

Head a little broader than long, rather strongly depressed; snout rounded or obtusely pointed, more or less projecting beyond the mouth, as long as or a little longer than the eye; canthus rostralis obtuse; loreal region oblique, concave; nostril equidistant from the eye and from the tip of the snout, or nearer the former; distance between the nostrils greater than the interorbital width, which is $\frac{2}{3}$ to $\frac{3}{4}$ that of the upper eyelid; tympanum more or less distinct, about $\frac{1}{2}$ the diameter of the eye and 2 to 3 times its distance from the latter.

Fingers moderate, obtuse, first longer than the second, third a little longer than the snout; subarticular tubercles moderate.

Hind limb moderately long, the tibio-tarsal articulation reaching the tympanum or the eye, the heels meeting or slightly overlapping when the limbs are folded at right angles to the body; tibia 3 to 4 times as long as broad, 2 to $2\frac{1}{2}$ times in length from snout to vent, shorter than the fore limb and than the foot. Toes obtuse, $\frac{1}{2}$ to $\frac{3}{4}$ webbed, 2 or 3 phalanges of fourth free, the web thicker and with convex border in the breeding male; the web extending about half way down between the outer metatarsals; subarticular tubercles rather small, moderately or feebly prominent; tarsal fold feeble or absent; inner metatarsal strongly projecting, hard, feebly compressed, semi-circular in outline, $\frac{1}{2}$ to $\frac{2}{3}$ the length of the inner toe; a small, round outer tubercle present or absent.

Skin of upper parts smooth or with small flat glands; a moderately broad, flat or moderately prominent glandular dorso-lateral fold, from above the tympanum to the hip; these folds parallel or converging on the anterior part of the back, where they are separated from each other by a space contained $4\frac{1}{2}$ to $5\frac{1}{2}$ times in length from snout to vent; a second pair of more or less wavy glandular folds along the middle of the back; a glandular fold from below the eye to above the arm. Lower parts smooth, posterior half of thighs with large flat granules.

Yellowish or reddish brown above, usually with dark brown or blackish spots or bands bordering the glandular dorsal folds; a dark streak from the end of the snout to the eye and a large dark temporal spot; a light streak on the upper lip, from the end of the snout to the extremity of the glandular fold behind the mouth; limbs usually with more or less regular dark cross-bands; frequently a yellow line from the tip of the snout to the vent and another along the middle of the thigh and the inner side of the tibia. Lower parts white, uniform, or throat and breast spotted with blackish.

Male with internal vocal sacs, strong fore limbs, a large pad on the inner side of the first finger, and the web between the toes more developed than in the female.

Nasal bones small, oblique, widely separated from each other; ethmoid largely exposed above, angular in front and penetrated between the nasals; frontoparietals separated from each other in front, embracing a fontanelle.

Measurements in millimeters.

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
	♂	♀	♂	♂	♀	♀	♀	♀	♀	♂	♀	♀
From snout to vent.....	40	40	44	44	43	56	50	37	37	46	43	51
Head.....	14	14	15	15	14	17	16	13	13	16	14	16
Width of head.....	15	14	16	15	15	19	17	14	13	17	15	17
Snout.....	4.5	4.5	5	5	5.5	6	5.5	4.5	4.5	6	5	6
Eye.....	4.5	4.5	5	5	5	6	5.5	4.5	4.5	6	5	6
Interorbital width.....	2.5	2.5	3	2.5	3	3	2.5	2	2	2.5	2.5	2.5
Tympanum.....	3	3	2.5	3	2.5	3	3	2	2	3	2	3
Fore limb.....	22	20	25	25	24	30	28	20	21	26	25	27
1st finger.....	4	4	4	4	4	7	5	3.5	4	4.5	4.5	5
2nd ".....	3.5	3.5	3.5	3.5	3.5	5.5	4	3	3	3.5	3.5	4
3rd ".....	6	6	6.5	6	6	8	6.5	5	5	6.5	6.5	7
4th ".....	3	3	3	3	3	5	3.5	2.5	2.5	3	3	3
Hind limb.....	58	60	67	67	66	83	76	52	55	75	72	70
Tibia.....	17	18	20	20	19	25	22	15	16	23	21	20
Foot.....	19	20	23	23	22	27	24	17	18	25	25	23
3rd toe.....	10	11	13	13	12	14	13	9	10	13	12	11
4th ".....	15	15	18	18	17	22	20	14	15	20	20	18
5th ".....	10	10	11	11	11	13	12	9	10	13	12	11

1-2. Port Smith, Great Slave R., Canada.—3-5. Banff, Alberta.—6-7. Rocky Mts., B. N. A.—8-9. Great Bear Lake.—10-11. Stanley, Wisc.—12. N. America.

The larva is unknown.

Habitat.—Western North America, from Alaska and Great Bear Lake to British Columbia, Alberta, Assiniboia, Manitoba, Minnesota, and Illinois.

As pointed out by Howe it is almost certain that the type specimen was not preserved in Massachusetts by Agassiz, but was sent to Baird from Cambridge, whence the confusion.

R. cantabrigensis is the American representative of *R. arvalis*, from which it differs in but very trivial characters. Had I not attached importance to the absence of the Δ -shaped interscapular marking in all the American frogs, I might have been tempted to degrade *R. cantabrigensis* to the rank of a variety of *R. arvalis*, as I am much struck by the resemblance in the cranial characters. It is also noteworthy that the light vertebral line is found in no other North American species, and the light line along the hind limb is a character met with, irrespective of affinities, in many forms from the African

and Indo-Malayan regions but not from elsewhere, with the single exception of *R. esculenta*, var. *chinensis*, in which it is very rarely present.

14. *Rana silvatica*.

Rana silvatica LECONTE, Ann. Lyc. N. Y., I, 1825, p. 282; HARL., Amer. Journ. Sc., X, 1825, p. 58, and Journ. Ac. Philad., V, 1825, p. 338; HOLBR., N. Am. Herp. I, p. 95, Pl. xv (1836); DUM. AND BIBR., Erp. Gén., VIII, p. 362 (1841); DEKAY, N. Y. Faun., III, p. 64, Pl. xx, fig. 50, and XXI, fig. 54 (1842); HOLBR., N. Am. Herp., Ed. 2, IV, p. 99, Pl. xxiv (1842); WIED, N. Acta Ac. Leop. Carol., XXXII, 1865, p. 114; DE L'ISLE, Ann. Sc. Nat. (5), XVII, 1872, No. 3, p. 4; HINCKLEY, Proc. Bost. Soc. N. H., XXI, 1881, p. 310, Pl. v, fig. 6; BOULENG., Cat. Batr. Ecaud., p. 47 (1882); COPE, Batr. N. Am., p. 447, fig. (1889); H. GARM., Bull. Illin. Lab., III, 1892, p. 330; HOWE, Proc. Bost. Soc., XXIX, 1899, p. 369; DICKERSON, Frog Book, p. 205, Pl. xiv, fig. 1, and Pl. LXXVIII and LXXIX (1906); WRIGHT, Publ. Carnegie Instit., No. 197, 1914, p. 87, Pl. XXI; BOULENG., Ann. and Mag. N. H. (9) III, 1919, p. 410.

Rana pennsylvanica HARL., Amer. Journ. Sc., X, 1825, p. 58; BOULENG., Bull. Soc. Zool. France, 1879, p. 188.

Rana temporaria var. *silvatica*, part., GÜNTHER, Cat. Batr. Sal., p. 47 (1858).

Vomerine teeth in small oblique groups on a level with or just behind the posterior borders of the choanæ, close together or nearer to each other than to the latter.

Head as long as broad or a little broader than long, rather strongly depressed; snout rounded or obtusely pointed, more or less projecting beyond the mouth, as long as or a little longer than the eye; canthus rostralis obtuse; loreal region oblique, concave; nostril equidistant from the eye and from the tip of the snout; distance between the nostrils equal to or greater than the interorbital width, which is equal to or less than (about $\frac{2}{3}$) that of the upper eyelid; tympanum very distinct, $\frac{1}{2}$ to $\frac{2}{3}$ the diameter of the eye and 2 to 4 times its distance from the latter.

Fingers moderate, obtuse, first longer than second, third as long as or longer than the snout; subarticular tubercles moderate or large, very prominent.

Hind limbs long, the tibio-tarsal articulation reaching the nostril, the tip of the snout, or a little beyond, the heels strongly overlapping when the limbs are folded at right angles to the body; tibia 4 to 5 times as long as broad, $1\frac{3}{5}$ to 2 times in length from snout to vent, as long as or slightly shorter than the fore limb and as long as or slightly longer or shorter than the foot. Toes obtuse, $\frac{2}{3}$ to $\frac{3}{4}$ webbed,

2 phalanges of fourth free, the web thicker and with convex border in the breeding male; the web extending about halfway between the outer metatarsals; subarticular tubercles moderate or rather small and feebly prominent; no tarsal fold; inner metatarsal tubercle very prominent, rather hard, sometimes feebly compressed, $\frac{2}{5}$ to $\frac{3}{5}$ the length of the inner toe; a small, round outer tubercle present or absent.

Skin of upper parts smooth or with small flat glands; a narrow or moderately broad, prominent glandular dorso-lateral fold, from above the tympanum to the hip; these folds parallel or slightly converging on the anterior part of the back, where they are separated from each other by a space contained $4\frac{1}{2}$ to $5\frac{1}{2}$ times in length from snout to vent; a glandular fold from below the eye to above the arm. Lower parts smooth, posterior half of thighs with large flat granules; the posterior part of the belly sometimes also granular.

Grayish or pinkish brown above, without or with small dark brown or black spots; a dark brown or black streak from the end of the snout to the eye and a large blotch of the same color on the temple, or loreal region and lower half of eye dark like the temple; a light streak on the upper lip, from the end of the snout to the extremity of the glandular fold behind the mouth; a V-shaped dark marking sometimes present between the eyes; dorso-lateral fold paler than the ground color, often edged with blackish or with a series of small blackish spots, on the outer side; limbs with more or less regular dark cross-bands. Lower parts white, posterior part of belly and hind limbs yellow, throat and breast sometimes with small brown or gray spots.

Male with internal vocal sacs, strong fore limbs, and a large pad on the inner side of the first finger; the web between the toes more developed during the breeding season.

Nasal bones small, oblique, widely separated from each other; ethmoid exposed in front of the parietals and forming an obtuse angle penetrating between the nasals.

Tadpole not unlike that of *R. agilis*, with 4 upper and 4 lower series of labial teeth, viz. a long upper marginal and 3 short laterals; 3 continuous lower and one (the innermost) interrupted.

Eggs as in *R. temporaria*, but smaller.

Habitat.—Eastern North America, from Manitoba, Ontario, and Quebec to South Carolina.

This species is strikingly similar to *R. agilis* in form, color, and habits, but the presence of vocal sacs in the males fully justify the specific separation; it remains much smaller. Some specimens appear to be connectant between it and *R. cantabrigensis*, and I am not fully

Rana silvatica.

Measurements in Millimeters.

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.
	♂	♂	♂	♂	♂	♀	♂	♀	♀	♂	♀	♀	♂
From snout to vent.....	34	42	41	41	37	48	40	35	42	42	45	43	45
Head.....	11	15	14	14	13	16	14	13	15	14	15	15	16
Width of head.....	12	16	15	15	13	17	14	13	15	15	15	15	16
Snout.....	4	5.5	5	5	4.5	6	5	4.5	6	5	5	5.5	6
Eye.....	4	5.5	5	5	4.5	6	5	4.5	5	5	5	5.5	6
Interorbital width.....	2	2	2.5	2.5	2	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Tympanum.....	2	3	3	3	2.5	3	2.5	2.5	3	3	3.5	3	3
Fore limb.....	19	25	24	25	23	29	24	21	23	26	28	25	26
1st finger.....	4	4	4	4.5	4	6	4	5	5	5	6	5.5	5.5
2nd ".....	3.5	3	3	3.5	3	5	3.5	4	4	4	5	4.5	4
3rd ".....	5	5	6	6	5.5	7	5	6	6	6	8	7	7
4th ".....	3	2.5	3	3	2.5	4	3	3	3.5	3	4	4	4
Hind limb.....	60	73	70	75	68	83	68	58	75	79	89	82	81
Tibia.....	17	23	22	23	21	27	22	20	25	25	28	26	26
Foot.....	19	23	23	24	21	27	23	20	23	25	28	25	25
3rd toe.....	10	13	13	14	12	15	13	11	12	13	15	13	13
4th ".....	15	18	18	19	16	22	18	15	19	19	21	20	20
5th ".....	10	12	12	13	11	14	12	10	11	13	14	13	13

1. L. Winnipeg.—2-6. Lucknow, Ontario.—7-8. London, Ontario.—9. L. Louise, Manitoba.—10-11. Cambridge, Mass.—12. Brooklyn, N. Y.—13 Long Id., N. Y.

Rana silvatica.*Measurements in Millimeters.*

	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.	24.	25.	26.
	♀	♂	♀	♂	♀	♀	♀	♀	♀	♀	♀	♀	♀
From snout to vent.....	40	45	50	41	52	50	45	60	59	59	58	55	54
Head.....	14	16	16	14	17	16	15	19	19	19	20	19	18
Width of head.....	14	16	17	15	18	17	16	21	21	20	21	20	19
Snout.....	5	5.5	6	5	6	5.5	5.5	6	6.5	6.5	6.5	6.5	6
Eye.....	5	5.5	6	5	6	5.5	5.5	6	6	6.5	6.5	6.5	6
Interorbital width.....	2.5	3	3	2.5	2.5	2.5	2.5	3	3.5	3.5	3.5	3	3
Tympanum.....	2.5	3	3.5	3	3.5	3	3	4	4	4	4	4	4.5
Fore limb.....	23	25	29	25	29	28	27	33	35	32	34	33	32
1st finger.....	5	4.5	5.5	5	6	5.5	5	7	8	6	8	6	6
2nd ".....	4	3.5	4.5	4	5	4.5	4	5.5	6	5	6	5	5
3rd ".....	6	6	7	6	7	7	6.5	9	9	8	9	8	7
4th ".....	4	3	3.5	3	4	4	3.5	5	5	4	5	5	4
Hind limb.....	74	74	86	73	86	84	79	101	102	97	99	95	89
Tibia.....	25	24	27	23	28	27	25	34	34	31	31	30	28
Foot.....	23	23	26	23	28	27	25	32	33	31	32	30	28
3rd toe.....	12	12	13	13	14	14	13	17	17	15	17	15	15
4th ".....	18	18	21	18	21	20	19	24	25	22	25	23	22
5th ".....	11	12	13	11	13	12	13	15	16	15	16	15	15

14. Long Id., N. Y.—15-16. Palisades, N. J.—17-20. Hackensack, N. J.—21. Chester Co., Penn.—22. Sullivan Co., Penn.—23-26. N. America.

convinced that the line of cleavage between the two species corresponds to that traced by Howe, who has endeavored to improve on the definitions given by Cope, which are entirely inadequate.

R. pretiosa, *R. cantabrigensis*, and *R. silvatica* are evidently closely related to the three widely distributed European species *R. temporaria*, *R. arvalis*, and *R. agilis*, which they represent in America; but I am inclined to regard this as a case of independent, parallel evolution in the two parts of the world from a common ancestor, of which *R. draytonii* is perhaps the surviving representative.

15. *Rana godmani*.

?*Levirana vibicaria* COPE, Proc. Ac. Philad., 1894, p. 197.

Rana godmani GÜNTHER, Biol. C.-Am., Rept., p. 204, Pl. LXIII, fig. A (1900); BOULENGER, Ann. and Mag. N. H. (9) III, 1919, p. 411.

Vomerine teeth in feeble oblique groups between the choanæ, equally distant from each other and from the latter, or nearer each other.

Head slightly broader than long, rather strongly depressed; snout rounded, feebly projecting beyond the mouth, as long as or a little longer than the eye; canthus rostralis obtuse; loreal region feebly oblique, concave; nostril equidistant from the eye and from the end of the snout; distance between the nostrils equal to or a little greater than the interorbital width, which equals that of the upper eyelid; tympanum very distinct, about $\frac{3}{2}$ the diameter of the eye, $1\frac{1}{2}$ to 2 times its distance from the latter.

Fingers moderate, obtuse or a little swollen at the end, first longer than the second, third as long as or a little longer than the snout; subarticular tubercles moderate.

Hind limb moderately long, the tibio-tarsal articulation reaching the eye, the heels overlapping when the limbs are folded at right angles to the body; $4\frac{1}{2}$ to 5 times as long as broad, $2\frac{1}{7}$ to $2\frac{1}{3}$ times in length from snout to vent, shorter than the fore limb, a little shorter than the foot. Toes slightly swollen at the end, $\frac{2}{3}$ webbed, 2 phalanges of fourth and one of third and fifth free; the web separating the outer metatarsal in third distal half; subarticular tubercles rather small, moderately prominent; no tarsal fold; inner metatarsal tubercles oval, about $\frac{1}{3}$ the length of the inner toe; no outer tubercle.

Skin smooth; a broad glandular dorso-lateral fold, as broad as the upper eyelid, from above the tympanum to the hip; the distance

between the dorso-lateral folds, on the back, $\frac{1}{6}$ to $\frac{1}{5}$ the length from snout to vent.

Brown or orange above, sometimes speckled and spotted with black; a black streak on the canthus rostralis and along the outer border of the glandular lateral fold; a more or less distinct whitish streak from below the eye to the shoulder; no cross-bars on the limbs, but a more or less distinct dark streak along the thigh and the tibia. Lower parts white.

Male without secondary sexual characters.

Nasal bones narrow, widely separated from each other and from the frontoparietals; only a small part of the ethmoid exposed; zygomatic branch of squamosal long, extending to below the eye.

Measurements, in Millimeters, of the types.

	♂	♀	♀
From snout to vent.....	56	80	74
Head.....	19	25	23
Width of head.....	20	26	25
Snout.....	7	10	9
Eye.....	7	9	8
Interorbital width.....	3.5	5.5	6
Tympanum.....	4	5	5.5
Fore limb.....	35	51	43
1st finger.....	5.5	10	9
2nd ".....	5	9	8
3rd ".....	6.5	12	11
4th ".....	5	9	8
Hind limb.....	87	122	113
Tibia.....	26	38	34
Foot.....	27	41	37
3rd toe.....	13	23	21
4th ".....	21	33	29
5th ".....	13	24	21

Habitat.—Rio Sucio, Costa Rica.

This frog strikingly resembles some specimens of the African *R. galamensis*.—another example of parallelism between New and Old World species, as close genetic relationship can hardly be postulated to account for this resemblance.

I cannot help thinking that *R. godmani* will some day prove to be identical with *Levirana vibicaria*, Cope. Except for the presence of feebly developed vomerine teeth, the longer inner finger and the more

extensive web between the toes, in the former, there is almost complete agreement between the descriptions of the two, which are from the same part of Costa Rica.

Cope's description is here reproduced:—

“Identical with *Ranula* but without vomerine teeth. Form robust, muzzle short, wide; hind limbs rather short, the heel reaching to the front of the eye. Canthus rostralis strongly marked, angulated at the nostril, anterior to which it is deflected to the apex, which does not project beyond the lip-border. Loreal region slightly concave; nostril nearly on canthus, .6 the length of the muzzle anterior to the orbit. Tympanum drum subround, about .7 the diameter of the eye-slit. Choanæ rather small, about equal to ostia pharyngea. Tongue large, obovate, deeply emarginate posteriorly. Digits with slight terminal enlargements, those of the fingers scarcely distinct, those of the toes supported by elongate T-shaped phalanges. Second (first) finger a little shorter than third (second); inferior tubercles inconspicuous. Toes half-webbed, fourth digit with three, the others with two free phalanges. Sole with one tubercle, the flat oval prae-hallax. Integument smooth everywhere. A wide glandular body connecting rictus oris and humerus; a glandular thickening extending from orbit to end of urostyle, which ¹⁴ is unusually wide between the orbit and the sacrum. No dermal folds.

Color above a dark olivaceous gray; side of head and a stripe from orbit to urostyle, black. Two rows of small black spots on each side of the vertebral column. Superior side of limbs colored like the back. Inferior surfaces of the body yellowish, more distinctly yellow on inferior surfaces of hind limbs. Concealed surfaces of femur with a reddish tinge, unspotted. Superior face of femur with a black stripe on the distal half. Lips unspotted, with a dark shaded border.

Length of head and body 65 mm.; length of head to rictus oris, 21 mm.; width of head at rictus oris, 25 mm.; length of fore limb, 40 mm.; of head 15 mm.; length of hind limb 101 mm.; of hind foot, 49 mm.; of astragalo-calcaneum, 16 mm.”

Rancho Rodondo, on the divide of the Irazu Range, and Isla Nueva, near the head of the Rio Sucio, on the Atlantic side.

¹⁴ The glandular thickening.—G. A. B.

16. *Rana areolata*.

Rana areolata BAIRD AND GIR., Proc. Ac. Philad., 1852, p. 173; BAIRD, Rep. U. S. Mex. Bound. Surv., Rept., Pl. XXXVI, figs. 11, 12 (1859); BOULENG., Cat. Batr., Ecaud., p. 41 (1882); COPE, Proc. Am. Philos. Soc., XXIII, 1886, p. 517, and Batr. N. Am., p. 412, figs. (1889); DICKERSON, Frog Book, p. 192, Pl. LXXIII (1906); HURTER, Tr. Ac. St. Louis, XX, 1911, p. 115; BOULENG., Ann. and Mag. N. H. (9) III, 1919, p. 411.

Rana capito LECONTE, Proc. Ac. Philad., 1855, p. 425, Pl. v; BOULENG., Cat., p. 34, and Ann. and Mag. N. H. t. c.

Rana circulosa RICE AND DAVIS, in Jordan, Man. Vert. E. N. Am., 2d ed., p. 355 (1878).

Rana areolata aesopus COPE, t. c., p. 517, and op. cit., p. 412, figs.

Rana areolata capito COPE, t. c., p. 518, and op. cit., p. 415.

Rana areolata circulosa COPE, t. c., p. 518, and op. cit., p. 413, figs.

Rana aesopus DICKERSON, op. cit., p. 193, Pl. XIV, fig. 3, and Pl. LXXIV; Deckert, Copeia, No. 80, 1920, p. 26.

Vomerine teeth in short slightly oblique series close together between the choanæ or extending a little beyond the level of their posterior borders.

Head large, $2\frac{2}{3}$ to 3 times in length to vent, as long as broad or a little broader than long, much depressed; snout rounded, not or but feebly projecting beyond the mouth, longer than the eye, which is large and prominent; canthus rostralis indistinct or obtuse; loreal region oblique, concave; nostril equidistant from the eye and from the tip of the snout; distance between the nostrils greater than the interorbital width, which is equal to or a little less than that of the upper eyelid; tympanum very distinct, $\frac{3}{5}$ to $\frac{4}{5}$ the diameter of the eye, 2 to 3 times its distance from the latter.

Fingers moderate, obtusely pointed, first longer than the second, third as long as the snout or a little longer or a little shorter; subarticular tubercles small, feebly prominent.

Hind limb rather short, the tibio-tarsal articulation reaching the eye or a little beyond, the heels meeting when the limbs are folded at right angles to the body; tibia $3\frac{1}{2}$ to 4 times as long as broad, $1\frac{3}{4}$ to slightly over 2 times in the length of head and body, as long as or a little shorter than the fore limb or the foot. Toes rather long, obtusely pointed, $\frac{1}{2}$ webbed, $2\frac{1}{2}$ or 3 phalanges of fourth and $1\frac{1}{2}$ or 2 of third and fifth free, the outer metatarsals bound together in their basal half or third; subarticular tubercles small, moderately prominent; no tarsal

fold; inner metatarsal tubercle elliptic, prominent, $\frac{2}{5}$ to $\frac{3}{5}$ the length of the inner toe; outer tubercle very small or absent.

Skin of back smooth or rough with elongate warts, or with narrow glandular folds; a rather broad glandular dorso-lateral fold from above the tympanum to the groin; the distance between the folds, on the back, $\frac{1}{5}$ to $\frac{1}{4}$ the length of head and body; sides somewhat corrugated and pustular, or with elongate glandules. Lower parts smooth, or posterior part of belly and thighs feebly granulate.

Upper parts brownish olive, minutely and obsoletely mottled with lighter, with numerous dark brown round blotches edged with yellowish or with yellowish centers; or pale yellow so thickly covered with large reddish brown spots as to reduce the ground-color to a network; glandular dorso-lateral folds yellowish; a white spot in the center of the tympanum; hind limbs with dark cross-bands, the interspaces between them sometimes very narrow. Lower parts pale yellow or white.

Male with external vocal sacs, forming loose folds above the arm; fore limb moderately thickened; a moderately strong pad on the inner side of the first finger.

The above description of the typical *R. areolata* is taken from a large male from Illinois, received from the Museum of Comparative Zoölogy, and a half-grown individual from Hitchcock, Texas, received from the American Museum; in its compilation I have also made use of the works quoted in the synonymy, the excellent photographs in Miss Dickerson's book having been particularly useful.

Of the frog known as *R. asopus*, I have had a larger material and also the privilege of seeing it alive. It differs in the rather larger head, $2\frac{1}{2}$ to $2\frac{6}{7}$ times in length to vent, always broader than long, the snout sometimes not longer than the eye; the tibio-tarsal articulation reaches the tympanum or the eye, the tibia is 3 to $3\frac{1}{2}$ times as long as broad and up to $2\frac{1}{4}$ times in length from snout to vent; the dorso-lateral fold is usually very broad.

Pale brown or gray above, the dorso-lateral folds pale yellow or orange, speckled with blackish and with numerous round dark brown or blackish spots on the head and body; tympanum reddish brown, with a white central spot; limbs with dark cross-bands, which are much narrower than the spaces between them. Lower parts white, spotted or vermiculate with brown on the throat and breast.

Nasal bones small and widely separated from each other and from the frontoparietals, which leave the ethmoid uncovered in front; zygomatic branch of squamosal long, extending to below the eye.

I have regarded this *R. æsopus* as specifically distinct from *R. areolata*, under the name of *R. capito*. There can be no question that Leconte's figure agrees with *R. æsopus* as defined by Cope and not with *R. areolata*; however, Dr. Barbour has recently informed me that Dr. Stejneger, having at his request reëxamined the type of *R. capito*, and compared it with the types of *R. areolata* and *R. æsopus*, states it to be unquestionably the same as *R. areolata* and not *R. æsopus*. I submit of course to Dr. Stejneger's verdict, but considering the state of things resulting from it, it seems to me that a strict definition of the species is an impossibility and I have therefore restored *R. æsopus* to the rank of a subspecies or variety of *R. areolata*, assigned to it by its original describer.

The larva of *R. areolata* is still unknown.

Measurements in Millimeters.

	Forma typica				var. <i>æsopus</i> .							
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
	♂	♂	♀	♀	♀	♀	♀	♀	♀	♂	♂	♀
From snout to vent.....	100	73	95	77	93	85	84	68	82	88	80	91
Head.....	33	30	34	30	34	31	30	26	30	31	30	33
Width of head.....	35	33	41	33	41	35	36	29	36	38	36	41
Snout.....	12	10	12	11	12	13	13	10	12	12	11	12
Eye.....	9	10	11	9	10	9	9	8	10	9	9	11
Interorbital width.....	4	4	5	4	5	5	5	4	5		4	4
Tympanum.....	7	7	8	6	7	7	7	6	7	7	6	8
Fore limb.....	55	42	47	37	51	47	46	36	45	50	43	50
1st finger.....	11	8	11	10	12	10	10	7	11	10	9	9
2nd ".....	10	7	8	8	10	8.5	8.5	6	8	9	8	7
3rd ".....	12	9	13	10	13	11	11	9	11	13	10	11
4th ".....	8	5	6	6	6	6	7	5	7	7	6	5
Hind limb.....	145	100	136	116	134	122	126	102	120	132	110	122
Tibia.....	47	34	45	37	42	40	40	33	40	40	35	41
Foot.....	47	34	45	39	45	39	41	33	42	45	37	43
3rd toe.....	26	15	21	18	20	19	19	16	19	21	17	21
4th ".....	40	25	33	28	33	30	31	27	32	34	26	33
5th ".....	25	14	20	17	23	19	20	16	20	21	16	?

1. Cathoun, Richland Co., Illinois.—2-3. Tarpon Springs, Florida.—4. Fort Meade, Florida.—5-8. Orlando, Florida.—9. Crescent City, Florida.—10-11. Near West Palm Beach, Florida.—12. Florida.

Habitat.—The typical form is known from Indiana, Illinois, Georgia and Texas; the var. *æsopus* from Florida. R. F. Deckert (l. c.) records

true *æsopus* from Hampton Co., North Carolina, but makes no mention of having compared his specimen with the forma typica (*areolata*), which might be expected to occur in both the Carolinas.

17. *Rana tarahumaræ*.

Rana tarahumaræ BOULENG., Ann. and Mag. N. H. (8) XX, 1917, p. 416, and (9) III, 1919, p. 411.

Vomerine teeth in small groups close together behind the level of the choanæ.

Head broader than long, much depressed; snout rounded, feebly projecting beyond the mouth, as long as the eye; canthus rostralis indistinct; loreal region very oblique, slightly concave; nostril equidistant from the eye and from the tip of the snout; distance between the nostrils equal to the interorbital width, which is equal to or a little less than that of the upper eyelid; tympanum distinct, without or with a few small asperities, $\frac{2}{3}$ to $\frac{1}{2}$ the diameter of the eye, once to once and a half its distance from the latter.

Fingers moderate, the tips feebly swollen, first longer than the second, third longer than the snout; subarticular tubercles large, prominent.

Hind limb long, the tibio-tarsal articulation reaching the tip of the snout, the heels meeting when the limbs are folded at right angles to the body; tibia 4 to $4\frac{1}{2}$ times as long as broad, $1\frac{5}{8}$ to 2 times in length from snout to vent, shorter than the fore limb, as long as or slightly longer or shorter than the foot. Toes with the tips swollen into small disks, the base of which is involved in the very broad web; outer metatarsals separated nearly to the base; subarticular tubercles rather large and prominent; no tarsal fold; inner metatarsal tubercle elliptic, feebly prominent, $\frac{1}{3}$ to $\frac{2}{3}$ the length of the inner toe; no outer tubercle.

Skin smooth, or upper parts with small pustules; a feeble, curved glandular fold from the eye to the shoulder.

Brown or olive above, with small blackish spots or numerous dots; limbs with irregular dark cross-bars; lower parts white, uniform on throat, breast, and limbs mottled with grayish brown.

Male without vocal sacs, with a thick blackish pad on the inner side of the first finger.

Nasal bones small and widely separated from each other and from the frontoparietals.

Habitat.—Sierra Tarahumare, N. W. Mexico, about 3000 feet altitude.

Measurements of type specimens in Millimeters

	1.	2.	3.	4.	5.	6
	♂	♀	♀	♀	♂	♀
From snout to vent.....	73	77	65	58	61	45
Head.....	25	25	21	20	21	16
Width of head.....	30	29	24	23	23	17
Snout.....	9	9	8	7.5	8	6
Eye.....	9	9	8	7.5	8	6
Interorbital width.....	4	4	3.5	3.5	3.5	2.5
Tympanum.....	4.5	4.5	3.5	3	3.5	2.5
Fore limb.....	47	45	40	36	40	30
1st finger.....	10	10	9	8	9	7
2nd ".....	9	9	8	7	8	6
3rd ".....	11.5	11	10	9	9.5	8
4th ".....	8	8	7	6	7	5
Hind limb.....	125	122	104	98	103	74
Tibia.....	40	39	32	29	31	24
Foot.....	40	38	32	31	32	25
3rd toe.....	22	21	18	17	18	13
4th ".....	33	31	27	26	27	20
5th ".....	25	25	22	21	22	16

1-4. Iquiro.—5-6. Barranca del Cobre.

This species is very closely allied to *R. boylii*, differing in the larger eye, the more oblique loreal region, the more distinct tympanum, the shorter tibia, and the absence of vocal sacs.

18. *Rana boylii*.

Rana boylii BAIRD, Proc. Ac. Philad., 1854, p. 62, and Rep. U. S. Explor. Surv., XII, ii, Pl. XXIX, figs. 2, 3 (1860); COPE, N. Am. Batr., p. 444, figs. (1889); STEJNEG., N. Am. Faun. No. 7, p. 226 (1893); DICKERSON, Frog Book, p. 221, Pl. II, fig. 7, and Pl. LXXXIV, figs. 1-3 (1906); CAMP, Univ. Calif. Publ. Zool., XVII, 1917, p. 117; BOULENG., Ann and Mag. N. H. (9) III, 1919, p. 411.

Rana pachyderma COPE, Proc. Ac. Philad., 1883, p. 25.

Rana boylii muscosa CAMP, t. c., p. 118.

Rana boylii sierræ CAMP, t. c., p. 120.

Vomerine teeth in very feeble groups or oblique series close together between or extending behind the level of the choanæ, sometimes very indistinct.

Head broader than long, much depressed; snout rounded, feebly projecting beyond the mouth, as long as the eye or a little shorter; canthus rostralis obtuse; loreal region moderately oblique, concave; eye rather small; nostril equidistant from the eye and from the tip of the snout; distance between the nostril, equal to the interorbital width, which is equal to or slightly less than that of the upper eyelid; tympanum feebly distinct, ill-defined, with small asperities as on the neighboring region, $\frac{2}{5}$ to $\frac{1}{2}$ the diameter of the eye, once to twice its distance from the latter.

Fingers moderate, the tips feebly swollen, first longer than the second (exceptionally first and second equal), third longer than the snout; subarticular tubercles moderate or rather large, prominent.

Hind limb long, the tibio-tarsal articulation reaching the tip of the snout or beyond, the heels overlapping when the limbs are folded at right angles to the body; tibia 4 to 6 times as long as broad, $1\frac{3}{5}$ to $1\frac{4}{5}$ times in length from snout to vent, shorter than the fore limb, as long as or a little longer than the foot. Toes with the tips swollen into small disks, the base of which is involved in the very broad web; outer metatarsals separated nearly to the base; subarticular tubercles rather large and prominent; no tarsal fold; inner metatarsal tubercle oval or elliptic, $\frac{2}{5}$ to $\frac{3}{5}$ the length of the inner toe; a round outer metatarsal tubercle.

Skin of upper parts more or less granular, pustular, and porous, sprinkled all over with small horny granules, often with large porous warts on the sides; dorso-lateral fold, if distinct, very broad and flat and confined to the anterior half of the body; a fold from the eye to the shoulder; one or two large glands behind the angle of the mouth; lower parts smooth, except the hinder half of the thighs which is covered with flat granules, some of which show a more or less distinct large central pore or pit.

Grayish brown to dark olive brown above (sometimes brick, and according to Miss Dickerson), usually with a dark cross-band between the eyes, numerous small darker spots on the body and more or less distinct dark cross-bands on the limbs; upper surface of snout sometimes paler than the rest of the head; often an oblique light streak below the eye; hinder side of thighs yellow, spotted or marbled with black; web between the toes yellow. Lower parts white in front and yellow behind, throat often mottled or spotted with blackish.

Male with internal vocal sacs, with very strong fore limbs and a thick pad, covered with a brown horny layer, on the inner side of the first finger.

Eggs nearly entirely black, measuring 2 millimeters in diameter.

Nasal bones small and widely separated from each other and from the frontoparietals; ethmoid exposed and obtusely pointed in front; zygomatic process of squamosal very short. Pectoral arch as in *R. temporaria*. Terminal phalanges feebly expanded distally.

Measurements in Millimeters

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
	♂	♂	♂	♂	♀	♀	♀	♀	♀	♀	♀	♀
From snout to vent.....	55	53	49	47	63	63	50	58	57	46	42	40
Head.....	19	18	17	16	20	20	16	20	20	15	15	14
Width of head.....	22	20	19	18	24	24	19	23	25	18	17	16
Snout.....	6	6	5.5	5	6.5	7	5.5	6	6	5	5	4.5
Eye.....	6	6	5.5	6	6.5	7	5.5	6	6	5	5	4.5
Interorbital width.....	3.5	4	3.5	3.5	4	4.5	3.5	4	4	3.5	3	3
Tympanum.....	3	3	2.5	2.5	3.5	3.5	2.5	3	3	2	3	3
Fore limb.....	38	37	35	33	40	41	31	37	40	29	27	25
1st finger.....	7	7	6	6	9	8	7	7	8	6	6	5
2nd ".....	6	6	5	5	8	7.5	6	6	7	5	5.5	5
3rd ".....	10	9	8	8	10	9	8	9	10	8	8	8
4th ".....	6	6	5	5	7	6	5	6	7	5	5	4.5
Hind limbs.....	110	101	87	86	111	116	84	101	107	77	78	72
Tibia.....	36	34	28	27	36	38	29	34	35	25	26	23
Foot.....	35	32	27	27	35	34	26	32	33	25	24	22
3rd toe.....	20	18	15	15	20	19	15	17	19	14	13	12
4th ".....	30	27	23	23	29	29	22	26	28	21	20	18
5th ".....	23	20	18	18	23	21	16	19	22	15	14	13

1-7. Palo Alto.—8. Mt. Diablo.—9. Camp Taylor, Marion Co.—10. L. Tahoe.—11-12. Mill Valley.

Habitat.—Oregon and California, up to 11,500 feet altitude.

19. ***Rana pustulosa*.**

Rana pustulosa BOULENG., Ann. and Mag. N. H. (5) XI, 1883, p. 343; GÜNTHER., Biol. C.-Am., Rept. p. 202, Pl. LXI, fig. 2 (1900); BOULENG., Ann. and Mag. N. H. (9) III, 1919, p. 411.

Vomerine teeth in short oblique series extending beyond the level of the posterior borders of the choanæ, nearer to each other than to the latter.

Head broader than long, rather strongly depressed; snout rounded, feebly projecting beyond the mouth, as long as the eye; canthus rostralis distinct; loreal region moderately oblique and deeply con-

cave; nostril a little nearer the tip of the snout than the eye; distance between the nostrils equal to the interorbital width or to the upper eyelid; tympanum very distinct, $\frac{3}{5}$ the diameter of the eye, from which it is separated by an equal distance.

Fingers moderate, the tips swollen, first longer than the second, third longer than the snout; subarticular tubercles large, prominent.

Hind limb long, the tibio-tarsal articulation reaching the tip of the snout, the heels overlapping when the limbs are folded at right angles to the body; tibia 4 times as long as broad, $1\frac{3}{4}$ times in length from snout to vent, a little shorter than the fore limb, a little longer than the foot. Toes with the tips swollen into small disks, webbed to the tips; outer metatarsals separated nearly to the base; subarticular tubercles rather large and prominent; no tarsal fold; inner metatarsal tubercle oval, $\frac{2}{5}$ the length of the inner toe; no outer tubercle.

Upper parts covered with small pustules; a strong glandular fold from the eye to the shoulder, the upper branch continued as a moderately prominent narrow dorso-lateral fold extending to the hip; the distance between the dorso-lateral folds, or the back, $3\frac{1}{2}$ times in length from snout to vent; lower parts smooth. Olive above, with rather indistinct blackish spots; flanks marbled with blackish and whitish; hinder side of thighs blackish, marbled with gray. Lower parts whitish, the throat and breast soiled with gray.

Male unknown.

Measurements of type specimens.

From snout to vent.....	106 mm.
Head.....	35
Width of head.....	41
Snout.....	12
Eye.....	12
Interorbital width.....	8
Tympanum.....	7
Fore limb.....	63
1st finger.....	15
2nd ".....	13
3rd ".....	16
4th ".....	11
Hind limb.....	188
Tibia.....	60
Foot.....	57
3rd toe.....	32
4th ".....	49
5th ".....	38

This species is known from a single female specimen from Ventanas in Durango, Mexico. It is nearly allied to *R. palmipes*.

20. *Rana palmipes*.

Rana palmipes SPIX, Nov. Spec. Test. Ran. Bras., p. 5, Pl. v, fig. 1 (1824); PETERS, Mon. Berl. Ac. 1872, p. 205, and 1873, p. 622; BOULENG., Cat. Batr. Ecaud., p. 48 (1882), Ann. and Mag. N. H. (6) II, 1888, p. 40, and VIII, 1891, p. 453; GÜNTHER., Biol. C.-Am., Rept., p. 202 (1900); BOULENG., Proc. Zool. Soc. 1913, p. 1026, and Ann. and Mag. N. H. (9) III, 1919, p. 412; NOBLE, Bull. Amer. Mus. N. H. XXXVIII, 1918, p. 316, Pl. xiv.

Rana juninensis TSCHUDI, Faun. Per., Herp., p. 64 (1845).

Ranula gollmeri PETERS, Mon. Berl. Ac. 1859, p. 402.

Rana affinis PETERS, l. c., and 1871, p. 402.

Rana clamata var. *guianensis* PETERS, Mon. Berl. Ac. 1863, p. 412.

Ranula affinis COPE, Proc. Ac. Philad., 1866, p. 130, and 1868, p. 117; SUMICHRAST, Bull. Soc. Zool. France, 1880, p. 189.

Pohlia palmipes STEIND., Novara, Amph., p. 15, Pl. I, fig. 5 (1867); GÜNTHER., Zool. Rec., IV, p. 147 (1867).

Ranula brevipalmata COPE, Proc. Ac. Philad., 1874, p. 131.

Ranula nigriratus COPE, l. c.

Rana vaillanti BROCCHI, Bull. Soc. Philom. (7) I, 1877, p. 175, and Miss. Sc. Mex., Batr., p. 11, Pl. II, fig. 1 (1882).

Hylarana brevipalmata BROCCHI, op. cit., p. 65.

Rana copii BOULENG., Cat. Batr. Ecaud., p. 49.

Rana nigrilatus BOULENG., l. c.

Ranula palmipes COPE, Bull. U. S. Nat. Mus., No. 32, 1887, p. 19.

Rana bonaccana GÜNTHER., Biol. C.-Am., Rept., p. 201, Pl. LX, fig. B (1900).

Rana melanosoma GÜNTHER., op. cit., p. 203, Pl. LXIII, fig. B.

Rana brevipalmata FOWLER, Proc. Ac. Philad., 1913, p. 166, Pl. IX.

Rana brevipalmata rhoadsi FOWLER, l. c.

Vomerine teeth in small oblique groups or short transverse or oblique series between the choanæ or on a level with the posterior borders of the latter, equally distant from each other and from the choanæ or nearer to each other.

Head as long as broad or a little broader than long, rather strongly depressed; snout rounded or obtusely pointed, projecting beyond the mouth, as long as or longer than the eye, which is large and very prominent; canthus rostralis distinct; loreal region moderately oblique, concave; nostril equally distant from the eye and from the tip of the snout, or a little nearer the latter; distance between the nostrils equal to or a little greater than the interorbital width, which is equal

to or a little less than that of the upper eyelid; tympanum very distinct, $\frac{1}{2}$ to $\frac{5}{8}$ the diameter of the eye, $1\frac{1}{2}$ to 4 times its distance from the latter.

Fingers moderate, obtuse, or rather pointed, with more or less distinct lateral dermal border, first longer than the second, third as long as or longer than the snout; subarticular tubercle rather small, feebly prominent.

Hind limb moderate or long, the tibio-tarsal articulation reaching the eye, the tip of the snout, or between these two points, the heels overlapping when the limbs are folded at right angles to the body; tibia $3\frac{1}{2}$ to 5 times as long as broad, $1\frac{3}{4}$ to $2\frac{1}{9}$ times in length from snout to vent, as long as or shorter than the fore limbs, as long as or a little longer (rarely a little shorter) than the foot. Toes with the tips swollen into very small disks, webbed to the tips, on two phalanges of fourth free; outer metatarsals separated nearly to the base; subarticular tubercles rather small, feebly prominent; no tarsal fold; inner metatarsal tubercle elliptic; feebly prominent, $\frac{1}{4}$ to $\frac{1}{2}$ the length of the inner toe; no outer tubercle.

Upper parts smooth or granular with small pearl-like tubercles; a strong glandular fold from the eye to the shoulder, the upper branch continued as a narrow or moderately broad dorso-lateral fold extending to the hip or not quite so far; the distance between the dorso-lateral folds, on the back, 4 to $5\frac{1}{2}$ times in length from snout to vent; a more or less distinct glandular fold, often broken up posteriorly, from below the eye to above the arm; tibia often with narrow glandular folds. Lower parts smooth.

Green, olive, gray, or brown above, sometimes green in front and brown behind, uniform or with small blackish specks or spots; the dorso-lateral fold sometimes lighter and edged with dark brown on the outer side; loreal and temporal regions often dark brown, with a light streak below; the tympanum sometimes reddish brown; hind limbs with or without more or less regular dark cross-bands; hinder side of thighs often marbled with black and yellow. Lower parts white, uniform or spotted or marbled with brown, the throat sometimes entirely brown.

Male with internal vocal sacs and a large pad on the inner side of the first finger, covered, during the breeding season, with a brown velvety horny layer.

Nasal bones small, oblique, widely separated from each other and from the frontoparietals; ethmoid largely exposed above, truncate or obtusely pointed in front and extending or not to between the nasals;

zygomatic process of squamosal larger than the posterior; terminal phalanges feebly expanded at the end.

Tadpole large and very similar to that of *R. catesbiana* in form and general appearance, but mouth larger with the series of horny teeth more numerous, viz. 3 short series on each side behind the long marginal upper series and 4 lower series, the innermost narrowly interrupted in the middle; beak narrowly edged with black.

Habitat.—Central and South America, from southern Mexico to Pernambuco and Peru.

This frog is interesting as the only representative of the genus *Rana* in South America. Few species have been more misunderstood and have given rise to more discussion than this *R. palmipes*, originally described from the Amazonian region of Brazil.

It has been made the type of a distinct genus (*Ranula*, *Pohlia*) by Peters and by Steindachner, and even referred to the Hylidæ by Günther (1867). Peters founded the genus *Ranula* on the feeble dentition: "Die Zähne des Oberkiefers sind so schwach und wenig zahlreich dass man sie erst bei genauer Untersuchung findet und am Gaumen fehlen sie ganz." The explanation is that *Ranula gollmeri* was described from a recently transformed young, from Caracas, measuring 50 mm. from snout to vent; of this I feel sure, having examined young from Pebas of exactly the same size with a short tail and toothless upper jaw. A second, larger specimen, also from Caracas, was described at the same time by Peters as *Rana affinis*, and regarded as so closely related to *R. temporaria* that it should perhaps rank as a local variety only. A little later, however, Peters recognized that the two supposed species were identical and correctly referred them to *R. palmipes*. In 1866, Cope took up the genus *Ranula* and defined it as the American representative of *Hylorana*, differing in the "important particulars of the incompleteness of the ethmoid arch, its superior plate being represented by cartilage." Cope, who maintained the definition up to the close of his labors, can only have examined young specimens, for in the adult the ethmoid is ossified exactly as in *Rana temporaria*.

Schlegel, Tschudi, and Duméril and Bibron referred *R. palmipes* to the synonymy of *R. esculenta*; Peters described another specimen as a variety of *R. clamitans*; Brocchi's *R. vaillanti* was described as allied to *R. mugiens*; whilst Günther (1900), overlooking the small terminal discs of the toes, compared his *R. bonaccana* to *R. clamitans* and *R. draytonii*.

Rana palmipes.*Measurements in Millimeters.*

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.
	♂	♀	♀	♀	♀	♀	♀	♀	♀	♂	♀	♂	♂	♂	♀
From snout to vent.....	56	73	65	57	103	96	78	66	60	52	63	68	67	57	110
Head.....	20	25	23	20	39	37	30	23	21	18	21	24	24	20	36
Width of head.....	20	25	23	20	39	38	31	23	21	18	21	24	24	20	42
Snout.....	7	10	8	7	17	15	10	9	7.5	6.5	7	9	9	7	13
Eye.....	7	8	8	7	12	12	9	8	7.5	6.5	7	9	9	7	11
Interorbital width.....	4	4	4	4	8	8	6	4	4	3.5	3.5	5	5	3.5	8
Tympanum.....	4.5	4.5	4	5	10	9	7	6	4.5	4	4	5	5	4	9
Fore limb.....	35	40	38	34	59	57	48	43	36	35	36	43	44	38	60
1st finger.....	8	9	9	9	15	14	10	9	8	7	9	8	8	7	17
2nd ".....	7	8	8	8	13	12	9	8	7	6	7.5	7	7	6	15
3rd ".....	9	11	11	10	16	16	13	11	10	9	10	10	11	9	20
4th ".....	6	7	7	7	14	13	10	8	7	6	7	6	8	7	15
Hind limb.....	88	123	114	96	172	163	136	107	91	87	100	113	118	100	180
Tibia.....	29	42	37	30	53	52	42	35	29	27	32	36	38	32	55
Foot.....	29	37	35	30	53	52	43	36	30	27	32	36	38	32	57
3rd toe.....	17	23	20	18	31	29	25	21	18	15	18	19	22	18	32
4th ".....	24	31	30	26	47	45	37	30	26	23	26	29	32	26	51
5th ".....	19	24	21	20	36	32	27	21	20	16	20	22	23	20	38

1. Cuernavaca, Mexico.—2-3. Tequasixtlan, Tehuantepec.—4. Vera Paz.—5-9. Bonacca Id., Yucatan (types of *R. bonaccana*).—10. Lanquin, Guatemala.—11. Duenas, Guatemala (type of *R. melanosoma*).—12-14. Hacienda Rosa de Jericho, Nicaragua (types of *R. melanosoma*).—15. Belize, Honduras (type of *R. vaillanti*).

Rana palmipes.*Measurements in Millimeters.*

	16.	17.	18.	19.	20.	21.	22.	23.	24.	25.	26.	27.	28.	29.	30.
	♂	♀	♀	♀	♀	♂	♀	♀	♀	♀	♀	♀	♀	♀	♀
From snout to vent....	51	62	96	95	70	87	93	92	76	51	52	95	59	53	113
Head.....	20	23	34	34	25	30	34	26	27	20	20	34	21	20	40
Width of head.....	20	23	34	34	25	30	34	27	30	20	20	35	21	20	44
Snout.....	7	10	14	14	10	13	14	13	11	7	7	14	8	7	17
Eye.....	7	8	11	11	9	11	11	11	10	7	7	11	8	7	12
Interorbital width.....	3.5	5	7	7	5	6	7	6	6	4	4	7	5	4	11
Tympanum.....	5	6	8	9	6	8	9	8	7	5	5	9	5	4	10
Fore limb.....	33	35	55	53	41	53	55	57	47	31	30	55	35	32	64
1st finger.....	8	9	13	13	10	13	13	14	10	8	7	14	9	8	16
2nd ".....	7	8	10	10	9	10	11	11	9	7	6	11	8	7	14
3rd ".....	10	10	15	15	11	14	16	15	14	9	9	15	11	10	19
4th ".....	7	8	10	10	8	9	10	10	9	6	5	10	8	7	14
Hind limb.....	84	100	159	155	113	141	163	170	120	82	82	143	89	85	185
Tibia.....	26	32	49	49	35	44	50	48	39	25	25	45	29	27	58
Foot.....	27	33	49	49	36	45	50	53	39	27	26	47	30	27	60
3rd toe.....	15	18	29	26	22	25	30	29	22	16	15	27	18	16	33
4th ".....	23	28	43	43	32	39	45	44	33	24	23	40	26	24	52
5th ".....	17	20	31	30	23	29	31	31	26	18	17	30	20	19	38

16. San Ramon, Nicaragua.—17. Tung District, Brit. Guiana.—18-20. R. Condoto, Choco, S. W. Colombia.—21-22. Salidero, N. W. Ecuador.—23. Carandelot, N. W. Ecuador.—24-25. Canelos, E. Ecuador.—26. Sarayaca, E. Ecuador.—27-29. Pebas, Peru.—30. Yakurayo, Peru.

21. *Rana cæruleopunctata*.

Rana cæruleopunctata STEIND., Verh. Zool.-bot., Ges. Wien, XIV, 1864, p. 264, Pl. xv, fig. 1; BOULENG., Cat. Batr. Ecaud., p. 50 (1882); GÜNTHER, Biol. C.-Am., Rept., p. 205 (1900); BOULENG., Ann. and Mag. N. H. (9), III, 1919, p. 412; NOBLE, Bull. Amer. Mus. N. H. XXXVIII, 1918, p. 318.

Ranula cæruleopunctata COPE, Proc. Ac. Philad., 1866, p. 130.

Ranula chrysoprasina COPE, l. c.

Hylarana cæruleopunctata STEIND., Novara, Amph., p. 48 (1867).

Trypheroopsis chrysoprasinus COPE, Proc. Ac. Philad., 1868, p. 117, and Journ. Ac. Philad., (2) VIII, 1876, p. 114, Pl. xxiii, fig. 12.

Hylarana chrysoprasina BROCCI, Min. Sc. Mex., Batr. p. 65 (1882).

Rana chrysoprasina BOULENG., op. cit., p. 49.

Vomerine teeth in oblique groups or short series between the choanæ and extending beyond the level of the posterior borders of the latter or entirely behind them, equally distant from each other and from the choanæ or nearer each other; sometimes very indistinct.

Head as long as broad or a little longer than broad, much depressed; snout rounded or obtusely pointed, moderately or feebly projecting beyond the mouth, as long as the eye; canthus rostralis strong; loreal region vertical or nearly so, slightly concave; nostril a little nearer the tip of the snout than the eye; distance between the nostrils greater than the interorbital width which is equal to or a little less than that of the upper eyelid; tympanum very distinct, $\frac{1}{2}$ to $\frac{2}{3}$ the diameter of the eye, $1\frac{1}{2}$ to 3 times its distance from the latter.

Fingers moderate, the tips swollen, first longer than the second, third longer than the snout; subarticular tubercles large, prominent.

Hind limb moderately long, the tibio-tarsal articulation reaching the eye or between the eye and the tip of the snout, the heels strongly overlapping where the limbs are folded at right angles to the body; tibia 5 to 6 times as long as broad, $1\frac{2}{3}$ to 2 times in length from snout to vent, shorter than the fore limb, as long as or a little longer than the foot. Toes with the tips divided into small disks, $\frac{2}{3}$ to $\frac{3}{4}$ webbed, the web reaching the disks of the third and fifth but leaving 2 or 3 phalanges of fourth free; outer metatarsals separated nearly to the base; subarticular tubercles moderate; no tarsal fold; inner metatarsal tubercle oval or elliptic, $\frac{1}{4}$ to $\frac{2}{5}$ the length of the inner toe; a round outer tubercle.

Skin smooth or finely granulate above, or with pearl-like tubercles on the posterior part of the back; a narrow glandular dorso-lateral

fold from above the tympanum to the groin, the distance between the two folds, on the back, $\frac{1}{6}$ to $\frac{1}{5}$ the length from snout to vent; lower parts smooth.

Grayish or reddish brown above, back uniform or with numerous small irregular bluish green spots; sides of head and body, below the canthus rostralis and the lateral fold, which may be better defined by a light line, darker brown or blackish brown; a white or whitish streak on the upper lip, continued to above the axil; limbs with dark cross-bands; hinder side of thighs black with a few large golden spots; lower parts white, throat and breast often brown or mottled with brown; belly sometimes spotted or marbled with brown.

Male without vocal sacs, with the fore limbs very robust and with a strong pad on the inner side of the first finger.

Nasal bones small, oblique, widely separated from each other and from the frontoparietals; upper part of ethmoid exposed in front. Terminal phalanges with feeble transverse expansion.

Eggs measuring $1\frac{1}{2}$ millimeters in diameter, in females 57 millimeters in length from snout to vent.

Mr. G. K. Noble, Bull. Amer. Mus. N. H. XX XVIII, 1918, p. 318, has raised doubts as to *Ranula chrysoprasina* Cope, 1866, from Costa Rica, being a synonym of *R. cæruleopunctata*, and suggested the possibility of the type, now apparently lost, being an aberrant specimen of *R. palmipes*. Against this we have Cope's statement that the loreal region is vertical, which cannot apply to *R. palmipes*, and that the back of the thigh bears "a few golden spots on a black ground behind," which is highly characteristic of *R. cæruleopunctata*. The web is too short for a *R. palmipes*; "toes fully, not widely palmate, three distal phalanges of fourth free." The apparent contradiction between *fully webbed toes* and *three phalanges of fourth free* is no doubt the result of a misprint: "feebly" should be used for "fully." The British Museum has received large collections from Costa Rica, including specimens of *R. cæruleopunctata*, but no *R. palmipes* was among them.

Habitat.—Nicaragua and Costa Rica, up to 1600 meters.—The types, with which some of our specimens perfectly agree, are preserved in the Vienna Museum, their place of origin unknown.

Measurements in Millimeters

	1.	2.	3.	4.	5.	6.	7.	8.	9.
	♂	♀	♂	♀	♀	♂	♂	♀	♀
From snout to vent.....	39	45	39	56	46	44	41	57	57
Head.....	13	15	13	18	16	15	14	19	19
Width of head.....	11	13	12	18	16	13	13	19	17
Snout.....	5	6	5	6.5	6	6	5.5	6	7
Eye.....	5	6	5	6.5	6	6	5.5	6	7
Interorbital width.....	3	3.5	3	4	4	3.5	3.5	4	4
Tympanum.....	3	3.5	3	4	4	3	3.5	4	4
Fore limb.....	22	27	25	36	30	28	29	36	33
1st finger.....	4.5	6	4.5	7	6	6	5	7	7
2nd ".....	4	5	4	6	5	5	4	6	6
3rd ".....	6	7	6	9	7	7	7	9	8
4th ".....	4	5	4	6	5	5	4	6	6
Hind limb.....	67	70	69	99	70	71	73	101	93
Tibia.....	21	24	22	31	23	22	24	31	29
Foot.....	21	22	20	30	21	22	23	31	29
3rd toe.....	12	12	11	16	12	13	13	17	15
4th ".....	17	18	16	24	17	19	19	26	23
5th ".....	12	12	11	17	12	13	13	18	16

1-2. Bebedero, Costa Rico.—3-5. S. Carlos, Costa Rica.—6-8. La Palma, Costa Rica, 1600 m.—9. Costa Rica.

This species is not without analogy with the Old-World forms connecting the subgenera *Rana* and *Hylorana*; another case of parallelism, according to me.



Boulenger, George Albert. 1920. "A monograph of the American frogs of the genus *Rana*." *Proceedings of the American Academy of Arts and Sciences* 55, 413–480.

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