



COUCH'S SPADEFOOT

Scaphiopus couchii Baird 1854

Status Summary

Scaphiopus couchii is a Priority 3 Species of Special Concern, receiving a Total Score/Total Possible of 56% (62/110). During the previous evaluation, it was also considered a Species of Special Concern (Jennings and Hayes 1994a).

Identification

Scaphiopus couchii is a medium-sized (5.7–9.1 cm SVL) anuran with a black keratinized spade on the heel of each hind foot and a vertically elliptical pupil (Stebbins 2003). The dorsal coloration is variable, ranging from green or greenish-yellow to brownish-yellow with a pattern of darker markings forming lines, spots, or a reticulating network (Grismer 2002, Stebbins 2003). Males are generally greener and have less conspicuous dorsal patterning than females (Grismer 2002, Stebbins 2003). The ventral surface is whitish (Grismer 2002). The call is a short (~1 s) low groan that declines in pitch and has been described as sounding simi-

lar to the bleating of a sheep (Elliott et al. 2009). Within its range, *S. couchii* can be distinguished from all other frogs by the presence of a conspicuous black spade on the hind feet and a vertically oriented pupil. Specimens that

Couch's Spadefoot: Risk Factors

Ranking Criteria (Maximum Score)	Score
i. Range size (10)	10
ii. Distribution trend (25)	0
iii. Population concentration/ migration (10)	10
iv. Endemism (10)	0
v. Ecological tolerance (10)	10
vi. Population trend (25)	15
vii. Vulnerability to climate change (10)	10
viii. Projected impacts (10)	7
Total Score	62
Total Possible	110
Total Score/Total Possible	0.56



PHOTO ON PREVIOUS PAGE: Couch's spadefoot, Cochise County, Arizona. Courtesy of Rob Schell Photography.

have been unearthed from burrows, or have newly emerged, may be covered in a dark hardened layer of skin that soon sloughs off (Mayhew 1965).

Taxonomic Relationships

Scaphiopus couchii was initially described based on morphology, and its distinctiveness has not been questioned since this time (Baird 1854). Intraspecific variation has only been examined in a small portion of the range in Arizona and New Mexico (Chan and Zamudio 2009). Little genetic structure was observed among the populations studied.

Life History

Scaphiopus couchii is xeric-adapted and primarily fossorial, spending the majority of its life in self-constructed burrows and emerging only during and immediately after intense summer rains (Mayhew 1965, McClanahan 1967, Stebbins 2003). This species has been found to be active on the surface after summer monsoon rainstorms in August and September, but not after winter rainstorms in October, December, or January (Mayhew 1965), suggesting that the activity period is limited to the summer in California as it is throughout the rest of its range. However, California differs from the rest of the range in that it receives the majority of its rainfall during the winter, suggesting that little local adaptation has occurred in this species (Mayhew 1965). Outside of California, surface activity is also tied to rain events, although *S. couchii* has (rarely) been found active on the surface during periods of high humidity, even when no recent rainfall has occurred (Mayhew 1962).

Emergence behavior is elicited by the low-frequency sound of rain falling on the desert soil, not from the rain itself (Dimmitt and Ruibal 1980a). Frogs emerge from deep (20–90 cm) burrows on the first night following the first heavy summer rain (Shoemaker et al. 1969, Dimmitt and Ruibal 1980a). Most breeding for a season usually occurs on this first night of activity (Woodward 1982). Following

this, the species may forage intermittently for up to 2 months, although much of this time is also spent in shallow (2–10 cm) burrows, which the frogs dig to avoid desiccation (Dimmitt and Ruibal 1980a). One feeding event can likely provide enough energy to allow an individual to persist for at least one year (McClanahan 1967, Dimmitt and Ruibal 1980b). Females deposit their eggs in ephemeral pools that form following intense summer rains (Woodward 1982). The development rate of this species is remarkably fast, with eggs hatching in as little as one day and metamorphosis occurring within 8–10 days if sufficient food is available (Mayhew 1965, Newman 1989, Morey and Janes 1994). Tadpoles are tolerant of a wide range of water temperatures (up to 39–42.5°C) such as are frequently encountered within the breeding pools (Brown 1969). This species likely does not breed every year in California and may skip reproduction and remain underground in sub-optimal years (Mayhew 1962).

Habitat Requirements

Scaphiopus couchii requires soils that are soft enough to allow burrowing. The species appears to prefer areas that contain at least some vegetation, although burrowing in completely open areas is also known (Mayhew 1965, McClanahan 1967). This taxon also requires the presence of temporary desert rain pools that retain water for at least 8 days to allow sufficient time for metamorphosis. The area in California in which *S. couchii* occurs receives an average of about 6.5 cm of rainfall per year, and its fine-scaled distribution may be linked to the amount of runoff that collects in localized areas (Mayhew 1965). The distances traveled between upland retreats and breeding sites are not known, nor are the precise terrestrial habitat requirements of adults or juveniles.

Distribution (Past and Present)

Scaphiopus couchii ranges throughout much of Texas, Mexico, southern Arizona, and southern New Mexico, from near sea level to 1800 m (Stebbins 2003). Scattered, localized

populations also occur in central Arizona and southern Colorado (Stebbins 2003). In California, this species ranges from the Colorado River west at least to the vicinity of the Algodones Dunes, ranging as far north as Chemehuevi Wash (~9 km north of Vidal Junction) and south to the vicinity of the United States–Mexico Border (Mayhew 1962, Tinkham 1962, Jennings and Hayes 1994a). A few observational records exist in the vicinity of the Salton Sea, and although these appear to be credible, verification is needed that populations are extant in this area.

This taxon's range in California is likely relictual from more mesic periods and is probably more fragmented now than it once was (Mayhew 1965). This species was not known to occur in the state until 1962 (Mayhew 1962, Tinkham 1962), and no significant declines have been documented since that time.

Trends in Abundance

No historical or current abundance data are available for this taxon within California. Human activities have both created and destroyed breeding sites for the species (S. Morey, pers. comm.), but no quantitative studies have documented the overall impacts of these activities on the species across California.

Nature and Degree of Threat

Scaphiopus couchii is likely persisting closer to its physiological limits in California than it is elsewhere within its range (Mayhew 1965). The California range is both hotter and drier than most of the rest of the range, and most of the limited rainfall occurs outside of the monsoon, during a time when *S. couchii* is usually inactive. The current populations in California likely persist due to the presence of local conditions that allow for the collection of sufficient quantities of water, such as the presence of basins on the eastern base of the Algodones Dunes and pools that form along desert washes. The relatively fragmented nature of the species' California distribution and the physiological

conditions under which it lives make it susceptible to localized extirpations due to habitat modification that destroys temporary pools and due to the effects of climate change. Recent models (PRBO 2011) indicate that average temperature will increase significantly, by more than 2°C in most months in the Sonoran/Colorado Desert of California. Given that *S. couchii* may already be near its physiological temperature limits, this may have an enormous impact on its viability in the state. In addition, some precipitation projections include an overall decrease of up to 45% (PRBO 2011), and increased variation in year-to-year precipitation (Cayan et al. 2008b), which could have severe detrimental impacts on this species by decreasing the number of years in which enough rainwater collects to allow breeding. Essentially, if the interpretation is correct that the California population exists at the physiological limits of the species' capacity, then predicted changes in rainfall and temperature may seriously reduce its range in the state.

Off-highway vehicle usage in the Algodones Dunes has degraded habitat in many areas (R. Fisher, pers. comm.). Noise generated by off-highway vehicle usage has been implicated in eliciting emergence in this species by mimicking the sound of falling rain that it uses as an emergence cue (Brattstrom and Bondello 1979). Temporary and permanent anthropogenic water sources associated with livestock (cattle ponds) and perhaps agriculture may help to provide suitable breeding habitat that is important to the persistence of this species.

Status Determination

The small and fragmented range of this taxon, coupled with its sensitivity to habitat disturbance through off-highway vehicle use and predicted climate change, justifies its Priority 3 status.

Management Recommendations

The primary, immediate management goal for *Scaphiopus couchii* is to protect existing habitat from further impact. Off-highway vehicle use

and larger modifications (solar projects, mining) may negatively alter both the hydrology of breeding pools and the suitability of soil for burrowing. In particular, if pools are modified such that they dry faster (through either more rapid draining or overall smaller size), their hydroperiod may become too short to allow metamorphosis. Specific areas requiring protection should be determined by the surveys outlined below. In the future, the impacts of projected climate change may seriously threaten this species in California, and proactive management may be required to counteract this threat; such management could include relocating populations to cooler or more mesic sites, deepening and maintaining the hydroperiod of natural breeding sites, and potentially creating completely novel breeding pools that can hold water if the climate changes.

Monitoring, Research, and Survey Needs

Range-wide surveys need to be undertaken for this taxon to identify suitable remaining habitat, determine the sizes of extant breeding populations, and to further characterize the species' range in California. To our knowledge, the northernmost population at Chemehuevi Wash has not been resurveyed since its original description in 1962 (R. Fisher, pers. comm.), and this is an important area in need of surveys. As the species distribution in California is patchy, largely in remote regions of the state, and given that the species does not emerge every year, care should be taken to search desert pool habitats even in areas where this anuran has not yet been documented. Surveys should ideally take place during the first night following the first major summer (monsoonal) rain event. Surveyors should be experienced with this frog's call (Elliott et al. 2009), as this will likely be the easiest way to find populations, and pools should be surveyed for tadpoles

within a few days after they fill during summer rains.

The movement ecology of this taxon and its potential to recolonize previously extirpated areas are unknown and are a topic in need of further study, particularly so in California where populations appear to be fragmented. Additional study of its physiological limits would also be helpful in establishing a more informed management plan, now and in the face of future climate changes. In particular, the severity of drought and the number of years between breeding events that can be tolerated are critical pieces of information for the long-term management of this species. Landscape ecological information, including the amount of terrestrial habitat needed, the relationship between population size and pool basin size, inundation duration and frequency, and the movement frequency of animals between breeding sites would all be valuable for future management considerations. Additional information on habitat use itself, including the extent that ongoing railroad and water diversion projects within the range subsidize or detract from potential habitat for this species, is also a critical research need that would inform ongoing management of this species.

Finally, given the spotty distribution of the species and the potential for genetic isolation among sites, multi-locus population genetic studies using microsatellites or single nucleotide polymorphisms of all extant California populations would provide a badly needed estimate of the extent to which populations are subdivided and therefore the optimal management strategies to protect genetic diversity. In addition, given how widespread the species is across the southwestern United States, genetic data comparing the uniqueness of the California population is essential for range-wide management.