

# Putative Cannibalism in the Western Spadefoot (*Spea hammondi*) in Northern Baja California, México

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The Western Spadefoot (*Spea hammondi*) is a small typically nocturnal member of the Family Scaphiopodidae. It is a species in decline, particularly in Southern California, but appears to be in decline throughout its range, which occurs from north central California into northern Baja California (Stebbins 2003, Thomson et al. 2016). *Spea hammondi* is behaviorally cryptic in that it spends the majority of its life underground (Storer 1925). *Spea* typically emerge intermittently to feed, and seasonally to breed, typically in small temporary pools, but also in slow moving creeks (Bragg 1965, Stebbins 2003, Baumberger et al. 2019, Flaxington 2021). Eggs are often laid in shallow pools, where they metamorphose within a minimum of 34 days (Morey 1998). Morey (1998) also suggested that larvae that develop in longer-lived pools take a longer time to metamorphose, typically allowing them to metamorphose at a larger size.

Larger size at metamorphosis has been reported to contribute to increased survivorship (Wilbur 1980). Crump (1986, 1990) showed that larvae that consumed conspecifics grew significantly larger, offering advantages to the individuals that cannibalized. Cannibalism is a common occurrence among anurans, with many species showing signs of this behavior (Bragg 1964, 1965, Pomeroy 1981, Jordon et al 2004, Kovács et al. 2009, Alvarez 2013, Schutt 2018). Bragg (1964, 1965), and Pomeroy (1981) reported cannibalism in four species of *Spea* (reported as: *Scaphiopus* spp.). Among these was *S. multiplicata*, which was an allopatric population split into its own species and separated from *S. hammondi*. Dodd (2013) expressed some concern that much of the published literature for *S. hammondi* was based on populations of *S. multiplicata*, which was historically part of the *S. hammondi* species complex but included two greatly disjunct populations (Stebbins 1966). Natural history accounts were likely extrapolated from observations that may have been in the Great Plains states, or outside of the current range *S. hammondi* (K. Dodd, pers. comm.). We note that a large portion of the currently accepted (considered putative) information on *S. hammondi*, comes from populations of different species in areas where *S. hammondi* does not currently range. We therefore contend that some information that has been accepted as part of the natural history of *S. hammondi* requires documentation from populations within the current range.

Herein, we report on observations of cannibalism among *S. hammondi* from vernal pools in northwestern

Baja California, México, within the current range of *S. hammondi*. We feel that these observations, although considered putative, are in fact a new published report, and add to the natural history for the species.

We visited three vernal pools that lay adjacent to the road that connects the town of San Telmo, on the Pacific Coast of Baja California, to the east in the San Pedro Martir National Park. On 5 April 2023 we conducted visual encounter surveys and dip net efforts to determine if *S. hammondi* were present in these pools. The first pool (30.957155°N, 115.819813°W, elev. 750 m) was a small depression in an annual grassland on the south side of the road described above. It was approximately 10 m across and 15 cm deep. Water was extremely turbid (100% opaque), and no anuran larvae were observed or dip-netted. At the second pool (30.970466°N, 115.779183°W, elev. 775 m) we encountered a pool at the base of a bedrock depression (we surmised it was an old excavation). The pool was approximately 12 m across and 40 cm deep. Water in the pool was visibly clear and contained many hundreds of *S. hammondi* larvae at approximately Gosner stage 39. The third pool was in a depression created by the construction of the roadway within a drainage (30.977685°N, 115.709668°W, elev. 1025 m). Water at this location was approximately 5 m across and 15 cm deep. This pool also supported a large number of *S. hammondi* larvae that were visually detectable. We spent the majority of our time (approximately 30–45 minutes) at the second pool which supported the largest number of larvae. We could see larvae moving around the bottom of the pool, with at least two larvae appearing to attack or consume the hind limbs of conspecifics. Several larvae were collected and handled, and returned to the site of capture, but no injured larvae were captured during the first visit.

On 5 May 2023, we returned to the three pools. The first pool was dry with no sign of anurans. The second and third pools, which were both dry but showed signs of recent moisture, supported hundreds of post-metamorphic *S. hammondi*. These small anurans were utilizing small cracks in the basin of the pond (Alvarez and Kerss 2023), or seeking refuge under the edges of rocks, twigs, and debris. We estimated each site to have approximately 300 post-metamorphic *S. hammondi*. Upon closer inspection we noted that some individuals moved in a manner that was atypical. We opportunistically collected as many individuals as possible and noted that approximately 15% of the *S. hammondi* at both pools had either one

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or both hind limbs appearing to have been consumed: bones, including the femur, were exposed or missing, and musculature and remaining tissue distal to the femur was missing (Figures 1 and 2).

We surmised that these were remnant injuries from cannibalistic attacks that we witnessed in April of the same year. We discarded the idea that this proportion of the population included malformations, which may be observed on other anurans. Instead, the exposed bone and missing muscle appeared to be a healed injury. We contend that these observations (i.e., direct attacks and remnant injuries) are the result of cannibalistic attacks on conspecifics. This is further supported by the presence of the fairy shrimp (*Branchinecta* sp.) in these pools, which has been reported to induce facultative carnivory in *Spea* larvae (Pomeroy 1981, Pfenning 1999, Levis et al. 2018).

We acknowledge that carnivory and cannibalism is putative for this species, but we further add that because the species was split, and much work on the previously allotopic species was outside of the current range of *S. hammondii*, we consider this the first report of carnivory and cannibalism in *S. hammondii* in its current known range.

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**Fig. 1.** Free-roaming post-metamorphic Western Spadefoot (*Spea hammondii*) with left rear limb completely missing. Photo by Jeff A. Alvarez.



**Fig. 2.** Close-up image of a Western Spadefoot (*Spea hammondii*) post-metamorph with right rear femur exposed, and remaining tissue missing. Photo by Jeff A. Alvarez.