

Genus-wide assessment of *Batrachus* (Amphipoda: Crangonyctidae) informs conservation and management of groundwater habitats

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The genus *Batrachus* is comprised of eight species of eyeless subterranean species found in caves, springs, and other shallow groundwater habitats across twelve states the Midwestern United States. We re-evaluated patterns of distribution in this genus and reviewed threats in the course of reassessing the NatureServe global and state conservation ranks and conducting the first IUCN Red List conservation status assessments for each species. We examined land cover and human population density within 2.5 km buffers around each occurrence. Four species (*B. angulus*, *B. cellulanus*, *B. speleopolis*, and *B. wilsoni*) are known from ≤ 3 localities and very restricted distributions. Dominant land cover varied among the eight species. For the possibly extinct and single-site endemic *B. cellulanus*, land cover was dominated by developed lands (86.8%). Land cover around the three *B. angulus* occurrences is dominated by forests (58.3%), but pasturelands are also common (15.3%). Fecal coliform enrichment may contribute to degradation of groundwater habitat of this species. Land cover for *B. speleopolis* and *B. wilsoni*, was also dominated by forests (62.7% and 44.0%, respectively), but pasture (24.6% and 29.0%, respectively) and developed (9.9% and 7.9%,

respectively) land cover were also common, suggesting a variety of human impacts on these rare species. Of the four species that are more widely distributed, land cover for *B. mucronatus* (88 sites) is heavily dominated by cover classes representing human modification, including croplands (68.8%) and developed lands (16.6%). Only *B. pseudomucronatus* is little affected by human activities, with 85.6% of its cover in forest. Combined human altered lands (developed, pasture, crops) comprise 89.2% and 90.6%, respectively, of the land cover for two species (*B. cellulanus* and *B. mucronatus*), 43.0–46.1% for three species (*B. brachycaudus*, *B. hubrichti*, and *B. wilsoni*), 23.1–24.6% for two species (*B. angulus* and *B. speleopolis*) and only 11.15% for *B. pseudomucronatus*. These data suggest a wide range of impacts and vulnerability across species, pointing towards the need to develop management strategies aimed at conservation at the species level instead of at the generic level. Based on both NatureServe and IUCN Red List conservation criteria, half of the *Batrachus* species are at significant risk of extinction, while the other four species are wide-ranging and not currently threatened.

