

-NOTE-

A Lightweight Modification of the McNeil Core Substrate Sampler

ABSTRACT

The McNeil core substrate sampler is widely used for quantitative bulk sampling of streambed sediments, but the large size and heavy weight of the standard-sized device limits its utility for sampling substrates in remote locations. We designed a lightweight modification that employs a 19-L plastic bucket as a collection basin yet retains the standard core tube diameter of 15 cm. The modified sampler weighs about one-third of the standard-sized McNeil sampler (3.9 kg versus 11.5 kg) yet is sufficiently robust that insertion of the core tube into the streambed is readily achieved. The modified sampler enhanced sampling efficiency and facilitated increased sample sizes for substrate sampling of rainbow trout (*Oncorhynchus mykiss*) redds during a 170 km-long survey of spawning tributaries.

The McNeil core substrate sampler (McNeil and Ahnell 1960, 1964) is widely used for quantitative bulk sampling of streambed sediments because it combines desired sampling features of accuracy, portability, and ease of use compared to freeze-core samplers (preservation of vertical stratification but low portability) or shovel-based methods (portable, simple to use, but less accurate) (Everest et al. 1982, Platts et al. 1983, Young et al. 1991, Schuet-Hames et al. 1996). The sampler consists of a hollow-core tube that is worked into the substrate to a desired depth and an excavation basin (Fig. 1) where the core sample is deposited prior to processing to determine particle size distribution via sieving. An upper barrel portion of the sampler keeps stream water out during excavation. The original McNeil substrate sampler was designed for sampling spawning gravels of Pacific salmon redds, which required a large, heavy-duty device for excavating substrate of these large redds in deep rivers. However, during previous sampling of cutthroat trout (*Oncorhynchus clarki*) spawning redds using the standard-size McNeil sampler (Magee et al. 1996), we found its large size and heavy steel-gauge construction limited its portability for sampling remote field locations and for sampling smaller redds of resident salmonids, which require less substrate excavation (egg depths typically <10 cm) than the large redds of anadromous salmonids wherein eggs at buried at much deeper depths (~30 cm; DeVries 1997).

We modified the standard McNeil core sampler to facilitate its use in remote locations by designing a more portable, lighter-weight device. To reduce weight, a design incorporating a 19-L plastic bucket was developed (Fig. 1). Use of the plastic bucket reduced the diameter of the upper barrel of the sampler (27 cm) by about half of the 50-cm standard size (Platts et al. 1983, Kondolf 2000). Further weight reduction was achieved by fabricating the coring tube and collection basin with 16-gauge stainless steel instead of the 10-gauge steel used in the standard McNeil sampler. We retained a standard core diameter of 15 cm in the design to insure adequate sampling of spawning gravel sizes used by resident stream salmonids (mean particle size ~ 7 cm; Thurow and King 1994).

The bucket bottom was removed and the bucket attached to the basin collar with six stainless steel bolts (12.7 mm diameter), nuts, lock-washers, and rubber grommets in evenly-spaced, pre-drilled holes (Fig. 1). Aquaseal™ sealant was applied to the bucket and basin collar joint to prevent leakage. The 5-cm-deep basin collar provided a tight-fitting sleeve for the bottom of the bucket and added stability to the device. The modified

sampler was only one-third of the weight of the standard McNeil sampler (3.9 kg versus 11.5 kg).

Our modified sampler performed well when used to sample substrate composition of 82 rainbow trout (*Oncorhynchus mykiss*) redds during a survey of 170 km of remote spawning tributaries to Hebgen Reservoir, Montana (Watschke 2005). The sampler was strapped to a pack frame and items required for onsite measurement of substrate composition via the wet sieve method (Platts et al. 1983, McMahon et al. 1996) were carried inside the sampler. The modified sampler was stable, lightweight, and leak-free, yet sufficiently robust that insertion of the core tube into the streambed was achieved without difficulty. Indeed, its lighter weight made it easier to achieve and maintain a desired core depth than with the standard sized sampler, which, in our experience, is more difficult to maneuver and to maintain desired core depth due its greater weight. The bucket handle on the modified sampler also facilitated transfer of sampled material from the collection basin to substrate sorting sieves and to the Imhoff fine sediment-settling cone used during the wet sieving process. Streams sampled ranged from 3 to 35 m in wetted width and substrate cores were readily obtained in water up to 0.5 m deep. Increased portability of our sampler enhanced sampling efficiency and facilitated increased sample sizes for stream substrate sampling.

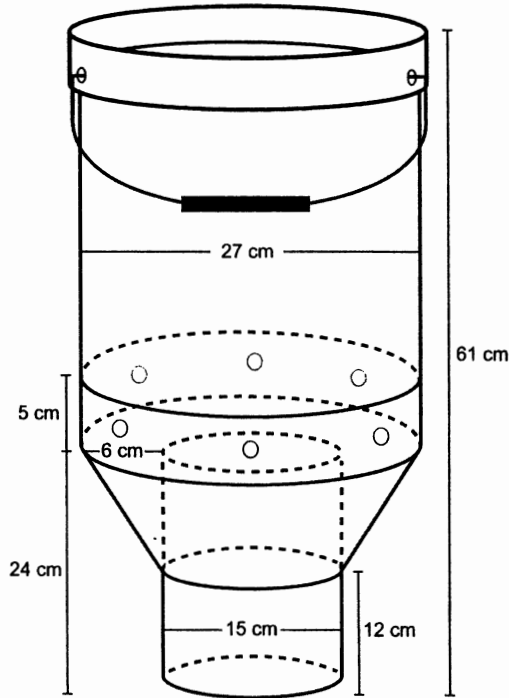


Figure 1. Schematic of the modified McNeil core sampler comprised of a stainless steel collection basin and coring tube attached to a 19-L plastic bucket.

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