

A STUDY OF THE GENUS SCAPHIOPUS⁽¹⁾

THE SPADE-FOOT TOADS

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INTRODUCTION

It is a little more than a hundred years since Holbrook, 1836, erected the genus *Scaphiopus* describing *solitarius*, a species found along the Atlantic Coast, as the type of the genus. This species, however, was described the year previously, 1835, by Harlan as *Rana holbrookii*; thus *holbrookii* becomes the accepted name of the genotype. Many species and sub-species have been named since this time, the great majority of them, however, have been considered as synonyms. In this study I have recognized the following species: *holbrookii*, *hurterii*, *couchii*, *bombifrons*, *hammondii*, and *intermontanus*. A variety of *holbrookii*, described by Garman as *albus*, from Key West, Florida, may be a valid form; but since I have had only a specimen or two for study, I have disregarded any discussion of it.

The study of the Scaphiopodidae made by Professor E. D. Cope (1889) has been followed in the main, since it has been most valuable in dealing with the anatomy of the species. In this study Cope proposed that the Spadefoot Toads of the western United States should be placed in a genus *Speca*, which he characterized as follows: "cranial derm free from cranium; the latter generally with a frontoparietal fontanelle; vomerine teeth present; toes webbed; cuneiform process large." The following two species he assigned to the genus: *hammondii* Baird found in the western United States and *multiplicata* Cope found in the Valley of Mexico. Cope also divided the species *hammondii* into three sub-species; those in North Dakota and Oklahoma, westward into the Rocky Mountains, he called *S. h. bombifrons*; those from Walla Walla, Washington, south through Idaho, Nevada and Utah, he separated off as *S. h. intermontana*; and those along the Pacific Coast, from Washington to Lower California and eastward into Texas and Arizona, he considered as *S. h. hammondii*.

(1) Contribution No. 75.

In a number of recent studies^{(2) (3) (4) (5)}, the Spadefoot Toads found within the range of "North Dakota and British Columbia to Oklahoma, Texas and Mexico, west to the Pacific Coast States" have been considered as a single species *Scaphiopus hammondi* Baird. In 1934, Hobart Smith proposed the re-establishment of Cope's *bombifrons* as a valid species, giving as its range western Kansas, Harding County; South Dakota; western Oklahoma; northeastern New Mexico, and Bannock County, Idaho. Since Smith proposed the establishment of *bombifrons* as a species, I have been engaged in a study of specimens taken in the intermountain region, especially in Utah. In making this study I have found it impossible to work out the relationships and distributions of the species under discussion without specimens from various parts of United States. Through the kindness of a number of museums and workers, I have been able to study over five hundred specimens.

In studying these specimens, an examination was made of the cranial structures, cutting spades, appendages and body measurements, color and texture of the skin, and distribution. Tadpoles of several species were studied, but since so little material was available, only a brief reference to this study is included here. Much remains to be done in carefully studying the larval stages of the several species.

From my study of the immature forms, I am convinced that a great deal can be learned concerning the range and relationship of the various species through an investigation of this kind.

I found Drs. Wright's,⁽⁶⁾ Storer's, and Smith's⁽⁷⁾ papers of value in studying the mouth structures of the immature stages.

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(2) Storer, Tracy L., 1925. "A Synopsis of the Amphibia of California," pp. 148-62. Univ. of Calif. Publication in Zoology, Vol. 27.

(3) Slevin, Jos. R., 1928. "The Amphibians of Western North America," pp. 84-87. Occasional Papers, California Acad. of Sci., Vol. 16.

(4) Tanner, Vasco M., 1931. "A Synoptical Study of Utah Amphibia." Utah Acad. of Sciences, Vol. 8, pp. 171-173.

(5) Stejneger, Leonhard, and Barbour, Thomas, 1933. "Check List of North American Amphibians and Reptiles," p. 26.

(6) Wright and Wright, 1933. Handbook of Frogs and Toads, pp. 40-41.

(7) Smith, Hobart M., 1934. "The Amphibians of Kansas," pp. 427-36. American Midland Naturalist, Vol. 15, No. 4.

Stejneger of the U. S. National Museum; Mr. Ross Hardy of the Dixie College for the loan of specimens; Dr. M. Graham Netting of the Carnegie Museum at Pittsburg for suggestions; and James Bee and Harry Chandler, graduate students at the Brigham Young University, for aid in making drawings and labeling illustrations used in this study.

THE GENUS SCAPHIOPUS

There seems to be little justification for Cope's separating the western *hammondii* group of species from the eastern *holbrookii* complex for the founding of the genus *Spca*. It is true that the *hammondii* specimens have "derm distinct from cranium, which is usually only ossified superficially in the superciliary bars," but while this difference, as well as others, exists between the two proposed genera, *Scaphiopus* and *Spca*, there are also many similarities which, in my opinion, hold the species under discussion in one genus. I am, therefore, reluctant to accept Professor Cope's proposal of establishing a genus for the western species, but I do believe that it is of advantage in discussing the genus *Scaphiopus*, to divide it into two sub-genera, *Scaphiopus* and *Spca*. Geographically the sub-genera are fairly distinct, having evolved, it would seem, from a common center of origin near northern Mexico, the sub-genus *Scaphiopus* having radiated into the eastern United States, while the sub-genus *Spca* is found in the western United States. These two sub-genera may be separated as follows:

- A. Parotoid distinct to indistinct. Head length 18.5 mm to 22.5 mm, width between nasal and orbit greater than 5 mm, width between orbits 5-7.4 mm, frontoparietal interorbital space wide, not modified, and with the skin rather tightly attached to the cranium, spade-like process cycle shaped, long 3.9-5.7mm. Species found in eastern and southern states into Texas. Pl. I. Figs. 1-6; Pl. II, Fig. 3; Pl. IIISub-genus *Scaphiopus*
- AA. Parotoid absent. Head length 15.6 mm to 16.5 mm, width between nasal and orbit less than 4 mm, width between the orbits 4 to 4.8 mm, frontoparietal interorbital space narrow, nasal modified by the presence of protuberances or fontanelle or valley without fonta-

nelle. Skin somewhat glandular and loosely attached to the cranium, spade-like process cuueiform, short, 2.9 to 3.5 mm. Species found in the northwestern states into Texas. Pl. I, Figs. 7-12; Pl. II, Fig. 1-2; Pl. III...

.....Sub-genus *Spea*

THE SUB-GENUS SCAPHIOPUS

In the sub-genus *Scaphiopus* the frontoparietal and nasal bones are broad without fossae; the head length and distance between the nasals and orbits is greater than in the sub-genus *Spea*. The color and skin texture is different, being brown to greenish with small uniform tubercles on the back and sides, while the *Spea* group has a blackish color on the back and whitish on the sides and venter with irregular placed and variably sized warts on the head, back, and dorsal portions of the legs. Species of this sub-genus are found in the eastern and southeastern states into Mexico.

The three species assigned to the sub-genus *Scaphiopus* are *holbrookii*, *hurterii*, and *couchii*. These species may be separated as follows:

- A. Pectoral glands present; parotoid and tympanum distinct.
 - b. Head length 18.5 mm, width of head 21.5 mm, body length 50.8 mm, between the nasal and orbit 5.2 mm, color brownish to olive green*holbrookii*
 - bb. Head length 22.3 mm, width of head 25.2 mm, body length 66 mm, between nasal and orbit 5.9 mm, frontoparietal area just back of the eyes elevated, glandular, and with roughened minute round warts. Color yellowish green to grey.....*hurterii*
- AA. No pectoral glands present; parotoid and tympanum indistinct.
 - c. Head length 19.7 mm, width of head 23.3 mm, body length 56.3 mm, between nasal and orbits 5.2 mm, frontoparietal area not elevated or rugose. Skin tuberculate on back, color greenish.....*couchii*

DISCUSSION OF THE SPECIES OF SUB-GENUS SCAPHIOPUS

(1) SCAPHIOPUS HOLBROOKII (Harlan). Solitary Spadefoot

Pl. I, Figs. 1-2; Pl. III

Rana holbrookii Harlan, Med. Phys. Researches, 1835, p. 105.*Scaphiopus solitarius* Holbrook, N. Am. Herp., 1836, Vol. 1, p. 85, Pl. XII.

TYPE LOCALITY: South Carolina.

MEASUREMENTS: The following are measurements in millimeters of five specimens of *Scaphiopus holbrookii* obtained by loan from the U. S. Natural Museum. An average of the measurements of the several specimens reported is included. No general description of the species is given since it is believed that the measurements, keys and illustrations are sufficient for the separation and limitation of the species under discussion.

	1	2	3	4	5	Ave.
Total length of body.....	54.0	52.0	54.0	42.5	51.5	50.8
Length of head.....	20.0	20.0	19.5	15.0	18.0	18.5
Width of head.....	22.0	22.0	22.5	18.0	21.0	21.1
Between nasal openings	4.3	3.8	3.5	3.5	3.5	3.7
Between nasal and orbit....	5.5	5.2	5.5	5.0	4.8	5.2
Width of orbit.....	6.5	7.0	7.0	6.5	6.5	6.7
Between orbits	7.0	7.0	7.0	6.5	6.5	6.8
Forearm	13.5	12.0	15.0	11.0	12.0	12.7
Hand	11.0	10.0	11.0	10.0	10.0	10.4
Femur	24.0	20.0	23.0	18.0	19.0	22.8
Tibia	19.0	17.0	19.0	15.0	16.0	17.2
Whole foot	30.0	28.5	32.0	24.0	25.0	27.9
Cutting spade	4.0	4.0	4.2	4.0	3.6	4.0

Number 1, specimen number 3710, collected at Cambridge, Mass.; number 2 and 3, specimen number 71026 and 71025, collected at Gainesville, Fla. by G. S. Miller; number 4, specimen number 31025, collected at Bay St. Louis, Mo. by A. Allison; number 5, specimen number 1673, collected at Pensacola, Fla.

DISTRIBUTION OF SPECIMENS STUDIED: Cambridge, Mass.; Bay St. Louis; Miss. (A. Allison); Delair, N. J. (W. P. Seal); Gainesville, Fla.; Houston and Brownsville, Texas.

REMARKS: This distinctive species is widely distributed throughout the eastern United States, but is scarcely met with, because of its secretive nocturnal habits. They breed usually in temporary pools and puddles from March to September. The tadpole stages lasts about 30 days, when the small toads leave the puddles, if they are not already practically dried up, and begin life on the land by hiding during the day in the soil oftentimes far removed from any permanent water.

(2) *SCAPHIOPUS HURTERII* Strecker. Hurter's Spadefoot

Pl. I, Figs. 3-4; Pl. II, Fig. 3; Pl. III

Scaphiopus hurterii Strecker, Proc. Biol. Soc. Washington, Vol 23, July 23, 1910, p. 116, pl. II, figs. 3-4.

TYPE LOCALITY: Waco, Texas (3½ miles east).

MEASUREMENTS: The following are measurements in millimeters of nine specimens of *Scaphiopus hurterii* obtained by loans from Dr. E. H. Taylor of Kansas State University and Mr. L. M. Klauber of San Diego, California.

	1	2	3	4	5	6	7	8	9	Ave.
Total length of body...	62.5	63.0	68.0	62.0	71.0	69.0	72.0	61.0	71.0	66.0
Length of head.....	20.0	22.0	22.0	22.5	22.0	23.0	24.0	22.5	23.0	22.3
Width of head.....	23.0	25.5	25.0	24.0	25.5	26.5	27.0	25.0	26.0	25.2
Between nasal openings	4.0	5.0	5.0	4.6	5.0	5.0	5.0	5.0	5.0	4.8
Between nasal and orbit	6.0	6.0	5.8	5.8	6.0	6.0	6.0	6.0	5.8	5.9
Width of orbits.....	7.0	7.0	7.0	7.0	7.0	7.0	7.8	7.0	7.6	7.1
Between orbits	6.8	7.0	7.0	7.5	7.0	7.0	8.0	7.0	7.5	7.4
Forearm	16.0	16.0	17.0	16.0	19.0	18.0	18.0	16.0	17.5	17.0
Hand	12.0	13.0	12.0	12.0	13.0	13.0	13.0	13.0	13.0	12.6
Femur	25.6	27.5	29.0	27.0	30.0	28.0	29.0	24.0	28.0	26.4
Tibia	20.0	21.0	23.0	22.0	24.0	24.0	24.5	21.0	22.0	22.4
Whole foot	34.0	32.0	39.0	34.0	39.0	40.0	42.0	34.5	35.0	36.6
Cutting spade	5.0	5.6	6.0	5.6	6.0	6.0	6.0	5.5	6.0	5.7

Number 1, specimen number A125, collected at Benton, Atoscosa Co., Texas, June 5, 1932 by Taylor and Smith; numbers 2-9, specimen numbers 30430, 30432, 30429, 30431, 30434, 30435, 30433, collected seven miles southeast of Lytle, Texas.

DISTRIBUTION OF SPECIMENS STUDIED: Benton, Atascosa, Co., Texas, Taylor and Smith; Lytle, Texas. (From L. M. Klauber Collection, San Diego, California.)

REMARKS: I am including Strecker's description of *hurterii* in order that it may be compared with the measurements of the specimens reported here. While the average size, especially of the whole foot, femur, forearm, width of head and body length is greater than *holbrookii*, contrary to Strecker's description, I believe this may be due to the fact that I have had a greater number of specimens for use in this study from a different locality to that of Mr. Strecker. I am in agreement with Dr. Hobart Smith that *hurterii* is a distinct form. The elevated rugose post interorbital area seems to be a most distinctive character.

STRECKER'S DESCRIPTION OF HURTERII FOLLOWS: "Size medium. Length of head and body, 67 mm. Head short, length about equal to width. (In *holbrookii* the head at angle of jaws is much wider than long.) Snout heavy and blunt, not extending beyond the mouth. Parotoids nearly round, higher and even more conspicuous than in the eastern species. Tympanum distinct but rather smaller than in *holbrookii*. (In type hardly more than half the diameter of the parotoid.) Crown distinctly rugose. No black granules in space between and in front of the eyes. Upper surfaces with small, closely set tubercles very uniform in size and distribution. Many tubercles on sides, buttocks and posterior portion of the abdomen. Many pustules on upper surface of tibia. Glands on thorax present, conspicuous. Enlargements resembling glands on inferior surface of femur (present in both specimens). Spade-like process of foot narrowly margined with black. Palmar tubercles rather small. Fingers slender. Tibia about equal to that of *S. holbrookii* but femur and foot much shorter.

Color above, pale greenish, with a pale yellowish line from each orbit; these converge again on the coccyx. Upper surface of head and area between the light lines, dark plumbeous. Parotoids olive. Sides of head and under surfaces yellowish-white.

The Refugio specimen is slightly smaller. (Length 63 mm) Coloration in life darker. Greenish above, light lines inconspicuous. In form and other important characteristics resembling the type."

(3) SCAPHIOPUS COUCHII Baird. Couch's Spadefoot
Pl. I, Figs. 5-6; Pl. III

Scaphiopus couchii Baird. Proc. Ac. Nat. Sci. Phila.; Vol. 7, 1854,
p. 62.

TYPE LOCALITY: Rio Nasas, Coahuila, and Matamoros, Tamaub-
pas, Mexico.

MEASUREMENTS:

	1	2	3	4	5	6	7	8	9	Ave.
Total length of body...	56.0	60.0	60.0	53.0	60.0	58.5	45.5	55.0	58.0	56.2
Length of head.....	20.5	21.0	21.0	20.0	20.5	20.0	15.0	19.5	20.0	19.7
Width of head.....	25.0	25.0	24.0	22.5	24.0	24.0	18.0	22.5	24.0	23.2
Between nasal openings	3.5	3.5	3.2	3.0	3.2	3.5	3.5	3.5	3.5	3.4
Between nasal and orbit	5.3	5.5	5.5	5.5	5.0	5.0	3.5	5.5	5.5	5.1
Width of orbits.....	8.0	8.0	8.0	8.0	8.0	8.0	6.5	7.5	8.0	7.8
Between orbits	5.5	5.5	5.5	5.0	5.0	5.0	4.6	4.5	5.0	5.1
Forearm	17.0	17.0	17.5	13.5	17.0	14.0	11.0	16.5	17.5	15.7
Hand	13.0	12.5	12.0	12.0	13.0	13.0	9.5	12.0	12.5	12.2
Femur	26.0	25.0	26.5	24.0	26.0	26.0	20.0	23.5	25.0	24.7
Tibia	21.0	21.0	21.5	18.5	21.0	20.5	17.0	20.0	20.0	20.0
Whole foot	30.0	32.5	33.0	29.0	33.0	32.5	24.0	31.5	22.5	29.8
Cutting spade	4.0	4.0	4.3	4.0	4.0	4.0	2.8	4.0	4.2	3.9

Numbers 1-3, specimen numbers 47132, 47134, 47130, collected at San Pedro, Lower California, Mexico, July, 1919 by Joseph Slevin; number 4, specimen number 13159, collected at Waco, McLennon Co., Texas; numbers 5-7, specimen numbers 35228, 35231, 35230, collected at Fairbanks, Cochise Co., Texas; number 8, specimen number 17771, collected at San Antonia, Bexer Co., Texas; number 9, specimen number 29348, collected 2 miles north of the San Xavier Mission, Arizona.

DISTRIBUTION OF SPECIMENS STUDIED: San Pedro, L. Calif., Mex. (Jos. Slevin); Waco, Texas, (Strecker); San Antonio, Texas; Colonia Dublan, Chihuahua Mex., (D. E. Beck); Fairbanks, Ariz., (Jos. Slevin).

REMARKS: *Couchii* is confined to the southwestern states, Lower California, into Mexico. It is next to *hurterii*, the largest Spadefoot in our fauna. The frontoparietal bones are well formed extending well into the nasal area. In color *hurterii* and *couchii* are similar.

Couchii does not have the elevated post interorbital area found in *hurterii*.

THE SUBGENUS *SPEA*

Throughout the Intermountain States to the Pacific Coast and south into Texas and Mexico is a division of toads closely related in external and skull characters. These are here considered under the subgenus *Spea*. The general facies of this subgenus is such that it is easily separated from the eastern *Scaphiopus* group. The head is much shorter; the width between the nasal opening and the orbit is noticeably less; also the interorbital width is less, being modified as in *bombifrons* and *intermontanus*. Pl. I, Figs. 9-12. Other distinctive characteristics are the presence of a fontanelle or a modified one, with the frontoparietal as well as the temporal bones greatly modified; also a cuneiform spade-like process, in contrast to the cycle-shaped spade found in subgenus *Scaphiopus*.

While the distribution of these two subgenera is poorly known at present, the only overlapping of the two appears to be in Texas.

Three species are included in the subgenus *Spea*; these may be separated as follows:

A. Presence of an interorbital boss.

b. Head width narrow—18.5 mm.

c. Body smooth with few individual tubercles or warts. Cutting spade narrow and long; hand, femur, tibia, and whole foot short; color grayish above; whitish on venter. In preservative the specimens are an olive green. *bombifrons*

AA. No interorbital boss present. (In some specimens of *intermontanus* there is a glandular interorbital elevation which resembles the true boss found in *bombifrons*. This may be removed and the true nature of the skull revealed. Pl. I, Figs. 9-12 show this difference.

bb. Head width wider 20.9-22.5 mm.

cc. Body rugose or with many individual prominences or warts. Color mottled

whitish and black above; venter whitish; in preservative the back becomes blackish with some white areas. At times the back is streaked with whitish lines. Venter white.

d. No frontoparietal fontanelle; interorbital space with prominent frontoparietal bones forming ridges as in Pl. I, Figs. 9-10 or in some specimens the interorbital space is filled with a glandular prominence resembling the *bombifrons* species; head width 22.5 mm, whole foot 31.2, confined in the main to the Great Basin area *intermontanus*

dd. A frontoparietal fontanelle present; interorbital space smooth; size intermediate between *bombifrons* and *intermontanus*; head width 20.9; whole foot 28.8; found on the Pacific Coast south into Arizona and Texas. *hammondii*

(4) *SCAPHIOPUS BOMBIFRONS* (Cope). Central Plains Spadefoot Toad
Pl. I, Figs. 11-12; Pl. III

Scaphiopus bombifrons Cope. Proc. Ac. Phila. 1863, p. 53.

Spea hammondii bombifrons (Cope). Bull. U. S. Nat'l Mus. No. 34, 1889.

Scaphiopus bombifrons Cope. Smith, Am. Midl. Nat., Vol. XV, No. 4, 1939, p. 427.

TYPE LOCALITY: Fort Union on Missouri River, Lat. 48 degrees N.

MEASUREMENTS: The following measurements were made possible through loans from Dr. E. H. Taylor of the Kansas University and Mr. Joseph Slevin of the California Academy of Sciences, San Francisco.

	1	2	3	4	5	6	7	8	9	Ave.
Total length of body...	48.0	45.5	45.0	50.0	51.5	50.0	50.0	53.0	47.0	48.9
Length of head.....	15.0	15.5	14.5	16.0	16.5	16.0	15.0	16.5	15.0	15.6
Width of head.....	17.0	17.0	16.0	20.0	20.0	19.5	20.0	20.0	19.5	18.8
Between nasal openings	5.0	4.0	4.0	4.5	4.5	4.5	4.5	5.0	4.5	4.5
Between nasal and orbit	3.0	3.0	3.0	3.0	3.5	3.0	3.5	3.5	3.5	3.2
Width of orbits.....	6.0	6.0	5.8	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Between orbits	5.0	4.5	4.2	5.0	5.0	5.0	5.0	5.3	4.2	4.8
Forearm	11.0	11.0	10.0	13.0	13.0	13.0	11.5	13.0	12.0	11.9
Hand	10.0	8.5	8.5	10.0	10.5	10.0	10.0	11.0	10.0	9.8
Femur	22.0	21.0	20.5	23.0	23.2	24.0	23.5	23.0	24.0	22.7
Tibia	17.5	16.0	16.0	18.5	19.0	19.0	18.5	20.0	18.0	18.0
Whole foot	16.0	23.0	23.0	28.0	27.5	28.0	27.5	28.5	27.0	25.4
Cutting spade	3.0	2.5	2.5	3.0	3.0	3.0	3.0	3.5	3.0	2.9

Numbers 1-3, specimen numbers 33118, 33117, 33119, collected at Goodnight, Texas, June, 1910 by Strecker; numbers 4-5, specimen numbers A100, A101, collected at 2 miles north of Lexington, Okla., June 3, 1932 by Taylor and Smith; Nos. 6-9, specimen numbers A131, 1632, 1633, 1634, collected 6 miles north of Elkhart, Morton Co., Kan., August 15, 1926 by E. H. Taylor and T. White.

REMARKS: All specimens of *bombifrons* have an interorbital boss which, upon the dissection of the head, is composed in the main of a bony structure in contrast to the glandular structure found in some specimens of *intermontanus*. Just what relationship exists between these two species is not clear.

Reference to Plate III shows the distribution of the specimens actually studied at the time of this writing. Just how the species of *Spea* are distributed in Colorado, Wyoming, and Montana is not known because of lack of specimens from these states. Spadefoot toads taken in the intermountain states are not common in collections.

(5) SCAPHIOPUS INTERMONTANUS (Cope). Great Basin
Spadefoot Toad

Pl. I, Figs. 9-10; Pl. II, Fig. 2; Pl. III

Spea hammondi intermontana Cope. Proc. Ac. Phila., 1883, p. 14.

TYPE LOCALITY: Salt Lake City, Utah.

MEASUREMENTS: The specimens reported here are all from the southeastern part of Utah, while specimens collected by Dr. H. C.

Yarrow at Provo, Utah; Capt. C. Bendire at Fort Walla Walla, Washington, and V. Bailey and J. O. Snyder at Pyramid Lake, Nevada have been studied; due to lack of space their measurements are not reported.

	1	2	3	4	5	6	7	8	9	Ave.
Total length of body...	51.5	55.0	56.0	51.0	55.0	63.0	53.0	59.0	53.0	55.2
Length of head.....	16.5	18.5	17.0	17.0	19.0	19.0	17.0	18.0	17.0	17.7
Width of head.....	22.0	23.5	22.5	23.0	24.0	26.0	21.0	23.5	23.0	23.2
Between nasal openings	4.5	4.5	4.5	4.7	5.5	5.0	4.0	4.5	4.8	4.7
Between nasal and orbit	3.0	3.5	3.5	3.5	4.0	3.5	4.0	3.5	3.0	3.5
Width of orbits.....	7.5	7.5	7.0	7.0	7.0	7.5	7.0	7.5	6.5	7.2
Between orbits	4.5	4.8	4.5	5.3	5.0	5.0	4.5	5.0	5.0	4.8
Forearm	14.0	16.0	15.0	14.0	15.0	15.0	12.5	14.0	14.0	14.4
Hand	12.0	14.0	12.0	12.0	12.0	13.0	12.5	12.0	12.0	12.4
Femur	26.0	29.0	26.0	24.0	26.0	29.0	24.0	27.0	27.5	26.5
Tibia	20.0	23.5	21.0	21.0	21.5	21.5	18.0	21.0	22.0	21.0
Whole foot	33.5	36.0	30.0	32.0	31.0	35.0	29.0	32.5	31.0	32.2
Cutting spade	4.0	4.0	3.9	4.0	4.0	4.0	3.0	4.0	3.5	3.8

Number 1, specimen number 50, collected at Garfield County, Utah, June 29, 1938 by Vasco M. Tanner and D. E. Beck; number 2 and 3, specimens numbers 55 and 799, collected at Willow Spring Tank, Kane County, Utah, June, 1936 by Vasco M. Tanner and James Bee; number 4, specimen number 545, collected at mouth of Brush Creek, Uintah County, Utah, July, 1937 by James Bee; number 5, specimen number 46, collected 10 miles south of Gandy, Utah, June, 1928 by Vasco M. Tanner and W. P. Cottam; number 6, specimen number 1980, collected at Orderville, Kane County, Utah, August 4, 1938 by La Voy Esplin; number 7, specimen number 781, collected at Zion National Park, Utah, July, 1925 by Vasco M. Tanner; number 8, specimen number 1977, collected at Steep Creek Lakes, Boulder Mt., Garfield County, Utah, 6500 ft. elevation, June 29, 1938 by W. W. Tanner; number 9, specimen number 8686, collected at Price, Carbon County, Utah, June, 1937 by Ross Hardy.

DISTRIBUTION OF SPECIMENS STUDIED: ARIZONA: Jacobs Lake, Kaibab Forest, July, 1927, V. M. Tanner. IDAHO: Boise, Ada County, July 19, 1917, Richard Erwin. NEVADA: Pyramid Lake, June 14, 1889, C. A. Keeler; June 26, 1893, V. Bailey; Joseph Slevin, July 4, 1916; The Willows, New Pyramid Lake, J. O. Snyder; Mesquite, V. M. Tanner. UTAH, Utah County: Provo, H. C. Yarrow, Payson, V. M. Tanner. Millard County: Gandy, June, 1928, V. M.

Tanner. Kane County: Orderville, July, 1937, Aug. 4, 1938, Truman Swallow and La Voy Esplin; Willow Spring Tank, June, 1936, V. M. Tanner and James Bee; Alton, L. M. Klauber. Washington County: Zion National Park, July, 1925, 1928, 1933, V. M. Tanner; Zion National Park and Toquerville, L. M. Klauber; St. George and Washington, V. M. Tanner. Garfield County: Posy Lake, Aquarius Plateau, June, 1936, V. M. Tanner; Escalante, June, 1936, 1938, V. M. Tanner, W. W. Tanner, and D. E. Beck; Steep Creek, Boulder Mountain, June 29, 1938, W. W. Tanner, D. E. Beck, and Geo. Cannon; Bryce Canyon National Park, July, 1927, V. M. Tanner. Emery County: North of Green River, L. M. Klauber; Green River City, June, 1927, Clarence Cottam. San Juan County: Caroline Natural Bridge, June, 1927, V. M. Tanner, Anson Call, and D. I. Rasmussen. Carbon County: Price, June, 1937, Ross Hardy; Helper and Price, June 16, 1939, V. M. Tanner, W. W. Tanner, James Bee and Grant Harris; Price, October, 1938, Horace Richards. Uintah County: Mouth of Brush Creek, July, 1937, James Bee. WASHINGTON: Ft. Walla Walla, C. Bendire.

REMARKS: The evolution of the subgenus *Spea* seems to be from *hammondii* through *bombifrons* to *intermontanus*. In these species there is a progressive development of the osseous parts of the cranium with a closure of the frontoparietal fontanelle in practically all specimens of *intermontanus*. *Intermontanus* is a large fairly rugose species capable of breeding under desert conditions in the brackish waters of the Great Basin and High Plateaus. This species is common in the southeastern part of Utah. More than a hundred specimens have been collected around Price and Helper, Carbon County and the Escalante Desert in Garfield County. Breeding specimens were taken in June along the Price and Escalante Rivers. They also leave these streams and are found from twenty to fifty miles out in the deserts, congregated around intermittent spring seeps. Great numbers in copula were observed at a small playa in Steep Creek, Boulder Mountain, Garfield County, on June 29, 1938 by D. E. Beck, W. W. Tanner, Geo. Cannon and James Bee. The playa developed after a rain storm which occurred on the night of June 27. No specimens were observed until after the storm, when they seem to come into this temporary pond literally by the hundreds. Breeding commenced at once, the males holding on to the females even after they were collected and placed in cages at camp. On June 20, 1936 tadpoles of various sizes were taken at Willow Spring Tank 50 miles south of Escalante. In a few

specimens the hind legs had started to emerge. Tadpoles were collected in the Price City Reservoir, number 3, on June 16, 1939, by the writer. Many of these were developing their hind legs at this date.

A DESCRIPTION OF THE LARVAE OF *INTERMONTANUS*: An examination of tadpoles from the above mentioned localities shows a labial disk surrounded by a continuous row of papillae, except for a slight interruption at the upper margin where there is a row of teeth on the disk about 6 mm long. In some specimens there is evidence of two rows in some parts of the disk. The labial teeth are in 2-4 rows; the top row is continuous extending to the corners of the mouth; the second row extends from the corners of the mouth along the first row to about one-fourth its length; the third and fourth rows are short; the fifth and sixth rows are continuous across the lower portion of the mouth. The fifth row is three times as long as one of the parts of the fourth row. The upper mandible has a median point with lateral edges serrate; lower mandible is about the same width as the upper one, with a median notch, but without the projection on the sides, the sides serrate and smoothly rounded off and extending to the angles of the mouth. The mouth structures differ from drawings by Drs. Smith, Storer and Wright. The tadpoles here reported more closely resemble *hammondii* than *bombifrons* judged by the drawing of the above mentioned workers. The mouth is 4.2 mm across, the interorbital space is 3.5 mm, the distance from the mouth to the nasals is 3.5 mm; while it is 1.7 mm from the nasals to the orbits. The body length of tadpoles, with the hind legs showing, is 23 mm; tail length 28 mm. In the water the larvae have a coppery color; while in alcohol preservative they are a bluish black color.

Intermontanus has a greater internarial distance than either *bombifrons* or *hammondii*; the average for 84 specimens is 4.6 mm. The femur and whole foot are both larger in *intermontanus*. I have been unable to use the tympanum and corneous tips of the toes in this study. These characters are variable and in some specimens the corneous tip of the toes is not present.

(6) *SCAPHIOPUS HAMMONDII* Baird. Hammond's Spadefoot Toad
Pl. I, Figs. 7 and 8; Pl. II, Fig. 1; Pl. III

Scaphiopus hammondii Baird, Rept. Expl. Surv., IV, Reptil., 1859,
Pl. fig. 2.

TYPE LOCALITY: Fort Reading, California.

MEASUREMENTS: The following nine specimens are chosen for report from a rather large collection loaned by Mr. L. M. Klauber of San Diego and Mr. Jos. Slevin of the California Academy of Sciences.

	1	2	3	4	5	6	7	8	9	Ave.
Total length of body...	47.0	48.0	46.0	56.0	49.0	54.0	61.5	60.0	55.0	52.9
Length of head.....	15.0	15.0	15.0	19.0	15.0	17.0	19.0	19.0	17.0	17.0
Width of head.....	19.0	19.0	18.0	23.5	19.0	21.0	24.0	25.0	22.0	21.2
Between nasal openings	4.0	4.0	4.0	4.0	3.5	4.0	4.5	4.5	4.0	4.0
Between nasal and orbit	3.5	3.5	3.5	4.5	3.8	4.0	4.5	4.5	4.5	4.0
Width of orbits.....	5.7	5.8	5.5	7.5	6.0	7.0	7.5	7.5	7.0	6.6
Between orbits	4.0	4.0	4.0	5.0	5.0	5.0	5.0	5.0	5.0	4.7
Forearm	12.0	12.0	11.0	14.0	11.0	14.5	14.0	15.0	13.0	12.9
Hand	11.0	11.0	10.0	12.0	10.0	12.0	12.0	12.0	11.5	11.3
Femur	21.0	23.0	21.0	23.0	19.0	25.0	26.0	25.0	23.0	22.9
Tibia	17.5	18.0	17.0	21.0	17.5	20.0	21.0	21.0	20.0	19.2
Whole foot	23.0	26.5	25.0	30.0	26.0	29.0	32.0	31.0	27.5	27.8
Cutting spade	3.0	3.0	3.0	3.5	3.0	3.5	4.0	3.6	3.5	3.3

Number 1 and 2, specimens number 10235 and 10238, collected at Cochise County, Arizona, July, 1928; number 3, specimen number 10296, collected at Brewster County, Texas, July 22, 1930; number 4, specimen number 62922, collected 5 miles north of Bonsell, California, May 24, 1927; number 5, specimen number 7131, collected at San Jacinto, Riverside County, California by L. M. Klauber; number 6 and 7, specimens number 23359 and 240, collected at San Diego, California by L. M. Klauber; number 8, specimen number 23461, collected at Ojos Negros, Lower California by L. M. Klauber; number 9, specimen number 27145, collected at Punta Bunda, Lower California by L. M. Klauber.

DISTRIBUTION OF SPECIMENS STUDIED: ARIZONA: Cochise County, July, 1928. CALIFORNIA: 3 miles N. of Bonsell, May 14, 1927; San Jacinto, Riverside County, L. M. Klauber; San Diego, L. M. Klauber; Berkeley, July, 1938, Tracy Storer. COLORADO: Oxford, La Plata County, Sept. 7, 1920, Ivan M. Way. MEXICO: Ojos Negros, and Punta Bunda, Lower California, L. M. Klauber. TEXAS: Brewster County, July 22, 1930.

REMARKS: Specimens of *hammondii* have shorter, narrower heads, with less internarial space, shorter forearm, femur, and whole foot

than *intermontanus*. The interorbital space is smooth, not possessing ridges or a boss as in *intermontanus* and *bombifrons*. The fontanelle is well developed. Specimens are not as worthy as *intermontanus*.

SUMMARY

An examination was made of the cranial structures, cutting spades, measurements of the appendages and body, color and texture of the skin and distribution of specimens of *Scaphiopus* from various parts of the United States and northern Mexico. This study supports the conclusion that the genus *Scaphiopus* may be divided, to advantage, into the subgenera *Scaphiopus* and *Spca*; also that the following: *holbrookii*, *hurterii*, *couchii*, *bombifrons*, *intermontanus*, and *hammondii* should be recognized as valid species.

The cranial structure, body size and markings, and larval characteristics seem to support the proposal, made here, that we separate the Utah and northern Great Basin Spadefoot Toads from the Pacific Coast and Central Plains species, establishing *intermontanus* Cope as a species.

A distributional study of *Scaphiopus* in the states west of the Mississippi River should add much to our knowledge of the range of the subgenus *Spca* here discussed.

Hurterii also seems to be a valid species.

Tadpoles of the various species should be collected and studied.

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EXPLANATION OF PLATES

PLATE I

Figures 1, 3, 5, 7, 9, and 11 are drawings showing the dorsal skull structures of the six species of Spadefoot Toads discussed in this study.

Figures 2, 4, 6, 8, 10, and 12 are drawings of the cutting spades of the six species of Spadefoot Toads under discussion.

PLATE II

Figures 1, 2, and 3 show the distinctive head and interorbital characteristics of *S. hammondii*, *S. intermontanus*, and *S. hurterii*.

PLATE III

The distributional map shows the areas in the United States where the six species of *Scaphiopus*, as here discussed, are found. The map has been made from a study of the specimens available during the progress of this report. Records from the literature have not been used.

STUDY OF GENUS SCAPHIOPUS

VASCO M. TANNER

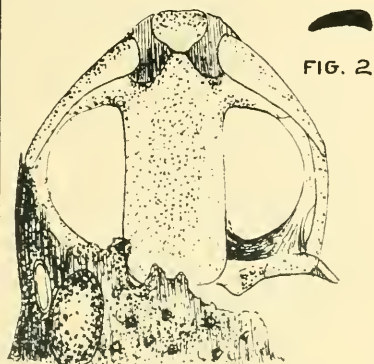


FIG. 1

SCAPHIOPUS HOLBROOKII

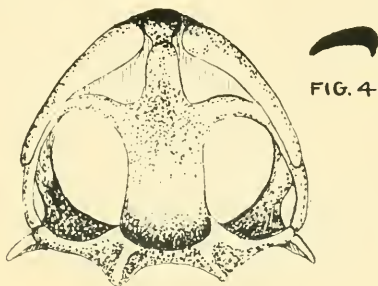


FIG. 3

SCAPHIOPUS HURTERII



FIG. 5

SCAPHIOPUS COUCHII

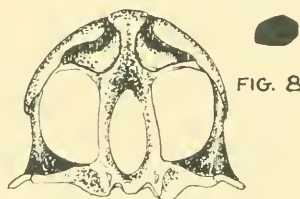


FIG. 7

SCAPHIOPUS HAMMONDII

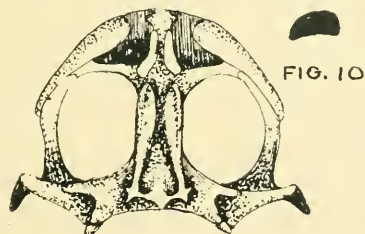


FIG. 9

SCAPHIOPUS INTERMONTANUS

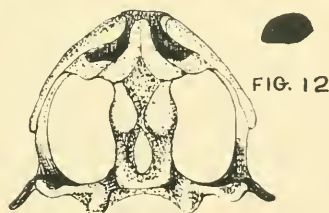


FIG. 11

SCAPHIOPUS BOMBIFRONS

Plate I

STUDY OF GENUS SCAPHIOPUS
VASCO M. TANNER



FIG. 1

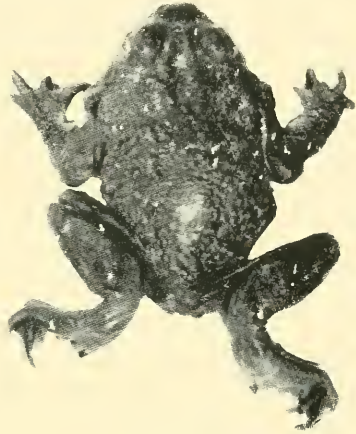


FIG. 2

SCAPHIOPUS HAMMONDII SCAPHIOPUS INTERMONTANUS

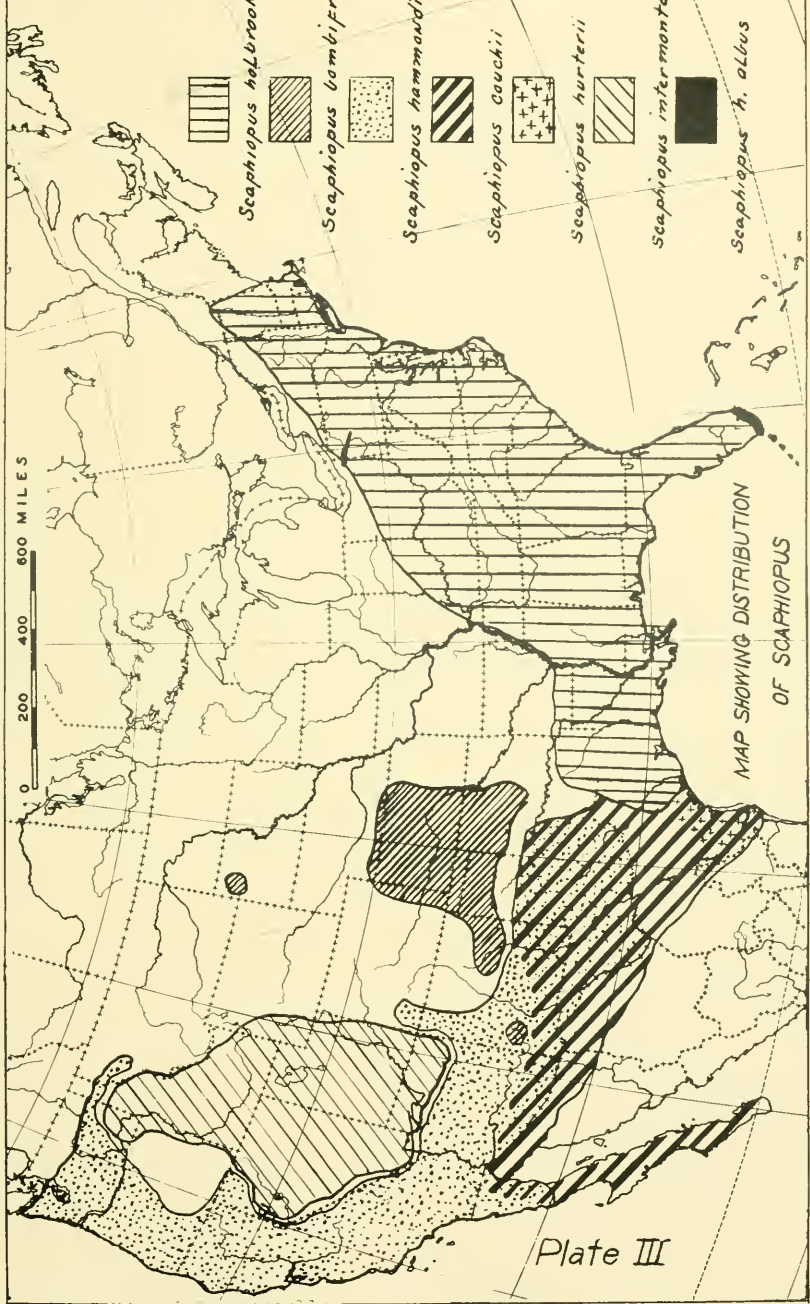


FIG. 3

SCAPHIOPUS HURTERII

Plate II

STUDY OF GENUS SCAPHIOPUS
VASCO M TANNER



Scaphiopus holbrookii

Scaphiopus bombifrons

Scaphiopus hammondi

Scaphiopus couchii

Scaphiopus hurterii

Scaphiopus intermontanus

Scaphiopus h. albus

0 200 400 800 MILES

MAP SHOWING DISTRIBUTION
OF SCAPHIOPUS

Plate III

