

Guideline for the Environmental Assessment of Subterranean Aquatic Fauna

Sampling Methods and Survey Considerations

This guideline provides general advice on the minimum requirements for sampling adequate to assess subterranean aquatic fauna in an environmental assessment process. This guideline specifically outlines information that must be considered during the development of subterranean aquatic fauna survey and sampling projects.

Desktop Review

A thorough desktop review provides background information that may be used to determine the necessity and scope for a survey of subterranean aquatic fauna. A desktop review uses existing information, including bore data and local geological setting, to assess the likely presence and composition of subterranean aquatic faunal communities in the project area and the likely degree of impact on subterranean aquatic fauna from proposed activities. It is expected that an appropriate risk assessment framework should be utilised (e.g. Clifton et al. 2007). Desktop reviews must address the following items using documented evidence:

- Assess the suitability of local habitat for subterranean aquatic fauna (based on local geological, hydrological and other information, including the distribution of any alluvium present in the project area and likely hydrological connectivity with geological formations targeted for development);
- Determine the presence and composition of subterranean aquatic fauna in the region and project area (based on previous published and/or unpublished studies); and
- Assess the likely degree of impact on any subterranean aquatic fauna including direct (e.g. drawdown of groundwater, compaction of habitat) and indirect impacts (e.g. siltation, groundwater contamination).

In some cases, a desktop review may demonstrate that the presence of subterranean aquatic fauna is unlikely and a project will not impact on subterranean aquatic fauna. Where a desktop review does not provide convincing evidence supporting this conclusion, a pilot survey must be carried out to determine the local presence or absence of subterranean aquatic fauna.

Pilot Survey

The appropriate scope of a survey will depend on the likely presence of subterranean aquatic fauna habitat. Where insufficient information is available to assess the likely presence of subterranean aquatic fauna habitat or a high level of uncertainty exists, a pilot survey must be undertaken to address knowledge gaps in the desktop review. The aim of a pilot survey is to verify the accuracy of the desktop review and to address any knowledge gaps regarding the suitability of local habitat for subterranean aquatic fauna (e.g. where no data exist for key aquifers or geological formations in a project area). A pilot survey involves collecting and

identifying subterranean aquatic fauna present in samples from ten representative bores. The sampling method and survey considerations are the same for a pilot survey as for a comprehensive survey (outlined below). Where pilot survey confirms the presence of subterranean aquatic fauna a comprehensive survey is required.

Comprehensive Survey

The aim of a comprehensive survey is to gather more detailed information on local subterranean aquatic fauna. A comprehensive survey must collect a total of 40 samples from a minimum of ten representative bores (e.g. four samples could be collected from ten representative bores, two samples could be collected from twenty representative bores, etc.). These samples must be acquired over at least two seasons, with sampling occurring at least three months apart.

Survey Design Considerations

The specific survey design is likely to vary according to situation, however generally a reasonable sampling effort must occur across the project area and in nearby areas outside the project area (acting as control sites). A reasonable sampling effort will collect most species present and provide sufficient information to demonstrate the likely impacts of a project on local subterranean aquatic fauna.

Sampling must encompass the full range of geomorphology present including outcropping and subcropping geological formations in the project area (with greater sampling occurring in more prospective subterranean aquatic fauna habitats). It is recommended that sampling be equally distributed between the project area and comparable nearby areas outside the project area.

Sampling must also occur in at least two seasons with sampling occurring at least three months apart. It is recommended that sampling be undertaken either soon after the wet season or late in the dry season.

Sampling must aim to use representative bores with the following characteristics:

- subterranean fauna would have access to the borehole;
- bore is at least six months old; and
- bore has groundwater present.

Further information on survey design considerations can be found in the Guidance for the Assessment of Environmental Factors Draft Guidance Statement No. 54A Sampling Methods and Survey Considerations for Subterranean Fauna in Western Australia.

Sampling Methods

Physio-chemical Data

Information on the geological formation, lithology and depth at which a bore is slotted must be captured and presented in an environmental impact assessment. In addition, information must be captured on the total depth of the bore. The Australian and New Zealand standards for water quality and groundwater sampling should be consulted prior to designing a sampling program (AS/NZS 5667.1:1998 and AS/NZS 5667.11:1998) and WMO026 Sub-artesian Water Quality Sampling Procedure. Depth to water table, temperature, pH and salinity (e.g. electrical conductivity) must be measured on site with a hand held meter at all sampled bores. This water quality data provides information on habitat suitability of subterranean aquatic fauna.

Subterranean Aquatic Fauna Sampling Methods

The effectiveness of survey in documenting subterranean aquatic fauna present in the area is dependent on the appropriateness of survey design, sampling method and effort expended. Sampling methods for subterranean aquatic fauna may include haul netting and pumping. Further information on these methods including detailed steps and techniques to preserve samples can be found in AEMF046 Sampling Bores for Stygofauna. Please note that water from the bore must not be purged prior to sampling for subterranean aquatic fauna and decontamination procedures should be used to minimise risk of cross-contamination between bore samples.

Subterranean Aquatic Fauna Identification

Assessing risk to subterranean aquatic fauna ideally requires identification at the species level. All specimens collected at a minimum must be assigned a morphological identification by appropriately qualified and experienced biologists, with finer-level identification by appropriate taxonomists where possible. For the following major taxonomic groups a representative subset of specimens collected must at a minimum be identified to the genus level: amphipoda; copepoda; isopoda; ostracoda; remipedia; spelaeogriphacea; syncarida; and thermosbaenacea. For the following major taxonomic groups a representative subset of specimens collected must at a minimum be identified to the order or family level: arcarina; coleoptera; decapoda; mollusca; nematoda; oligochaeta; rotifer; polychaeta; and turbellaria.

Genetic Identification

Genetic analysis uses genetic markers to distinguish species where there is a lack of morphological differences. This technique can provide a rapid and efficient method to determine taxonomy. It is recommended that genetic analysis is completed for some samples but this technique must only be employed after morphological identification has been completed and specimens have been appropriately labelled for genetic analysis. Specimens for genetic work will need to be preserved appropriately for DNA preservation.

Data Provision

All data acquired during stygofauna sampling must be provided in a suitable format (e.g. Microsoft® Excel) to enable upload into relevant state wide databases. Data provided must include bore registration number (or identification name if no registration number exists), location of the bore sampled (latitude and longitude with specified datum), sampling date, sampling method used, geological formation and lithology sampled, water quality measurements, taxa identified and the abundance of each taxa.

It is recommended that voucher specimens (and any DNA sequences) for all taxa be appropriately collected, curated and deposited promptly in a publicly accessible collection for verification purposes and possible future use.

Further Information

AEMF046 Sampling Bores for Stygofauna

AS/NZS 5667.1:1998

AS/NZS 5667.11:1998

Clifton, C., Cossens, B. & McAuley, C. 2007, *A Framework for assessing the Environmental Water Requirements of Groundwater Dependent Ecosystems. Report 1, Assessment Toolbox*, Land and Water Australia, Canberra.

Sampling Methods and Survey Considerations for Subterranean Fauna in Western Australia (Technical Appendix to Guidance Statement No. 54)

WMO026 Sub-artesian Water Quality Sampling Procedure