



## Monitoring hyporheic habitats: techniques for unclogging minipiezometers

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**Abstract:** Temporarily installed mini-piezometers become unusable with time due to the accumulation of inert material inside the tube or during the installation process. This paper aims at presenting a technique for unclogging minipiezometers.

**Key Words:** hyporheic zone, groundwater, field techniques, clogging, minipiezometer.

**Resumo:** Monitoramento de habitats hiporréico: técnicas para desobstrução de minipiezômetros. Minipiezômetros instalados temporariamente adivem inutilizáveis com o tempo devido à acumulação de material inerte no interior do tubo ou durante o processo de instalação. Este artigo tem como objetivo apresentar uma técnica para desobstrução de minipiezômetros.

**Palavras Chaves:** zona hiporréica, água subterrânea, técnicas de campo, entupimento minipiezômetros.

River ecosystem analysis and river basin management should consider several factors jointly acting at large scale, such as climate, geology and water exchanges (longitudinal, lateral, vertical and temporal) (Danielpol *et al.* 2004, 2008, E.C. 2006, Pozdniakova *et al.* 2013, Valett 1993, Ward 1989, Winter 2007). At a lower scale, the exchanges between surface and ground water are mediated by the hyporheic zone (HZ), intimately connected to both benthic and groundwater habitats (Bencala 2005, Di Lorenzo *et al.* 2013, Krause *et al.* 2011, Palmer 1993). The HZ largely contributes to ecosystem services provided by rivers (Boulton *et*

*al.* 1998, Dole-Olivier 2011, Kawanishi *et al.* 2013). Understanding the ecological functions of the HZ is crucial and requires quantitative comparisons between benthic, hyporheic and groundwater assemblages, chemico-physical and hydrological features and energy fluxes (Boulton 2007a,b). However, such comparisons are often hampered by sampling and field problems.

Several techniques have been developed and used for sampling hyporheic invertebrates (Dole-Olivier *et al.* 2014 and references herein). Mini-piezometers are simple instruments for measuring the direction of water flow between

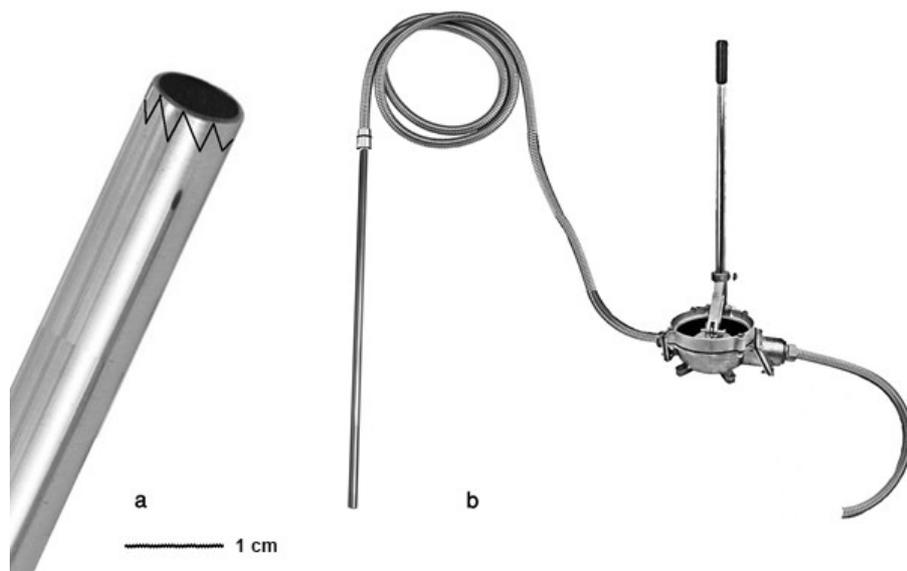
groundwater and a surface water body or for studying hyporheic fauna and/or water characteristics (Lee & Cherry 1978).

Often, temporarily installed mini-piezometers become unusable with time due to the accumulation of inert material inside the tube or for the syringe effect while one removes the T-bar during the installation (Boulton 2007b), so it is necessary to remove them or replace them for unclogged ones with high loose of time and energy. This manipulation, in case of biological studies implicate a waiting time of two-three weeks for fauna re-colonization and to avoid the piping effect during the suction (Kondolf *et al.* 2008)

This brief communication aims at presenting a technique for unclogging minipiezometers 2.5 cm in diameter and 150 cm in length, slotted at the tip. Our purpose here is to describe in details this methodology to provide an easy-handle and cheap tool that will assist researchers on the ecological investigation of groundwater–stream water interactions in the HZ.

Installed minipiezometers, especially used for long-term research, may become unusable by time due to the accumulation of inert material inside the tube. Under these circumstances, it is

necessary to remove the minipiezometers and replace them with unclogged ones with high waste of time and energy. However, the replacement should be avoided in case of hyporheic fauna monitoring as it may disturb the community. To prevent faunal disturbance, minipiezometers should be unclogged on the field without removing them. To this end, a suitable device is an aluminum drilling probe, built using a tube of 1 cm in diameter and 1 meter in length. Teeth are cut at the tip of the probe by a pincer (Fig. 1a). The probe, coupled to a diaphragm pump (Fig.1b), can be inserted into the minipiezometer. Two operators are needed to use the device: one operates the pump, the other inserts the probe into the minipiezometer moving it up and down, rotating it and simultaneously pouring water into the minipiezometer. If the vacuumed sediments clog the pump, by keeping the pump in pressure, it is possible to disconnect the probe and the hose filled with solid material, empty them and repeat the process until the minipiezometer is completely unclogged. With this methodology, it is possible to unclog about 2-3 mini-piezometer  $h^{-1}$  in a working day. The minipiezometer unclogging operation is quick and effortless.



**Figure 1.** Unclogging probe. a) Scheme of the Probe Teeth; b) probe connected to a membrane pump.

The mini-piezometer unclogging operation is quick and effortless and the device has an extremely low cost. Besides, the operation causes

low stress on pipe and on environment, needing a little waiting time before sampling.

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