A new method for sampling stygofauna from groundwater fed marshlands

Remko Leijs[1], Ben Roudnew[1], Jim Mitchell[1] and Bill Humphreys[2]

[1]School of Biological Sciences, Flinders University of South Australia, Bedford Park, GPO Box 2100, Adelaide SA 5001, Australia. Email: (RL) remko.leijs@flinders.edu.au; (BR) roud0002@flinders.edu.au; (JM) jim.mitchell@flinders.edu.au.
[2]Terrestrial Invertebrates, Western Australian Museum, Locked Bag 49, Welshpool DC, WA 6986, Australia. Email: Bill.Humphreys@museum.wa.gov.au

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Access points to groundwater for sampling stygofauna traditionally are cave waters, springs, wells and boreholes, and the hyporheic environment of rivers. All of these habitats were sampled during a broad scale survey of groundwater fauna in South Australia, but sampling density per area was constrained by suitable access points. In areas with groundwater suitable for irrigation, boreholes installed with the purpose of monitoring and regulating drawdown are frequently used for sampling of stygofauna. In contrast, the equipment in pastoral or domestic water supply boreholes or wells constrains sampling by means of Cvetkov nets[1]. Areas with rivers, creeks and springs with sufficiently coarse sediment size were sampled using the Bou-Rouche[2] method. Here we describe a method specifically designed for areas that have limited access to the groundwater, because they do not meet the characteristics discussed above, but which do have upwelling groundwater supplying marshlands.

Groundwater fed marshlands in the hills around Adelaide, South Australia, are characterised by dense vegetation, often consisting of sedges (*Carex* sp.), *Gahnia* and *Leptospermum* shrubs and thick peat soils. Such habitats are impossible to sample for stygofauna using the conventional methods. We envisaged that if stygofauna would be present at such localities it should be found in the immediate vicinity of the groundwater upwelling from the underlying rocks or in the fractured rocks themselves. In order to create an environment that could be sampled with a Cvetkov-plankton net, and that could be monitored over time, we decided to place PVC pipes as close as possible to the sub-surface spring. Suitable sites were chosen at the end of the summer, a time when groundwater upwelling areas were easily located by green vegetation amid the pale and dry surrounding vegetation. A suitable location to test this method was 'Minnawarra', a property near Spring Mount, 56 km south of Adelaide. This property has numerous groundwater fed marshlands and soaks, several of them on slopes, so that the precise location of the sub-surface springs could be found with minimal effort. A 90 mm hand auger with several extensions was used to drill a hole to where the sub-surface spring was expected. After several drilling attempts it appeared that the spring could be found directly beneath the highest spot of wet soil on the surface, indicating that the groundwater moves vertically, and not down slope. Drilling was continued until the underlying rocks became too hard. A 90 mm PVC pipe with 4 mm slots in the bottom 40 cm was inserted in the hole to prevent collapse and contamination from the surface environment, but allowing exchange of water and potential fauna in the lower part of the borehole. Figure 1 presents a schematic overview of a soak and the placement of the bore. A manual diaphragm pump with 25 mm tubing was used to clean out the bore (Fig. 2) until the water became clear. To prevent surface contamination the pipe was closed with a cap with a 3 mm air hole.

Two bores were installed in separate soaks about 70 m apart, both were drilled to a depth of about 2.5 m. After pumping, both bores quickly refilled with water overflowing the top of the casings, indicating that they were positioned close to the sub-surface spring. Sampling of the pumped water immediately following installation of the bores yielded only a few stygobiotic copepods, but no other fauna. Ten months later we sampled the bores using a Cvetkov-plankton net, and by filtering the pumped water. One bore contained mostly Cyclopoidea, Harpacticoidea and a few Turbellaria, while in the other bore over a hundred specimens of a stygobitoic amphipod (new species, new genus, probably belonging to the Neoniphargidae) were collected, as well as two species of Turbellaria and a few Cyclopoidea and Harpacticoidea.

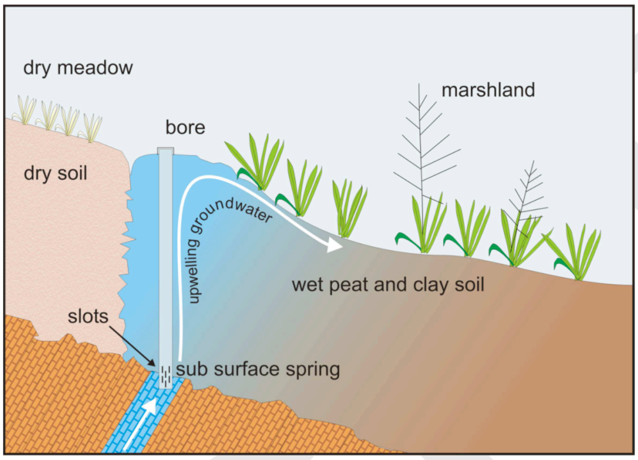

Figure 1. Schematic overview of a groundwater fed marshland fitted with a bore for collecting stygofauna.

Figure 2. Bore with manual diaphragm pump.

It is possible that the open space created near the outflow of the underground spring acts in a similar way as the unbaited fauna traps described by Bork et al.[3], and it is expected that some time is required for fauna to colonise the space, and therefore an interval of several months before sampling may improve the catch. This method proves to be effective for collecting stygofauna from groundwater-fed marshlands in areas unsuitable for application of the Bou-Rouche method, especially where the subsurface spring is too far below ground level.

Literature Cited:

1. Cvetkov L. 1968. Un filet phréatobiologique. *Bulletin de l'Institut de Zoologie et Musée. Académie Bulgare de la Science* **27**, 215–218.
2. Bou C. & Rouch R. 1967. Un nouveau champ de recherches sur la faune aquatique souterraine. *Comptes Rendus de l'Académie des Sciences de Paris* **265**, 369-370.
3. Bork J., Bork S., Berkhoff S.E. & Hahn H.J. 2008. Testing unbaited stygofauna traps for sampling performance. *Limnologica* **38**, 105-115.