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A benthic sled for sampling soft bottoms

S. Blomqvist & L. Lundgren

Department of Systems Ecology, Section Marine Ecology, Stockholm University; S-106 91 Stockholm, Sweden

ABSTRACT: A new benthic sled is described. Favourable features of the sled include: simple operation, broad runners, balanced towing position, simple height adjustment of the sediment cutting edge and quick exchange of the collecting bag. Metallic parts are aluminium, making the sled light (15 kg). This sled has functioned well in coastal research for more than a decade.

INTRODUCTION

The benthic sled is a basic piece of gear that is drawn across the sediment surface to collect bottom organisms (see reviews by Menzies, 1964; Menzies et al., 1973; Eleftheriou & Holme, 1984; McIntyre & Warwick, 1984; Schwoerbel, 1986; and bibliographies by McIntyre, 1970; Rosenberg, 1978; Elliott et al., 1993), and sometimes also to collect nodules (Kidd et al., 1990). In essence, a sled is a demersal trawl provided with runners. Usually, benthic sleds are slowly towed by a boat, but there are also designs for operation by wading in the intertidal zone (Pullen et al., 1968), and for diver operation in deeper water (Sibert et al., 1977). On soft bottoms, sleds are often preferred to traditional dredges because they can, if properly designed and handled, skim off the surface of a considerable stretch of bottom, without digging too deep into the sediment and clogging with mud.

A commonly used type of benthic sled is that described by Ockelmann (1964), primarily designed for collecting meiobenthos and small macrofauna in coastal waters. Hessler & Sanders (1967) describe another sled intended for sampling invertebrate macrofauna of the deep-sea floor. In the present paper we report on a similar type of benthic sled, inspired by these two gears, but with several useful modifications.

DESCRIPTION AND OPERATION

The benthic sled is double-sided (Fig. 1), light-weight (15 kg), and can be operated from a small craft. The double-sided design allows the sled to operate properly no matter what side is up when it settles on the bottom. The sled has two broad runners to prevent it from sinking too deeply into the sediment. The runners are joined by stout front and rear cross members, and by two cutting blade bars. The leading tapered edge of the blades point forward. These bars, and two uprights, form a frame for the attachment of the rectangular, canvas-lined opening of the collecting bag. The bag is secured to the cut-

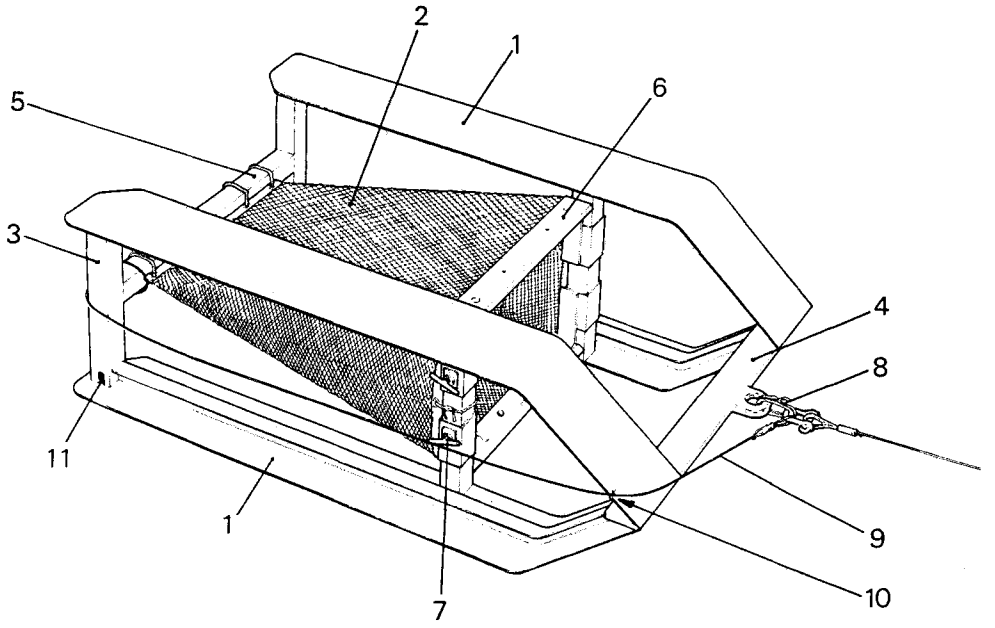

Fig. 1. Drawing of the benthic sled. Dimensions of the sled: total length 1125 mm, total breadth 700 mm, cutting breadth 400 mm and bag volume 55 litres. 1: runners; 2: collecting bag; 3: upright (hollow); 4: front cross member (solid); 5: rear cross member (hollow); 6: cutting blade bar; 7: wing-bolts of linear guide; 8: weak link (polyester cable); 9: safety wire; 10: safety wire holder; 11: drainage hole

ting blades with screw mounted aluminium strips. The cutting blade is designed to cut off a layer of surface sediment, which then passes back into the bag. The back end of the bag is tied to the rear cross member. Throughout, the metallic parts are aluminium alloys (DIN 1725: AlMg 2.5 and AlMgSi 0.5). In addition to being light weight, these alloys are resistant to corrosion and are easy to keep clean.

The blade bars can be moved vertically, by loosening the wing-bolts of the linear guides, allowing easy adjustment of the cutting depth. The blades can be set from 40 mm beneath the runners to 35 mm above the runners. The collecting bag consists of an outer bag of strong twine netting (mesh size 10 mm), usually used in combination with an inner fine lining of variable mesh size (usually 1 or 0.5 mm). The bag is easy to exchange, by untying the fixing strings, which are interlinked by brass grommets, and unscrewing the covering strips. The bags are shaped like a triangle in long section in order to facilitate sediment winnowing and the collection of organisms.

The leading edge of the collecting bag is set at a position on the runners which maintains the sled in a level position during towing, even when the bag is loaded with sediment (Fig. 2). No ballast is needed. A minimum length of towing wire of four times the water depth is recommended. The towing wire is connected to the front cross member, via a weak-link (polyester cable). This link arrangement (Fig. 1) helps prevent the tow wire from breaking, should the sled become fouled on the bottom. When the weak-link

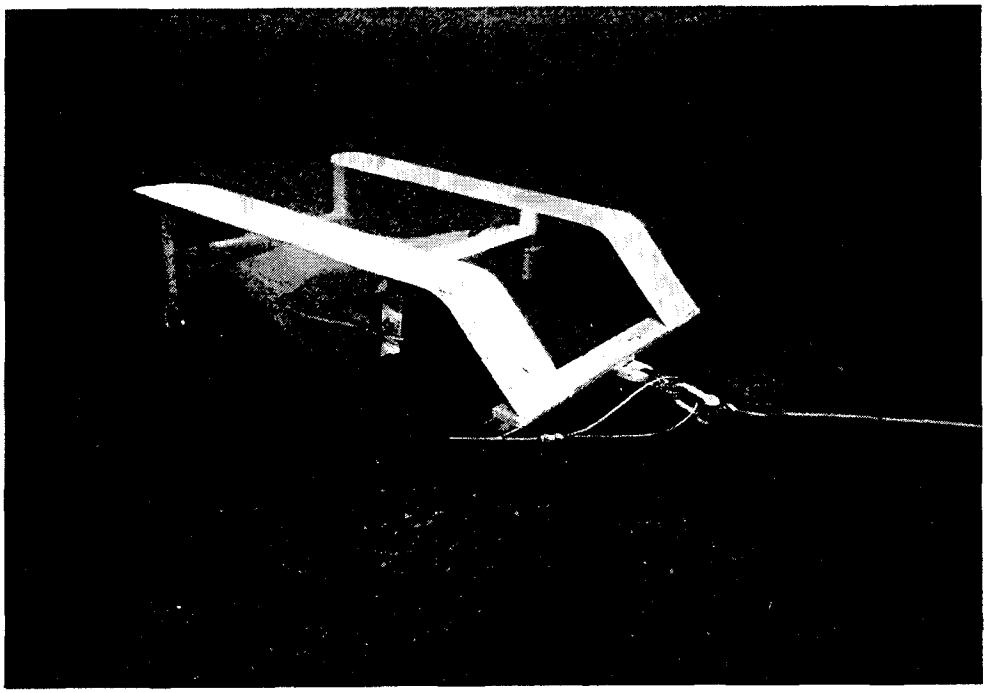

Fig. 2. Underwater photograph of the benthic sled, operating on a soft sediment at a depth of 10 m in the Baltic Sea

snaps, load is transferred to the safety wire attached to the rear cross member, and the sled jolts sideways, thus normally freeing itself.

CONCLUDING REMARKS

Compared to similar benthic sleds, the present device has the following advantages: (1) a convenient design which is simple to operate, (2) a balanced towing position with little tendency to upset during sampling (cf. Menzies 1972; Menzies et al., 1973), (3) easy adjustment of cutting bar height, and (4) quick exchange of collecting bags. The sled has functioned well during collections of benthic animals in coastal areas of the Baltic Sea for more than a decade (Lopez & Elmgren, 1989; Abrams et al., 1990; Hill et al., 1990, 1992; Ólafsson & Elmgren, 1991; Ólafsson, 1992; Ólafsson et al., 1993; Eriksson et al., 1996). A larger model (cutting breadth 800 mm) has been used successfully for shipboard sampling of epibenthic mysids (Rudstam et al., 1989), and for sampling demersal fish in shallow water by manual hauling ashore (Nellbring, 1988).

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