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## Distribution, Conservation and Current Status of Three Endemic *Heterosternuta* (Coleoptera: Dytiscidae: Hydroporinae) in Arkansas

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Running Title: Distribution, Conservation and Current Status of Three Endemic *Heterosternuta* in Arkansas

The genus *Heterosternuta* Strand contains 14 species of predacious diving beetles restricted to the eastern half of North America (Larson et al. 2000). Several species are regionally endemic in parts of the Interior Highlands and Appalachian Mountains (Wolfe 2000). The Sulphur Springs diving beetle, *Heterosternuta sulphuria* Matta and Wolfe (Matta and Wolfe 1979) and *H. phoebeae* Wolfe and Harp (Wolfe and Harp 2003) are restricted to Ozark streams, whereas *H. ouachita* Matta and Wolfe (Matta and Wolfe 1979) is more widespread, found in streams in both the Ozark and Ouachita mountains. All three are species of greatest conservation need in Arkansas (Anderson 2006). The combined global and subnational ranks for these species are the following: *H. sulphuria*; G1?S1?, *H. phoebeae*; G?S2, and *H. ouachita*; G?S2; a question mark denotes inexact numeric rank (Anderson 2006). Surveys were initiated in 2007 to determine locations of additional population of *H. sulphuria* in Arkansas. During these surveys conducted through 2012, additional collections of *H. phoebeae* and *H. ouachita* were made. Updated county records for these species are reported here and additional notes on their conservation status are provided.

### *Heterosternuta sulphuria*

*Heterosternuta sulphuria* was first collected in 1955 from Sulphur Springs, AR (Matta and Wolfe 1979). Additional historical surveys produced only four specimens from over 1000 beetles collected from the watershed of the Buffalo National River (Harp 1989, Wolfe and Harp 2003). Longing and Haggard (2009) provide new records for *H. sulphuria* including localities associated with relatively well-protected public lands. In total, *H. sulphuria* is reported from 12 counties in northern and northwestern Arkansas (Figure 1). Although new information for this species suggests a downgrade of conservation status based on

total number of occurrences across the 12 counties (42 to date), its distribution across isolated upland aquatic habitats and observed flightlessness (Longing, unpublished data), suggests that a relaxed conservation ranking for this species based on total occurrences could potentially be in contrast to its overall vulnerability. We suggest a preliminary conservation status of S1-S3 until further information on this species is developed.

Based on field observations in Arkansas, potential exemplar populations for *H. sulphuria* are noted from upper Sneed's Creek watershed of the Ponca Wilderness- Buffalo National River (BNR). It would be useful for conservation purposes to survey such protected sites across southern Missouri for comparison with populations at BNR. Increased vulnerability of populations on unprotected lands in Arkansas will likely emphasize the importance of protected locations such as BNR for sustaining populations. Other protected areas where *H. sulphuria* was collected include the Ponca and Indian Creek Wilderness Areas in the watershed of BNR, Hobbs State Park and Conservation Area, and various locations within the Ozark-St. Francis National Forest (Longing and Haggard 2009, Longing, unpublished data).

From a total of 11 small streams surveyed in Washington County, four populations were found in watersheds dominated by urban land-use. From these urban streams, individuals were collected from stream margins with vegetated riparian corridors. Additional studies are being conducted to determine relationships of land cover and *H. sulphuria* occurrences at a variety of spatial scales (e.g., local, riparian and watershed) to support specific conservation actions in small watersheds exposed to land-development. Populations could potentially provide targets for voluntary best management practices and riparian conservation across small watersheds in northwestern Arkansas and other

areas in the Ozarks vulnerable to urbanization.

### *Heterosternuta phoebeae*

This species is reported from three counties from historical surveys (Harp 1989, Wolfe and Harp 2003, *unpublished data*), with all collections from tributaries of the Buffalo National River. Recent surveys provide additional records for Madison, Carroll and Marion Counties. These county records extend the known range of this species outside the watershed of the Buffalo National River to the Kings River watershed (Dry Fork Creek) and two streams draining into Table Rock Lake, East Sugarloaf Creek and Indian Creek near Urbanette, Arkansas. Additional surveys of streams adjacent to the watershed of the BNR should provide a better assessment of the distribution and conservation status of *H. phoebeae*.

### *Heterosternuta ouachita*

Records for *H. ouachita* come from several historical surveys (Matta and Wolfe 1979, Pippinger and Harp 1985, Harp 1989, Harp and Robinson 2006) showing occurrences across 11 counties. One new record for *H. ouachita* (Washington County, Kruger 2009) extends its known range further into northwestern Arkansas. More surveying of streams in the Ouachita National Forest and the Upper Kiamichi River Wilderness would further inform our knowledge of the distribution and conservation status of this species.

The known range of *H. phoebeae* extends across seven counties in Arkansas while that of *H. sulphuria* extends across 12 counties. These two endemic species have co-occurred infrequently, yet were often collected from different longitudinal zones in the same stream-river network. *Heterosternuta sulphuria* primarily occupied first, second and third order Ozark streams (mean watershed area 5.5 km<sup>2</sup>, n = 42) while *H. phoebeae* was rare in these smaller watersheds (mean watershed area 47.6 km<sup>2</sup>, n = 11). Furthermore, the flight capacities of these two species are different, as *H. sulphuria* shows flightlessness in laboratory observations and experiments, whereas *H. phoebeae* is a relatively stronger flier (Longing et al., *unpublished data*). Therefore, we expect that *H. phoebeae* would have a broader distribution than the potentially locally-isolated *H. sulphuria*, but this appears not to be the case; the more broadly distributed *H. sulphuria* could be isolated in small watersheds and therefore a multitude of populations in these habitats could be

threatened. Ongoing research is addressing issues of gene flow and landscape variables that contribute to maintaining biodiversity across small Ozark watersheds.

Conservation of *H. sulphuria* across small watersheds has important implications regarding biodiversity, conservation and policy-making in northwestern Arkansas, a region undergoing rapid population growth. Benton and Washington Counties showed population increases of 44.3 and 28.8 percent, respectively (2010 Census, U.S. Census Bureau, www.census.gov). Efforts to protect *H. sulphuria* populations and habitats could guide conservation actions towards a focus on stream and river networks, a firmer ecological basis for policies that aid local and regional conservation programs. Understanding the relationships between population conditions and conservation actions (e.g., riparian conservation and restoration) is a necessary next step to ascertain conservation actions and the potential of *H. sulphuria* as an indicator species.

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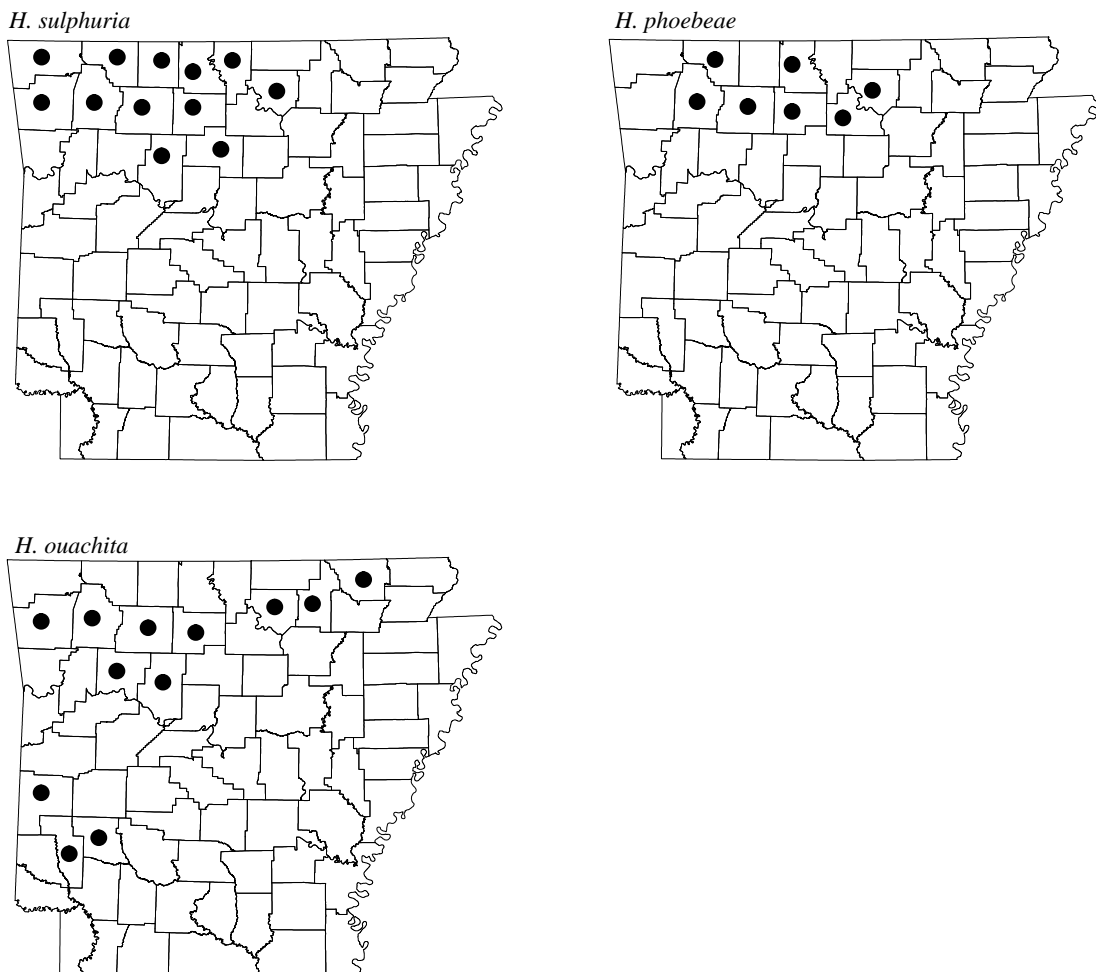


Figure 1. Distribution of the regionally endemic *H. sulphuria*, *H. phoebeae* and *H. ouachita* in Arkansas.