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Development and test of a remotely operated Minisampler for discrete trawl sampling

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ABSTRACT

Systems that take discrete samples of the catch while trawling are widely used in fisheries investigations. We have developed the Minisampler, a relatively small system to be used particularly on small vessels and small trawls. The device is simple, has low weight and is reasonably cheap to make. The Minisampler consists of a tele-command deck unit, a dunking transducer, a stainless steel frame and one or two acoustical trigger-units. Each of them releases a metal bar that opens/closes a collecting bag. Thus is possible to take two or three remotely controlled discrete samples during a tow. We tested the system successfully in a flume tank and during sea trials from a commercial trawler. The Minisampler is a multi-purpose tool and provides opportunity for new experimental designs to improve scientific work using demersal or pelagic trawls in marine or freshwater environments.

1. Introduction

Various systems have been developed to take discrete samples of fish or plankton in the water column. One such system is the MultiSampler system, which was particularly designed to sample from large pelagic trawls (Engås et al., 1997) and is widely used to support hydroacoustic fish stock surveys (Ona, 2003; Røstad et al., 2006; Pedersen et al., 2009), as well as macroplankton surveys (Korneliussen et al., 2009; Wiebe et al., 2010). The MultiSampler is 1.3 m wide and 2.5 m long and weighs ~300 kg in air. It is built for use on research vessels, where the working space on deck is generally good.

Recently the MultiSampler has been used in relation to studies of codend selectivity in commercial demersal trawls (Madsen et al., 2008a; Grimaldo et al., 2009). These experiments provided important knowledge about the fish escape, which was found to be substantial during the haul-back process. This escape increases the probability of unaccounted fishing mortality (Madsen et al., 2008a; Grimaldo et al., 2009) and it appears to be important to assess when testing selective devices. However, it is very difficult or impossible to handle a MultiSampler on a small vessel, including commercial vessels where the working space is limited. Furthermore, different test codends are often compared by fishing them simultaneously (e.g., in a twin trawl setup) and under these conditions, the ease of handling the sampling units is crucial.

Here we describe the development of a new and simple device that can be attached to a trawl to divide the catch into two or three fractions. The small size of the device makes it possible to use from smaller vessels. The concept may lead to new experimental designs that will support scientific work and provide valuable information about the fishing process. The system can be used for multiple purposes ranging from marine and freshwater surveys with demersal and pelagic trawls to trawl selectivity experiments conducted from commercial vessels.

2. Materials and methods

We have constructed two different Minisampler devices: a dual-sampler and a triple-sampler (Figs. 1–3). The dual-sampler consists of a frame with an attached collecting bag that can be released by an acoustic release unit triggered from a deck unit on a vessel. The triple-sampler has two collecting bags that can be released by two different acoustic release units. The stainless steel frame of the dual-sampler weighs ~10 kg in air and the triple-sampler ~14 kg.

The main difference between the dual-sampler and the triple-sampler is the height, 92 cm and 127 cm, respectively (Figs. 1 and 2). The main frame is made of 20-mm tubes with a wall thickness of 2 mm. Distance pieces of 10 mm attach a 10 mm tube along the outside of the main frame. This tube is used to fasten the device to the codend or cover (Fig. 3). The net of the collecting bag is attached to an upper bar and to metal rings that run on vertical sliding tubes (25 mm) located inside the main frame and to the release bar, which also runs on the sliding tubes. The acoustic releasers are attached by ropes to the upper panel of the codend or cover well in front of the

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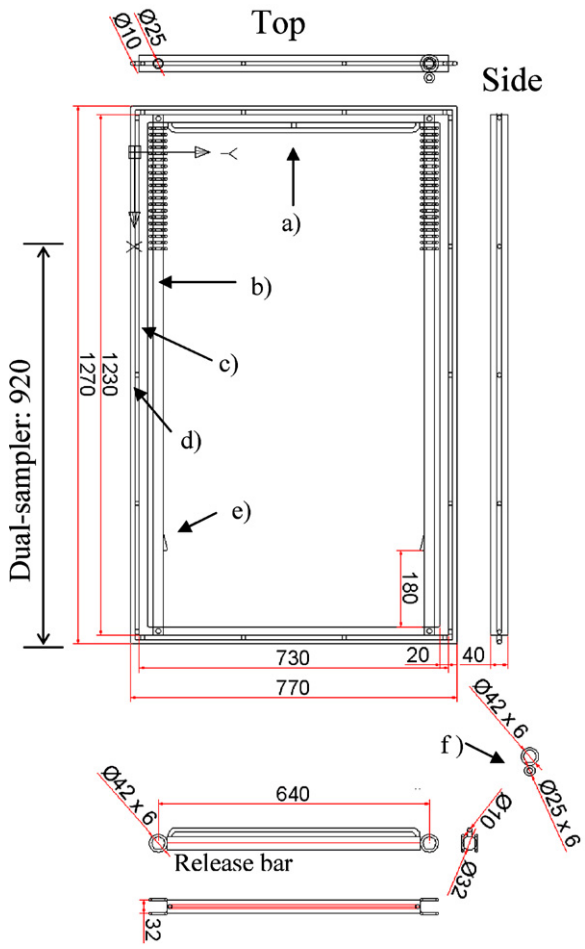

Fig. 1. Drawing of the triple-sampler frame. Dimensions are indicated in mm and Ø indicates diameter. The height of the dual-sampler is indicated. The letters indicates: (a) net attachment bar; (b) sliding tube; (c) main frame; (d) frame for net attachment; (e) lock; and (f) sliding ring for net attachment.

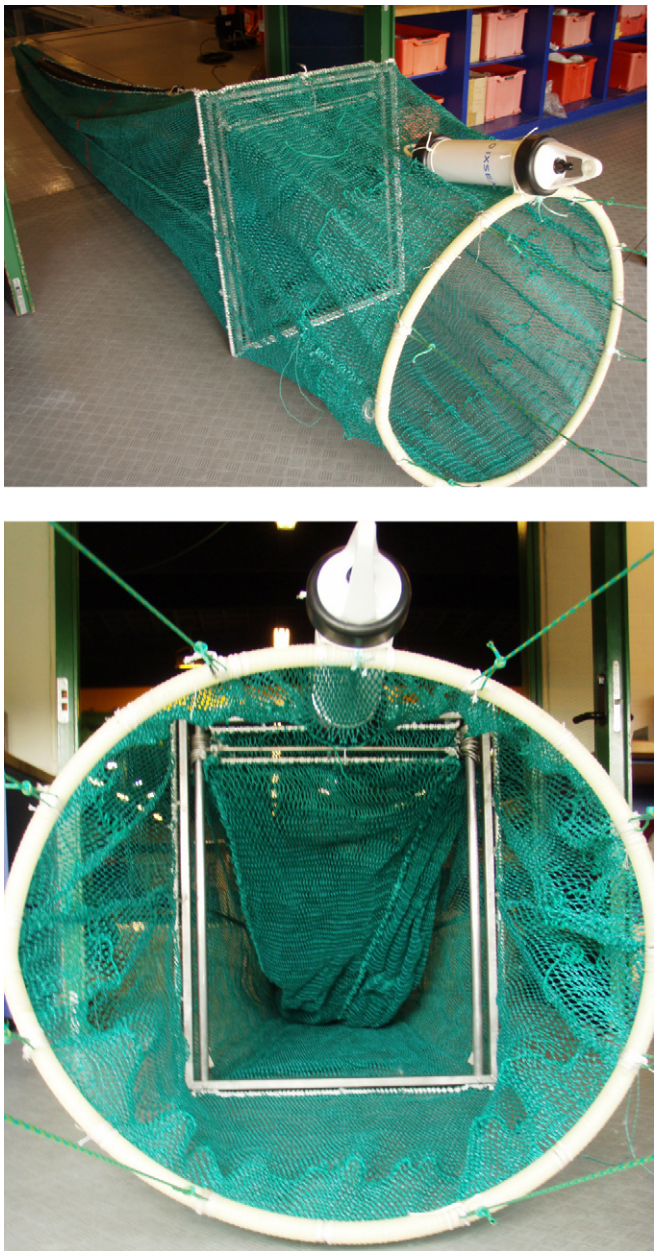

Fig. 2. Picture of the dual-sampler installed in netting with the acoustic releaser on top of the netting. The white frame in the front is for attachment to wires when tested in the flume tank. No net skirts are mounted.

frame. They are positioned with the receiver transducer pointing towards the vessel and the release latch towards the frame. It may be possible to attach the acoustic releasers in a fixed holder directly onto the frame although this may make the system more sensitive to handling. One rope from the releaser to the middle or two ropes to the sides of the release bar keeps the release bar at the top of the frame until the release mechanism is activated.

When the loop rope is released, two kites made of halved float spheres (Fig. 3) and the 3.8 kg weight cause the release bar to open the collection bag and simultaneously prevent access to the former collecting bag. The kites have a 20 cm and 27 cm diameter for collecting bags 2 and 3, respectively. A 3 cm diameter hole in the centre of the kite reduces wobbling movements. A net skirt (Fig. 3) is attached to netting from about 0.5 m in front of the frame descending down to the frame. This ensures that fish cannot pass through the small opening between the release bar and the main frame into the collecting bag before it is released. In addition the triple-sampler has a net skirt in the lower panel preventing the fish from entering the area under the lock (Fig. 1) and subsequently entering collecting bag 2 when collecting bag 3 is released. In the final version of the triple-sampler we have attached a vertical bar to the main frame for attachment of the skirt netting.

The frame is mounted in a 90° vertical position. If it was sloping backwards from top to bottom the release bar would be dragged down more easily assisted by the water flow. But it would also have to be larger to keep the effective circumference of the netting the same and hence more difficult to handle. Simple locks at each side of the device in the lower part of the frame (Fig. 1) prevent the release bar from moving back up and reopening the codend or cover. Locks are placed 18 cm above the end of the sliding tube on the triple-sampler and 5 cm above on the dual-sampler. The difference is due to the use of 10 net rings for each collecting bag and an extra release bar.

The acoustic release system (model OCEANO 500) is a product available from IXSEA (www.ixsea.com). It weighs 6.5 kg in air and 2 kg in water. The depth range is 400 m. The deck equipment consists of a tele-command unit (TT701) and a dunking transducer unit (OIPET801-30).

We made the first sampling collecting bag (bag 1) not releasable to reduce the size of the sampler by not using space on the sliding tubes. The first sampling bag can be opened if a flushing period is needed before starting sampling. The length of the collecting bags