



The Conservation Status of Stygofauna

white paper

Government Initiative Place Stygofauna Under the Microscope

With the recent release of the Queensland Government's 'Guideline for the Environmental Assessment of Subterranean Aquatic Fauna' (Department of Science, Information Technology, Innovation and the Arts, October 2014), it is timely to review the conservation issues relating to stygofauna in Queensland (and more broadly) and the importance of robust environmental assessment of stygofauna to inform sustainable development.

What are Stygofauna and why the concern?

Subterranean aquatic fauna (i.e. stygofauna) are a highly specialised group of animals that live within groundwater ecosystems, such as alluvial and fractured rock aquifers. Traits of stygofauna that allow them to persist in underground aquatic ecosystems include tiny size (as space is limited in most aquifers), absence of eyes and pigmentation (as their habitats are constantly in darkness), and elongated appendages (for tactile sensing of their surrounding environment). Stygofauna are dominated by invertebrates, especially various types of crustacean, although several species of blind fish are known from kast groundwater ecosystems in Western Australia.

Research on stygofauna in Queensland is very limited, but the few studies that have been completed indicate that stygofauna are likely to be ubiquitous, that individual species of stygofauna appear to be geographically restricted (i.e. stygofauna are narrow range endemics), and that they can occur in aquifers with highly variable water quality characteristics, including very low and high electrical conductivity (i.e. very fresh and very salty ground water). The narrow distributions of stygofaunal species demonstrates that they have limited abilities for dispersal and range expansion even over evolutionary time scales (i.e. hundreds of thousands to millions of years); thus, over much shorter time scales (such as those relevant for environmental management; months to years) the ability of stygofauna to disperse and recolonise areas where groundwater ecosystems have been heavily impacted is extremely limited. Instead, stygofauna are likely to become locally extinct in areas where groundwater environments have been severely impacted, whether by contamination, severe compaction or dewatering.

Giving the vulnerability of stygofauna to impacts to groundwater ecosystems, and high levels of development, it is fitting to review whether stygofauna should be listed as threatened species under conservation legislation.

Classifying Stygofauna as threatened

To be classed as threatened there must be some 'risk of extinction' to a species, either in the short term (critically endangered, endangered) or in the longer term (vulnerable). Risk factors for extinction include threatening processes (e.g. habitat destruction), declining population size, narrow distribution and / or dependency on a specialised habitat type. Where one or more of these risk factors is reasonably considered to create a risk of extinction to a species, then the species may be classified as threatened under appropriate conservation legislation

In Queensland, the Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and Queensland's *Nature Conservation Act 1992* are the main legislative instruments for the protection of threatened species.

Currently, one stygofaunal species, the Cape Range remipede (*Lasionectes exleyi*) from the Pilbra Region of Western Australia, is listed as a threatened species (vulnerable) under the EPBC Act [and under Western Australia's *Wildlife Conservation (Specially Protect Fauna) Notice 1998*]; no stygofaunal species are currently protected under legislation in other states. Reasons for the listing of the Cape Range remipede under the Commonwealth legislation include its narrow distribution (i.e. restricted to the Bundera Sinkhole), dependency on a specialised habitat type and absence of any other formal protection. These reasons do not appear to be unique to this species, and for example in regions of Queensland where high levels of groundwater development are currently occurring and planned to occur, stygofauna likely satisfy several of the criteria for being threatened (i.e. presence of threatening process, narrow ranges, dependency on a specialised habitat).

One notable region of Queensland is the Surat Basin, which has been declared the 'Surat Cumulative Management Area' under Queensland's *Water Act 2000*. This is a region where the combined pressures of existing and future groundwater extraction for agriculture and coal seam gas development are recognised as potentially having cumulative broad-scale impacts to groundwater ecosystems. To assess and manage potential impacts to groundwater ecosystems within the Surat Cumulative Management Area, the *Water Act 2000* requires the preparation of the Underground Water Impact Assessment Report for the Surat Cumulative Management Area, composed of a 'Water Monitoring Strategy' and a 'Spring Impact Management Strategy'. The requirement for the Spring Impact Management Strategy is largely based on springs (i.e. the community of native species dependent on the natural discharge of groundwater from the Great Artesian Basin) being listed as threatened (endangered) under the EPBC. Will it require stygofauna to also be listed under conservation legislation, for appropriate assessment and management of groundwater to ensure reasonable management of groundwater fauna in Queensland?

As stygofauna science is a relatively new field, most stygofaunal species have not been formerly described (i.e. stygofauna contain many new species that have not yet been given a scientific name). This represents an impediment for protecting stygofauna for example under Queensland's *Nature Conservation Act 1992*, as species need to have a scientific name to be listed under this legislation. However, the EPBC provides for the protection of threatened 'ecological communities' (such as springs). These ecological communities can contain multiple undescribed species; thus, the listing of stygofauna communities within the Surat Cumulative Management Area (and other regions where significant groundwater development is planned) represents an opportunity for the protection of this threatened fauna.

Opportunities to keep a step ahead

There is also an opportunity for proponents of developments that modify groundwater ecosystems, especially those that extract large volumes of water within the Surat Cumulative Management Area, to get 'a step ahead' and implement appropriate assessment of stygofauna in areas of their operation. The release of the Queensland Government's guidelines for assessment of subterranean fauna demonstrates that there is a current and likely increasing expectation by the regulators for stygofauna assessments to be incorporated into environmental monitoring and reporting frameworks. Fortunately, the additional investment required to implement stygofauna assessments is minimal: stygofauna are easily sampled from groundwater bores (although the sampling equipment is specialised), and these groundwater bores are commonly monitored for water quality and hydrological parameters. Expanding the scope of existing groundwater monitoring programs to include stygofauna would incur minimal additional cost.

The implementation of stygofauna assessment across Australia represents an opportunity to improve environmental management, and reduce risk and uncertainty of developments that modify groundwater ecosystems.

This white paper was prepared by Dr Ben Cook, Principal Ecologist – Freshwater, December 2014.