

*Bufo exsul* Myers, 1942(a)

## BLACK TOAD

Gary M. Fellers

### 1. Historical versus Current Distribution.

Black toads (*Bufo exsul*) are known historically from four different spring systems in Deep Springs Valley, Inyo County, California. Buckhorn, Corral, and Bog Mound springs are in the immediate vicinity of Deep Springs Lake, while Antelope Spring is 7 km to the NW. Schuierer (1962) suggested that the population at Antelope Spring might have been introduced there in the early 1900s, but recent genetic research could not corroborate that the Antelope Springs toads were introduced (E. Simandle, personal communication).

A small, introduced population of black toads occupies a flowing well near Salt Lake (Saline Valley, 65 km SWS of Buckhorn Springs) in Death Valley National Park. In 1961, black toads were released at Cottonwood Springs in the Owens Valley (30 km to the west of Deep Springs; Schuierer, 1962), but there are no subsequent reports of this species in the valley.

The entire natural range of this species encompasses approximately 15 ha, one of the smallest ranges for any North American amphibian.

### 2. Historical versus Current Abundance.

Myers (1942) estimated the population at 600–700 individuals based on one visit to the site in 1940. In 1954, Schuierer (1961) noted that this estimate was much too low and stated that there was "an excess of 10,000 adults." Schuierer also noted that population numbers appeared to fluctuate with fewer toads seen in 1958 compared with 1960. In 1971, Schuierer (1972) enlisted the members of a biology class to systematically count the toads at Deep Springs. They counted 3,967 toads in the sloughs, ponds, and bog. Difficulty of counting toads in the boggy areas likely resulted in a tally that was too low, but he did not try to resolve the difference between his earlier estimate of 10,000 toads and the count of approximately 4,000 toads. As part of the same census, Schuierer (1972) reported large numbers of tadpoles: "three cubic meters of suitable habitat may contain as many as five thousand larvae."

In 1971, the population appeared to be "stable and maintaining itself" (Schuierer, 1972), but he found the most accessible and frequently visited part of the toad habitat had more smaller, presumably younger, toads. He attributed this to "collecting pressure" from herpetologists and indicated that the population could "not withstand the collectors, amateurs or professionals, who harvest numbers of adult toads."

In 1999 Murphy et al. (in preparation) evaluated population size in one area (Corral Springs) using PIT tags and mark-recapture. They estimated the population to be > 8,400

toads, a number that is similar to that of Kagarise Sherman (1980) for the same spring. The population at Antelope Springs has always been reported as small (Schuierer, 1961, 1962; Stebbins, 1985), but the actual size is difficult to estimate due to the difficulty of seeing toads in the dense vegetation. There are no population estimates for Bog Mound or Buckhorn Springs, but the habitat at Buckhorn is more extensive than at Corral Springs. It is likely that the total number of black toads in Deep Springs Valley is about 24,000 individuals (J. Murphy and E. Simandle, personal communication). Though geographically restricted, the population appears to have been stable for the last 15–20 yr.

### 3. Life History Features.

#### A. Breeding.

Reproduction is aquatic. i. Breeding migrations. There is no migration, but Kagarise Sherman (1980) noted that males tend to stay near breeding sites while females move away. Black toads lack vocal sacs; they have a release call that is somewhat higher in pitch than that of western toads (Stebbins, 1985), but males apparently do not have an advertisement call (Schuierer, 1961).

ii. Breeding habitat. The breeding (and non-breeding) habitat in Deep Springs Valley includes a series of marshes, ponds, bogs, and sloughs. The springs are located at an elevation of 1,450–1,700 m (4,900–5,600 ft). The valley is in an isolated, desert basin located between the Inyo and White Mountains of northeastern Inyo County, California. Breeding begins in late March and continues into April (Schuierer, 1961).

#### B. Eggs.

i. Egg deposition sites. Shallow marshes or quiet pools bordering the larger wetlands (Schuierer, 1972). In the laboratory, eggs hatched in 4–5 d at 20 °C (Schuierer, 1972). Egg laying takes place from late March to late May (Stebbins, 1985).

ii. Clutch size. There are no published estimates of clutch size. Livezey (1960) described the eggs and oviposition sites. Eggs are deposited in strings, generally within a 30–35 cm area. The strings are entwined among grasses and watercress. Eggs masses are either at the water surface or up to 10 cm deep. Eggs generally are laid in the shallower parts of the marsh (Schuierer, 1961) where the water depth ranges from 15–20 cm deep (Livezey, 1960).

#### C. Larvae/Metamorphosis.

i. Length of larval stage. Schuierer (1961) states that the larval period is from 3–5 wk. Wright and Wright (1949) mention that two or three size-classes of tadpoles were present on 12 May 1942, but there seems to be no evidence that tadpoles overwinter because Schuierer (1972) reported seeing tadpoles of all sizes in May 1971.

ii. Larval requirements. Tadpoles are commonly found in shallow water of marshes or pools bordering the sloughs (Schuierer,

1961, 1972). These areas are subject to wide fluctuations in temperature (Schuierer, 1961).

a. FOOD. Undescribed; tadpoles probably feed on both organic and inorganic matter suspended in the water and on the surface of plants, rocks, and other substrates.

b. Cover. Schuierer (1962) describes breeding sites as "principally in unshaded marshes that border the sloughs." In the water, there are "dense mats of vegetation interlaced with swamp-like sedge areas. These boggy sites overlay a semi-soft black anaerobic mud, 1–3 feet thick" (Schuierer, 1972).

iii. Larval polymorphisms. Unknown and unlikely.

iv. Features of metamorphosis. Tadpoles reach a total length of 35 mm (Wright and Wright, 1949). Schuierer (1961) reported the size of newly transformed juveniles as 14–19 mm. Juveniles will grow to 22–33 mm SVL by November of their first year (Schuierer, 1961).

v. Post-metamorphic migrations. None.

D. Juvenile Habitat. Similar to adults, juveniles generally remain in shallow marshy areas.

E. Adult Habitat. "Like other desert valleys to the east of the Sierra Nevada, Deep Springs is exceedingly dry, and on its floor the vegetation consists of sparse low desert brush (*Chrysothamnus*)" (Myers, 1942). Schuierer (1961) provides a figure that details the plant associations for the alkali area, marsh, slough, stream margins, and head of the springs. The vegetation includes *Polypogon*, *Juncus*, *Ranunculus*, *Carex*, *Lemna*, *Muhlenbergia*, *Plantago*, *Scirpus*, *Zenichella*, *Rottippa* (*Nasturtium*), *Mimulus*, *Sisyrinchium*, *Epipectis*, and *Salix*. Toads do not frequent rocky portions of creeks that have no vegetation (Wright and Wright, 1949). The mountains that form Deep Springs Valley support juniper (*Juniperus californica*) and pinyon pine (*Pinus monophylla*).

Adults are the most aquatic members of the *Bufo boreas* group (Schuierer, 1961). Black toads have never been reported > 12 m from water (Schuierer, 1961).

Black toads are active primarily from late May to mid September (Schuierer, 1962) in conditions that range from snowfall to hot summer days (Schuierer, 1972). Adults generally are diurnal, but they are active at night during the late spring and early summer. Schuierer (1961) reported toads active during the morning and early evening hours when air temperatures ranged from 17–22 °C. Toads were less active when temperatures were in excess of 25 °C. At temperatures above 30 °C, toads were sluggish even when prodded.

"Just below the first spring, in the water runways between tussocks, [we] began to see *Bufo exsul*. The bottoms are mud, water 2–4 inches deep. These areas more or less shaded by tussocks. Soil dark and mucky. Depressions between tussocks 8 inches to 1.5 feet deep. The toads often dashed into holes in

tussocks or into shaded runways" (Wright and Wright, 1949).

**F. Home Range Size.** Unknown, but probably small.

**G. Territories.** Unknown.

**H. Aestivation/Avoiding**

**Dessication.** Black toads shift their activity from diurnal to nocturnal during the warmer months, but aestivation has not been reported.

**I. Seasonal Migrations.** None.

**J. Torpor (Hibernation).** Black toads use rodent burrows located 25–50 cm above the water level of the streams and sloughs. Toads found in burrows during November 1958 were huddled together and torpid (air temperature 12 °C), but became active when handled (Schuierer, 1961). At that same time, some toads were active near springs where water temperatures were about 20 °C.

**K. Interspecific Associations/Exclusions.** The only other amphibian reported within the range of black toads (Deep Springs Valley) is the western spadefoot toad (*Spea hammondi*; Schuierer, 1961).

**L. Age/Size at Reproductive Maturity.** The average SVL of males is 50 mm (range 44–59) and females is 52 mm (range 46–69; Schuierer, 1961). There are no published data on age at reproduction or on size versus age. Murphy et al. (in preparation) note that toads at Corral Springs tend to be small, especially compared with those at Antelope Spring (51.1 mm versus 74.7 mm SVL). The reason for this is unclear, but they note that European carp (*Cyprinus carpio*) at Antelope Spring are also small.

Murphy et al. (in preparation) found the sex ratio skewed significantly in favor of females (62.7% of population). This was unexpected since Kagarise Sherman (1980) found fewer females than males. Murphy et al. believe that the shift in sex ratio may be due to changes in habitat.

**M. Longevity.** Unknown.

**N. Feeding Behavior.** Stebbins (1951) examined the stomachs of several dozen black toads and found the remains of beetles, ants, and lepidopteran larvae. Livezey (1961) examined the food habits of 23 adult and 24 juvenile toads and provided a detailed table listing number and percent frequency of each food type. He noted that "...juvenile toads eat more small food materials than the adults, as well as more larval stages of dipterans and coleopterans...juvenile toads consumed considerably greater absolute numbers of food items." The primary food items were Diptera, Coleoptera, Hymenoptera, Homoptera, with lesser numbers of Hemiptera, Odonata, Collembola, Corrodentia, fairy shrimp (Anostraca), spiders, mites, and mollusks.

Schuierer (1961) examined the stomachs of 26 toads and found Hymenoptera, Diptera, Coleoptera, and small numbers of Hemiptera, Gastropoda, and Arachnida.

**O. Predators.** None reported, but eviscerated toads have been observed suggesting predation from Common Ravens

(*Corvus corax*; E. Simandle, personal communication).

**P. Anti-Predator Mechanisms.** Black toads are "more aquatic than other members of the *Bufo boreas* group. Adults are often found resting on the surface of the water near water cross clumps or along the margins of the sloughs and ditches in tussocks of the dwarf bulrush. When disturbed, they swim to the bottom where their coloration blends with that of the dark substratum. Their swimming is more frog-like than toad-like. Locomotion on land is by walking, with the body raised high off the ground" (Schuierer, 1961). "When prodded, they progress by short, ineffective hops" (Schuierer, 1961). "Unless pressed, the toads seemed to prefer to walk rather than to hop" Stebbins (1951).

"The brownish black ground color with yellow-white mottling blends in with the substratum, both on land and in the dark-colored water courses..." (Schuierer, 1961).

As with other *Bufo*, black toads produce skin secretions that are toxic and function as a deterrent to predators.

**Q. Diseases.** None reported.

**R. Parasites.** "Some toads were parasitized by an undetermined intestinal nematode. Occasionally leeches were found on toads" (Schuierer, 1961).

**4. Conservation.** Schuierer (1961) noted that "the annual recanalization of the water courses for irrigation has notable effect upon the population. When stream modification occurred after oviposition, the marsh area dried before metamorphosis was completed." He also noted that collecting had affected the population. Subsequently, Schuierer (1972) reviewed the status of black toads in 1971 and concluded that the population appeared to be in good condition (compared with 1962). Schuierer indicated that the primary threat to the population was from "collectors, amateurs or professionals" who were removing toads from the population. His conclusions were based on the relative lack of large adult toads from the most accessible areas. Schuierer (1972) also noted that the toads seem to have "adjusted to various climatic conditions and periodic droughts, as well as changes in the irrigation pattern of its habitat."

Busack and Bury (1975) reported that livestock grazing at the springs and canals was a potential problem for the toads. Bury et al. (1980) made five specific conservation recommendations that addressed issues of spring management, introduced predators, livestock grazing, marsh burning, channel modifications, and management of the area by both state and federal government and Deep Springs College.

All native habitat for the black toad is owned by Deep Springs College. Cattle graze throughout Deep Springs Valley, but the college fenced the springs in the early 1970s and currently allows only brief, seasonal grazing. This has resulted in an increase in vegetation, especially sedges (*Scirpus* sp.) and cattails (*Typha* sp.; Murphy et al., in

preparation). The college has also eliminated the practice of diverting water from the springs for irrigation and no longer allows the raking and burning of vegetation. All these management practices are in keeping with the recommendations of Bury et al. (1980).

As with any species with a highly restricted distribution, there is concern that a catastrophic event or introduction of a disease or predator could eliminate the entire species.

Black toads were listed as Rare by the California Fish and Game Commission in 1971, but that status was changed to Threatened in 1984.

*Acknowledgments.* I thank John Murphy and Eric Simandle for valuable comments based on their extensive experience with black toads.

Gary M. Fellers  
Western Ecological Research Center, USGS  
Point Reyes National Seashore  
Point Reyes, California 94956  
gary\_fellers@usgs.gov