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OBSERVATIONS ON BREEDING BY EASTERN SPADEFOOTS (*SCAPHIOPUS HOLBROOKII*) IN AUGUSTA COUNTY, VIRGINIA -- The Eastern Spadefoot (*Scaphiopus holbrookii*) is sparsely distributed in the Ridge and Valley physiographic province of Virginia (Merkle, 1977; Tobey, 1985; Mitchell & Reay, 1999). Mitchell & Reay (1999) did not record this fossorial toad from Augusta County, but three specimens have been reported from the Shenandoah Valley Sinkhole Pond System (SVSP) in the Big Levels area of the George Washington National Forest in the southeastern corner of the county. These records include two spadefoots (one adult, one juvenile) found within the Maple Flats Pond Complex (Mitchell & Buhlmann, 1999) and another (juvenile) found within the Loves Run Pond Complex (Gibson, 2002). However, there are no records of breeding by *S. holbrookii* in the region prior to this report, and few published accounts of breeding by this species anywhere in Virginia (e.g., Trautman, 1931; Richmond, 1947, Burger, 1957, de Rageot et al., 1969; Jopson, 1984). Spadefoots are known to breed in Virginia almost anytime that heavy rains fall between March and August (Burger, 1957; Hansen, 1958). The following account summarizes our observations of spadefoot breeding at SVSP.

DRC and HMW heard the initiation of a breeding chorus at Pond 3 within the Maple Flats Pond Complex of the SVSP at 1845 h EST on 30 March 2001. Seven or eight males began calling at this time and a single female was found on the pond's north shore. Air temperature was 16° C and conditions were clear. The National Weather Service's IFLOWS rain gauge at Mills Creek (ca. 1.2 km from Pond 3) recorded 1.04 inches (2.6 cm) of rain the previous day. Pond 3 had filled to a depth of 40 cm (approximately one quarter capacity) within 24 h of our first observation of calling males. The size of the breeding chorus increased over the next several days. Calling males were recorded and photographs of pairs in amplexus were taken on 2 April 2001.

The night of 6 April 2001 was unseasonably warm and humid, and the moon was full. SMR heard three calling males at Pond 3 shortly after dusk. When he returned two hours later, a breeding chorus of spadefoots was evident. Judging from calls heard during a 5-10 min period while standing at a single point along the pond shoreline, SMR estimated that 15-20 chorusing males were present. However, a subsequent eyeshine count (Corben & Fellers, 2001) made during two complete circuits of the pond revealed

that three times that many spadefoot males (ca. 50 total) were actually present in the chorus. Adult male spadefoots were easily detected from distances up to 50 m because of their bright orange (dull red *vide* Pearson, 1955) eyeshine reflectance, behavior (calling or mate searching), and the sparse emergent and woody vegetation in the pond. Many males were clustered together in small groups throughout the pond, but the various members of each group were usually calling asynchronously, which largely explains the low original estimate. Three mating pairs were also detected by the eyeshine method. One male was encountered on the forest floor while hopping toward the pond. Fresh eggs were abundant in the pond the following day.

Spadefoot egg strings were first observed suspended to prairie willow (*Salix humilus* var. *tristis*) in Pond 3 on 2 April 2001. Although spadefoot eggs can hatch within 24 h (Richmond, 1947), we did not observe hatching until 14 April. This long incubation was presumably due to relatively cold temperatures within Pond 3, which rose to near full capacity (130 cm deep) by 14 April. Richmond (1947) reported that eggs laid in mid-March at a site in New Kent County, Virginia, took seven days to hatch, whereas those laid in mid-August hatched the next day. Because egg deposition at Pond 3 occurred in early April, the pond's filling left most egg strings suspended in the deeper, colder strata of the pond. Pond 3 began to recede quickly by 17 April and was completely dry by 27 April. There was no indication that any spadefoot tadpoles reached metamorphosis. Raccoons and opossums predated heavily on larvae in the drying pond and no metamorphs were found under cover in the pond's dry basin or in the surrounding forest.

Pond 3 is one of the most ephemeral ponds within the SVSP; it frequently does not fill at all in the course of a year (Buhlmann et al., 1999). Pond 3 did not fill at all in 1999, 2000, or 2002. The last opportunity for spadefoots to have bred in this pond (prior to 2001) was in 1998 when the pond retained water until mid-June. However, the pond was not sampled intensively for amphibians in 1998 and it is therefore unknown if spadefoot reproduction was successful. Spadefoot populations have been previously documented to skip reproduction in years without favorable weather conditions (Richmond, 1947; Pearson, 1955; Hansen, 1958).

All 32 ponds within the Maple Flats Pond Complex were surveyed for amphibians during the first week of April 2001. Three ponds in the Loves Run Pond complex also were surveyed on 6 April 2001. One of the latter, plus two other ponds in the Loves Run Pond complex, were surveyed by members of the Virginia Herpetological Society on 19 May 2001 (Gibson,

2002). *Scaphiopus holbrookii* was only found to be breeding in one additional pond within the Maple Flats Pond Complex. During the first week of April, four males and one female entered Pond 2, which was completely encircled by a drift fence and pitfall trap array. The clutch from this single female hatched successfully but no metamorphs were found at the drift fence. Because Pond 2 retained water until early June, we suspect that predation by ambystomatid salamander larvae explains the mortality of spadefoot tadpoles in this pond.

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- Don R. Church and Henry M. Wilbur  
Department of Biology  
University of Virginia  
Charlottesville, Virginia 22903
- Steven M. Roble  
Virginia Department of Conservation and Recreation  
Division of Natural Heritage  
217 Governor Street  
Richmond, Virginia 23219
- Fred C. Huber and Michael W. Donahue  
George Washington and Jefferson National Forests  
5162 Valleypointe Parkway  
Roanoke, Virginia 24019