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Two Experimental Techniques that have been used for obtaining Roundfish in good Condition

by

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Summary

Two methods have been developed for raising physoclistous fish to the surface without subjecting them either to external damage due to net abrasion or to internal damage due to the expansion of the swim-bladder. One method was to replace the cod-end of a trawl by a large, detachable, cylindrical container. This was arranged so that it could be detached from the trawl with fish inside and raised to the surface slowly and independently of the trawl net. The other method was to introduce a handline-caught fish into a cage at the bottom of a handline so that it could be raised to the surface as slowly as desired. Both methods have worked satisfactory in early trials but so far only a few fish have been raised to the surface slowly enough to prevent swim-bladder rupture. The majority of fish obtained by both methods have, however, been in extremely good condition externally, compared with conventionally trawl-caught fish.

Introduction

Many commercially valuable fish species, including the gadoid species haddock and whiting cannot easily be studied experimentally in captivity due to the difficulty of obtaining specimens in good condition. Their depth range is such that it is virtually impossible to catch them by normal fishing methods without rupturing their swim-bladders. Furthermore, trawl and, to a lesser extent, seine-caught fish frequently suffer from extensive scale loss and external bruising and crushing. Fish caught on handlines often appear in good condition compared with trawl-caught fish but are still subject to internal damage and can usually only be caught in limited numbers. In an attempt to overcome these difficulties, two methods have been tried out to reduce internal damage by bringing the fish to the surface slowly and to reduce external damage by retaining them in containers of water. These are:

1. The "detachable cod-end" method: the cod-end of trawl is replaced by a large, closeable cylinder that can be detached from the net with fish inside and raised to the surface independently of the trawl.
2. The "handline cage" method: a fish caught on a handline is drawn into a cage at the bottom of the line and then raised to the surface slowly.

Description of apparatus

(a) The detachable cod-end (Figures 1-7).

The cod-end consists of a plastic cylinder 0.76 m in diameter and 1.6 m in length, supported in a metal frame. At the beginning of a haul this is connected to a metal ring on the end of the trawl by means of a time release mechanism. The opening at the front of the cod-end is 35 cm in diameter and can be closed by a spring-operated door. During towing this door is held open, against the spring, by a line that ends in a loop over the holding pin (Figure 2).

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To recover the cod-end after it has become detached from the trawl, it is provided with a dahn line, coiled inside a container and held by a wire that passes to a loop on the holding pin. An inflatable buoy and a radio beacon are also secured by wires that end in loops on the holding pin.

The inflatable float is inflated by a 125 gm cylinder of CO_2. A pin, secured by a line to the trawl ring, is pulled out of the operating mechanism at the moment of release and causes the float to start inflating. At the same time the wires running to the door, the inflatable float, the radio beacon and the dahn line container lid, all fall freely off the holding pin.

The cod-end is provided with floats to give nearly neutral buoyancy. These are covered with netting to prevent the dahn line from becoming entangled with any of them. As a safety precaution, expandable weights are fitted to each side of the cod-end that drop off when the cod-end is released. The cod-end, plus the inflatable float, plus the radio beacon, are positively buoyant, thus ensuring that if for any reason the dahn line fails to run out properly, the entire cod-end will float to the surface.

At the surface the radio beacon gives out a signal that can be picked up on the ship's radio. For operations at night, a light is incorporated in the beacon. For daylight work, the inflatable float gives adequate visual aid for finally picking up the dahn line.

The radio beacon, which was designed by my colleague J. G. Whyte, is a 1 watt 2 MHZ C.W. transmitter keyed on a 33% duty cycle at 2 pulses per second. On submergence it is switched to standby by a sea-water conductivity switch. The unit is also provided with an integral one watt light keyed synchronously with the transmitter. The unit was manufactured to his design by Underwater Marine Equipment Ltd., Fleet, Hants. The time release mechanism was supplied by the same firm.

The cod-end is raised to the surface in stages by suspending it from a surface buoy. For taking it on board, partly full of water, the last 5 metres of dahn line consists of $1\frac{1}{2}$" wire, which, during towing is coiled on top of the cod-end and secured with twine. This holds it in place during towing but breaks when the cod-end is hauled towards the surface.

Finally, the cod-end is brought on board, suspended vertically from a single lug, with water and fish inside.

(b) The handline cages (Figure 8)

Each cage consists of a plastic container. Incorporated in the base is an 18 cm circular opening, filled in by a 1" thick sheet of foam plastic with a star-shaped hole in its centre.

The handline is threaded through this cage and, during fishing, the cage remains in the boat beside the operator. As soon as a fish is caught the cage is dropped over the side and allowed to slide down the line.

At the bottom of the line the fish is first drawn into the container through the foam plastic in the base. Near the bottom of the line, just above the hook, is a metal bob. Just before the cage comes to rest with its weight on the bob, a spring-operated pair of scissors at the top of the cage is tripped, and cuts through the nylon holding the hook. The fish is then free to swim about in the cage, although it still has the hook in its mouth. The line and cage are then suspended from a float on the surface and the cage raised in stages to the surface.

Results of trials

(a) The detachable cod-end

A satisfactory method of handling this equipment has been developed during a series of research ship cruises in 1967 and 1968. In the first experiments the cod-end was detached from the trawl, but raised at normal hauling rates. The catches taken on these trials showed that the external appearance of small haddock, cod and whiting was very superior to that of fish caught by trawl in the normal way; in particular they had suffered very little loss of scales and external abrasion and other damage.

In June 1968 the first successful attempt to raise fish to the surface slowly was made on board "Explorer". Three cod-ends were detached from the trawl and raised from the sea-bed (70 m) to the surface in times ranging from 17 to 42 hours. Of these, only the 17 hour cod-end was found to contain fish. The absence of fish in the other two was due to a minor defect in the door-closing mechanisms, permitting the fish to escape. The 17 hour cod-end had been raised in stages. Each lift was such as to produce an approximately 30% reduction in pressure and approximately three hours were allowed to elapse between each lift. Altogether there were:

241 small haddock (ca. 20 cm)
69 medium-sized haddock
2 medium-sized cod
1 large whiting
7 lemon sole
2 gurnard

These fish appeared to be in remarkably good condition, and when taken on board, only 9 small haddock and 1 large haddock were dead or dying. The remainder were alive and most of them were swimming actively. Their overall external condition was similar to that of line-caught rather than trawl-caught fish. About 30% of the haddock had some scale loss although in relatively few individuals was it extensive. Of the larger fish only 15 haddock showed any signs of scale loss, and in all but 5 of these it was very slight.

However internal examination of 20 of the haddock of various sizes showed that all had ruptured swim-bladders, while of the cod one had a ruptured bladder and one had not. The large whiting had an intact swim-bladder and appeared to be in perfect condition both internally and externally. 17 of the medium-sized haddock were kept in the fish tank aboard ship and subsequently transported to the laboratory aquarium, where all survived and appeared to thrive. All these fish were feeding within a week of capture and at the time of writing (July) appeared to be in good condition.

The handline cages

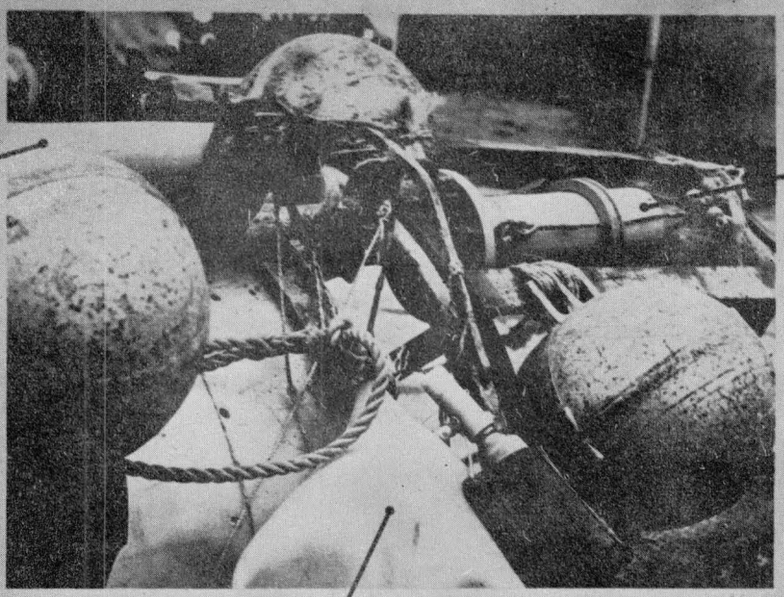
Handline cages have been used on two occasions during handline fishing operations in Loch Ainort, Isle of Skye. On the first occasion (August 1966), 14 cages were used and raised from the sea-bed (35 m) to the surface in stages. Each lift corresponded to a 50% reduction in pressure and 24 hours or more were allowed to elapse between each lift. From these cages, 8 haddock were finally obtained, each in perfect condition externally, but all with ruptured swim-bladders.

On the second occasion (June 1968), 12 cages were used and these yielded 6 haddock and 2 codling. The depth was 35 m again and this time each lift corresponded to a 30% reduction in pressure. Again, 24 hours or more were allowed to elapse between each lift. Because of the difficulty of getting out to the handline cages in bad weather, the fish in these cages were confined for a total of 5 days on both occasions. When they were brought to the surface these fish all appeared to be in perfect condition externally. Two haddock were examined internally and found to have ruptured swim-bladders. The other 4 haddock and the 2 codling are, at the time of writing, still alive and feeding well in the laboratory aquarium. A striking feature of the codling is their apparently perfect buoyancy control and this is so much more apparent than is usually the case with cod in the aquarium that it is possible that these fish have intact swim-bladders.

These experiments show that repeated reductions in pressure of 30% are too great for haddock even when as many as 24 hours are allowed to elapse between each reduction. They also show that cod and haddock can be confined in comparatively small containers, for quite long periods without apparent ill effects.

Finally it must be stressed that the experiments conducted so far have been of a preliminary nature aimed principally at testing the equipment and developing satisfactory handling methods. However, the results from the experiments with the detachable cod-end indicate clearly that it greatly reduces the incidence of external damage (scale loss, abrasion etc.) of "delicate" species such as haddock when compared with that incurred by normal trawling methods. It remains, however, to adjust the rate of hauling to a level at which the incidence of swim-bladder rupture and internal damage is significantly reduced.

1.



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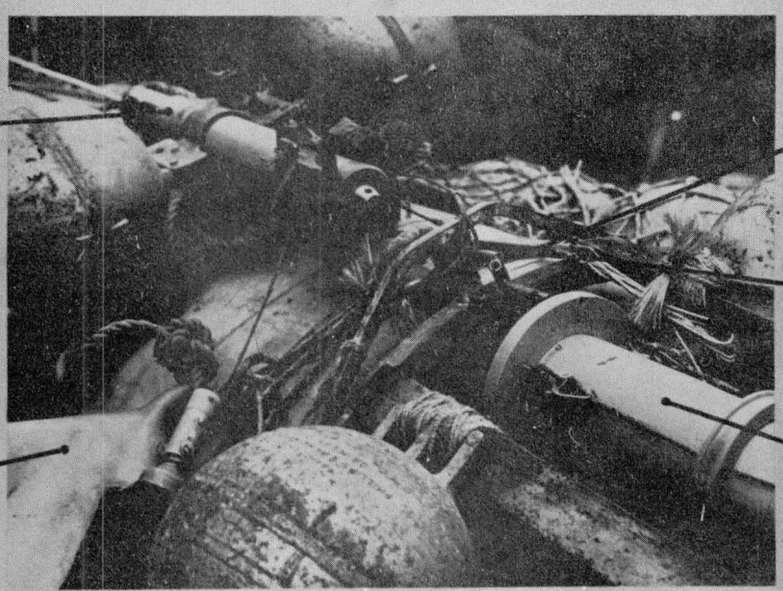

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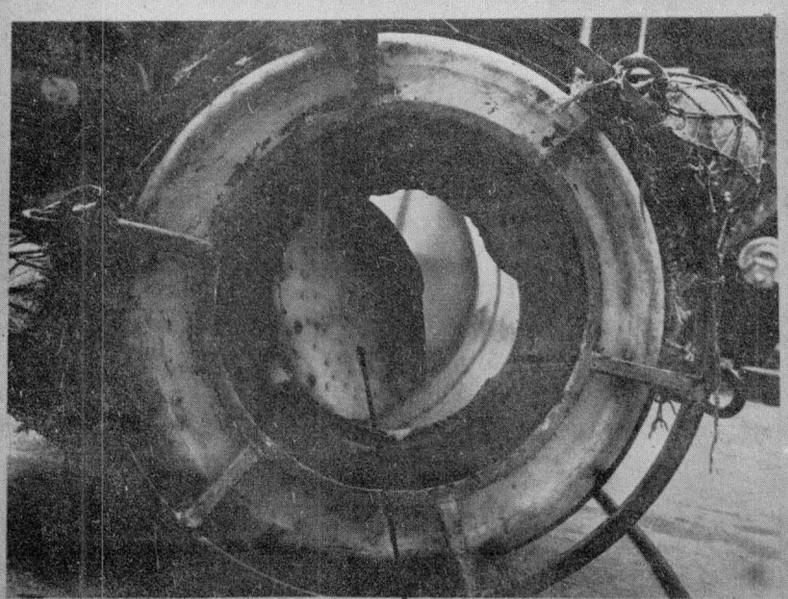
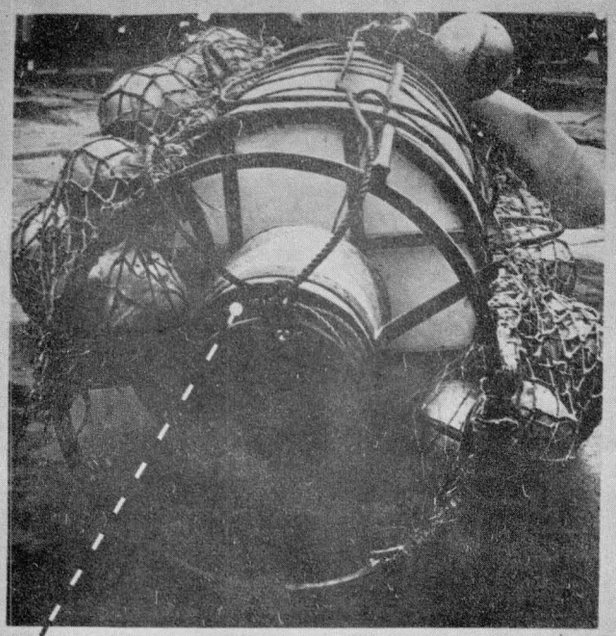


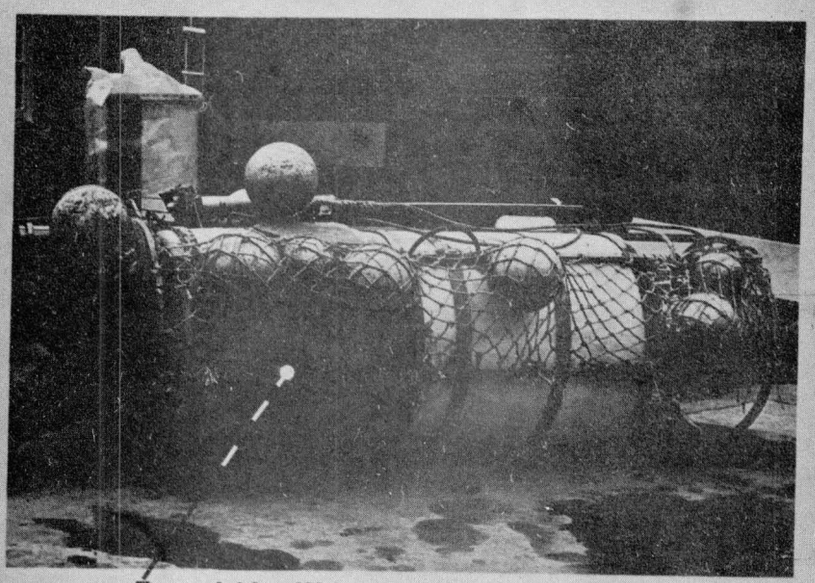
Front of Cod-end showing door partly open

4.



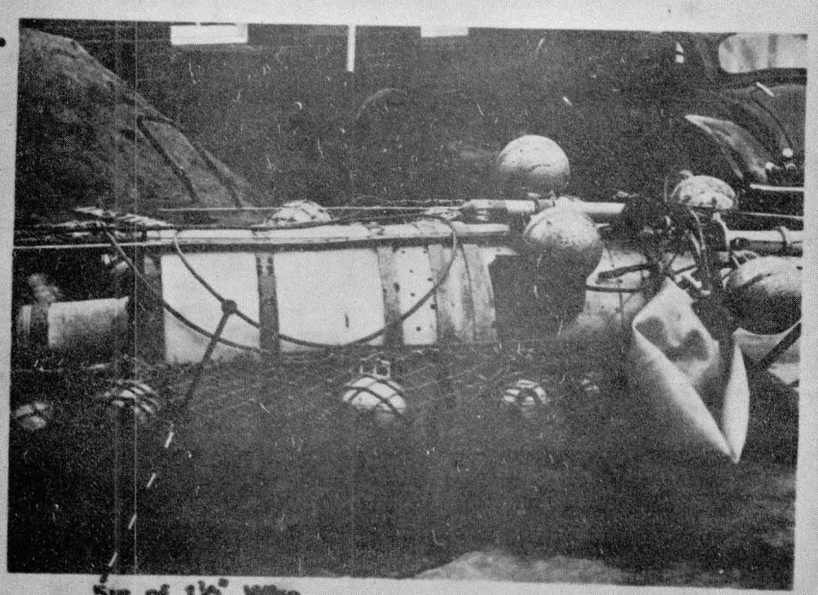
Rear View of Cod-end Showing Dhan Line Coiled in Container

5.

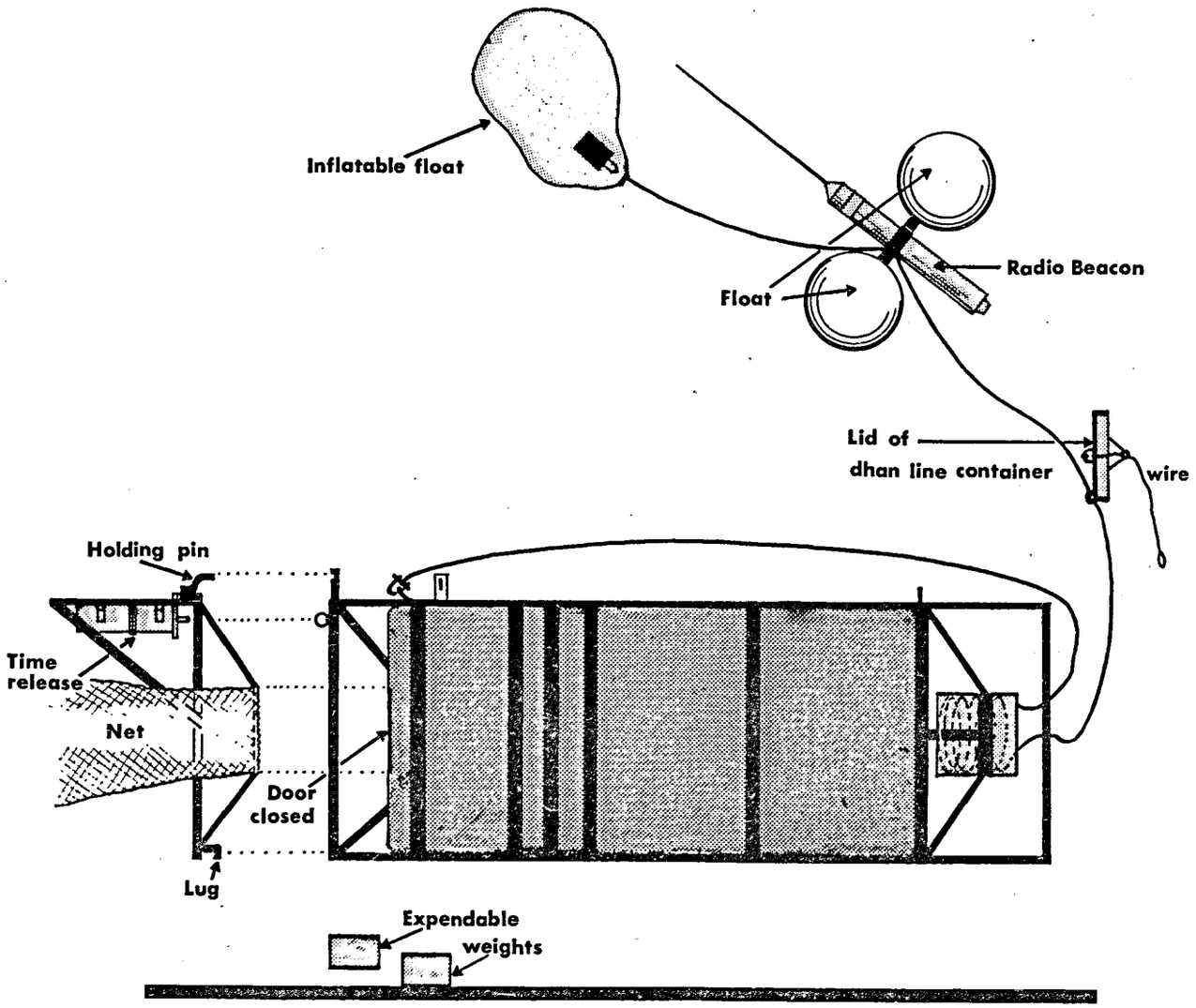


Expendable Weight

6.



5m of 1½" Wire



DIAGRAMMATIC SKETCH OF COD-END AT MOMENT OF RELEASE

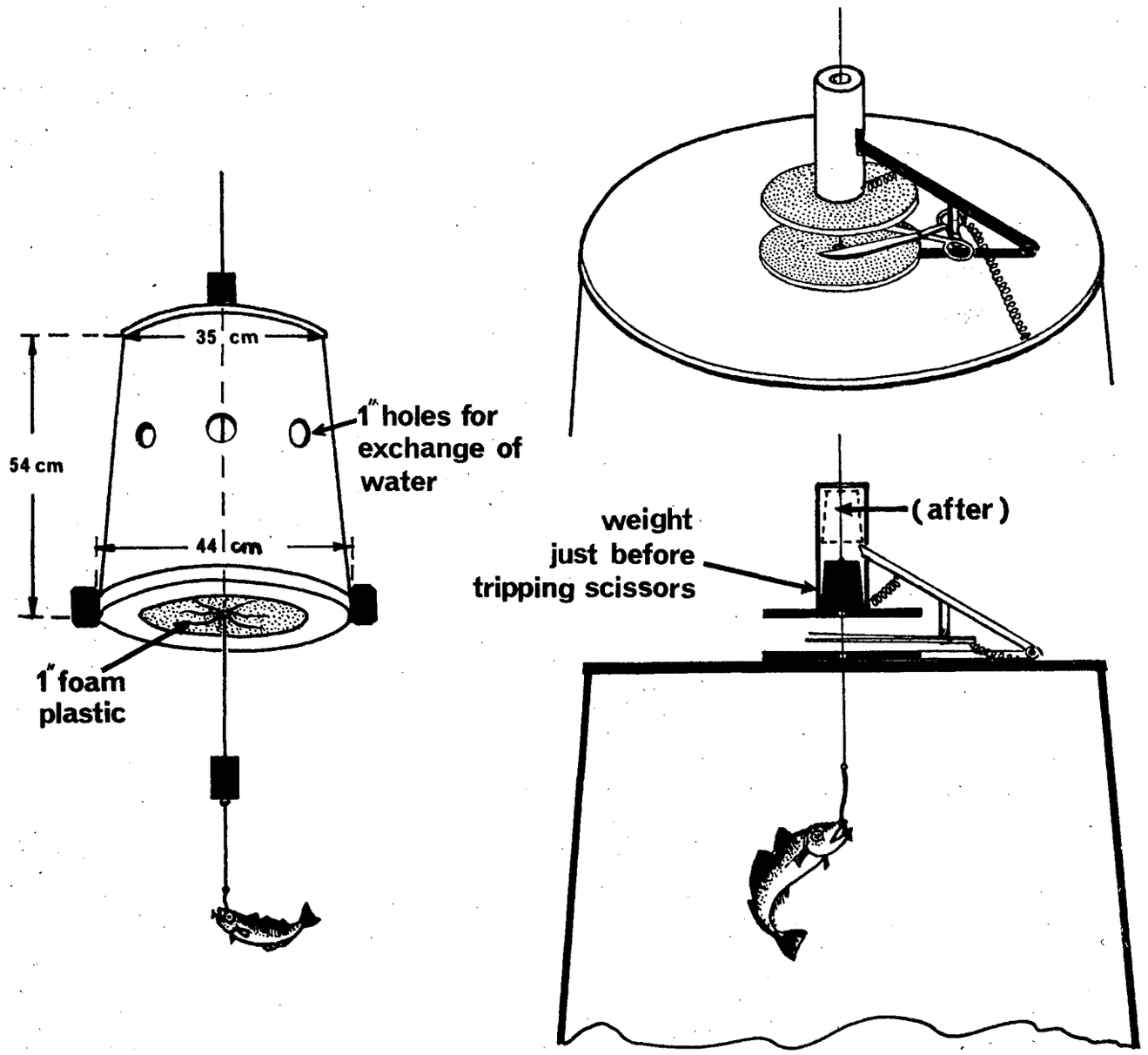


Fig. 8. DIAGRAMMATIC VIEWS OF A HANDLINE CAGE