

Catalogue of American Amphibians and Reptiles.

HULSE, ARTHUR C. 1978. *Bufo retiformis*.***Bufo retiformis* Sanders and Smith
Sonoran green toad**

Bufo debilis retiformis Sanders and Smith, 1951:153. Type-locality, "14.4 mi S. Ajo, Pima County, Arizona." Holotype, Univ. Illinois Mus. Natur. Hist. 5847, an adult male (fide Savage, 1954) collected by Max Hensley and W. Leslie Burger 1 July 1948. (Type not examined by author.)

Bufo retiformis: Bogert, 1962:31.

- CONTENT. No subspecies are recognized.

- DEFINITION AND DIAGNOSIS. This is the largest species of the *Bufo debilis* species group: adult males attain snout-vent lengths ranging from 40 to 47 mm and females from 45 to 49 mm (Savage, 1954). The parotoid glands are large but inconspicuous, being widest at a point approximately $\frac{1}{3}$ back from the anterior edge. Warts on the parotoids are greatly reduced and each is tipped with black. The cranial crests are reduced or absent, the supraorbital and preorbital crests are comprised of a series of small black tipped warts, the postorbital, suborbital, and labial crests are comprised of only a few black tipped warts. The warts of the upper eyelid are tipped with black. The dorsum is covered with low black tipped warts, the warts of the sides of the body are larger than those on the dorsum. Ventrally they are covered with small dark tipped granules. The dorsal coloration consists of yellow blotches containing green central areas and separated by relatively narrow thin black reticulations. The ventral surfaces, as well as the throat region in females, are immaculate white. In mature males the region of the vocal sac is greyish black.

- DESCRIPTIONS. Sanders and Smith (1951) supplied a good description of the holotype. Savage (1954) gave additional detailed descriptions of the adult, including detailed diagnostic measurements for both males and females, and a description of intraspecific variation. Ferguson and Lowe (1969) described coloration, cranial osteology, cranial crests and parotoid glands. Martin (1972) gave a brief description of the osteology of the species group, placing major emphasis on cranial characters. Eggs of the species have been described by Ferguson and Lowe (1969) and by Zweifel (1970). Zweifel (1970) discussed egg size, general tadpole morphology, and coloration. Tadpole morphology is similar for all members of the species group. Tadpoles of the group differ in several ways from all other *Bufo*, thus far studied. They are unique in possessing two rows of lower labial teeth and in having a dextral anal opening as opposed to one or three rows of lower labial teeth and a medial anal opening in other species. In addition they hatch at a later stage than do most *Bufo*, stage 19 as opposed to 16 or 17.

Bufo retiformis eggs before preservation are about 1.15 mm in diameter and are yellow with only a band of melanin. Hatchlings are 3.1 to 3.4 mm in length as in all members of the *debilis* group. Zweifel (1970) noted some differences in coloration of the tadpoles within the group.

Savage (1954) described the call of *Bufo retiformis* as "a rising

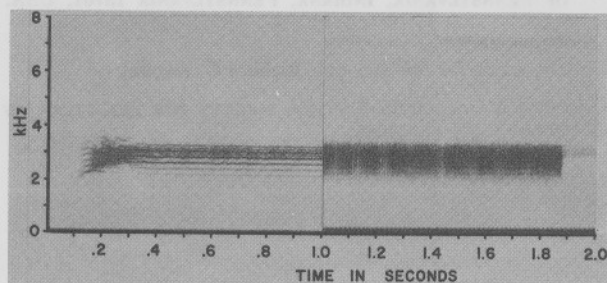


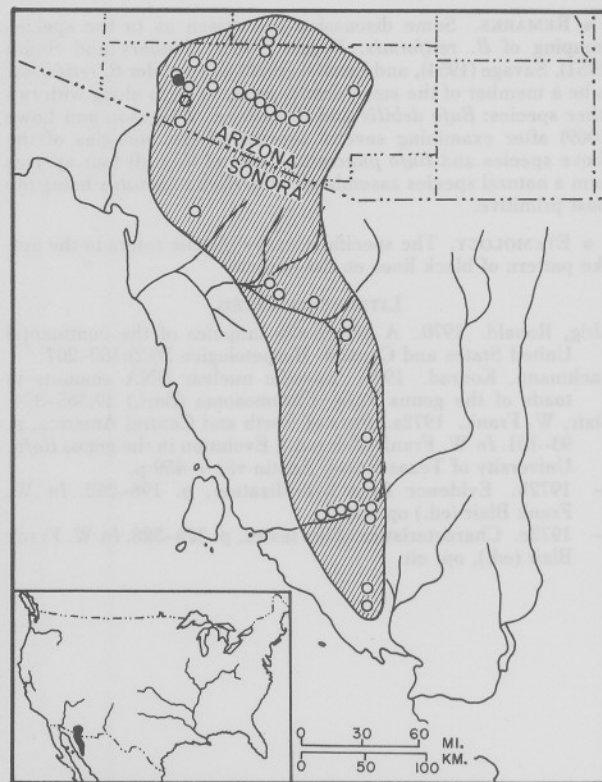
FIGURE. Audiospectrogram of mating call of *Bufo retiformis*: 11 mi north of Hermosillo, Sonora, Mexico, 19 August 1960, water 26°C, air 24°C; narrow band (45 Hz) left, wide band (300 Hz) right; Amer. Mus. Natur. Hist. Dept. Herpetology tape, specimen AMNH 65775.

crescendo of a single drawn-out note, not unlike the buzzing of an electric alarm clock, with a slight trill giving the effect of a vibrating police whistle." Stebbins (1966) described it as "A combined buzz and whistle, a wheezy call lasting 1 to 3½ sec., gradually lowering in pitch or remaining constant and ending sharply." Bogert (1962) analyzed the mating call: pulsations per second 184 to 224; duration 1.1 to 3.2 s; emphasized frequency 3,400 to 3,800 Hz. At similar temperatures in areas of overlap, *Bufo retiformis* had a call approximately 1,000 Hz lower than *Bufo kelloggi*. The call is highly ventriloquistic (Stebbins, 1966).

- ILLUSTRATIONS. Sanders and Smith's (1951) description included a fair photograph of the dorsal view of the preserved holotype. Other black and white photographs of dorsal aspects are in Ferguson and Lowe (1969) and Bogert (1962). For illustrations in color, see Leviton (1971), Blair (1972a) and Stebbins (1966). Savage (1954) illustrated the skin pattern of *B. retiformis* and compared it with other members of the *debilis* complex. The skull was illustrated by Martin (1972) and Ferguson and Lowe (1969). Ferguson and Lowe (1969) figured the eggs. Zweifel (1970) presented line drawings of tadpoles. Sound spectrograms were given by Bogert (1962) and Ferguson and Lowe (1969). In addition Bogert (1962) figured the sound spectrogram at $\frac{1}{4}$ normal speed. Photographs of adult hybrids (*Bufo retiformis* × *B. kelloggi* and *B. punctatus* × *B. retiformis*) were given by Ferguson and Lowe (1969). Karyotypes are illustrated by Cole et al. (1968) and Bogert (1972) and ideograms of the chromosomes by Bogert (1972).

- DISTRIBUTION. *Bufo retiformis* is restricted to southern Arizona and Sonora, Mexico, north of Guaymas. Bogert (1962) and Stebbins (1954 and 1966) provided respectively, locality and range maps of the species. Additional collecting since then has extended the known range slightly eastward in Sonora; slightly east in Pima County, Arizona; and northward into Pinal County, Arizona (Nickerson and Mays, 1968).

Bufo retiformis would appear to be most commonly found in the open, rolling mesquite-grassland between an elevation of 500 and 1,500 ft. The only region where *Bufo retiformis* enters the Pacific Coastal Plain of Mexico is in the vicinity of Hermosillo. Bogert (1962) suggested that this invasion of the coastal plain near



MAP. The solid circle marks the type-locality; open circles indicate other records.

Hermosillo might be due to an increase in well drilling and irrigation, thus making the habitat more suitable for *B. retiformis*. It is quite possible that the northward extension of the range of *B. retiformis* into southern Pinal County, Arizona may also be a result of increased agricultural activity and the concomitant irrigation of the area. If this is true, *Bufo retiformis* may continue to extend its range northward following the irrigated lands of the Santa Rosa and Gila valleys.

• FOSSIL RECORD. None.

• PERTINENT LITERATURE. Bogert (1962) discussed dispersal and distribution of *Bufo retiformis*, including its zone of sympatry with *Bufo kelloggi*, and concluded that due to habitat manipulation for agricultural uses it appeared to be replacing *B. kelloggi* to the south and west of Hermosillo. Habitat is discussed by Bogert (1962) and call site selection by Bogert (1962), Ferguson and Lowe (1969), and Stebbins (1966). *Bufo retiformis* calls from clumps of grass, usually three feet or less from the water's edge. Zweifel (1970) suggested that the eggs were not laid in long strands as is common in many species of *Bufo*. Ferguson and Lowe (1969) placed *Bufo punctatus* in the same species assemblage as *B. retiformis*.

Bogert (1962) and Ferguson and Lowe (1969) analyzed mating calls in *B. retiformis* and noted differences in pulse rate, duration, and emphasized frequency from the other members of the species group. Effects of temperature on calling activity were discussed by Ferguson and Lowe (1969).

Ferguson and Lowe (1969) discussed intra-group hybridization with *Bufo kelloggi* and *B. debilis* and inter-group hybridization with *Bufo punctatus*. Blair (1972b) also examined intra and inter-group hybridization. Riemer (1955) discussed what he considered to be natural hybrids between *Bufo retiformis* and *B. kelloggi*, but Bogert (1962) stated that they were *Bufo kelloggi*.

Bogart (1972) and Cole et al. (1968) reported on chromosome number ($n = 22$) and configuration. Blair (1972c) gave characteristics of the testes and Bachman (1970) discusses specific nuclear DNA amounts. Altig (1970) included *retiformis* in a key to the tadpoles of the continental United States and Canada. Jaeger and Hailman (1972) reported on effects of light intensity on phototactic responses and Lutz (1972) discussed parotoid gland toxins.

Distributional records and miscellaneous notes are found in Chrapliwy and Williams (1957); Lowe (1964); Nickerson and Mays (1968); Riemer (1955); Smith and Chrapliwy (1958); and Williams and Chrapliwy (1958).

• REMARKS. Some discussion has arisen as to the species grouping of *B. retiformis*. Bogert (1962), Sanders and Smith (1951), Savage (1954), and Zweifel (1970) all consider *B. retiformis* to be a member of the small *debilis* group of *Bufo* along with two other species: *Bufo debilis* and *B. kelloggi*. Ferguson and Lowe (1969) after examining several aspects of the biologies of the above species and *Bufo punctatus* contend that all four species form a natural species assemblage with *Bufo punctatus* being the most primitive.

• ETYMOLOGY. The specific name *retiformis* refers to the net-like pattern of black lines on the dorsum.

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