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FURTHER EXPERIMENTS ON CATCHING ROUNDFISH IN GOOD CONDITION

by

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Introduction

In a previous paper (Jones 1968), two methods were described for obtaining roundfish in good condition. These were:

1. The detachable codend method intended for use when trawling, the objective being to detach the codend from the net and subsequently to raise it to the surface slowly. The intention was to enable fish, such as haddock, to remove gas from their swim bladders sufficiently slowly to prevent them rupturing.

2. The handline cage method intended for use when fish were caught on handlines. Once hooked, a fish was drawn into a cage at the bottom of the line, released from the line so that it was free to swim within the cage, and then raised to the surface slowly, again with the objective of avoiding rupture of the swim bladder. This paper describes further developments of these methods and some of the results obtained.

Developments in technique

(a) The detachable codend

In the original design the codend consisted of a single cylinder 0.76 m in diameter and 1.6 m in length. Subsequent experiments were aimed at increasing the size of the codend so that larger numbers of fish could be contained and raised in a single operation. Several ways of doing this were attempted and during 1969 a satisfactory technique was evolved for detaching and slowly raising codends up to 1 m in diameter and 3 m in length.

(b) The handline cage

The handline cage technique was found to be particularly applicable to Looh Ainort (Isle of Skye) on the Scottish west coast, where haddock can usually be captured in useful numbers with some degree of certainty. Each cage described in the previous paper was fitted with a pair of scissors, arranged in such a manner as to cut the nylon holding the fish after it

had been drawn inside. It was found that the operation of the scissors became unreliable after a time due to corrosion. Scissors were therefore discarded and the nylon securing the fish was parted by breaking, instead of by cutting. The method of achieving this is illustrated diagrammatically in Figure 1, and was found to be extremely reliable.

The condition of the fish caught was assessed initially from their external appearance and later from the percentage returns of those that had been tagged and released.

Condition of fish when newly caught

(a) Handline cage results

Field trips using 20-30 handline cages were carried out in September 1968 and during the summers of 1969 and 1970. On each occasion about 20-40 haddock were obtained, all of which were used for experimental work in the aquarium at Aberdeen. These fish were characterised by:

(a) an extremely good external appearance

(b) the fact that they were so lively that care had to be taken to avoid damaging them physically when transferring them from one container to another

(c) a very high survival rate (more than 90% from capture to captivity in the aquarium).

In September 1968 experiments were done to determine the effect of different rates of raising on the condition of the swim bladder. It was found that when cages were raised at such a rate that the pressure on the fish was reduced by 10% every 2 hours, nearly all of those examined at the surface had intact swim bladders. Pressure reductions of 10% every $1\frac{1}{2}$ hours on the other hand yielded 20-30% of fish at the surface with ruptured swim bladders.

(b) Detachable codend results

Some indications of the condition of fish caught by this method are given in Table 1. These fish were caught in July 1969 in the Moray Firth and 14 miles east of the Orkneys in depths ranging from 60 to 90 m. Only fish selected as "good" on the basis of their swimming ability and external appearance were tagged and were then confined in deck tanks for up to 4 hours for subsequent observation. These fish can be divided into three categories:

1. Fish that had been raised to the surface at normal hauling rates immediately after capture.

2. Fish that had been allowed to spend various periods on the bottom before being hauled to the surface at normal hauling rates.

3. Fish that had been raised to the surface slowly after spending periods from 1 to 5 hours on the bottom. In these instances the rate of hauling was adjusted so as to reduce the pressure on the fish by 10% every two hours.

The results in Table 1 show that the immediate post-tagging mortality was highest in fish that had been quickly raised to the surface immediately after capture. In this category 23% of the haddock and 22% of the whiting died, or became moribund, within a few hours of tagging.

At the other extreme, the lowest post-tagging mortality was observed in fish that had been raised slowly to the surface. Of these, only 12% of the haddock and 12% of the whiting died or became moribund within a few hours of tagging.

For fish that had been raised quickly, after various periods on the bottom, intermediate results were obtained. The percentage of haddock dying or becoming moribund within a few hours of tagging was lowest for those fish that had spent the longest period on the bottom, i.e. for haddock that had spent 19 hours on the bottom the value was 10% whereas for haddock that had spent only 11-12 hours on the bottom the value was 20%. Less consistent results were obtained for whiting but this could be attributed to the very small numbers obtained.

Percentage returns of tagged fish

In the handline cage experiments none of the fish were tagged, the relatively small numbers of haddock caught being all used for aquarium experiments. In the detachable codend experiments however, the best of the fish were tagged and the result from two experiments are shown in Table 2. Of the haddock tagged the percentages returned ranged from 3 to 7% for fish raised slowly and from 1 to 3% for fish raised quickly. For whiting the values were 7% for fish raised slowly and 5-11% for fish raised quickly. These results indicated therefore, that whilst the technique of raising haddock slowly used in 1969, was able to yield moderate numbers of taggable fish per haul, the percentage return of these fish was not very different from that obtained for fish that had been raised quickly.

These results would suggest that several factors may be of importance in relation to the short term condition of the fish caught:

(a) Trawled haddock condition can be improved, at least superficially, by raising them slowly.

(b) Trawled haddock condition can also apparently be improved by leaving them on the bottom for a period, and then raising them quickly.

(c) A characteristic of the detachable codend fish was that although they were more lively than normal trawl caught fish, they could usually be held for tagging without difficulty. Handline caught haddock on the other hand, and especially those that have been raised to the surface slowly, are usually extremely lively when they reach the surface.

Even those that are raised quickly, appear to be more lively than the majority of trawled fish that are raised slowly. Also the rate of survival in the aquarium of handline haddock raised quickly, although not as good as that of those raised slowly, is usually extremely high.

These observations suggest that swim bladder rupture may not necessarily be the only factor affecting the condition of trawl caught fish. Some other factor that influences trawl more than handline caught fish may be more important. One possible difference between trawl and handline caught fish is that the fish caught by trawl may be subject to fatigue due to swimming, before and during the course of towing. It is possible therefore that, in addition to swim bladder rupture, fatigue may also have been an important factor influencing the condition of the trawl caught fish. This might explain why fish that had spent a period on the bottom and were then raised quickly, were apparently in better condition than fish that had been raised quickly without a delay on the bottom. It might also help to explain why the percentage returns of fish raised slowly in a detachable codend before being tagged and released, were not significantly greater than those of trawled fish raised rapidly in a detachable codend.

Experiments designed to modify the water flow through the codend

Although there were some holes in the 1969 detachable codend, permitting a very restricted entry of water, it is probable that the main lines of water flow were as depicted in Figure 2, with an area of considerable turbulence just in front of the codend. It is possible therefore that fish became fatigued by swimming just in front of the codend, before they entered the codend.

To counteract this, a completely different style of codend was tried out. This is depicted in Figure 3 and consists essentially of an 11.3 m long cylinder of canvas, kept open with circular metal rings, and with an apperture

on top, covered with ½" knotless netting to permit the passage of water. It was hoped that by using a codend of this design, a sufficiently large reservoir of relatively motionless water would be created at the rear of the codend, within which fish could lie without becoming fatigued.

Three cruises with codends based on this principle have been carried out to date. The first was on FRS "Scotia" in December 1970 when only one ring (the one labelled A3 in Figure 3) was used. The fish caught were classed as "floaters", "swimmers" and "taggable". "Taggable fish were selected from the best of the swimmers. In all cases the codend was raised to the surface at normal hauling rates and the fish were lifted from the sea within a bag of water as depicted in Figure 4. The results are shown in Table 3. This shows that 32-39% of haddock, and 39% of cod were classed as taggable (i.e. good swimmers with all, or nearly all their scales intact) and furthermore a few of these fish were as lively as handline caught fish.

Two further experiments were carried out, both on commercial trawlers, in which 3 rings, as shown in Figure 3 were used to hold the net open. Both cruises were very successful. On the first, in February 1970, in the Buchan Deeps, 567 taggable haddock were obtained from 9 hauls. During the second cruise the codend was further modified by extending the canvas at ring A3 (Figure 3) so that it enclosed three-quarters of the codend instead of only half. On this cruise, carried out in March 1970 21 miles ESE of Fair Isle (140 m), 1,223 taggable haddock were obtained from 12 hauls. All of the fish tagged were in very good condition and of them, 779 were classed as "perfect" in that there was no trace of scale damage and the external body sheen of slime was intact. It is also of interest that in this experiment about half a dozen sprats were caught which had their scale covering intact. This is significant, since small clupeoids captured in a trawl, usually exhibit considerable scale damage. These experiments are encouraging, as they make it possible to obtain much larger numbers of taggable haddock per haul than is possible using conventional trawling techniques. Even if the percentage returns are no higher than before, this would therefore appear to be a useful development.

Summary

Experiments with methods for catching haddock in good condition are described. They suggested that in the case of trawl caught haddock fatigue, presumably induced by swimming in front of and inside the net, may be as important, if not more important, than swim bladder rupture, in influencing fish condition. Experiments using a codend designed to contain a volume of comparatively undisturbed water where fish might be able to rest, yielded much larger numbers than would normally be expected of trawl haddock in good and lively condition. Further experiments are planned to determine the optimum design for a codend of this type for obtaining roundfish in good condition.

Reference

Jones, R. 1968 Two experimental techniques that have been used for obtaining roundfish in good condition. ICES CM 1968/F:2 (Mimeo)

Table 1. The percentages of tagged fish dying or becoming moribund within 2-4 hours of tagging during the "Explorer" July 1969 cruise.

	Haddock		Whiting	
	No. tagged	% dead or moribund	No. tagged	% dead or moribund
Fish raised quickly to the surface immediately after capture	195	23	54	22
Fish left on the bottom for 11-12hrs	108	20	10	20
various periods and then 15hrs	63	30	1	0
raised quickly to the surface 19hrs	159	10	6	33
Fish raised slowly to the surface after 1-5 hrs on the bottom	201	12	67	12

Table 2. Showing the numbers of fish tagged and the percentages recaptured using a detectable cod-end.

Date	Ground	Depth (m)	Method of raising	Number tagged	% returned
A. Haddock					
May 1969	58°31'N01°15'W	120	slowly	164	7
"	"	"	quickly	89	1
July 1969	Moray Firth and 14 miles east of the Orkneys	90	slowly	177	3
		"	quickly	424	3
B. Whiting					
May 1969	58°31'N01°15'W	120	slowly	122	7
"	"	"	quickly	18	11
July 1969	Moray Firth and 14 miles east of the Orkneys	90	slowly	122	7
		"	quickly	55	5

Table 3. Showing the average numbers of fish caught per haul classified according to external condition and the percentages classified as "swimmers" and "taggable".

("Scotia" - December 1970)

Species	Ground	Depth m	No. of hauls	Average numbers of fish per haul			%(1) Swimmers	%(1) Taggable
				Floaters	Swimmers	Total		
1+ haddock	Ling Bank	80	7	21	31	52	60	No tagging attempted
	Off Aberdeen	70	6	350	138	488	28	
Older haddock	Ling Bank	80	7	39	42	81	51	39
	Off Aberdeen	70	6	86	91	177	51	32
Cod	Off Aberdeen	70	6	24	14	38	37	39
Whiting	Off Aberdeen	70	6	86	8	94	8	No tagging attempted

(1) Percentages of the total numbers caught in each case

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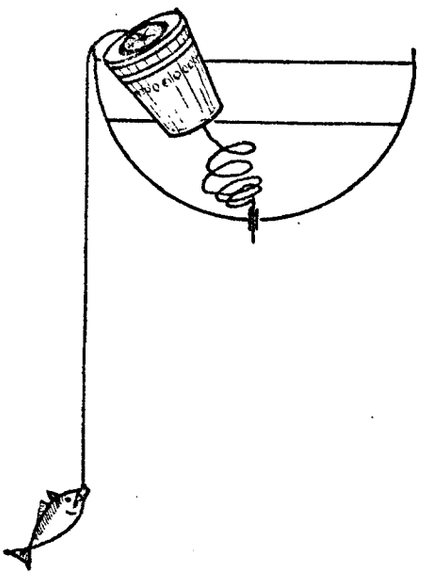
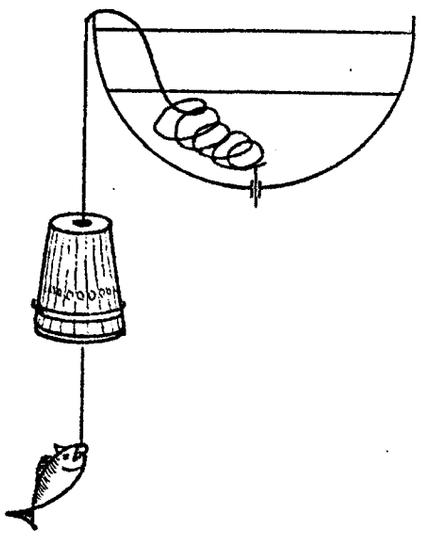
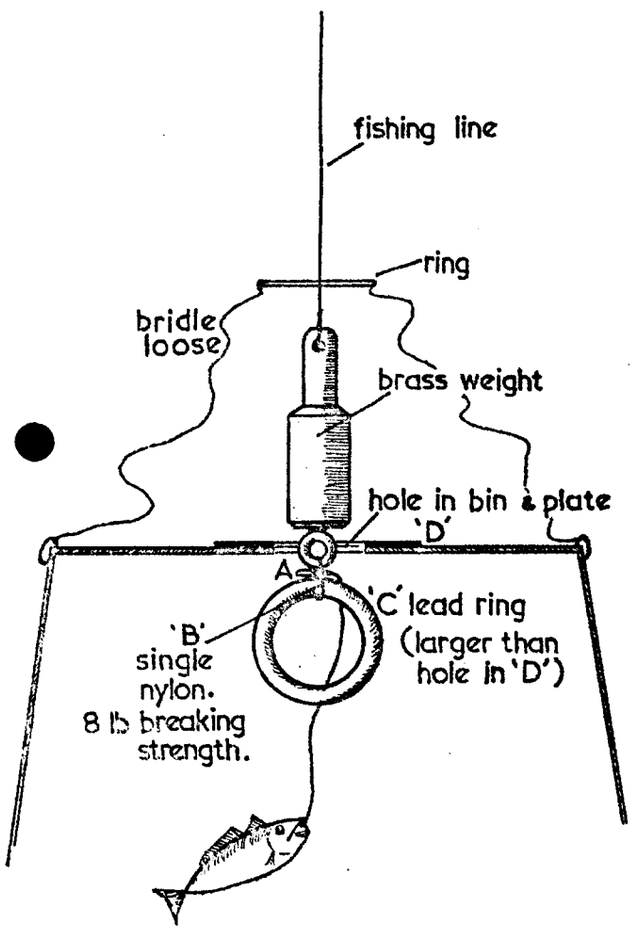
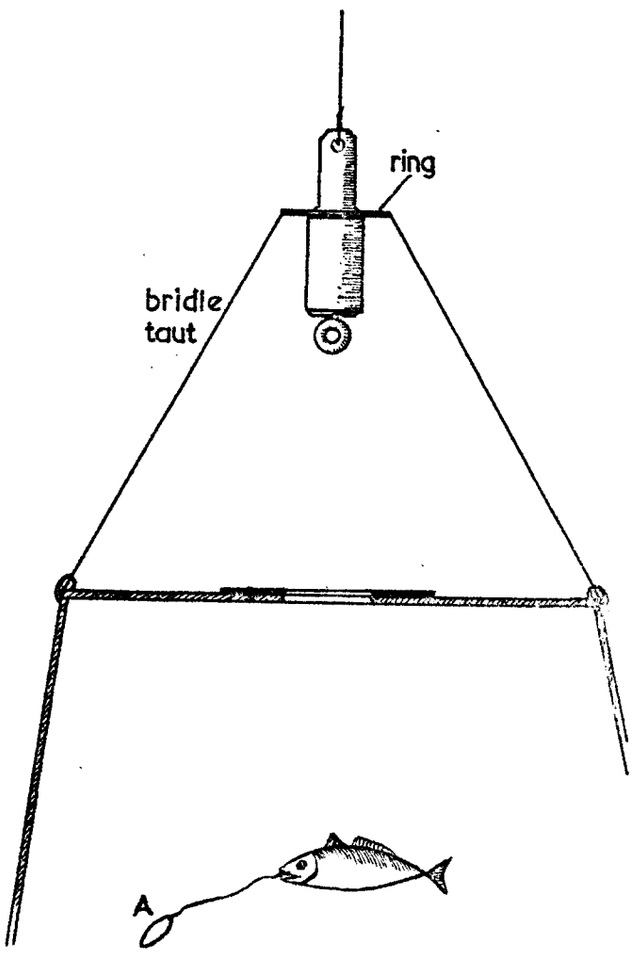
FIG. 1.

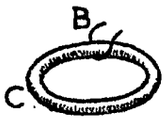






Situation just before circular weight 'C' comes into contact with plate 'D' causing entire weight to rest on nylon 'B'





Situation after 'B' has snapped, releasing loop 'A'

FIG 2 DIAGRAMMATICAL INDICATION OF PROBABLE LINES OF WATER FLOW IN FRONT OF DETACHABLE CODEND

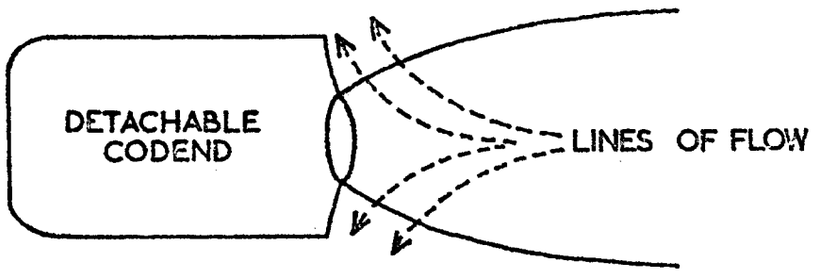


FIG. 3 CANVAS CODEND

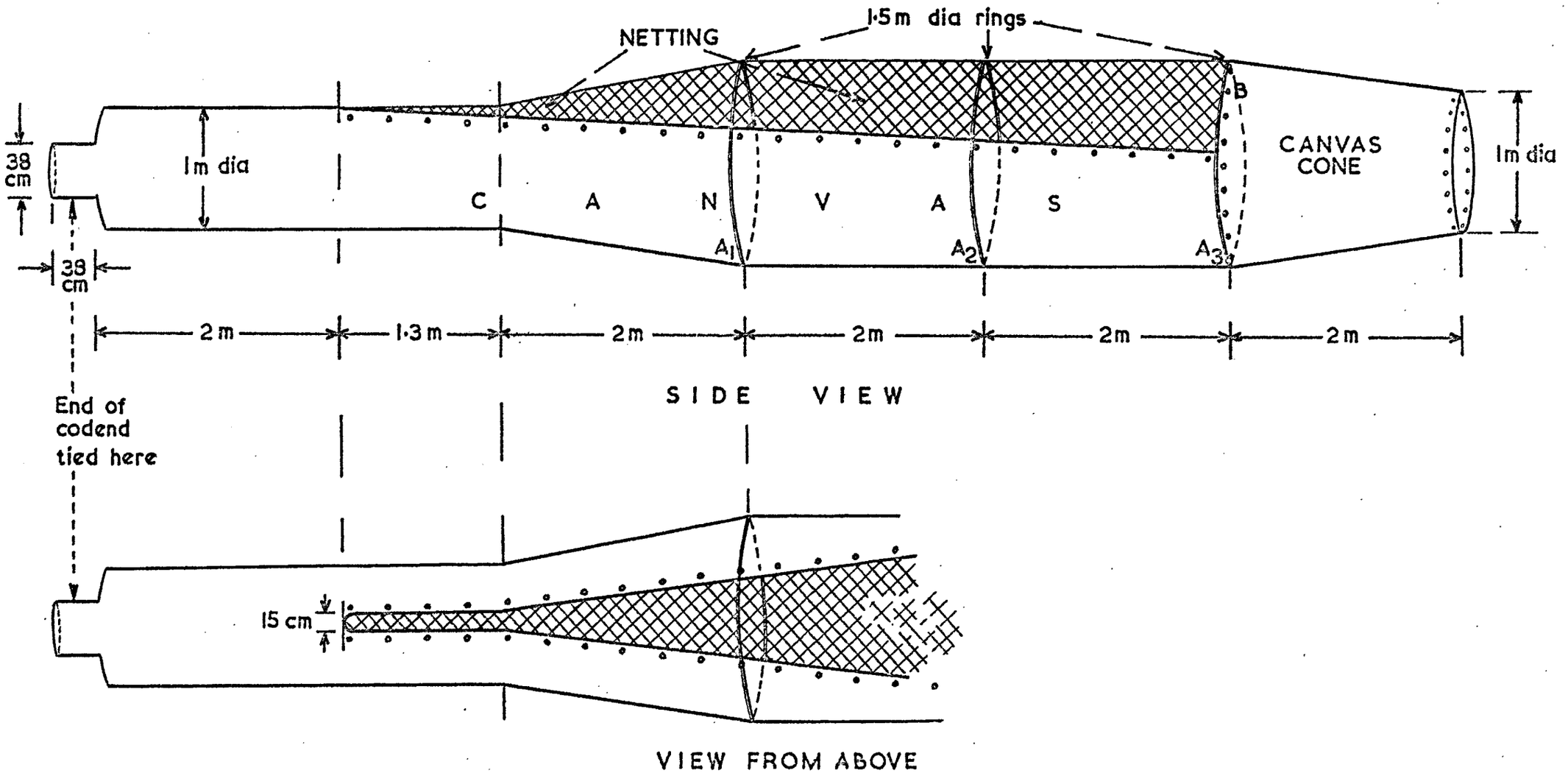


FIG. 4. METHOD OF HAULING CODEND AND RELEASING FISH INTO DECK TANK