Catalogue of American Amphibians and Reptiles.

WASSERMAN, AARON O. 1968. *Scaphiopus holbrookii.*

Scaphiopus holbrookii (Harlan)
Eastern spadefoot toad

Rana holbrookii Harlan, 1835:105. Type-locality, "South Carolina"; restricted to "Charleston," Charleston County, South Carolina, by Schmidt (1953:58). No type is known.

Scaphiopus solitarius Holbrook, 1836:85. Type-locality, "Carolina, Georgia, Tennessee"; restricted to "Charleston," Charleston County, South Carolina, by Schmidt (1953:58). No type is known.

S. [*caphiopus*] *holbrookii* Baird, 1859:12. First use of this combination.

Scaphiopus albus Garman, 1877:194. Type-locality, "Key West, Fla." Syntypes, Mus. Comp. Zool. 1453 (12 specimens), Blake Expedition: Barbour and Loveridge, 1929:334.

Scaphiopus hurterii Strecker, 1910:116. Type-locality, "Waco [McLennan County], Texas (3½ miles east)." Holotype, Baylor University Collection 4179; Bryce Brown reports (*in litt.*) that the specimen cannot be found.

• CONTENT. Two subspecies are recognized: *holbrookii* and *hurterii.*

• DEFINITION. This *Scaphiopus* is characterized by pectoral glands, distinct tympana and parotoid glands, and curved metatarsal tubercles at least three times longer than broad. The dorsum usually has two light bands forming an hourglass. Body length reaches 72 mm in *holbrookii* and 82 mm in *hurterii.*

• DESCRIPTIONS. Wright and Wright (1949) and Tanner (1939) described adults of both subspecies. Wright (1932) and Bragg (1944a) described the eggs and tadpoles of *holbrookii* and *hurterii* respectively; Livezey and Wright (1947) described the eggs of both subspecies. Gosner and Black (1954) and Hampton and Volpe (1963) provided supplementary data on larval development in *holbrookii,* relating particularly to ontogenetic changes in diagnostic traits; Bragg, Mathews, and Kingsinger (1964) discussed similar variations in *hurterii.* W. F. Blair (1955, 1958) analyzed mating calls of both subspecies. Refer to the record album "Voices of the Night," 2nd ed. (Comstock Publ. Co., Ithaca, New York) for a phonograph recording of the mating call.

• ILLUSTRATIONS. See Dickerson (1906) for colored and black-and-white photographs of adult *holbrookii;* adults of both subspecies are illustrated by Conant (1958) and Wright and Wright (1949). Additional photographs of *holbrookii* appear in Wright (1932), and Burger (1957). The skulls of both forms were illustrated by Wasserman (1958), Zweifel (1956), and Smith (1937). Wright (1932) presented photographs of the eggs which were also illustrated in Livezey and Wright (1947). Wright and Wright (1949) published photographs of the larva including the mouthparts, which are further illustrated by Hampton and Volpe (1963).

• DISTRIBUTION. *Scaphiopus holbrookii* ranges from Massachusetts southward throughout Florida and the Keys, and westward to Oklahoma and Texas. It is found primarily in deciduous or coastal pine forest, being restricted essentially to sandy or light soils. North of Georgia it follows the Atlantic Coastal Plain and river valleys. Judged from scant collecting records, a fairly wide gap separates the ranges of *holbrookii* and *hurterii* in Louisiana and Arkansas (see Wasserman, 1958 and H. M. Smith, 1937 and "Comment," below). In Louisiana, the two forms apparently are separated by unfavorable soils of the Mississippi flood plain (Wasserman, 1958). The westernmost records for *holbrookii* are from southeastern Louisiana (Wasserman, 1958) and northeastern Arkansas (Dowling, 1957). The range of *hurterii* extends from central Louisiana westward to the Balcones Escarpment of the Edwards Plateau in central Texas (H. M. Smith and Buechner, 1947), and from the Rio Grande northward into eastern Oklahoma and western Arkansas. Locality records are scattered throughout many publications. Zweifel (1956) mapped known records for both subspecies (but see "Comment"); Hansen (1958) listed breeding dates and localities for *holbrookii;* and Wasserman (1957) mapped the distribution of *hurterii* in Texas.

For locality records of *holbrookii* not included in the above citations, see: Alabama: J. S. Brown (MS); Arkansas: Hurter and Strecker (1909); Florida: Duellman and Schwartz (1958); Georgia: Neill (1957a); Illinois: P. W. Smith (1961), and Brandon and Austin (1966); Indiana and Illinois: P. W. Smith and Minton (1957); Indiana: Minton and Minton (1960); Kentucky: Barbour and Gault (1952); Maryland and the Delmarva Peninsula: Reed (1956) and Cooper (1965); New Jersey: Gosner (1959), and Wilhoft and Gosner (1964); North Carolina: Huheey and Stupka (1967); Ohio: Gier (1945); Virginia: deRageot (1964), and Burger (1957). For locality records of *hurterii* other than those already cited, see: Arkansas: Burger, Smith and Smith (1949); Oklahoma: Bragg (1944b and 1952), and H. M. Smith and Leonard (1934); Texas: B. Brown (1950), and Axtell and Wasserman (1953).

Statements of several authors that the range of *holbrookii* extends into Oklahoma and Texas have no solid basis. Ortenburger and Freeman (1930) reported a specimen of *holbrookii* from Cimarron County, Oklahoma, some 600 miles west of its known range, but this record is unsubstantiated. Bragg (1944b) suspected this specimen was a *hurterii,* but even

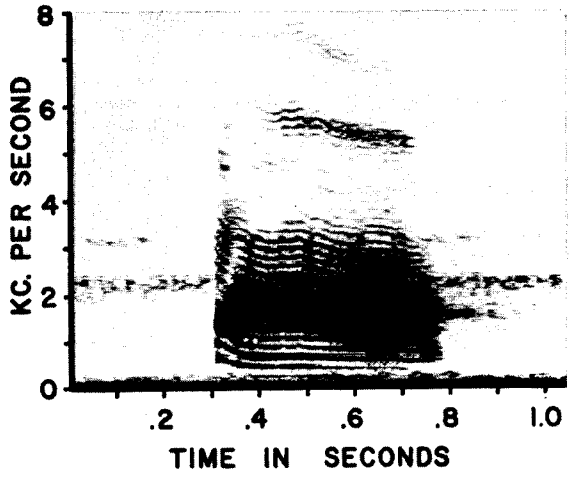
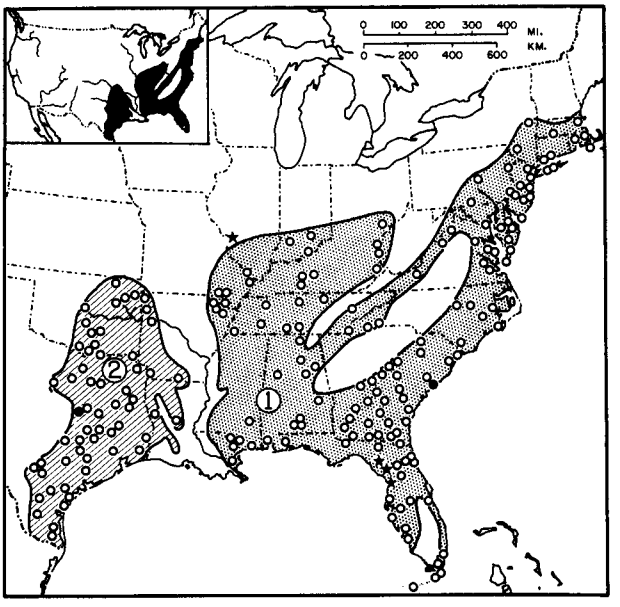


FIGURE. Audiospectrogram (narrow band, 45 cycles per second) of mating call of *Scaphiopus h. holbrookii:* Monmouth County, New Jersey, 29 May 1968, body temperature 18.3° C, specimen Amer. Mus. Nat. Hist. 79976 (A. Wasserman recording).



MAP. Solid symbols mark type localities, open symbols indicate other records. The stars indicate fossil localities.

that is unlikely; more likely it was a *bombifrons*. H. M. Smith and Leonard (1934) erroneously reported *hurterii* as *holbrookii* from Cleveland County, Oklahoma.

• FOSSIL RECORD. Parmalee (1967) identified *Scaphiopus* cf. *holbrookii* in early postglacial cave deposits 15 miles north of its present range in Illinois. Lynch (1965) identified *S. h. holbrookii* from the Illinoian or Kansan stage of the Pleistocene of Florida. Holman (1958, 1959a and 1959b) found *holbrookii* in material from the Wisconsin and Illinoian stages of the Pleistocene of Florida. Gut and Ray (1963) found *holbrookii* in Florida Pleistocene deposits tentatively assigned to the Illinoian stage. Auffenberg (1956) identified *Scaphiopus* cf. *holbrookii* from the lower or middle Miocene of Florida.

• PERTINENT LITERATURE. Pearson (1955, 1957, and 1958) demonstrated home range activity and territoriality in *holbrookii* in Florida. Rothman and Smith (1960) reviewed winter breeding records in *holbrookii*. Hansen (1958), Gosner and Black (1955), and Green (1964) discussed the relationship of temperature and moisture to breeding in *holbrookii*; and Hansen (1958) reviewed the breeding pattern with reference to environmental effects. Pointing out the essentially xeric breeding pattern of *holbrookii*, Hansen (1958) suggested that water uptake stimulates ovulation and spermiation. William Beck, as cited in Oliver (1955), stimulated mating behavior in *holbrookii* under conditions of reduced atmospheric pressure. Brattstrom and Lawrence (1962) compared thermal acclimation rates in *holbrookii* and species of *Rana* and *Bufo*. Hansen ("1951" [1952]), using pregnancy urine, and Knepton (1951), using commercial human chorionic gonadotropin, demonstrated consistent positive spermiation by a variety of anuran species, except *holbrookii*, which proved negative in all tests. Hansen (1959) tested *in vitro* ovulation in *holbrookii*. H. M. Smith (1937) and Zweifel (1956) compared cranial morphology of *holbrookii* and *hurterii*. Zweifel (1956) discussed the evolution of North American spadefoots and suggested that *holbrookii* may be the most primitive living form. W. F. Blair (1958) found closer similarities in mating calls of *holbrookii* from Newton, Georgia, and of *hurterii* from Huntsville, Texas, than among populations of *hurterii*. McAlister (1959) found an accessory fold anterior to the vocal cords to be unique to the larynxes of *holbrookii* and *hurterii*. Wasserman (1957) discussed hybridization and introgression between *hurterii* and *couchii* in Texas. Wasserman (1958), noting similarities in the ecology of *hurterii* and *holbrookii*, demonstrated complete interfertility between the two forms in the laboratory, including a high degree of fertility in backcrosses. Wasserman (1963 and 1964) reported results of hybridization tests between *holbrookii* and other spadefoot species. Volpe and Dasgupta (1962), Ting and Price (1950), and Ting (1951) used *holbrookii* sperm to produce intergeneric androgenetic and gynogenetic hybrids. Wasserman and Bogart (1968) described chromosomes of *hurterii*. Witschi (1933) and Ting and Price (1950) gave chromosome counts for *holbrookii*. Axtell ("1958" [1959]) described the response of a female *hurterii* to a calling conspecific male. Gosner (1959) described microscopic characteristics of tadpole teeth of various anurans including both subspecies. A. P. Blair, Hargreaves and Chen (1940) examined histological preparations of the *holbrookii* parotoid gland, and chemical aspects of its secretion. Wilhoft and Gosner (1964) found differences in epithelial height and follicle number in thyroids of oversized and normal *holbrookii* tadpoles. Boschwitz (1966) found a correlation between size of ultimobranchial body and thyroid activity in *holbrookii* tadpoles. Dent and Schullein (1950) compared blood clotting time of *holbrookii* with that of other anurans. Enlow and Brown (1956) described histological preparations of *holbrookii* bone; and Elias and Shapiro (1958) presented a similar study on the skin of both subspecies. Hebard (1964) presented blood serum protein patterns of several anurans including *holbrookii*. Czopek (1965) compared the amount of respiratory surface vascularization in *holbrookii* and other anurans. Szarski and Czopek (1965) measured liver cell size of *holbrookii*. Thorson and Svihla (1943) showed that, among ten species of anurans, *holbrookii* could endure the greatest degree of exsiccation. Noble (1926) described aspects of hatching in *holbrookii*; and Bragg (1961) compared developmental rates of three anuran species including *hurterii*. Richmond (1947) demonstrated planktonic feeding behavior in early larvae, and schooling aggregations in maturing tadpoles of *holbrookii*. Carr (1940) and Duellman and Schwartz (1958) reported on the stomach content of *holbrookii* in Florida. Bragg (1962) observed predation on mosquito larvae and fairy shrimp by *hurterii*. Instances of predation on *holbrookii* adults were cited by Goin (1947), Holman (1957), and Lynch (1964); Bragg (1950a) noted predation on larval *hurterii* by larvae of water scavenger beetles. Bragg (1965) reviewed ecological studies and natural history for both subspecies. Life history and ecological studies of *holbrookii* include Ball (1936), Burger (1957), Driver (1936), Neill (1957b), Overton (1914, 1915a, and 1915b), Stone (1932), and Wasserman (1966). For similar observations on *hurterii*, see W. F. Blair (1949) and Bragg (1944b–1945, 1950b, 1954, 1959, and 1964).

• ETYMOLOGY. The specific name *holbrookii* honors the early American herpetologist, Dr. John E. Holbrook; *hurterii* was named for Julius Hurter, herpetologist of St. Louis, Missouri.

1. *Scaphiopus holbrookii holbrookii* (Harlan)

Rana holbrookii Harlan, 1835:105. See species account.
Scaphiopus solitarius Holbrook, 1836:85. See species account.
Scaphiopus holbrookii holbrookii: Stejneger and Barbour, 1917:26. First use of trinomial.
Scaphiopus holbrookii albus: Stejneger and Barbour, 1917:26. First use of this combination. See species account.
Scaphiopus holbrooki holbrooki: Barbour and Gault, 1952:192. Emendation of ending.

• DEFINITION. The head is wider than long at the angle of the mouth; the interorbital region is not raised above the postorbital region. Minute spines are generally present both on the interorbital region and the area immediately posterior to the eyes. Sexually mature males exhibit a considerable amount of yellow or yellowish-green coloration in the lyre-shaped lines on the dorsum.

2. *Scaphiopus holbrookii hurterii* Strecker

Scaphiopus hurterii Strecker, 1910:116. See species account.
Scaphiopus holbrookii hurterii: Wright and Wright, 1933:44. First use of this combination.
Scaphiopus holbrooki hurteri: Schmidt, 1953:58. Emendation of ending.

• DEFINITION. The head is short, the length about equal to the width; there is an elevated osseous boss in the interorbital region. No spines are present on the boss, but there is a concentrated patch of spines posterior to each eye. Sexually mature males tend to be bright olive; the pattern may be indistinct. Females tend to be brown, or bronze dorsally, with the pattern usually distinct as white or buff lines.

COMMENT

Authors have been divided in their opinion of the taxonomic status of *hurterii*. Central to the problem is the question of possible sympatry with *holbrookii*. Zweifel (1956), led to believe that both forms were in contact at Pollock, Grant Parish, Louisiana, concluded that the considerable geographic gap between them was filled. However, examination by Wasserman (1958) of specimens and records in the Tulane University Collection disclosed errors in both identification and locality entries, which when resolved, show that the range gap between *hurterii* and *holbrookii* in Louisiana and Arkansas remains. In view of the similarities in their ecology and breeding habits, and of the high degree of interfertility between them (Wasserman, 1958), intergradation almost certainly would occur if the two should come in contact. W. F. Blair (1958) studied the mating calls and agreed with Wasserman (1958) that the two forms had not diverged sufficiently to be regarded as different species.

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