ASSESSMENT OF THE CONSERVATION STATUS OF *HABROSCELIMORPHA CIRCUMPICTA JOHNSONII* (FITCH) IN MISSOURI

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ABSTRACT

ABSTRACT: An isolated population of *Habroscelimorpha circumpicta johnsonii* (Fitch) is located in central Missouri. Although numerous collection records of the species exist, these have come from only three sites in Cooper, Howard, and Saline Counties. We surveyed the three known sites and two potential new sites with apparently suitable habitat for *H. c. johnsonii* in central Missouri during the 2001-2003 field seasons. The beetle was encountered at only two localities, one of which was new. Populations did not appear to be robust at either site, and in fact only a single individual was observed at the one known site where the species was found. All three historical sites were found to have experienced significant degradation by cattle trampling, vegetational encroachment, or anthropogenic disturbance, all of which have severely compromised the ability of these sites to support viable populations of *H. c. johnsonii* and resulting in a state ranking of "S1" ("critically imperiled") for the species. The fourth site suffered severe degradation due to prolonged flooding and vegetational encroachment in the years following the survey, and no beetles have been observed there since 2003. It is possible that *H. c. johnsonii* is now extirpated from Missouri.

INTRODUCTION

The authors have been conducting a faunal survey of tiger beetles in Missouri for the past ten years (MacRae and Brown 2001b). To date, 24 species have been formally documented from the state, including the previously unrecorded *Cylindera* (s. str.) *celeripes* (LeConte) in loess hilltop prairie remnants in northwestern Missouri (TCM and CRB, unpublished data) and a vagrant occurrence of *Cicindela* (*Cicindelidia*) *trifasciata ascendens* LeConte in southeastern Missouri (Brown and MacRae 2005). Several other species are known from highly restricted areas within the state. One of these is *Habroscelimorpha circumpicta* (LaFerté–Sénectère), which is associated with bare areas surrounding inland saline seeps and coastal areas (Erwin and Pearson 2008). The species is mainly distributed in the central to south-central United States from Nebraska south to Texas and west to New Mexico and Colorado, with populations in Missouri and North Dakota representing isolated outposts (Willis 1967, Pearson et al. 2006). Three subspecies of *H.*

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circumpicta are recognized: the nominate subspecies, occurring along the Gulf Coast; *H. circumpicta johnsonii* Fitch, occurring broadly in inland areas; and *H. circumpicta pembina* Johnson, occurring only in North Dakota (Pearson et al. 2006). The Missouri population, currently assigned to *H. c. johnsonii*, has been found associated only with saline seeps occurring in a small area in the central part of the state and is widely disjunct from the nearest population of *H. c. johnsonii* occurring several hundreds of miles to the west in Kansas (Willis 1967, MacRae and Brown 2001a). Individuals from this population are exclusively bluish-green in color, contrasting with other inland populations that contain varying proportions of reddish and/or dark morphs in addition to bluish-green morphs (Willis 1967). Its unique coloration and highly disjunct distribution may warrant subspecific status for the population (R. L. Huber, in litt.).

Saline seeps are historically limited in Missouri to the central counties of Saline, Cooper, Howard, and Pettis (Nelson 2005). In the second half of the 19th century, some of the more significant saline seeps were commercially developed as health spas and to bottle and distribute the spring water due to its perceived health benefits (Figg 2001). The development of the seeps was abandoned by the beginning of the 20th century; however, these activities may have contributed to the decline of saline seeps in central Missouri, most of which are now significantly degraded due to altered hydrology, cattle trampling, invasion by exotic plants, and other anthropogenic disturbances (Figg 2001, Nelson 2005).

Habroscelimorpha c. johnsonii has been found in association with these saline seeps at three locations in central Missouri. Boone's Lick State Historic Site (Howard Co.) has been the primary site, with a long history of collection records dating back to 1954 and as recent as 1992. The site was apparently a favorite for entomology students at the University of Missouri, Columbia, with many of the specimens they collected deposited in the Enns Entomology Museum. In more recent years, the species was found at two additional sites: Blackwater Spring (Cooper Co.), and Salt Branch of Camp Creek (Saline Co.), where significant numbers of beetles were encountered from 1985-1992 by R. L. Huber and D. W. Brzoska (R. Huber and D. Brzoska, in litt.). For example, R. L. Huber observed "hundreds of the little buggers" at Salt Branch of

Camp Creek site during July, 1985. Despite these numerous collection records, *H. c. johnsonii* was listed as a species of conservation concern (Missouri Natural Heritage Program 2010) with a status of S2S3 at the time this study was initiated due to the rarity of its required saline seep habitats in Missouri.

More recent observations by the second author beginning in the 1990's suggested that populations of this beetle had declined dramatically from historical levels, and the sites themselves appeared to have suffered significant degradation that reduced their suitability as habitat for the beetle. As a result of these observations, surveys were conducted during the 2001–2003 field seasons to assess the conservation status of *H. c. johnsonii* in Missouri (Brown and MacRae 2004).

METHODS

The sites included in the study were the three historical sites and two potential new sites that were identified in a habitat search using the Missouri Natural Heritage Database (MNHD). Potential new sites were selected based on quality, salinity, and presence of the barren areas required to support populations of the beetle. Based on this information, Blue Lick Conservation Area (Saline Co.) and Moniteau Lick (Howard Co.) were selected as additional survey sites and monitored concurrently with the three historical sites (Table 1, Fig. 1).

Sites were surveyed by visual observation and, on one occasion, by using a light attractant. Searches were conducted during late June through early August which is the known period of adult activity for the species. When beetles were encountered, an estimate of the number of individuals was recorded. Adult beetles measure approximately 13–15 mm in length and are readily identified in the field by their distinctive bluish-green

Table 1. Saline seeps surveyed for *Habroscelimorpha circumpicta johnsonii* in central Missouri during 2001–2003, with comments on historical and current status.

Site	Name	County	GPS Coordinates	Habitat Description[1]
1a	Boone's Lick State Historic Site	Howard	39°04'58.84" N 92°52'46.77" W	"No associated plants or animals" (MNHD 1984). "Of historical interest only" since the "natural community barely remains" (MNHD 1999). Historically open around the seep with beetles present (DWB, RLH, TCM). Now heavily vegetated.
1b	Creek adjacent to Boone's Lick State Historic Site	Howard	39°04'54.07" N 92°52'53.28" W	No information available from MNHD. Historically open saline areas along creek (DWB). Small saline seeps remain but are subject to frequent trampling by cattle.
2	Blackwater Spring	Cooper	38°58'02.60" N 92°58'52.83" W	"Low quality spring, good flow" (MNHD 1985). "Salt flats and shallow marsh with associated plants. Site used for cattle in winter" (MNHD 1999). Historically open ground surrounded the spring (RLH). Now heavily vegetated.
3	Salt Branch of Camp Creek	Saline	39°04'49.41" N 93°06'13.48" W	"Few barren salt flats," "good population of blue tiger beetle" (MNHD 1985). Fescue invasion and a "destroyed" plant community (MNHD 1999). Beetles found on open path (RLH). Now a disturbed vehicle crossing.
4a	Blue Lick Cons. Area (north seep)	Saline	39°00'35.94" N 93°13'12.19" W	"Severely disturbed," natural community "largely nonexistent" (MNHD 1985). An open mud flat now surrounds the spring.
4b	Blue Lick Cons. Area (middle seep)	Saline	39°00'08.10" N 93°13'14.55" W	"Severely disturbed," "integrity of the area as a community has been lost" (MNHD 1984). An open mud flat now surrounds the spring.
4c	Blue Lick Cons. Area (south seep)	Saline	38°59'41.44" N 93°13'29.26" W	"Saline seep impacted by previous cropping attempts, increased siltation and drainage attempts" (MNHD 2001). Surrounded by open mud flat 2001-2002, mostly flooded in 2003 and 2004, dry due to apparent draining in 2005, and again flooded and overgrown in 2008. Now encroached by cattails, possibly a result of decreased salinity due to dilution.
5	Moniteau Lick	Howard	39°04'37.75" N 92°34'41.75" W	"Heavy past grazing" and "extensive gray mineralized mudflats" (MNHD 1989). "Continued winter cattle use," of "questionable significance" (MNHD 1999). Now heavily encroached by vegetation and frequently trampled by cattle.

[1] Sources of information: DWB = David W. Brzoska, MNHD = Missouri Natural Heritage Database, RLH = Ronal Huber, TCM = Ted C. MacRae.

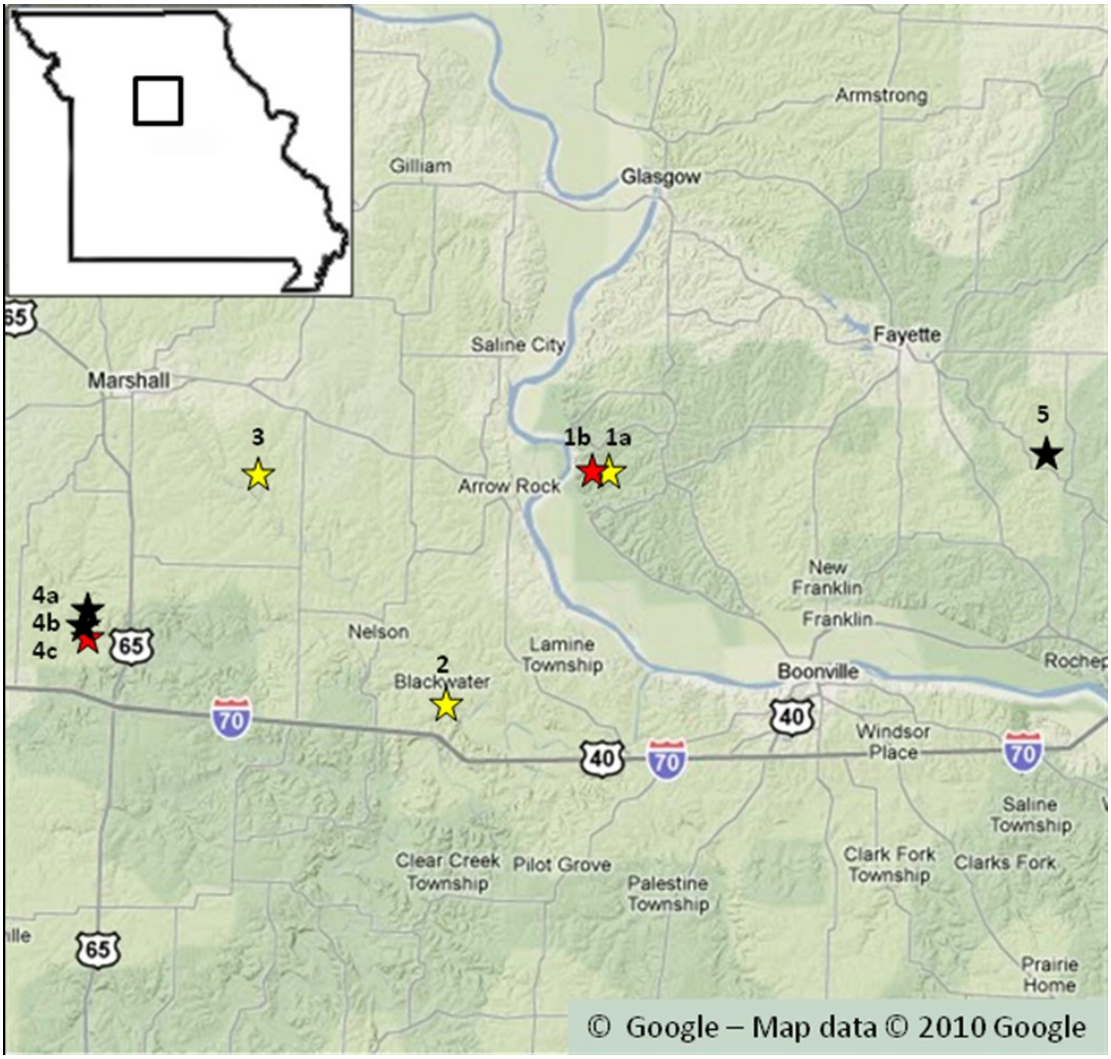

Figure 1. Saline seep survey sites (see Table 1 for key to numbers). Red stars indicate sites where *Habroscelimorpha circumpicta johnsonii* was observed during this survey, yellow stars indicate sites where the species has been recorded historically but was not seen during this survey, and black stars indicate sites from which the beetle has not been recorded at any time. Black box on inset map of Missouri denotes survey area in central Missouri.

coloration with whitish maculations extending along the length of the elytral margins (Fig. 2).

RESULTS

Table 2 lists the localities surveyed, the dates of each visit, and the number of beetles encountered. Adult *H. c. johnsonii* were encountered at only one of the three localities where it was known to occur historically (Table 2, Fig. 1). This locality is on private property immediately adjacent to Boone's Lick State Historic Site, where a number of small saline seeps were found along the banks of a small creek (Fig. 3). Only one adult was found (8.vii.2001) in nine visits, and the ability of this area to support a viable population is doubtful due to frequent trampling by cattle (Fig. 3a). The impact of cattle disturbance at this site was especially evident on one occasion when a large number of cattle were observed walking over the ground where the beetle had been found (Fig. 3b). In adjacent Boone's Lick State Historic Site, Boone's Lick Spring proper was historically surrounded by an extensive barren area, and it is from this area that the majority of beetles have been observed historically. The area around the seep is now heavily shaded by surrounding forest and highly encroached by herbaceous vegetation. No beetles were observed in this area at any time during the survey, and it is unlikely that the area is still capable of supporting the beetle.

The other two sites from which the beetle had been recorded historically (Blackwater Spring and Salt Branch of Camp Creek) appear now to be incapable of supporting the beetle. Like Boone's Lick, Blackwater Spring was described as open in the past (J. Luscombe, D. W. Brzoska, R. L. Huber, in litt.) but is now heavily encroached by vegetation. At Salt Branch on Camp Creek, one small, still-flowing seep was located along the banks of the creek which corresponded to the description of the historical location. However, since the site serves as a vehicle crossing point and appeared to have been recently disturbed by heavy equipment, it was considered incapable of supporting the beetle.

Of the two potential localities surveyed, the beetle was found in small numbers at only one: Blue Lick Conservation Area (Saline Co.) (Table 2,

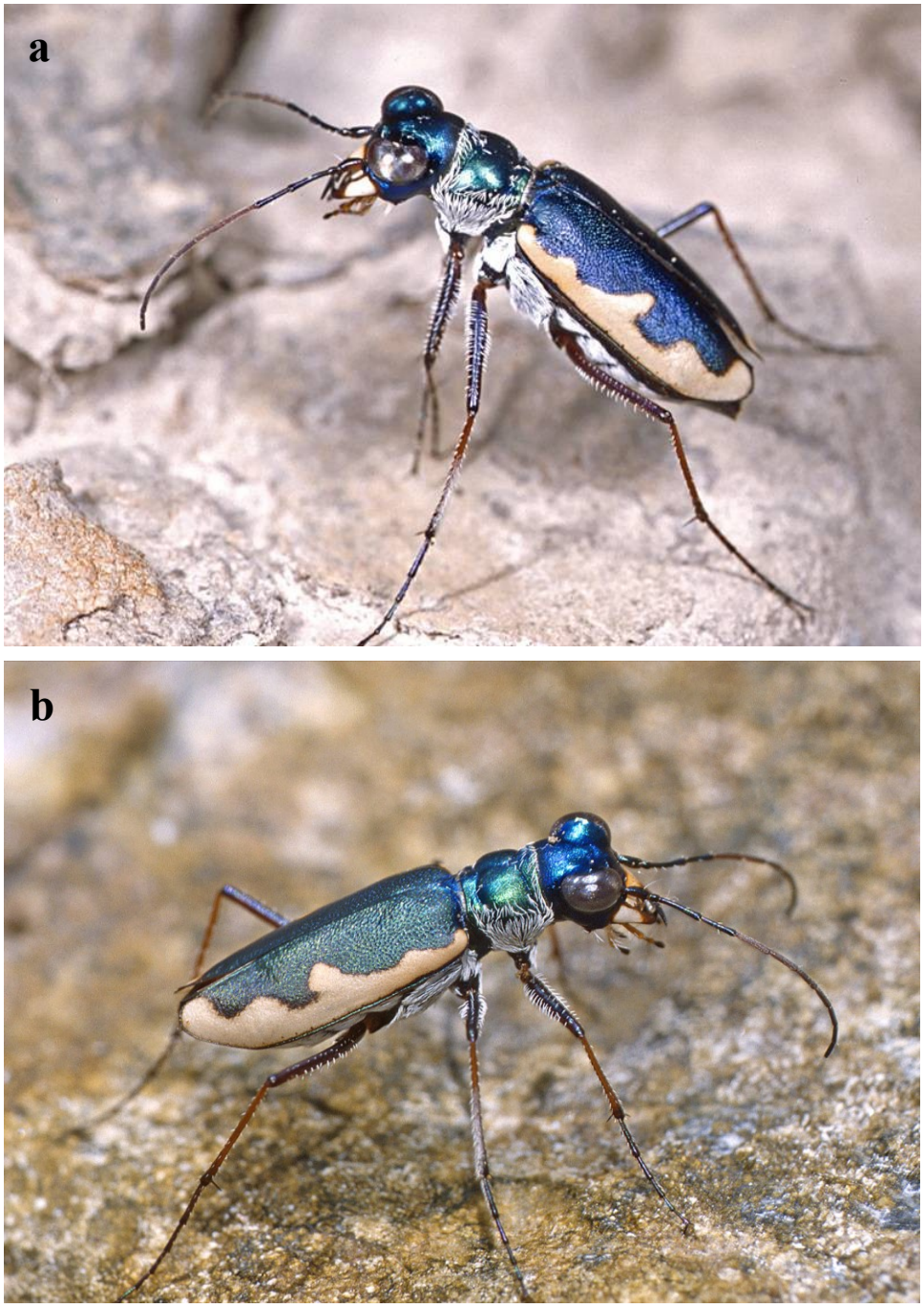

Figure 2. *Habroscelimorpha circumpicta johnsonii* adults showing the blue to blue-green coloration exhibited by Missouri disjunct individuals: a) Blue Lick Conservation Area (south), 22.vii.2001; b) same locality, 7.vii.2002. Photos by CRB.

Table 2. Survey results for *Habroscelimorpha circumpicta johnsonii* in central Missouri during 2001–2003.

Site	Name	Date	# Observed	Comments
1	Boone's Lick State Historic Site and creek on adjacent private property[2]	24.vi.2001	0	–
		8.vii.2001	1	area trampled by cattle
		22.vii.2001	0	–
		11.viii.2001	0	–
		7.vii.2002	0	–
		13.vii.2002	0	–
		26.vii.2003	0	cattle in creek; survey not possible
		9.viii.2003	0	–
3	Salt Branch of Camp Creek	24.vi.2001	0	–
		8.vii.2001	0	–
		10.viii.2002	0	–
		9.viii.2003	0	–
2	Blackwater Spring	22.vi.2001	0	–
		14.vi.2002	0	–
		26.vii.2003	0	–
4	Blue Lick Conservation Area[1]	24.vi.2001	0	area partially flooded
		8.vii.2001	0	–
		22.vii.2001	1	–
		11.viii.2001	0	–
		29.vi.2002	2	–
		30.vi.2002	3	–
		7.vii.2002	4-5	15+ active larval burrows observed
		13.vii.2002	4	–
		10.viii.2002	1	–
		28.vi.2003	0	majority of area flooded 3 active larval burrows observed
		27.vii.2003	0	majority of area flooded 2 active larval burrows observed
		9.viii.2003	3	partially flooded; some habitat exposed
5	Moniteau Lick	14.vii.2002	0	

[1] Beetles observed at south seep only.
[2] Beetle observed on private property.

Figure 3. Saline seeps where *Habroscelimorpha circumpicta johnsonii* was found: a) cattle-trampled saline seep along creek adjacent Boone's Lick State Historic Site, 11.viii.2001; b) cattle in area of saline seep adjacent Boone's Lick State Historic Site, 26.vii.2003; c) Blue Lick Conservation Area (south), 30.vi.2002; d) Blue Lick Conservation Area (south) under chronic inundation, 9.viii.2003; e) Blue Lick Conservation Area (south) drained and dry, 15.vii.2005; f) Blue Lick Conservation Area (south) flooded and overgrown, 15.vii.2008. Photos by CRB.

Figure 4. *Habroscelimorpha circumpicta johnsonii* larva (presumed), Blue Lick Conservation Area (south), 7.vii.2002. Photo by CRB.

Fig. 1). Three saline seeps are located at this site, all of which exhibited large, barren, undisturbed saline flats that appeared to be highly suitable habitat for the species. Despite this, beetles were only encountered at the "south" seep (Fig. 3c). The highest numbers of adult beetles were observed at this seep on 7.vii.2002 (4–5) and 13.vii.2002 (4). Smaller numbers were observed also on 22.vii.2001; 29.vi, 30.vi, and 10.viii.2002; and 9.viii.2003. Third-instar larvae (Fig. 4), presumably representing this species based on location within moist saline mudflats and close proximity to adults, were observed at the south seep as well, with as many as 15–20 active larval burrows noted on 13.vii.2002. Fewer beetles were observed during 2001 and 2003 than in 2002. Flooding of the area around the seeps in 2001 may account for only one beetle observation during that year, and flooding was clearly responsible for the paucity of adults observed during the 2003 season since the area was submerged for the majority of the season (Fig. 3d). The flooding in 2003 was apparently due to earth movement activities conducted by Missouri Department of Conservation (MDC) personnel at the south seep intended to improve the area by reducing the potential for long-term inundation. Unfortunately, follow-up visits to Blue Lick during the prime activity period of the beetle in subsequent years have found that the area continues to be unsuitable for the beetle. The inundation of the area observed in 2003 continued through 2004. In 2005 MDC drained the area in an effort to restore the site, but in 2008 it was once again flooded and heavily encroached by marsh vegetation as well (Fig. 3e-f). Similar observations were made by Steve Spomer (in litt.) during 2009.

No beetles were encountered at the second potential new site, Moniteau Lick. The Natural Heritage Database describes the area as containing "extensive gray mineralized mudflats," but during our survey the habitat was found to be heavily encroached by vegetation and suffering recurrent cattle trampling and was considered incapable of supporting a viable population of the beetle.

CONCLUSION

Until recently, an isolated population of *H. c. johnsonii* was consistently and often abundantly associated with saline seeps at three sites in central

Missouri. Apparent declines in the population and the quality of their habitats were noted beginning in the 1990s. These declines have been confirmed as a result of this survey. During the 3-year study period, only a single adult beetle was encountered at these sites, all three of which exhibited significant degradation due to vegetational encroachment, cattle trampling, or other anthropogenic disturbance. Only two potential new sites were identified in the Missouri Natural Heritage Database, and concurrent surveys revealed a small population of the beetle at only one of them. Three apparently suitable saline seeps exist at this site; however, beetles were only observed at one of them, and prolonged flooding at this seep during the third year of the study and in subsequent years has apparently resulted in significant vegetational encroachment and loss of habitat. No beetles have been observed in repeated visits to this site during subsequent years.

In 2004, the conservation status of *H. c. johnsonii* was revised to "S1" or "critically imperiled" due to the highly restricted nature of the beetle's preferred saline seep habitats in Missouri, the apparent threat to the integrity of these habitats, and the drastic reduction in the beetle population documented by our study (Brown and MacRae 2004). In view of the subsequent loss of habitat at the Blue Lick Conservation Area south seep in the years following the survey, we now conclude that the Missouri disjunct population of *H. c. johnsonii* is below detectable limits and possibly extirpated. It is unlikely that additional saline seeps of sufficient quality capable of supporting viable populations of the beetle remain to be found in central Missouri, and of the four sites where it has been recorded, three appear to have suffered irreparable degradation. Only Blue Lick Conservation Area appears to still contain sufficient suitable habitat at the middle and north seeps to support the beetle. It is this site that offers the last hope for saving this species from extirpation within Missouri, whether through natural or assisted recolonization by the endemic population (if it still occurs in Missouri) or through reintroduction with stock from the main population in the central-southern United States. It is imperative that these last, high quality examples of Missouri's critically imperiled saline seeps be protected if the beetle is to have any chance of surviving in the state.

The loss of this beautiful and distinctive beetle from Missouri's native fauna would represent a significant and tragic loss to this state's natural heritage. We urge the Missouri Department of Conservation, the Missouri Department of Natural Resources, and other conservation organizations within the state to identify and allocate the resources needed to develop and implement a recovery plan for the species in Missouri.

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