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Modern Purse Seine Fishing with Winch and Sonar

Technical Report No.288

July 1986

SEA Fish Industry Authority
Industrial Development
Unit

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WITH VMDH AM SOUR

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- 7b in this position the vessel would have about J of the net shot and would start to alter its course once the mark has passed aft of the beam
- 7c After the first I net is shot the skipper should try to keep the mark between 70 and 90 degrees on the starboard side but care must be taken not to alter too quickly as this would result in too small a circle being made and some net still remaining on board when coming back to the dhan buoy.
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WPB WMCH AND SONAR

CRY

The technique of purse seining in Indonesia is comparatively primitive when compared to modern purse seining in Scotland.

However it is not easy to develop a compromise technique since there is a lack of capital in Indonesia which could not approach anywhere near the investment in a steel purse seiner of the type currently found in Scotland.

The author, an experienced purse seine captain, spent several months in Indonesia on the Sumatra Fisheries Development Programme under a consultancy agreement with the Sea Fish Industry Authority.

This report describes the basic components of purse seining and how the method works. Since simple sonar techniques would greatly increase the value of purse seining the author has described the use of sonar and how the fisherman could interpret the sonar display.

Finally the author describes shooting a purse seine in different conditions of wind and tide.

There are appendices giving details of the net which was designed for the SFDP

M CERN PURSE SEa7B FISHING
WITH WINCH AND
SONAR

1 INTRODUCTION

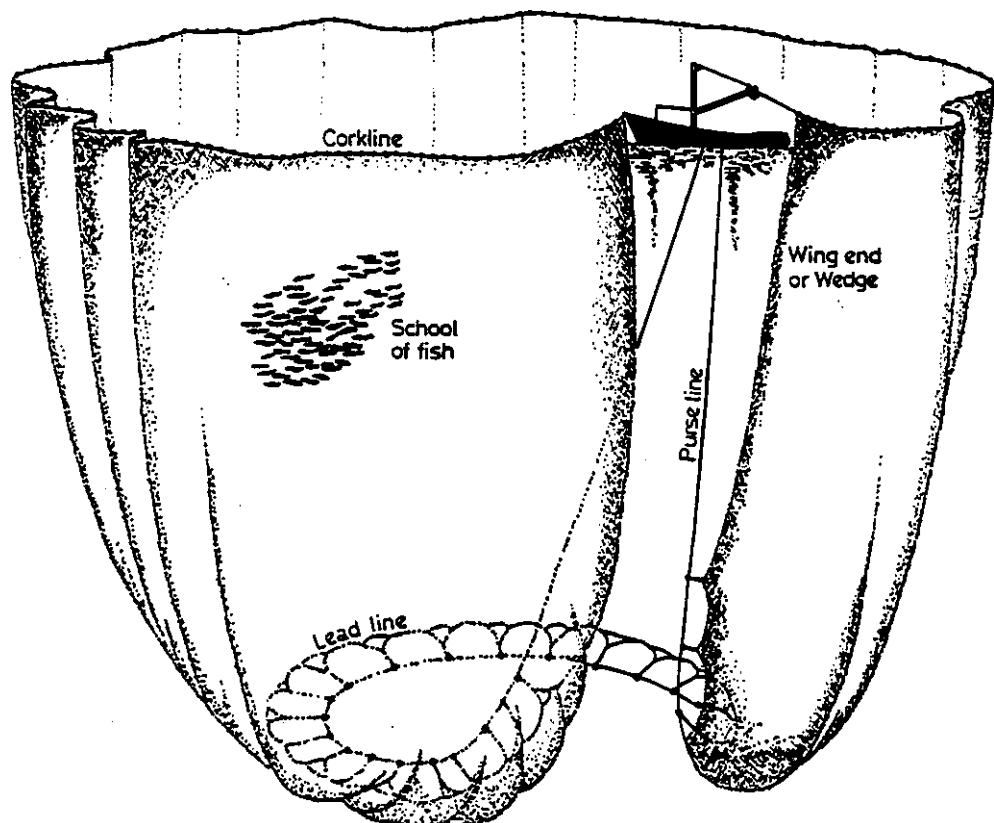
The purse seine is a highly efficient, but sidle method of catching pelagic fish. It involves the shooting of a long, deep net round a school of fish, completely trapping the school with a wall of netting. once this **is** done the bottom of the net is pulled shut, after which there is no escape for It can be used in shallow or deep water, depending on the experience of the skipper and crew and the type of deck machinery used.

In Indonesia it has been the practice to rely heavily on manual labour for hauling the net and low engine power.

Electronic fish detection is rarely, if ever used. This paper describes how the use of a winch designed for pursing and

Purse seining is particularly important for the capture of pelagic fish such as tunas Rastrelliger spp. (Kenbung), mackerels, sardines and anchovies.

Once the school is located either by **electronic fish detection**, or **surface disturbance caused by fish and sea birds**, the school is quickly surrounded by a wall of netting up to 1,000m in length and 90m deep. The net is then pulled together to form a purse or bag shape which prevents the fish from diving and escaping. This bag is gradually closed up alongside the boat.



Not to scale

Fig.1 Purse net prior to closing the purse

3. IMPROVING THE PMM SF- FIS-C IN DD(NFSIA

3.1 Deck Machinery

The amount of machinery required depends on the size of net being used and the depth of water to be worked in. The following would be required: See Fig. 2a, Fig. 2b.

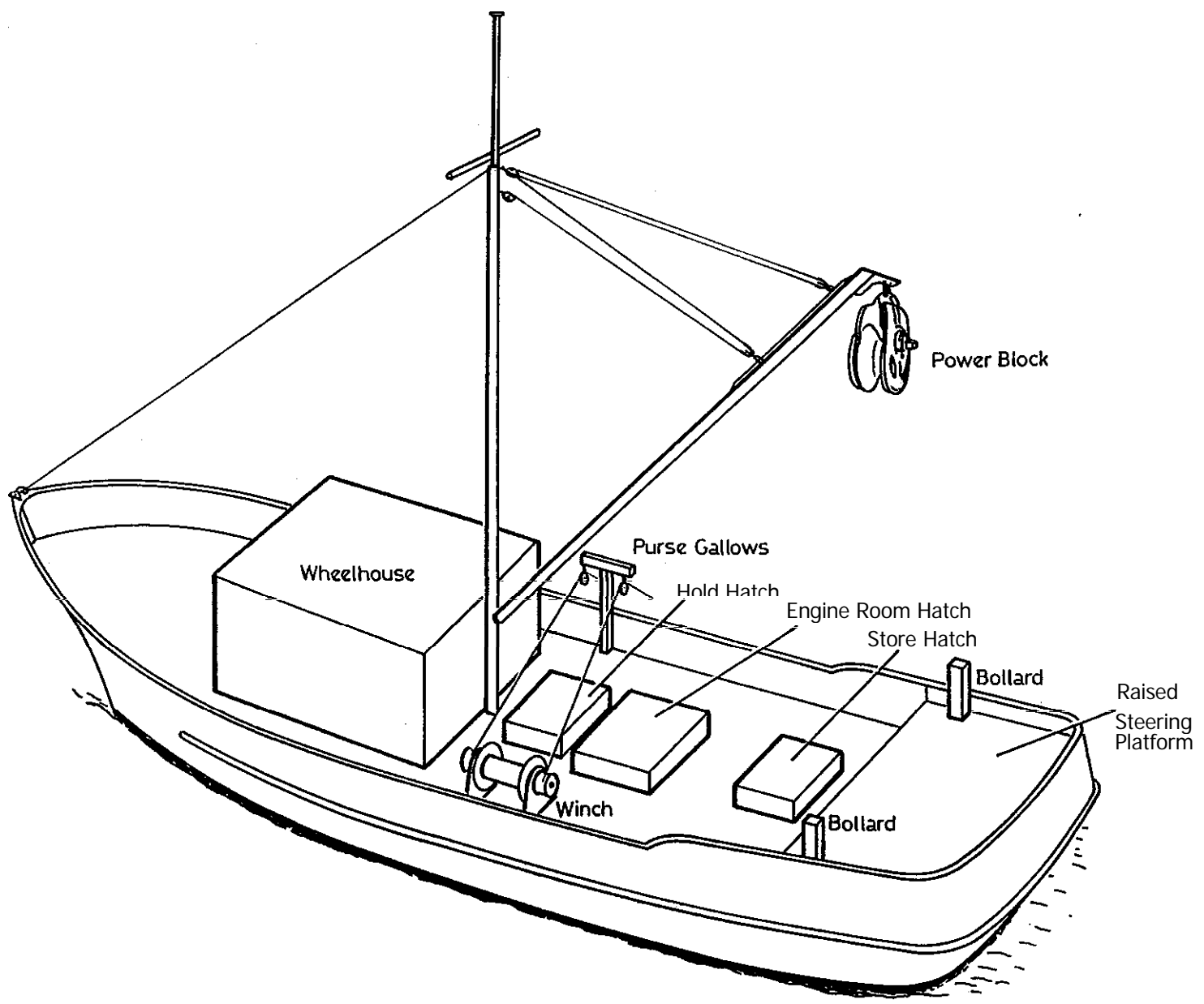
a) Power Block

It is important to have a power block when working heavy gear. The purse seine, is much heavier and stronger than other types of fishing nets, due to its size and the large amount of fish it is capable of catching. To haul the net by hand requires a larger crew and more deck space for storing the net. In Sumatra the net is usually stored on one side, giving the boat a heavy list. While hauling, with all the crew on one side, the boat takes on an even more severe list which reduces its safety

b) Winches

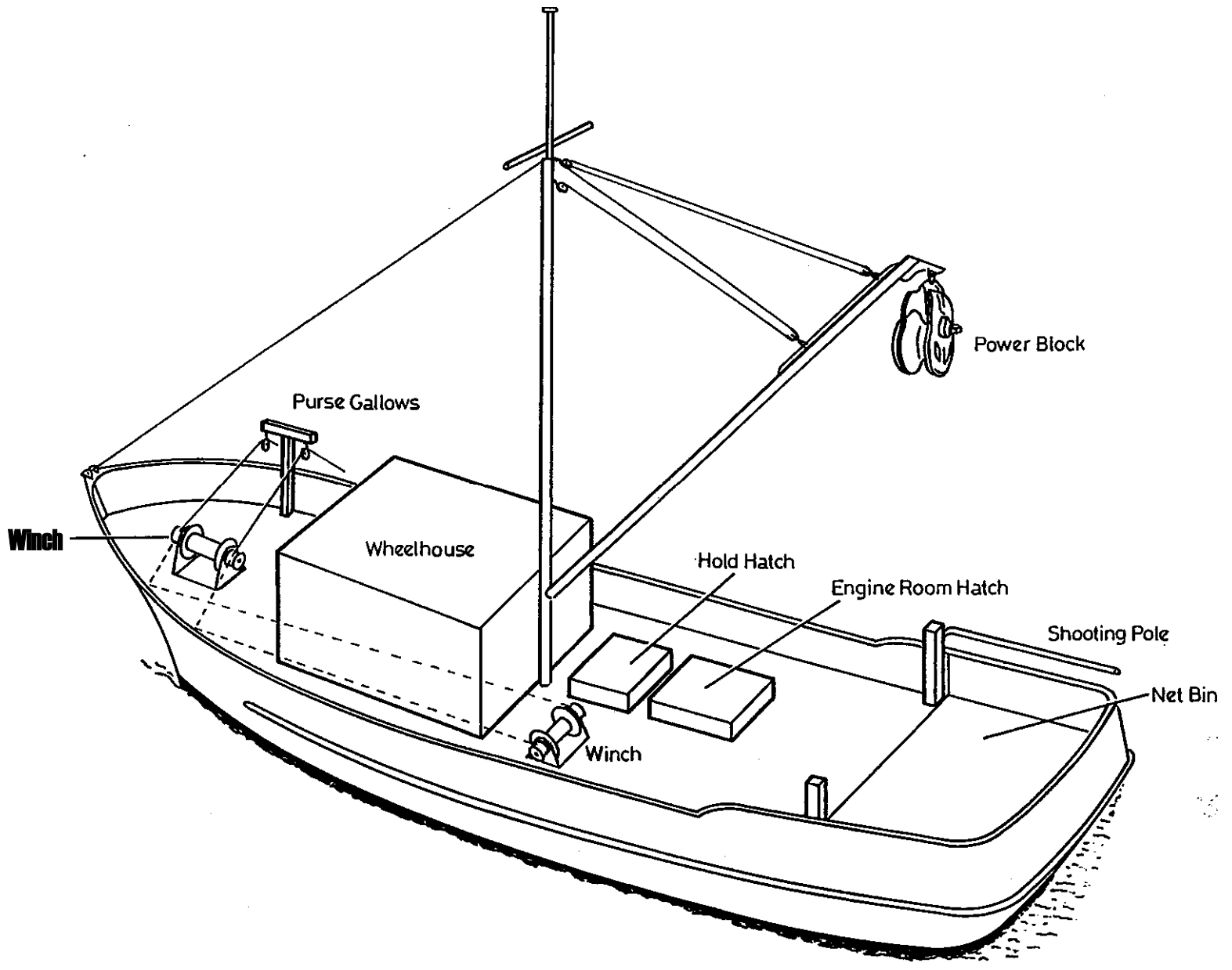
Powerful hydraulic winches are essential on purse seiners. Hydraulic winches allow the user more power and deckspace, compared to the belt driven winch. In the past, belt driven winches have been used but are unreliable when extra strain is applied to the winch, and sometimes they fail to haul back the gear, due to the belt slipping. They were also difficult to instal due to the drive shaft needed.

Modern hydraulic winches do not need a drive shaft and can be installed in a small space. After installation they require very little maintenance. The winch must be able to haul at different speeds, as the pursing operations are not always carried out at the same speed. Sometimes the net will be pursed in 6 minutes, at other times pursing could take up to 20 minutes. It all depends on how deep the fish are, and the depth of water where the net is shot. It is also necessary to



21 to N C A A

V r o c w



C) **Crew Training**

When starting out with a completely new crew it would be advisable for the skipper to shoot and haul the net in daylight several times, just to teach the crew the procedure. As most shooting and hauling will be done in complete darkness, the crew must be able to go about their duties with a good understanding of the job being carried out, or mistakes will be made which could lead to the net being damaged or crew being injured or lost overboard. For this reason some members of the crew should be trained to do one job only in the shooting/hauling operations. Even the most simple job if not carried out at the correct time can mean the key men have been trained in their duties, other members of the crew whose jobs are stowing the net while hauling, may then be trained to do one of the important jobs to act as a reserve or standby man. This ensures the smooth running of the boats. Should someone be injured or unwell and not able to go to sea, then his standby can take over his job, not disrupting the routine, and keeping the vessel at sea.

d) **Sonar Technique**

The purse net is only shot when a school of fish is found. In Sumatra the skipper relies on seeing a "boil" of fish on the surface, or seabirds diving to take fish. There is a vast array of fish finding equipment available to a purse seiner for more accurate location of a school, which is not needed on other types of fishing boats. The most important of these is the SONAR. Most large purse seiners will have 2 or 3 types of sonar sounding at one time. The reason for this is the different types of fish to be caught. of second importance is a good depth sounder. Fish without an air bladder (mackerel, tuna) are almost impossible to find using a low frequency sonar, and fish with air bladders (herring, sardines) do not show up well on high frequency sonar. A purse seiner therefore will have at least a HIGH FREQUENCY SONAR

Once a school of fish have been detected on the sonar, it is very important that the purse seiner does not go too near the school as this will disturb them, and scatter the fish. However, before he can shoot the net there are four things the skipper must know from his sonar:

- i) How deep the fish are;
- ii) The direction they are moving;
- iii) The depth of the sea bed at that place; and
- iv) Type of bottom or sea bed

To find out these things the skipper must circle the school of fish, keeping a good distance from and not disturbing them.

i) To find out how deep the fish are, the skipper notes the degree of TILT on SOLAR and the distance from the school. It can only be found with experience, but a good guide to start with is to keep the mark 50 fathoms and the degree of tilt required to find the mark will be roughly the depth they are swimming at i.e. if at 50 fms the sonar requires 25° of tilt then the fish will be at 25 fms.

ii) While circling the school, the direction of the fish are moving can also be found by keeping the school at 90° on the beam and fixed distance from the boat.

During this manoeuvre it will be observed that whilst keeping on a certain course the school will come closer to the boat or move away. By noting the course the boat was heading and adding or subtracting 90° , then the school will be moving in that direction i.e. if while the boat was going in a northerly direction i.e. 360° and the school came towards the boat when it was moving west.
($360^{\circ} - 90^{\circ} = 270^{\circ}$)

iii) & iv)

The depth of the sea bed and the nature of the sea bed bottom can be found by using the echo sounder or using reliable charts of the area. It can be found by using the sonar but this will only come with experience and the sounder is preferred. The sea bed may be smooth or rough, sandy or rocky and with experience the skipper will learn to detect the differences on his sounder. The use of charts should only be used as a guide to the type of bottom and depth, as sometimes wrecks and rocky peaks on the sea bed will not be shown on the charts. They can cause severe damage to the net and on some occasions the total loss of the net. The purse net can cost

e) **Mooting the Purse Net**

once the skipper has decided to shoot, the first end will be put overboard. There is a rope at the bunt end of the net, and at the end is a plastic float with a light, then the purse wire. This part of the gear is called the dhan. When the dhan is being towed the skipper will manoeuvre the boat into the correct position to start shooting. This would be with the wind about 10° on the starboard bow and the fish school bearing 045° on the sonar and a range of 100 metres from the ship. Fig. 7a. Men in this position, shooting will commence, keeping a straight course until the mark of fish is bearing about 110° . Fig. 7b. The net should be marked in quarter lengths and when the first quarter mark is passed. The boat then starts to circle the school keeping it

i.e. $\frac{1}{4}$; $\frac{1}{2}$; $\frac{3}{4}$ etc. This gives the skipper a guide to how much net he has left to complete the circle so he can make suitable alterations if he is shooting too wide a circle or too tight. Once the net has all been shot the boat will tow the end of the net back back to the dhan (with experience the boat will not be far from it) and pick up the bunt end and purse wire which is then connected to the winch. Then pursing will begin. Fig. 7d. The amount of purse wire shot will all depend on conditions of the bottom and the depth of the school.

If the skipper is shooting in shallow water then during shooting operations he will call to the winchman to brake the wire at $\frac{1}{4}$; $\frac{1}{2}$ and $\frac{3}{4}$ marks. This will stop the net from sinking too quickly. When shooting the net, it is important that the vessel starts with the wind on the bows. The reason for this is to help keep the boat out of the net while hauling. If the boat was to start shooting with the wind on the side, the boat would drift down wind into the net, making pursing and hauling very difficult.

The first thing to decide before shooting the net is the direction the fish school is moving. This is usually decided by tracking the fish movement on the sonar. When it has been decided which direction the fish are moving we can then proceed to shoot the net accordingly.

Figure 3

As the school will be moving away from the boat we start shooting close to the fish and by the time the net is shot the school will have moved further into the circle of the net

Figure 4

if the school is moving across the wind then most of the net will be shot the same way, starting close by the school and then across the wind until the skipper thinks he has shot plenty net away from the fish.

Figure 5

if the wind and current are from the same direction and the school fish are moving fast, we must start shooting in front of the school leaving the school at the mouth of the net, by the time we came back to the net the fish should have moved into the

Figure 6

Shooting with the wind on the beam is the most difficult situation and should not be attempted until a lot of experience has been gained.

it also requires much engine power to keep the boat out of the net. With a boat which has a small engine it would be advisable to work in partnership with another boat in which the second boat passes a rope, then proceeds to tow the fishing boat away from the net.

The purse net is not always shot in a circle. The shape of the net depends on the way the fish are moving and how fast. Sometimes we might have to shoot half the length of the net in a straight course just to get down past the school.

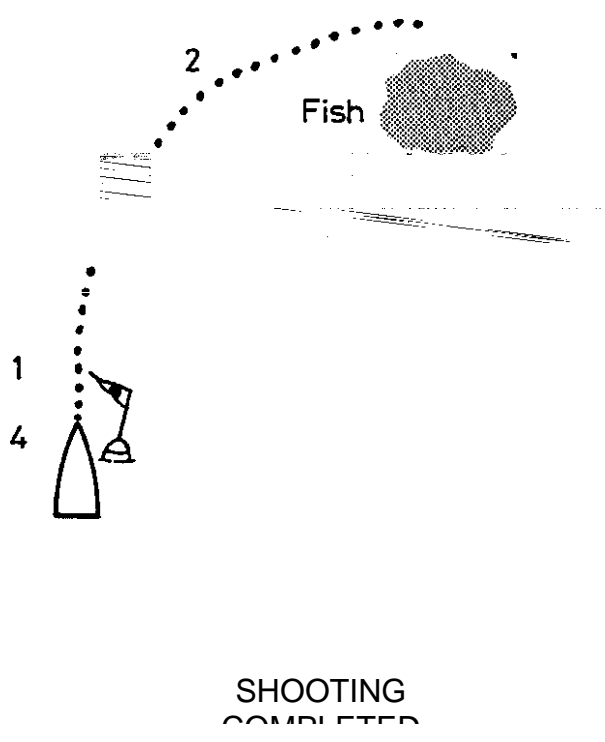
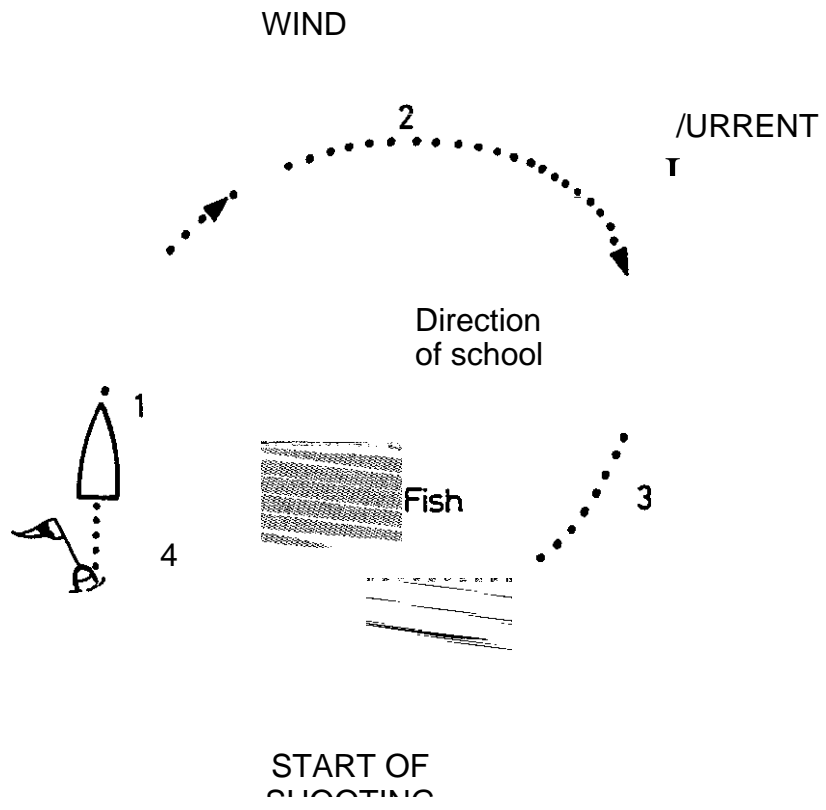
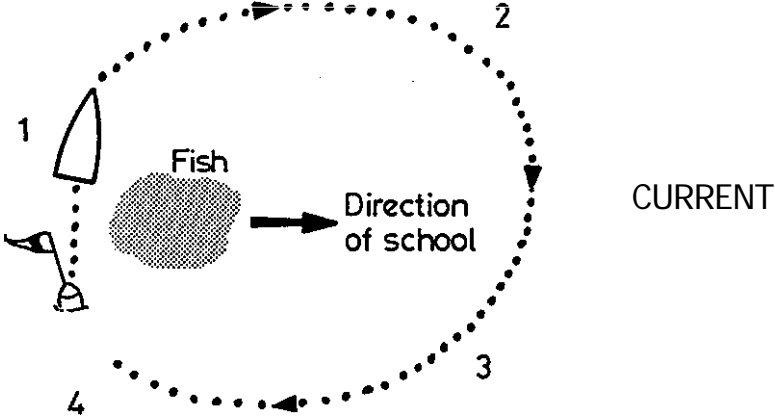
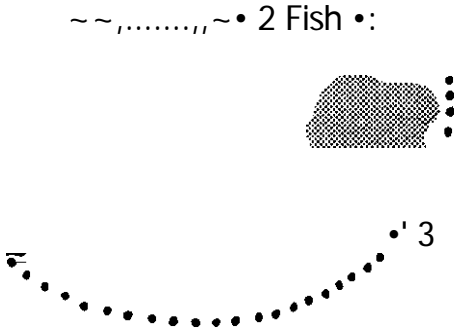


Fig.19 School moving into wind and current

WIND



SHOOTING



COMPLETION

Fig.20 School moving across wind and into current

WIND **S** CURRENT
V

2

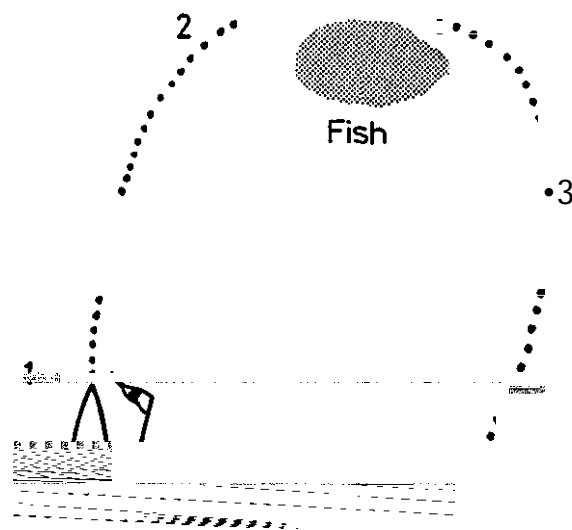
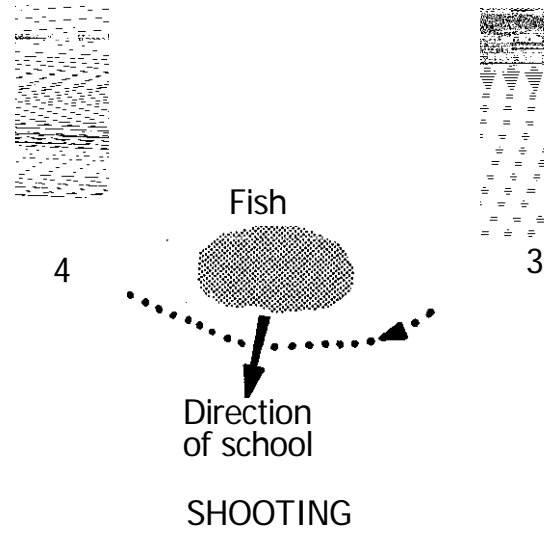
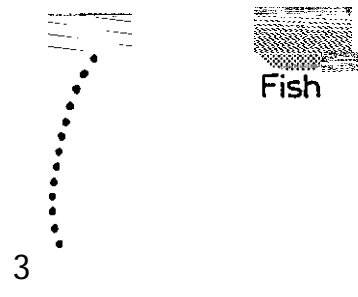


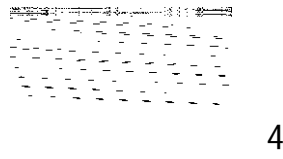
Fig.21 School moving in the same direction as wind and current

WIND



SHOOTI
NG

WIND



PURSING

Fig.22 Shooting with the wind on the
boom

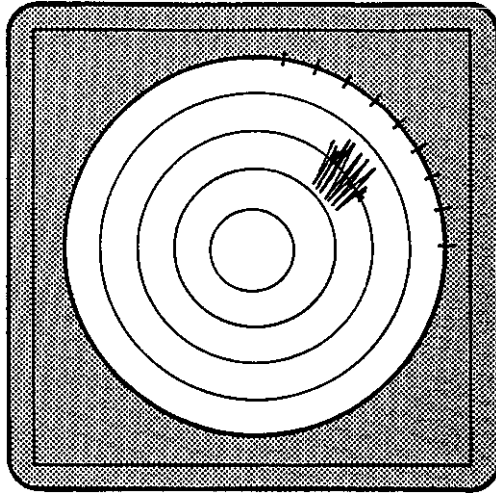


Fig.7a

Typical sonar display, the vessel would start shooting the net with the fish school in this position.

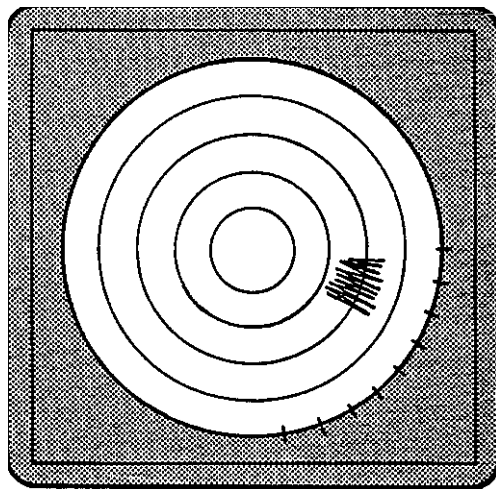


Fig.7b

In this position the vessel would have about $\frac{1}{4}$ of the net shot and would start to alter its course once the mark has passed aft of the beam.

Fig.7 Sonar display during shooting

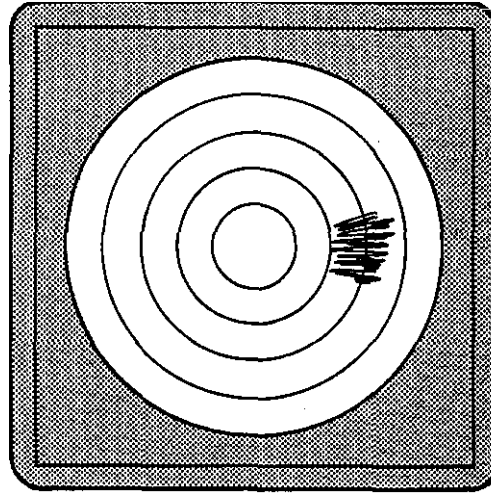


Fig. 7 c

After the first ¹/₄ net is shot the skipper should try to keep the mark between 70 and 90 degrees on the starboard side but care must be taken not to alter too quickly as this would result in too small a circle being made and some net still remaining onboard when coming back to the dhan buoy.

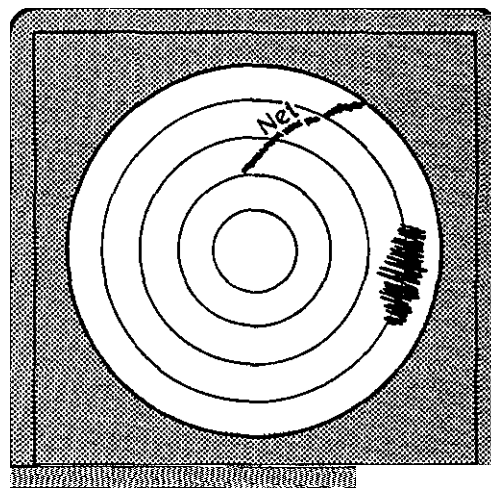


Fig.7d

This is how the mark will appear when shooting is complete and the vessel is coming back to the dhan buoy. The net will also be seen on the sonar and the skipper will be able to tell whether he has been able to stop the school from escaping.

f) Pursing

After the dhan buoy has been picked up and the end of the purse wire connected to the winch, then the vessel is ready to start pursing. Sometimes this may not start immediately. If the fish are deep down and there is no danger of damaging the net on the bottom, then the skipper can give the net time to sink deeper.

If this is the case then when pursing commences, it will be at a very slow speed. During this time the skipper should watch the school on the sonar to make sure the fish are still inside the circle of the net.

once he sees the net on the sonar below the depth of the school of fish, then he will decide to purse a little faster. Until the purse wires at the gallows are close together, the net is still considered to be fishing. once they have come together, pursing will be carried out as fast as possible, to bring the purse

i-ben shooting in shallow water and on a hard sea bed, the procedure will be different and the purse wire will be pursed as fast as possible giving the net little time to sink. In this operation pursing will start at full speed whenever the dhan is picked up.

While the pursing is in progress the boat comes astern trying to keep out of the net. Sometimes this is not possible and pursing will have to stop, but usually this is only when the boat is pursing at full speed.

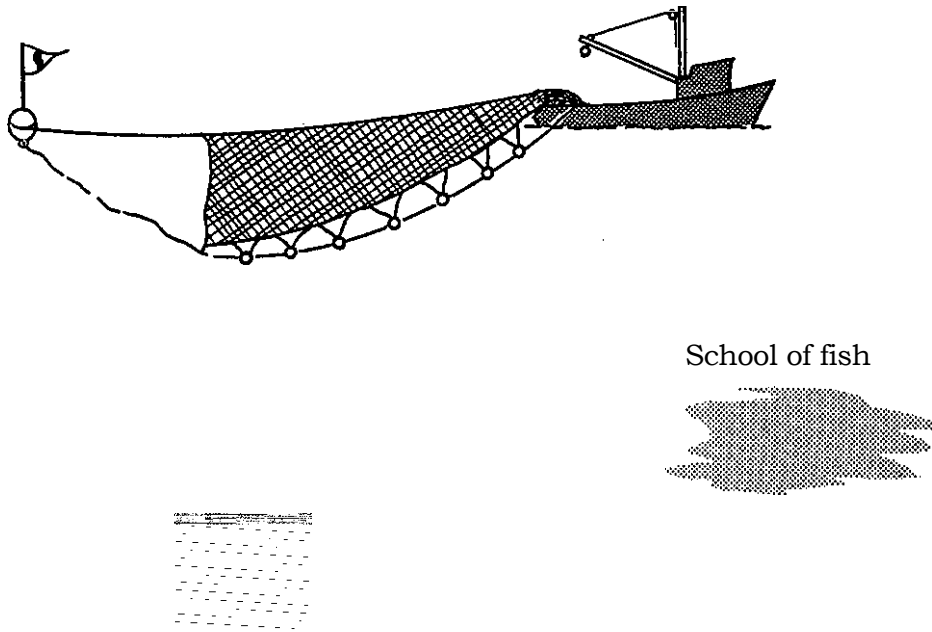


Fig.8a Starting to shoot the net (side view)

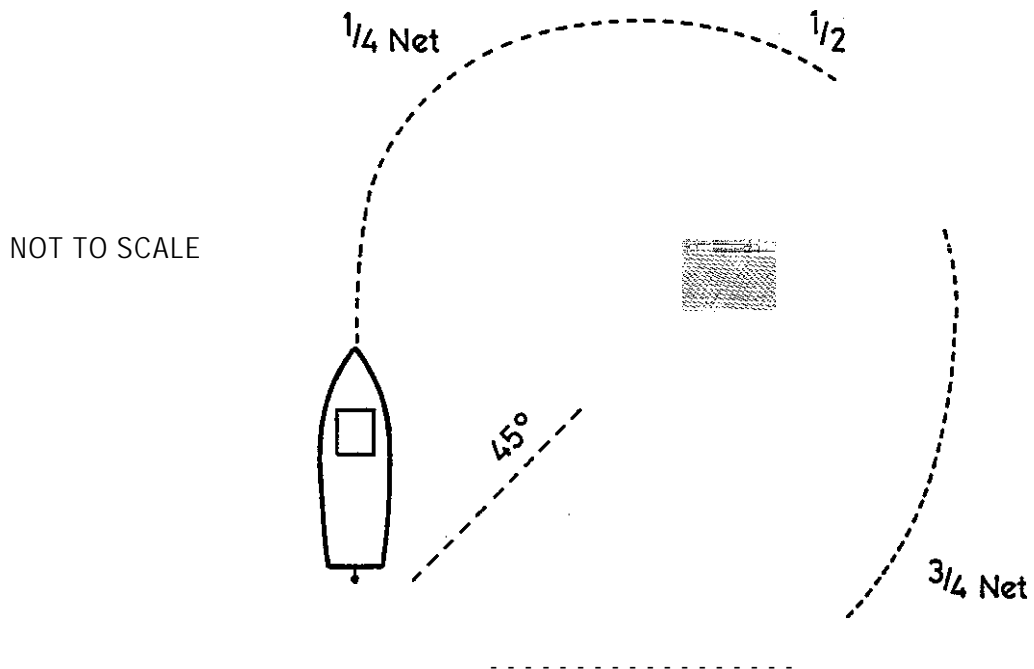


Fig. 8 b Starting to shoot the net (plan view)

g) **Hauling the Net**

Once the pursing has finished, hauling the net can commence. The purse rings will be unclipped from the purse wire, hauled through the block and placed on the shooting pole ready for shooting again. While hauling, care must be taken that the net is being hauled evenly. If this does not happen and the floatline is left to fall behind the leadline, then when the bunt end is reached the fish will be tipped

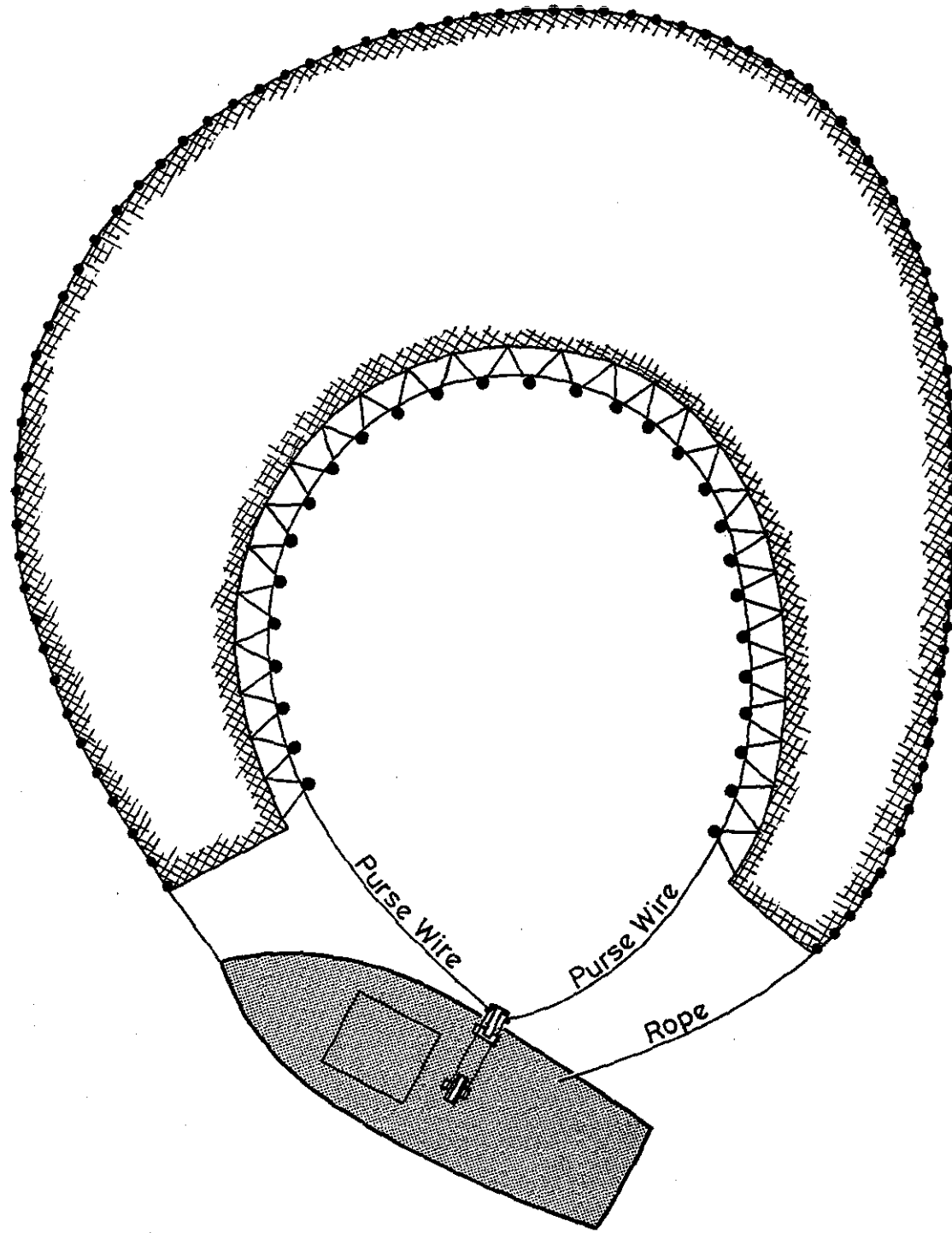
When hauling, and the floats have fallen behind, the procedure is to clip two rings together and pull them through the block thus pulling twice the amount of footrope compared to the floatline. This operation might have to be carried out two or three times during hauling.

During hauling the boat will be pulled into the net, but this will not matter as long as the propeller is not turning, and there are no obstructions such as bilge keels or echo sounder transducers for the net to catch on below the waterline.

It is not possible to lay down a set of rules on how a boat will handle during hauling. This can only be found by experience on how the boat will manoeuvre according to the different weather conditions and the setting of the net.

h) **Stowing the Net**

The net is stowed on the stern of the boat with the leads on the starboard side and the floats on the port side. The leads and floats must be stowed carefully, so that they will run smoothly over the side whilst shooting. The purse rings are stowed on a shooting pole, the rings are placed in the correct sequence for shooting and then the purse wire is threaded through them, then connected to the dhan rope which is coiled on top of the net, ready for shooting.



STARTING TO
PURSE

Here the boat will come astern trying to keep out of the net while the winch pulls the purse wire in, closing the bottom of the net.

3.2 Purse Seine Construction

a) Time and Location and Labour

Construction of SFDP fishing gear was by P.T. Maluku Mini Murni staff on 12th August 1985. First estimate of construction time was three weeks, but it took until 10th October 1985. Some material including supply of rope S twist (10 mm) was difficult to find, and so 7 mm S twist was substituted. It took 36 days to make the net:

12 - 31 August, 1985	:	16 days
2 - 9 September, 1985	:	7 days
12 - 30 September, 1985	:	4 days
1 - 10 October, 1985	:	<u>9 days</u>
TOTAL		36 days

The work started daily at 0900 hours and finished at 1700 hours. Rest periods of about 30 minutes were taken each day.

Construction took place at Balai Penelitian Perikanan Laut (Marine Fisheries Research Institute, Ancol - Jakarta). The workers were recruited from Pasar Ikan - Jakarta and were mostly fishermen, plus some staff at BPPL Jakarta. Every day about ten men worked under the guidance of P.T. Maluku Mina Murni and SFDP.

b) Dimension and Rigging of Purse Seine (See Figure 1) One unit of purse seine, consisted of:

bunt

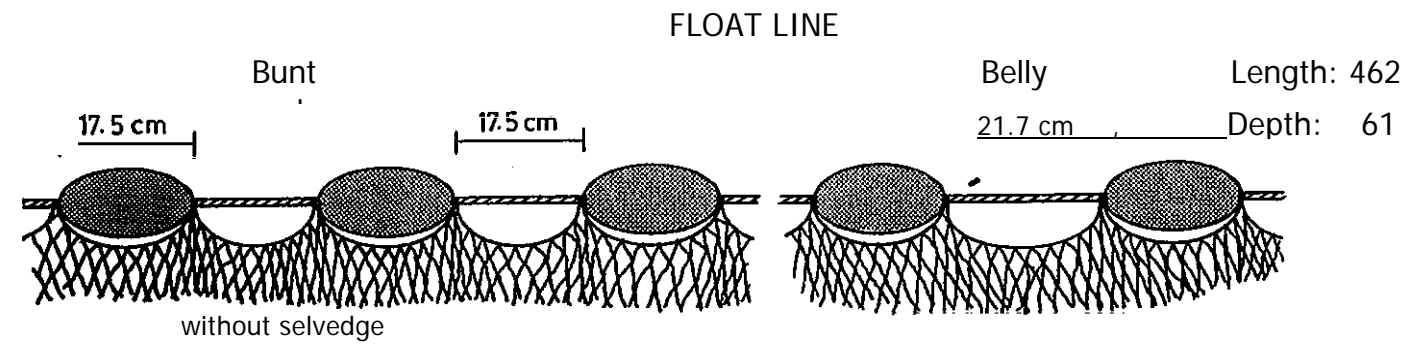
belly/main body

selvedge

float

sinker

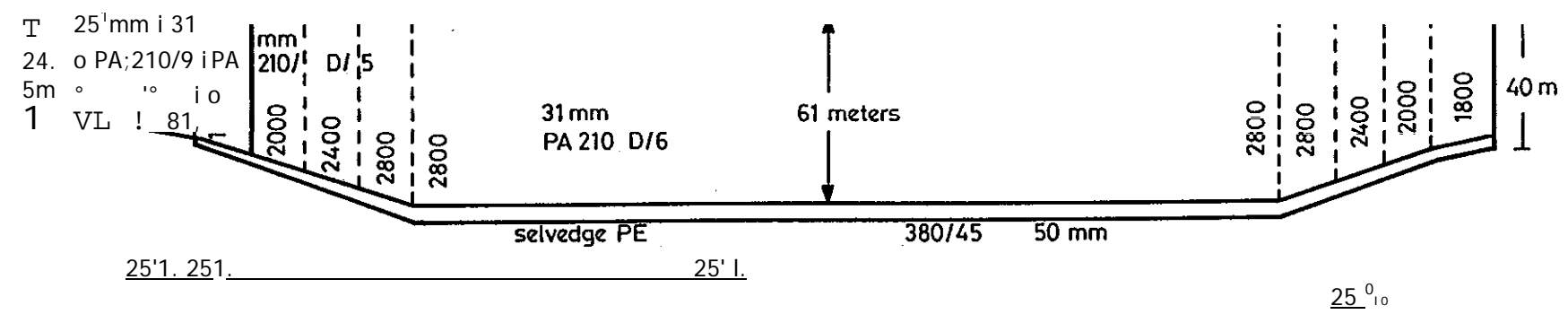
ring



Float line length 462 meters

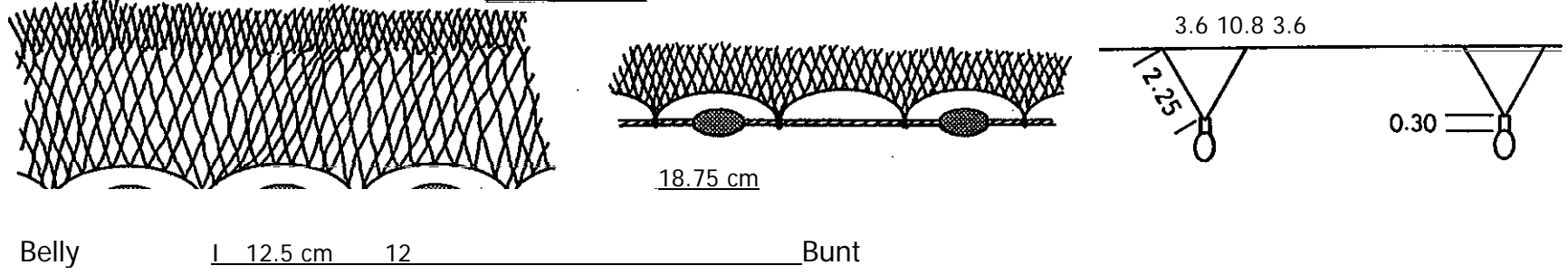
30% 30 0! 30 0! 301c

42m 70m 280m 70m



Sinker line length 495 meters

SINKER LINE



PURSE SEINE SPECIFICATION

NO. ITER	SPECIFICATION	QUANTITY
I. WEBBING		
1. Belly	PA 210D/6,31 mm (1 ¹ / ₄ " 800MD x 100 yards in length	21 PCs
2. Bunt	PA 210D/9,25 mm (1" 800MD x 100 yards in length	2 PCs
3. Selvedge	PE 380D/45,50 mm (2" 100MD x 100 ML	1 PCs
II. ROPE		
4. Float line	PE 10 mm (Z) M	500 m
5. Float side line		
6. Sinker side line	PE 7mm (S) M	1200 m
7. Bunt & Wing line		
8. Sinker line	PE Ø 10 mm (Z) M	500 m
9. Bridle	PE Ø 10 mm (Z) M	300 m
10. Purse line	Wire Ø 10 mm (Z) M	600 m
III. ACCESSORIES		
11. Float	Vinyl sponge soft y 80	1089/228,69 kg
12. Sinker	PB 240 gram	1121/269,04 kg
13. Ring	Steel/Bronze	50/50 kg
14. Swivel & 2 shackles	14 mm, steel	1 PC
15. Float	PL Ø 300 mm	1 PC
IV. TWINE		
16. Mending twine	PA 210D/18	13 bal/26 kg
17. Hanging line	PA Ø 5 mm (Z) 200 m / coil	5 coils
18. Other line	PE Ø 25 mm (Z) 200 m / coil	1 coil
19. Mending twine for joining: section to be of 3 different colours		
V. OTM		
20. Small buoys to be attached to 1/4; 1/2; 3/4 of net	Plastic 30 cm	3 PCs
21. Becketts for rings	PE - 6 mm	1 coil
22. End buoy ± 40 cm with battery light		1 piece

3.3 Net

Setting Hint

In the bunt were 6 pieces of webbing, NO. 210 D/9, and mesh size 25 mm (1 inch), bunt length 60 metres stretched, and hanging ratio of 708, giving 42 metres.

Length of webbing in the bunt:

3 pieces, 1400 meshes (35 m)

3 pieces, 1600 meshes (40m) (see Figure 2 Appendix 2)

Netting sheets were joined together by lacing system with multifilament No. 210 D/18.

Belly/Body

material used in belly nylon 210 D/6 with mesh size 31 mm (1.25 inches) length of webbing 420 m. Belly sections consisted of:

2 pieces 1600 meshes (46,6m) 4

pieces 2000 meshes (62 m) 36

pieces 2800 meshes (55,8 m) 2

pieces 1800 meshes (55,8 m)

For reference see design drawing of purse seine.

Floats

Floats were all soft vinyl/sponge type. They measure:

length 180 mm wide 110 mm

diameter of hole rope 22 mm

bouyancy, 800 grams

Bridles and Rings

Bridles of 10 mm Z twist polyethylene were made up. The bridle ends were attached 3.6 metres apart and each bridle was 10.8 metres distant.

made of brass about 1.0 kg each.

Rings were

A total of