Research Note

A diver-operated electric suction sampler for sympagic (= under-ice) invertebrates

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The construction and operation of a diver-operated suction sampler for sympagic fauna are described. An interchangeable sampling cylinder with a 0.5 mm sieve connected to a battery driven turbine pump makes it possible to 'vacuum' predetermined areas of the ice under-surface, even if the surface is rugged and perforated by brine channels. Several samples can be obtained during one dive by using different sampling cylinders.

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The sympagic fauna (= under-ice fauna) are those animals living directly on the ice under-surface, within the soft lower ice layer, or in brine channels or pockets within the more solid congelation ice (Carey 1985). The most conspicuous sympagic invertebrates in the Arctic are amphipods, with *Gammarus wilkitzkii* being the largest (sometimes >50 mm long). The earliest estimates of the densities of the sympagic fauna were made using baited traps (Barnard 1959), but more direct sampling techniques using SCUBA-diving have since become more common. These include scraping defined areas of under-surface with modified plankton nets (Mel'nikov & Kulikov 1983; Cross 1982; Gulliksen 1984) and underwater photography (Gulliksen 1984). In my experience these methods may underestimate the density of the sympagic fauna in areas with rugged ice, as they fail to include animals hiding in crevices and brine channels. A manual suction pump (Aarset & Willumsen 1985) has been constructed for sampling such animals, but this pump has certain limitations in quantitative sampling.

Field experience using different sampling methods during a number of expeditions organized by the Norwegian Research Program for Marine Arctic Ecology (Pro Mare) in Arctic ice covered waters has led to the construction of a new quantitative sampling device for sympagic fauna.

Description of the device

The suction sampler consists of a submersible electric boat pump (Biltema, Norway, art. 25–970) powered by a rechargeable 12V airtight battery (Panasonic, Japan, LCR12V6.5P) housed in a watertight p.v.c.-(polyvinyl chloride) cylinder with an outer diameter of 125 mm (Fig. 1). Access to the battery is through a screwcap (a) in the end. The sampling device is mounted in front of the pump and consists of an outer cylinder with a snap-on lid (j), a flexible silicon hose (k) (internal Ø = 18 mm) mounted in the centre of the lid and an inner interchangeable 0.5 mm mesh cylinder (i) with a solid bottom. The cylinder cap is flanged and has a hole in the centre which fits the extension of the hose. The sampling cylinders can be sealed with a cork and replaced under water.

The pump is of a turbine type with a capacity of 5000 l per hour. The capacity of the battery is 6.5 Ah. The motor is turned on and off using an external magnetic switch. The sampler weighs 6500 g and is 53 cm long, excluding the flexible hose. Underwater, the sampler has a slight negative buoyancy. To avoid accidental loss, it is attached to the diver by a rope.

The pump may also be used for sampling ice algae and sympagic meiofauna by mounting a plankton net to the exhalant opening of the pump (1).

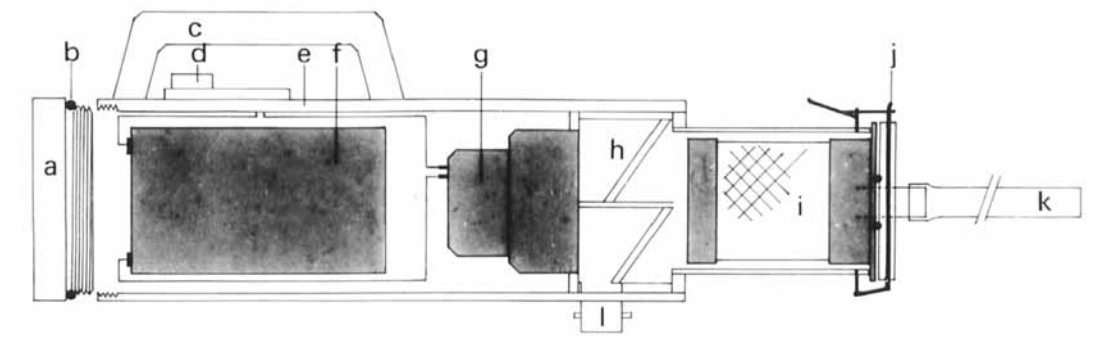

Fig. 1. Main components of the electric suction sampler. a: Screwcap, b: o-ring, c: handle, d: electric switch, e: p.v.c.-cylinder, f: battery, g: motor, h: turbine (g+h is a one-piece submersible boat pump), i: sampling cylinder, j: snap-on lid, k: flexible hose, l: outflow.

Handling of the device

The sampler is operated by a diver controlling the magnetic switch with one hand and the hose with the other. Several samples can be obtained by using different sampling cylinders.

The pumping capacity is large enough to suck in amphipods hiding in brine channels and small melting holes 40 to 50 cm within the ice when the hose is placed in the channel opening. All animals collected appeared to be unharmed by the sampling method. The capacity of the battery is sufficient to keep the pump running continuously for c. 20 minutes at sub-zero water temperatures.

The internal diameter of the flexible hose is large enough to sample all sizes of sympagic invertebrates.

Quantitative samples were obtained by sampling within a floating frame enclosing 40 × 40 cm of the ice sub-surface. The frame was made of stainless steel (30 mm thick and 3 mm wide). Extruded polystyrene, measuring 3 × 3 cm in 'diameter', was taped along the outside of the frame as a floating device. Random samples (or rather stratified random samples) were obtained by releasing the floating frame from 5–10 m below the ice sub-surface. Nails were attached perpendicular to the frame in its corners, enabling it to 'stick' in current or non-horizontal surfaces.

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