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A FLUSHING-CORING DEVICE FOR COLLECTING DEEP-BURROWING INFAUNAL BIVALVES IN INTERTIDAL SAND

In planning a study on the population dynamics and annual secondary production of deep-burrowing infaunal bivalves, a device was required which could take samples in shallow intertidal sand. Though many grabs or coring devices described in the literature (Brett 1964; Hopkins 1964; Maitland 1969; Kajak 1971) might have been suitable for taking short cores (20-30 cm deep) in intertidal or even subtidal areas, none were found suitable for taking large numbers of quantitative samples to a depth of 65-70 cm below the sediment surface. A device similar to one described by Van Arkel and Mulder (1975) was built to achieve this goal.

Materials

The device (Figure 1) was built according to the specifications outlined in Table 1. All materials are obtainable from either hardware or plumbing supply houses and are interconnected using polyvinyl chloride (PVC) cement, nuts, and bolts.

Operation

When intertidal samples are taken, the site is visited at high tide or when the water over the site

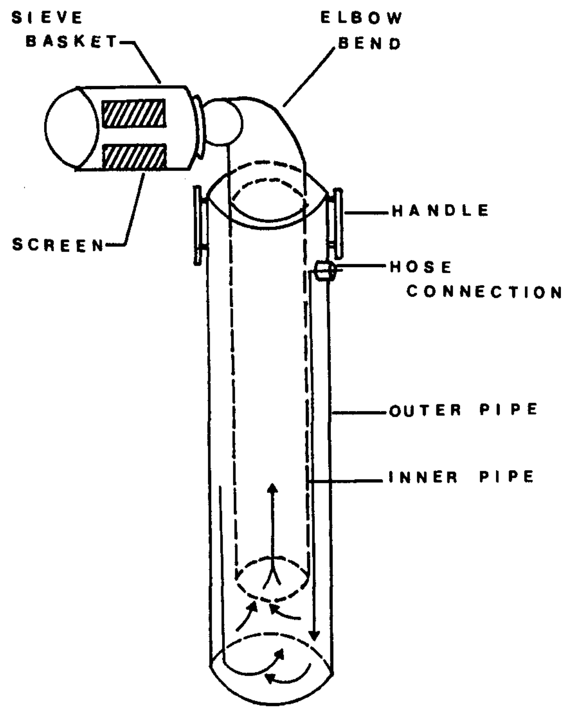

FIGURE 1.—Flushing-coring sampler. Arrows indicate direction of waterflow. Centrifugal water pump, gasoline engine, and water hoses are not shown.

TABLE 1.—Dimensions and materials used in the construction of the flushing-coring sampling system.

Item	Dimension (cm) Diameter	Length	Material
Inner pipe	10.2	100.0	Polyvinyl chloride
Outer pipe	16.0	115.0	Polyvinyl chloride
Hose connection to sampler	5.1	5.1	Polyvinyl chloride
Elbow bend	10.2	—	Polyvinyl chloride
Sieve basket	16.0	30.0	Polyvinyl chloride
Side handles	2.54	20.3	Aluminum
Screen mesh (2 per sieve basket)	—	12.7	Aluminum
Hose (pump[1] to sampler)	5.1	1,000.0	Plastic
Hose (water supply to pump[1])	5.1	610.0	Heavy plastic

[1]High-pressure (22 m^3/h) water pump and 3-hp gasoline engine.

is at least deep enough to allow the pump intake hose to be submerged. The device may also be operated on exposed tidal flats if a water supply is within reach of the intake hose. The small screen over the end of the intake hose prevents debris from entering the water pumping system.

The boat is anchored and the sampling device lowered over the side and pushed several centimeters into the sediment prior to starting the pump. The operator may choose to stand in the water with waders in areas where currents and wind cause the boat to move a great deal resulting in an unstable work platform.

When the pump is activated, water is forced down the space between the inner and outer PVC pipes, forcing a suspension of sediment and all associated organisms up the smaller inner pipe and into the attached sieve basket. The operator forces the device down into the sediment to the desired depth, then the pump is shut off. At this point, the sieve basket contains all organisms and objects too large to pass through the screen. Most sediment washes easily through.

Discussion

After collecting more than 2,000 samples over a 1-yr period, no problems have been encountered with the system. A 2.5 mm mesh screen was used on the sieve basket. As the device was designed specifically to take quantitative samples of the deep-burrowing, stout razor clam, *Tagelus plebeius* Solander, for a secondary production study, the 2.5 mm mesh was adequate for sampling small bivalves and adults. Collections were made from small aluminum or fiber glass boats (3.8-4.9 m long). The system was also tested at a beach site where the water pump was placed on the shore while the operator carried the sampler into adjacent intertidal waters. Though possible, this method lacks the mobility of sampling from a boat.

Most bivalves were recovered in an undamaged condition (Table 2). In no case was a bivalve recovered with a shell broken such that shell length could not be measured, though in some specimens, small breaks in the shell allowed body fluids to escape resulting in a specimen unsuitable for an accurate biomass determination. The soft shell clam, *Mya arenaria*, and the stout razor clam have thin gaping shells that are much more susceptible to damage than the hard clam, *Mercenaria mercenaria.* Van Arkel and Mulder (1975) reported that damage to small polychaete worms was no more than if a hand corer and ordinary sieve had been used. Polychaetes were not specifically examined for damage in the present study. Many were collected in the sieve basket and though some were obviously broken, most were not.

TABLE 2.—Condition of bivalves recovered in 1,575 separate samples by the flushing-coring device.

Species	Collected (no.)	Broken[1] (no.)	Broken (%)
Tagelus plebeius	1,479	186	13
Mya arenaria	513	45	9
Mercenaria mercenaria	36	0	0
Ensis directus	3	0	0
Total bivalves	2,031	231	11

[1]Any break in the shell, no matter how small, that might allow loss of body fluids.

The maximum shell lengths (largest external dimension of the shell) of the collected specimens were 10.4, 9.15, 10.2, and 10.8 cm for *M. mercenaria*, *T. plebeius*, *Mya arenaria*, and *Ensis directus*, respectively. The heaviest bivalve, *Mercenaria mercenaria*, was estimated to weigh 200-300 g. Several of the large *M. mercenaria* were placed in the sediment and repeatedly "sampled" from the sand flat to the sieve basket to test the lifting capability of the system. The test specimens were always easily raised.

Direct visual observations in shallow water indicate that no water or sediment escapes under the outer pipe when in operation. The outer pipe has a large diameter (16 cm), thus the surface area of a single sample (0.02 m^2) is quite large.

The main advantages of this system are its mobility (as mobile as a small, shallow-draft boat) combined with the fact that deep cores can be taken and sieved in one fast process. Samples can routinely be taken to a depth of 65-70 cm below the sediment surface. Organisms can be immediately placed in storage containers, ready to be processed upon returning to the laboratory. The use of PVC parts and removable sieve basket screens allows the investigator to build and modify the device to one's own specifications depending on the particular goals of the study.

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