

# ‘The Smallest Elephant in the Room’

should stygofauna be listed as threatened  
in parts of Queensland?

Presenter: Dr Ben Cook  
[bencook@frcenv.com.au](mailto:bencook@frcenv.com.au)

# Groundwater Ecosystems

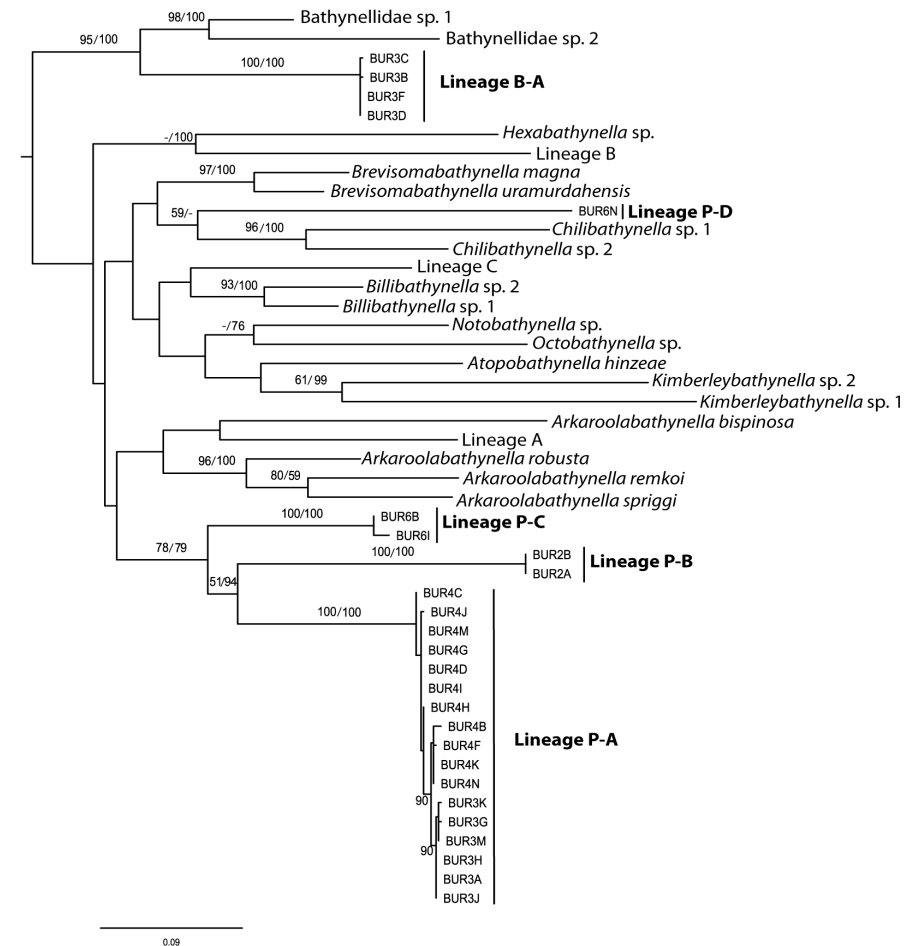
- 97% of the world's unfrozen freshwater resides in subterranean aquifers
- groundwater historically viewed as 'sterile' water storages
- ecological roles of groundwater are increasingly becoming recognised:
  - sustain wetlands, springs and base-flow stream ecosystems
  - intercept root zone of many dependent vegetation types
  - recognised as an ecosystem in their own right
    - diverse types of groundwater ecosystem (karst, alluvium, fractured rock)
    - unique and highly specialised fauna (stygo fauna)

# Introducing Stygofauna

- Aquatic animals that live in aquifers (groundwater)
- Dominated by invertebrates, especially crustaceans
- Adaptations to subterranean life
- Limited research to date, but key findings are:
  - high species diversity
  - narrow distributions
  - high endemism
  - when we look we tend to find them
- Thought to provide 'ecosystem services' and maintain quality of groundwater

# Research Case Study: Burdekin River Alluvial Aquifer

- 26 bores surveyed over a one week period
- 6 bores contained stygofauna (23%)
- Five species across two families were identified:
  - four of which were found in only a single bore
  - all of which likely belonged to a new genera



# National Water Quality Management Strategy

‘Little is known of the lifecycles and environmental requirements of these quite recently-discovered [stygofaunal] communities, and given their high conservation value, the groundwater upon which they depend should be given the highest level of protection’ (ANZECC & ARMCANZ 2000. Box 1.2, page 1-2).

# What determines if a species is 'threatened'?

- Threatened – 'at risk of extinction'
- Risk factors:
  - threatening processes
  - trends in population size
  - narrow distribution
  - dependent on limited or specialised habitat

# What determines if a species is 'threatened'?

- Threatened – 'at risk of extinction'
- Risk factors:
  - threatening processes
  - trends in population size
  - narrow distribution
  - dependent on limited or specialised habitat
- Other key factors relevant for conservation biology :
  - capacity for demographic recovery (generation time, fecundity)
  - population structure (social, spatial)

# Does stygofauna qualify as ‘threatened’?

- Threatened – ‘at risk of extinction’
- Risk factors:
  - Threatening processes – aquifer drawdown
  - Trends in population size – unknown
  - Narrow distribution – narrow range endemic
  - Dependent on limited or specialised habitat – localised sections of groundwater ecosystems
- Other key factors relevant for conservation biology :
  - Capacity for demographic recovery – unknown, thought to be low
  - Population structure – high degree of spatial population subdivision

# Does stygofauna qualify as 'threatened'?

- Threatened – 'at risk of extinction' – possibly, in some regions
- Risk factors:
  - Threatening processes – aquifer drawdown
  - Trends in population size – unknown
  - Narrow distribution – narrow range endemic
  - Dependent on limited or specialised habitat – localised sections of groundwater ecosystems
- Other key factors relevant for conservation biology :
  - Capacity for demographic recovery – unknown, thought to be low
  - Population structure – high degree of spatial population subdivision

# Cape Range Remipede

## *Lasionectes exleyi*

- Listed as 'Vulnerable' under the EPBC 1999
- Listed as 'rare and likely to become extinct' in WA's *Wildlife Conservation (Specially Protected Fauna) Notice* 1998
- Reason for listing:
  - Endemic to Bundera Sinkhole, a specialised subterranean groundwater ecosystem
  - Identified threats:
    - Lack of formal protection of habitat
    - Impacts to water quality from visitors to the sinkhole
- These reasons don't appear unique to this species

# Compare Conservation of Springs

## *Environment Protection and Biodiversity Conservation Act 1999:*

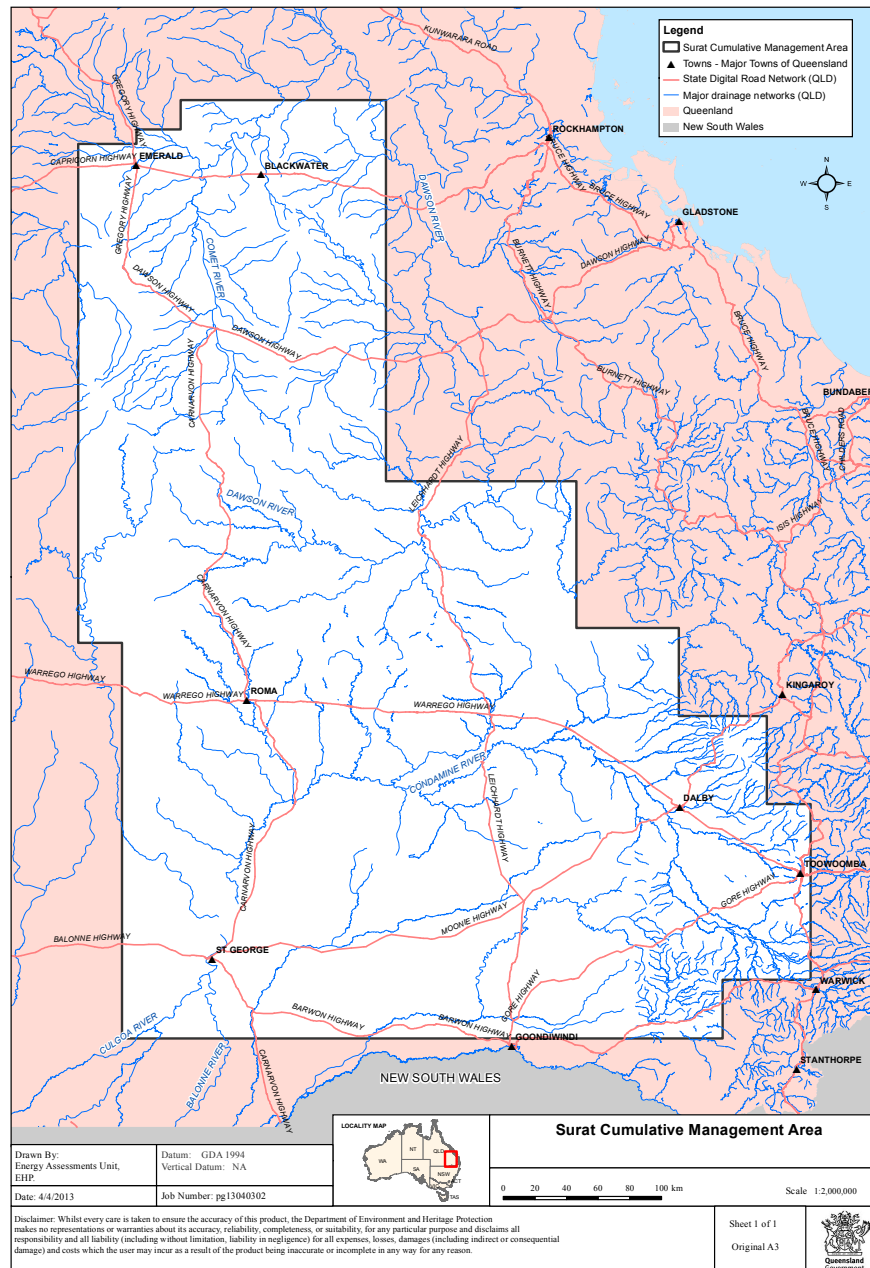
- ‘community of native species dependent on natural discharge of groundwater from GAB’
  - ‘Endangered Ecological Community’
- several species that live in springs are listed as threatened (some also listed under NC Act)
  - salt pipewort

## *Underground Water Impact Report (UWIR) for Surat Cumulative Management Area – statutory instrument under the Water Act 2000:*

- Spring Impact Management Strategy (SIMS), including comprehensive survey of hydrological and ecological attributes of springs
- Water Management Strategy, requires monitoring of groundwater pressure and quality across network of bores.
  - Ecological assessment of groundwater ecosystems not required

# Surat Cumulative Management Area

- Multiple adjacent existing and proposed 'users' of groundwater
- Underground Water Impact Report
  - ecological assessment of springs
  - no requirement for ecological assessment of groundwater



# Challenges for Stygofauna Conservation

- The taxonomic impediment and the listing of a multitude of undescribed species
- Survey effort required to detect stygofauna
  - high false-negative detection rate; adequate assessment requires multiple surveys
- Adequacy of impact assessment requirements for stygofauna within ToRs for major resource development projects
  - often only desktop study is required; 'difficult' without a primary literature
  - assessments (when required) ask for presence of 'significant' stygofauna, which is undefined
    - commonly meant that detected stygofauna can be dismissed as 'not significant'
- Focus of ecological assessment of groundwater on surface expression of groundwater (ie springs)
- Recent move towards streamlining environmental approvals processes, rather than additional requirements for environmental assessment

# Opportunities for Stygofauna Conservation

- Stygofauna and their habitat are recognised as having high conservation value in national policy
  - National Water Quality Guidelines (ANZECC & ARMCANZ 2000)
- The listing of stygofauna as ‘threatened ecological communities’
  - overcome ‘taxonomic challenges’ of listing undescribed species
  - compare ‘ecological communities dependent on discharge of groundwater’
  - needed so that groundwater is managed as an ecosystem rather than as a ‘sterile’ water supply
- Widen existing groundwater monitoring initiatives to include assessment of stygofauna
  - assess adequacy of hydrogeological triggers for maintaining stygofauna

# Potential Consequences for those Impacting Groundwater

- Opportunity for those that already undertake monitoring of physical properties of groundwater to also monitor groundwater ecology
  - low additional cost
  - leading edge understanding of threatened ecological communities
- Given Government's current interest in GDEs, and if policy becomes mandated in legislation, it may become expected that
  - impact assessment of threatened communities is based on primary data
  - ongoing management of threatened communities is supported by baseline monitoring

# Conclusions

## Stygofauna:

- a frontier for biological diversity discovery
- likely threatened in areas where groundwater use is high, such as cumulative management areas
- potential for listing as a threatened ecological community
- empirical assessment within existing monitoring programs
- protection can be achieved:
  - ecological trigger levels for groundwater
  - offsets (sensu WA guidelines for stygofauna assessment)
  - small investment in baseline assessment
- let's look after the 'horse' before it bolts