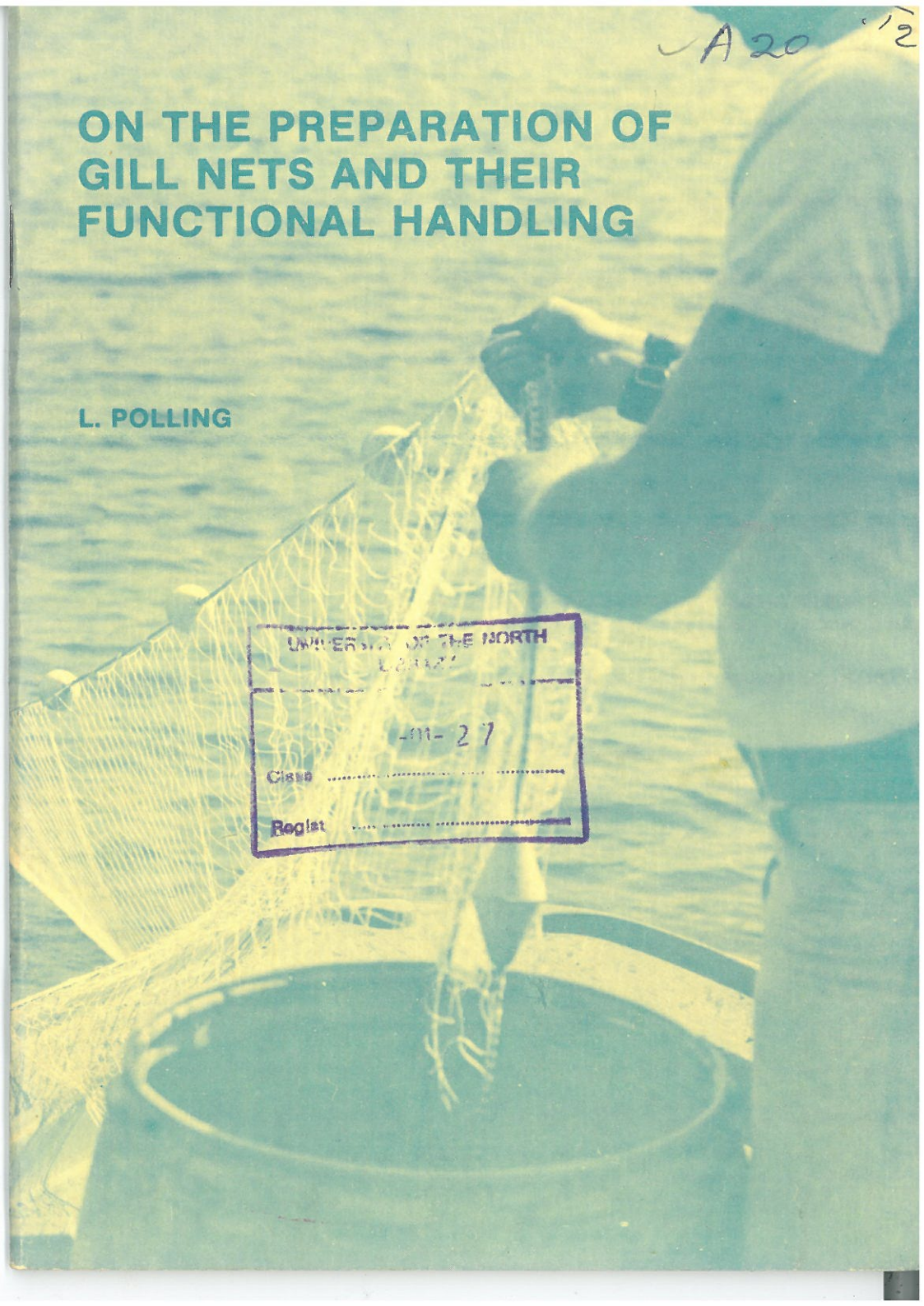


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ON THE PREPARATION OF GILL NETS AND THEIR FUNCTIONAL HANDLING

L. POLLING

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ON THE PREPARATION OF GILL NETS AND THEIR FUNCTIONAL HANDLING



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ABSTRACT

The paper deals with technical aspects of gill nets such as the manufacturing of floats, weighted footropes and netting needles. Further aspects such as colouration of nets, hanging in, colour coding, coupling to anchorpoints, anchoring, transportation, setting and raising of nets are also fully discussed. Included are 30 explanatory text figures.

An asterisk in the text denotes trade names which are available from the author.

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Republiek van Suid-Afrika

1979

SERIES/REEKS A20

ISBN NO. 0 949 992 63 1

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ACKNOWLEDGEMENTS:

I wish to extend my sincere thanks to Professor J.E. Saayman, Dr. T. Hecht and Mr B. Gauldie of the Zoology Department of the University of the North, who have, at all times, shown keen interest in this project and assisted me in various ways.

I would also like to express my sincere thanks to the following persons for valuable discussions: Dr. I.E. Gaigher of the Nature Conservation Division of the Cape Provincial Administration and Dr. P. Mulder of the Nature Conservation Division of the Transvaal Provincial Administration.

To Mr P. Schultheisz of Optolabor (Pty.) Ltd., I owe a special word of thanks for the great trouble he took in obtaining the required netting material.

Finally, I wish to extend my sincere thanks to all others who have assisted me in various ways and whose names are too numerous to mention.

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3. Colour code.

INTRODUCTION

During recent years there has been an ever increasing interest in inland fisheries resources both from a scientific and from a commercial point of view. Many of the inland Universities and Provincial Fisheries Research Institutions are involved in research on natural fish populations and their biology and ecology.

A number of methods can be employed in obtaining representative samples of natural populations. These include electrofishing, the use of longlines, bag-seine netting and the use of gill nets. In large impoundments electrofishing becomes ineffective, longlines often snag on submerged trees, and seine nets too, can only be used at a few places along the shores of any large impoundment due to submerged rocks and trees. Such localized sampling does not allow for a random population sample as many species are territorial and also exhibit seasonal migration.

As a result of the frequently extreme physical conditions found in S.A. impoundments, passive fishing by gill nets is a matter of practical necessity. Moreover, gill nets can be placed so that practically all habitats with, presumably, their entire fish population is sampled.

However, gill nets pose a number of problems, which include amongst others:

1. the availability of suitable nets in S.A. as regards to mesh sizes and twine thickness.
2. the mounting method of locally produced nets, which is clumsy and, as a result, rather frustrating during fishing operations.

Unmounted gill nets are available on the local and overseas market but problems are again encountered in obtaining the suitable type of floats and weights from the local market. These are available from the overseas market but at exorbitant prices.

Techniques had, therefore, to be developed to overcome these and other problems of mounting gill nets. Moreover, it was aimed at developing these techniques with the minimum use of special equipment and skills.

Several methods for mounting of gill nets have been field-tested by the author and the Zoology Research team of this University. After numerous trials and modifications a satisfactory method was found and it is the purpose of this paper to report on the advances. This paper gives an illustrated and explanatory account of manufacturing gill net floats, weighted footropes, setting needles, hanging in, colour coding, net coupling, transport, setting and raising.

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A. NETFLOATS

Net floats available on the local market are ill-suited for use on gill nets due to their shape and size. An alternative had to be found when a series of experimental gill nets, ranging in stretch mesh sizes from 30 mm. to 180 mm. had to be prepared for our Freshwater research team.

Various materials were tested for workability and durability. Eventually, a two component Polyurethane foam * was selected for more elaborate tests.

After a series of experiments an easy method was found whereby the two mixed Polyurethane components were allowed to react inside an aluminium mould. By altering the quantities used, the correct hardness and density was established.

Two different sizes of floats had to be produced (Fig. 1.), the larger one for use on nets with a stretched mesh size from 70 mm. to 180 mm., and a smaller float for use on nets with a stretched mesh size from 30 mm. to 50 mm..

Twenty floats of each size, taken at random from a batch, were tested for carrying capacity and water absorption. The carrying capacity of the large floats was found to be between 72 and 84 grammes each. The smaller floats can carry a load of between 24 and 28 grammes each. Water absorption was tested by submersion of the floats in water for 168 hours (one week). It was found that they absorbed 4% of their own weight in water. It was, moreover, found that the water was wholly absorbed during the first 48 hours, after which the weight remained constant. Water absorption can, therefore, be regarded as negligible.

Field testing the floats for carrying capacity and durability produced positive results and they have already been used with great success by our research team.

The design of the floats was dictated by the type of work for which they were to be used. Floats tend to fall through the meshes of the larger size nets resulting in tangled nets. Apart from the high annoyance factor it also causes complications during net setting in windy weather. On consideration of the above a conical point was decided upon. This design proved suitable for overcoming these problems. It was, moreover, tested by purposely entangling the floats in the meshes; the floatline, being pulled, slipped effortlessly out of the meshes.

Fig. 2 shows the outer dimensions of the floats presently in use for gill nets with a stretched mesh size from 30 mm. to 70mm., while Fig. 3 shows the outer dimensions of the floats for gill nets with a stretched mesh size from 70 mm. to 180 mm..

Fig. 4 shows the design and dimensions of both sections of the aluminium moulds for the small floats while Fig. 5 gives the dimensions of the moulds used for the larger floats. The inner surface of the lathe-turned aluminium moulds must be highly polished for effective use.

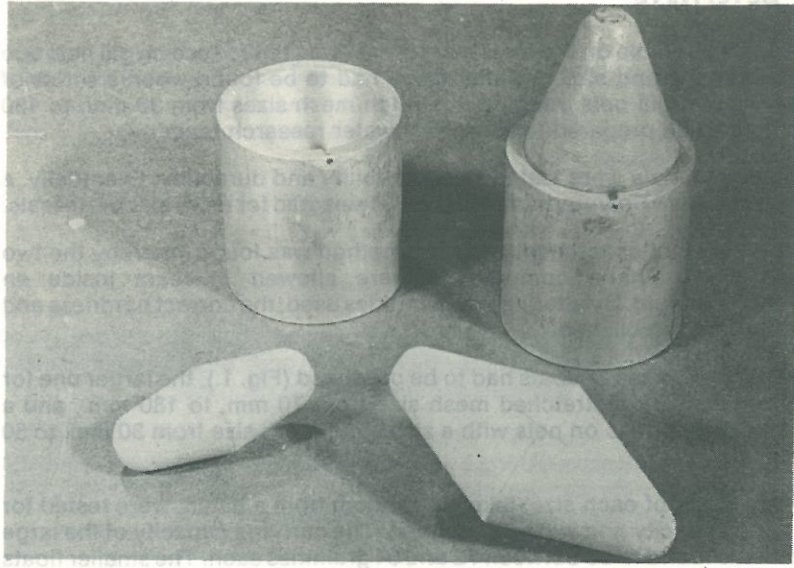


Fig. 1
Two types of floats

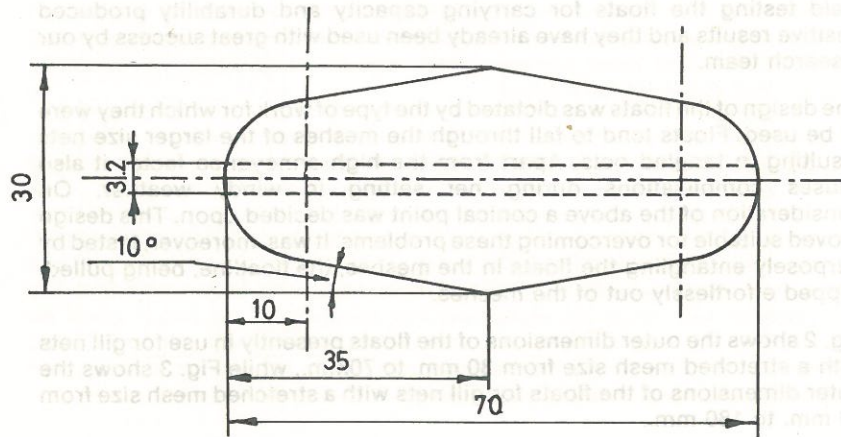


Fig. 2
Outer dimensions of the smaller float

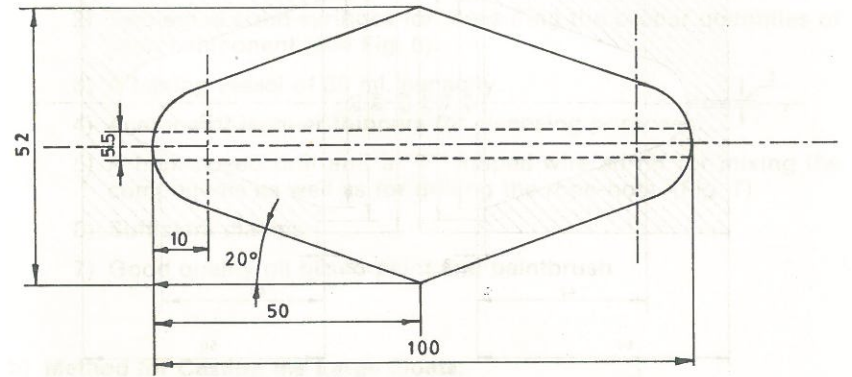


Fig. 3
Outer dimensions of the larger float

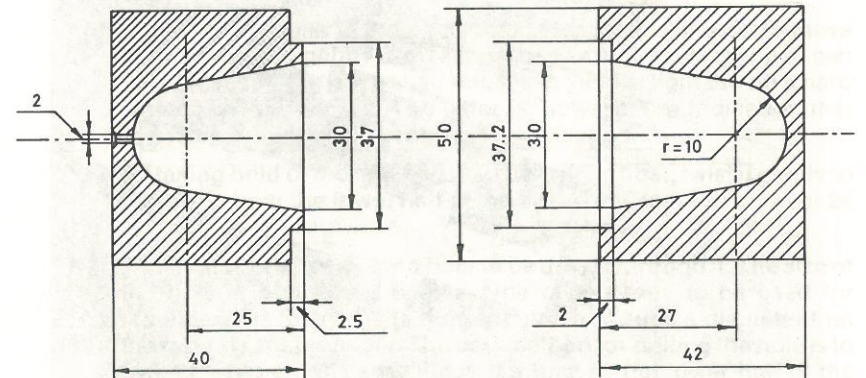


Fig. 4
Dimensions and design of moulds for small float

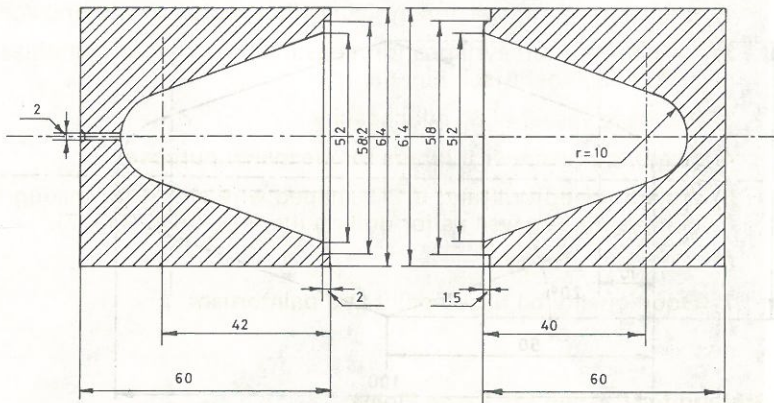


Fig. 5
Dimensions and design of moulds for large float

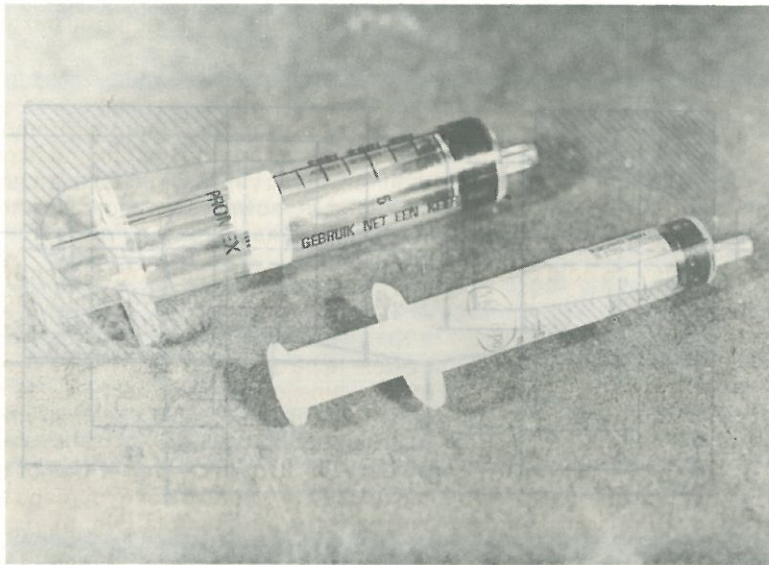


Fig. 6
Syringes with the quantity marker

a) Float Casting Materials Required:

- 1) A thin (no. 5) grease or petroleumjelly to act as a releasing agent.
- 2) Two equal sized syringes for measuring the proper quantities of each component (see Fig. 6).
- 3) A mixing vessel of 30 ml. capacity.
- 4) Acetone or lacquer thinners for cleansing purposes.
- 5) A high speed drill and a "T" shaped wire stirrer for mixing the components as well as for drilling the rope-hole. (Fig. 7).
- 6) Sufficient clamps.
- 7) Good quality oil based paint and paintbrush.

b) Method for Casting the Large Floats:

- 1) Apply a thin coat of releasing agent on the inner surface of each mould.
- 2) Draw 9 ml. of each component into the marked syringes and transfer to the mixing vessel.
N.B. Each syringe must only be used for only one Polyurethane component.
- 3) Mix the components quickly but thoroughly and pour the mixture into the bottom half of the mould.
- 4) Place the upper half in position and fix in clamp.
- 5) Leave the mould in a clamped position for ca. 30 minutes. Remove from clamp and gently turn the two halves until the upper half can be removed. If the upper half refuses to yield, a light tap on a hard surface will dislodge it. The latter is, however, an indication that insufficient releasing agent has been applied.
- 6) By taking hold of the now exposed part of the float, twist it gently to remove it from the lower half of the mould and leave to cure for 24 hours.
- 7) The float is now ready for a hole to be drilled through it. The size of the hole is dependant on the type of top rope to be used for mounting the gill net. The hole should be of such a diameter that the rope fits snugly into it. The best method for drilling the hole is to make use of a drillstand. Place the float in the lower half of the mould and drill the hole halfway through so as not to damage the mould. Turn the float over and complete the hole (Fig. 8).
- 8) The float should now be cleaned with a rag and painted in the desired colour with an oilbased paint. After drying, the float is ready to be worked into the net.

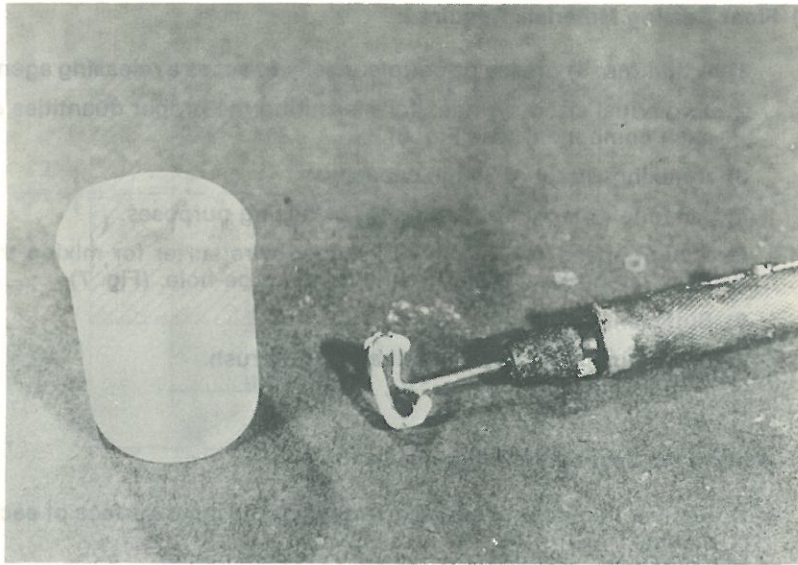


Fig. 7
"T" shaped stirrer

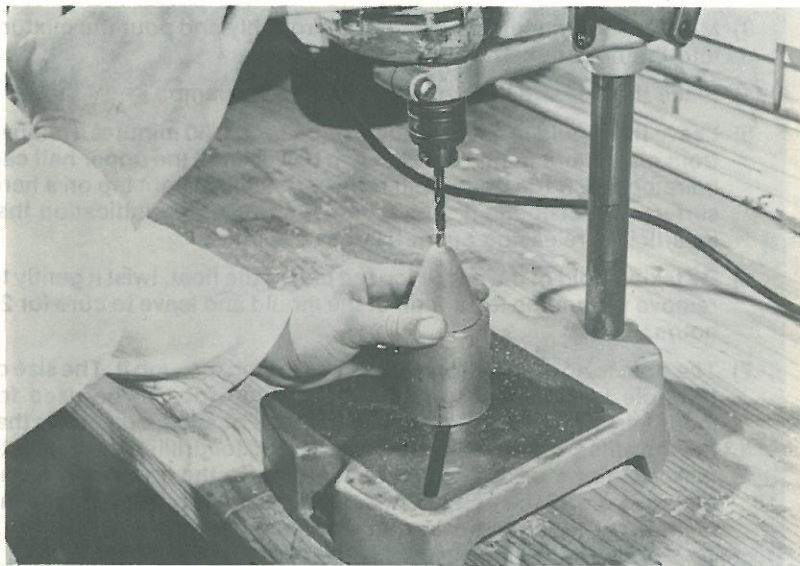


Fig. 8
Drilling the hole

N.B. The casting method for the smaller floats remains the same as for the larger type except for quantities. Only 3 ml of each component of the Polyurethane foam is necessary per float.

After each casting, the moulds should be properly cleaned, as well as all the tools used for mixing. To ensure that the proper quantity of each component of the resin is used, the syringes can be marked with masking tape on the 3 ml or the 9 ml mark, depending on the type of float being made. Although as little as half the quantity of resin will fill the mould completely, an inferior product of low density and strength will result. It is, therefore, important that the prescribed quantity should be used in order to obtain a durable product.

If, for some reason, a float should become damaged and ineffective on the net, a new float can easily be fitted in its place. The following method should then be followed:

- a) Remove the remaining portions of the damaged float.
- b) Cut a new float lengthwise into two equal halves (Fig. 9).
- c) Coat both halves with a silicon-based glue * and fit over the open space on the floatrope.
- d) Keep both halves in place by taping them into position with masking tape or the like. The net so repaired will be ready for use within about two hours. (Fig. 10).

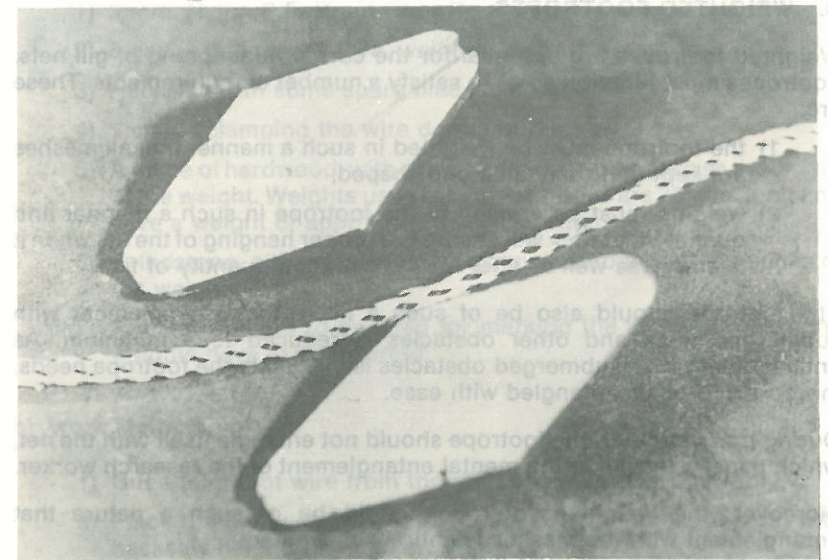


Fig. 9
Float cut lengthwise

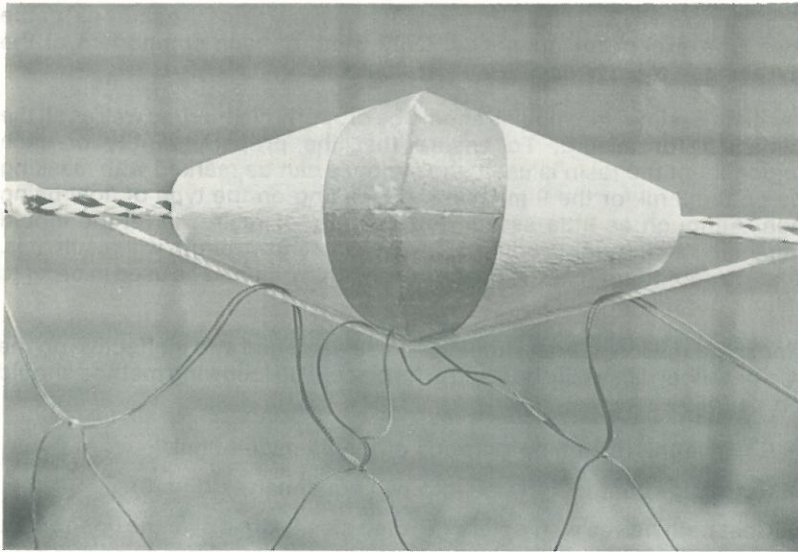


Fig. 10
New float kept in place during curling

B. WEIGHTED FOOTROPES:

Weighted footropes are essential for the correct functioning of gill nets. Footropes must function so as to satisfy a number of requirements. These are:

- 1) the footrope must be weighted in such a manner that all meshes are kept uniformly diamond shaped,
- 2) weights must be applied to the footrope in such a manner and quantity that they will ensure the proper hanging of the net when it is empty as well as after having caught a quantity of fish.

The footrope should also be of such a make that entanglement with submerged trees and other obstacles is reduced to a minimum. As entanglement with submerged obstacles is inevitable the footrope needs, moreover, to be disentangled with ease.

During transportation the footrope should not entangle itself with the net, which usually results in the mental entanglement of the research worker.

Moreover, the weighted footrope should be of such a nature that entanglement with the meshes is entirely eliminated.

To meet these requirements it was finally decided to produce a footrope with internal weights spaced at regular, calculated intervals. Such

footropes can be imported but only at an exorbitant cost. A cheaper, but as effective method had, therefore, to be found.

Prior to this a number of methods had been used but were found to be inadequate. These included the use of a similar footrope as that used for seine nets, which is weighted by round lead sinkers. This method was, however, soon abandoned. Another method tried was by manufacturing metal rings larger than the respective mesh size and fixing these to the net via the footrope. This resulted in easier handling of the nets but the hanging of the net was undesirable.

The internally weighted footrope currently used is best manufactured from 3 mm Nylon P.E. Braid cord (Cod-end cord). The weights are made from 8 gauge galvanized wire which are distributed inside the cord to obtain the desired calculated weight.

Nets fitted with this kind of footrope were found to satisfy all the requirements mentioned before. It is, however, essential that the nets should after use be hung to dry and stored dry as corrosion of the weights will damage the footrope and shorten its lifespan.

Nets with such footropes used in estuaries should be rinsed in fresh water after use and then hung up to dry.

a) Materials required:

- 1) 3 mm. Nylon P.E. Braid Chord*.
- 2) 8 gauge galvanized wire, weight is appr. 1 gram/mm.
- 3) Hacksaw with some spare blades.
- 4) Vice for clamping the wire during cutting.
- 5) A piece of hardwood, with a hole drilled into it as deep as the length of the weight. Weights used for our footropes are 30 mm. long and have a weight of approx. 30 grammes each.
- 6) Grindstone, either electrical or manual, to round off the edges of the weights.
- 7) A marked board to be used for marking the footrope where the weights have to be inserted.

b) Work Method:

- 1) Cut a length of wire from the roll and straighten it roughly.
- 2) Place the hardwood marker over the end of the wire and cut with hacksaw behind the marker. (Fig. 11).
- 3) Round off the cut edges on either side of the weight. The weight is now ready to be inserted into the footrope. (Fig. 12).

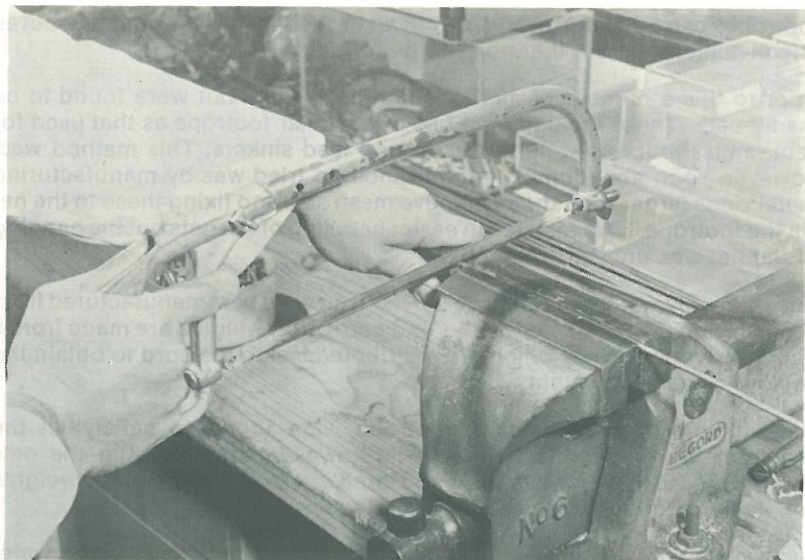


Fig. 11
Cutting a weight

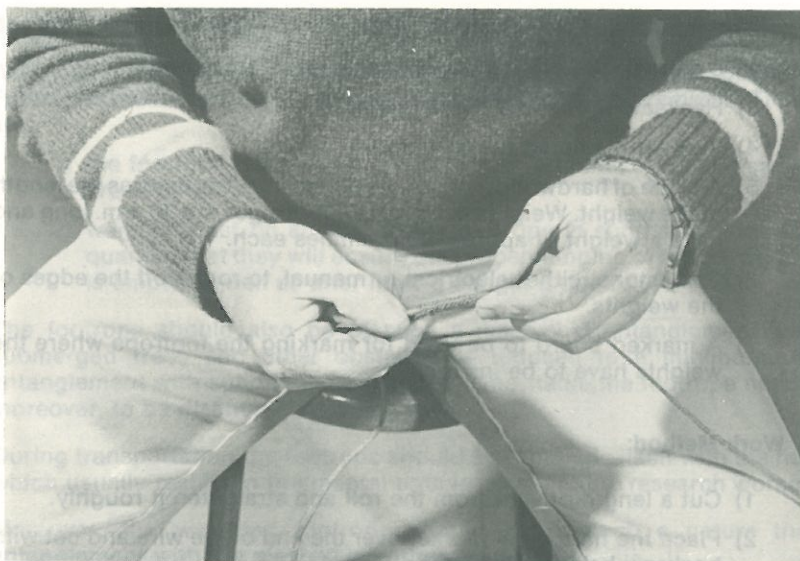


Fig. 12
Inserting the weight into the footrope

- 4) Mark the rope with a pointed instrument by inserting this instrument between the strands. Do not make any marks with a felt tipped or similar pen as this might be confusing when the footrope is being marked for hanging into the gill net. (Fig. 13).
- 5) Insert the weight into the rope.

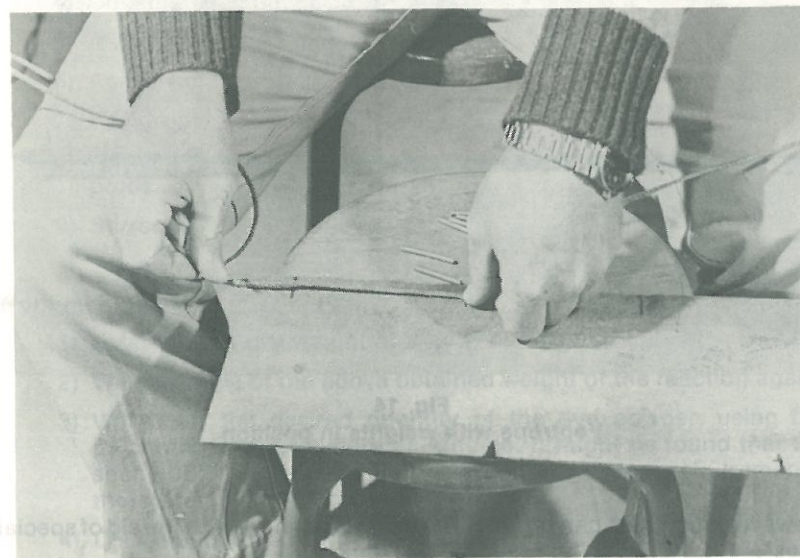


Fig. 13
Footrope stitched into place, showing positions of the weights

To obtain a weight of approx. 1500 grammes per 100 metres of weighted footrope, which has been found to be sufficient in our series of gill nets, the weights should be spaced 200 mm. from top to top. (Fig. 14).

It is obvious that the weights have to be inserted before the footrope is worked into the net. If this operation is carried out after the footrope has been fitted, the total length of the footrope will be affected and it will no longer be of the required length. This in turn results in the tapering of the net.

Should it happen that a stitch falls on a weight, the latter can then easily be shifted to either just behind or just in front of the stitch.

C. COLOURING GILL NETS:

Unmounted gill nets are normally manufactured of a white nylon twine which might be of an undesirable colour.

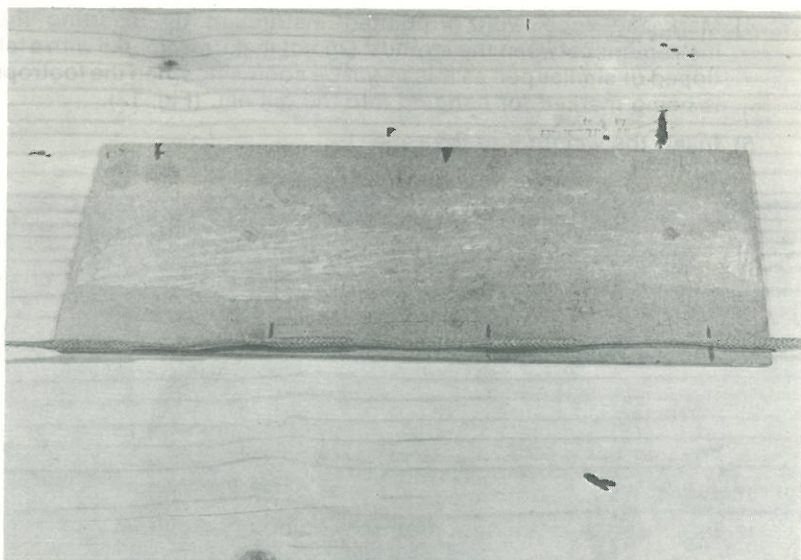


Fig. 14
Footrope with weights in position

However, such nets can be coloured in the laboratory with the aid of special dyes*.

A new net, which has not been dyed, is visible underwater, especially if the water is very clear. In turbid and silty water, the net twine partly acquires the colour of the water.

Experiments are currently underway to determine the effect of gill net colour on catch per unit of effort. For purposes of our experiments, four colours — green, brown, yellow and blue — were chosen.

The colouring process is a clean one and of short duration.

Best colouring results were obtained using the quantities given below:

Yellow dye	:	0.5% dry net weight.
Blue dye	:	0.5% dry net weight.
Brown dye	:	1.0% dry net weight.
Green dye	:	0.5% dry net weight.

After the dyeing process discussed below, the net should be hung up loosely as a shrinkage of approx. 10% occurs during the drying of the net. If the wet net is hung up too tight, damage will occur.

Materials needed:

- 1) Powdered dye of the desired colour*
- 2) Reaction agent*.
- 3) A container of approx. 8 to 10 l. capacity.
- 4) Cookingplate, either gas or electrical.
- 5) A balance accurate to 1 gramm.
- 6) Acetic Acid.
- 7) Eye dropper or pipette.
- 8) pH-meter, preferably of the electronic type, with a heat resistant probe.
- 9) Stirrer.

Work method:

- 1) Establish the dry weight of a new, unmounted gill net.
- 2) Weigh off 2% of the above obtained weight of the reaction agent.
- 3) Weigh off the desired quantity of the dye powder, using the percentages given before as a guide. It might be found that the shade obtained with our figures does not suit your requirements, therefore adapt if necessary.
- 4) Dissolve the dye powder in approx. 1 l. of cold water.
- 5) Place approx. 4 l. of water in the container to be used and place on heat source. Add the reaction agent to this as well as the previously dissolved dye.
- 6) With an eye dropper or small pipette, add sufficient acetic acid to adjust the pH of the mixture to 6.
- 7) As soon as the temperature reaches approx. 40°C. the net must be wholly immersed and stirred into the mixture. Stirring should now continue until boiling point has been reached (Fig. 15).

N.B. Feeding the net into the mixture results in an unevenly finished product.

- 8) When boiling, try to keep the gill net completely covered by the dye mixture and keep turning the net over in order to allow the dye to come into contact with all the net surfaces. An even colouration will then be obtained.
- 9) After boiling for approx. 5 minutes, the container can be removed from the heat and cooled down with cold water or allowed to cool off on its own accord.
- 10) As soon as the net is cold enough to handle, it should be rinsed once with fresh water and hung up loosely to dry.

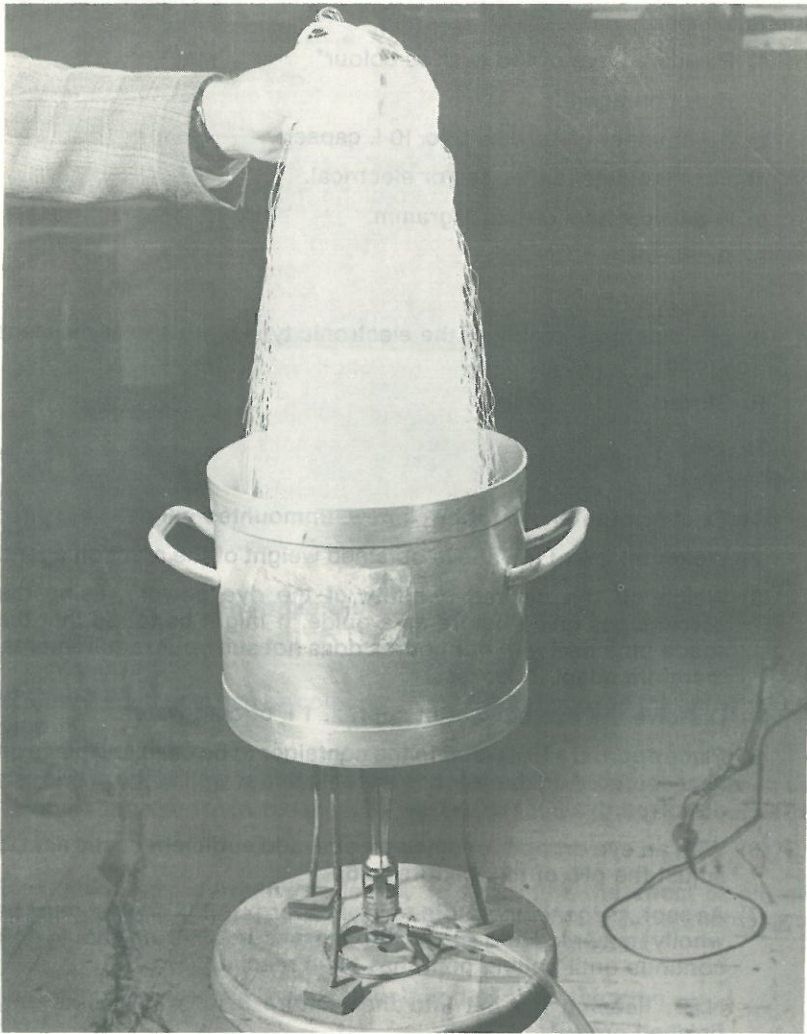


Fig. 15
Immersion of the gill net into dye

The dye process is a clean one. Freshly coloured wet gill nets can be handled without fear of staining either hands or clothing.

Some twine, of the same thickness, should also be dyed for net-repairing purposes.

D. NET SETTING NEEDLE:

An essential piece of equipment for anyone working with nets, be it gill nets or seine nets, is a needle. This tool is needed for repairing as well as setting and should, therefore, be of a durable quality.

It can be made of virtually any type of material, from ivory to an emergency-tool made from a piece of reed found along the waters edge.

As most gill nets used for commercial fishing, have a stretched mesh size larger than 50 mm, a needle made to the dimensions shown in the drawing included in this part will satisfy all possible needs (Fig. 16).

Such needles can be obtained commercially* but a method was worked out in order to allow the fisherman in the field to make his own.

For this reason, various kinds of indigenous wood have been tested and the results obtained with most were found to be satisfactory.

Although the needle can be made by hand, using a pocket knife and some sandpaper, the use of some woodwork machinery will speed up the manufacturing process considerably. Such machinery will be found in any professional or amateur workshop.

Materials and Tools required:

- 1) Bandsaw or circular saw. (The latter should be equipped with a tungsten blade if hardwood is to be cut with it).
- 2) A selection of pieces of hardwood, like Leadwood (*Combretum imberbe*), Red Bush-Willow (*Combretum apiculatum*), Wild Olive (*Olea africana*) etc.

Note: These woodtypes have been tested by the author with good results.

- 3) An electrical or manual drill with a set of drills.
- 4) Coarse halfround and flat files.
- 5) Various grades of sandpaper.

Work Method:

- 1) Select a piece of hardwood of the proper length. This should be somewhat longer than the total length of the needle.
- 2) With the aid of the bandsaw, cut one side of the log so that a flat surface is obtained. If required, this surface can be sandpapered with a coarse sandpaper until flat. (Fig. 17).
- 3) Mark out two holes on either side of the log and drill the holes in such a fashion as to be able to screw the log onto a larger, squared, piece of wood. The log will now be safer to handle under the bandsaw and some slices of the required thickness (approx. 5 to 7 mm.) can now be cut from it. (Fig. 18).

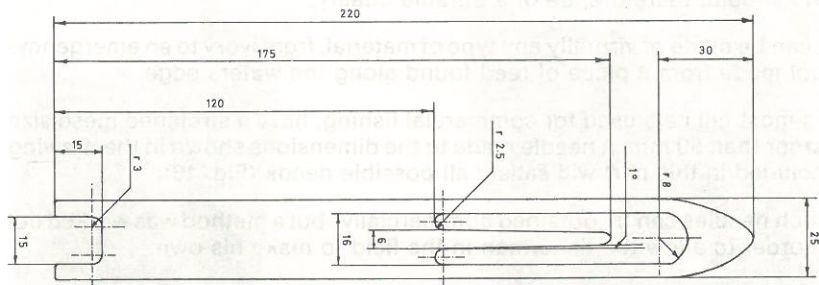


Fig. 16
Dimensions of a net needle

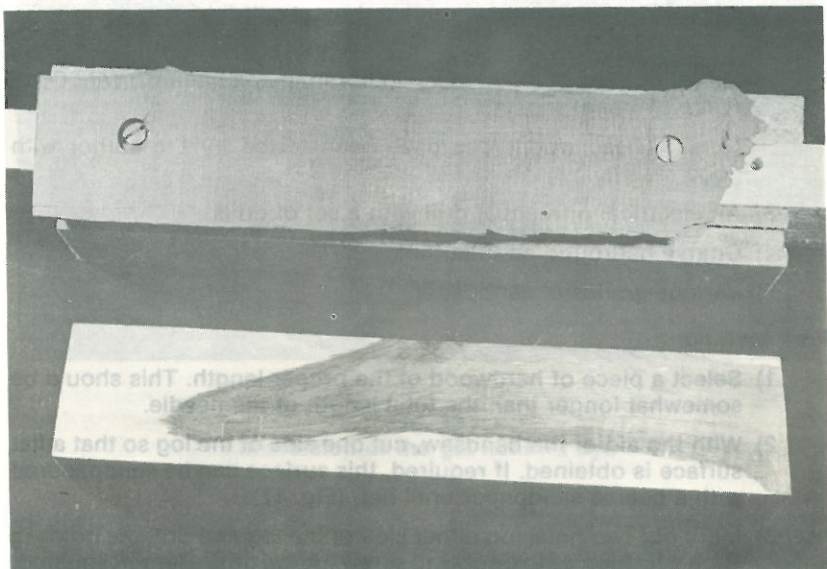


Fig. 17
Log with flat surface

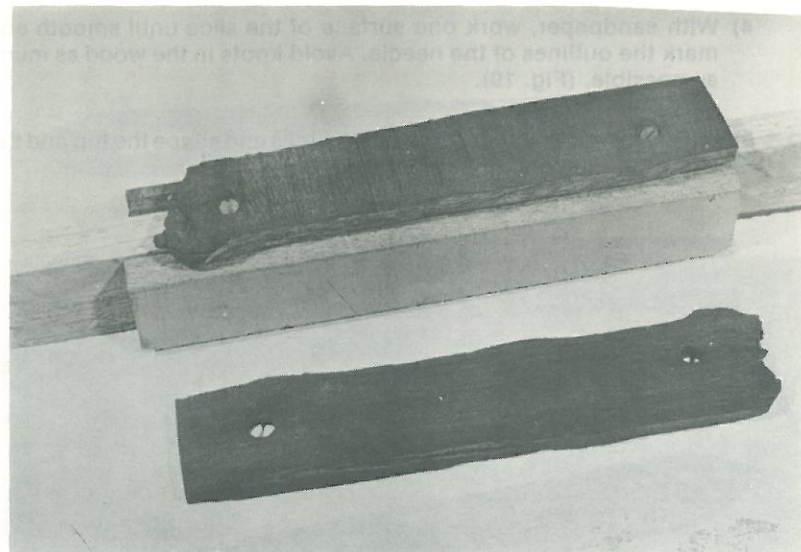


Fig. 18
Log with slices cut off

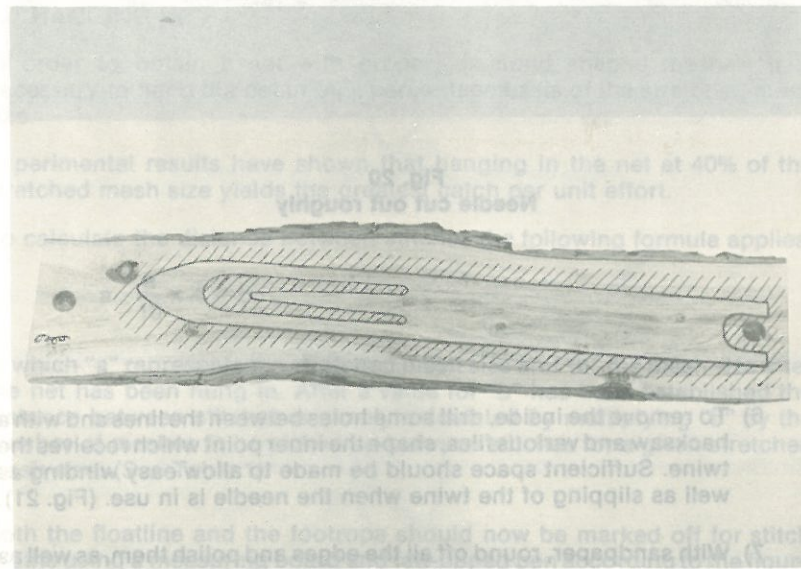


Fig. 19
Slice with outlines of net needle

- 4) With sandpaper, work one surface of the slice until smooth and mark the outlines of the needle. Avoid knots in the wood as much as possible. (Fig. 19).
- 5) With the bandsaw, cut along the outlines and shape the top and the end of the needle. (Fig. 20).

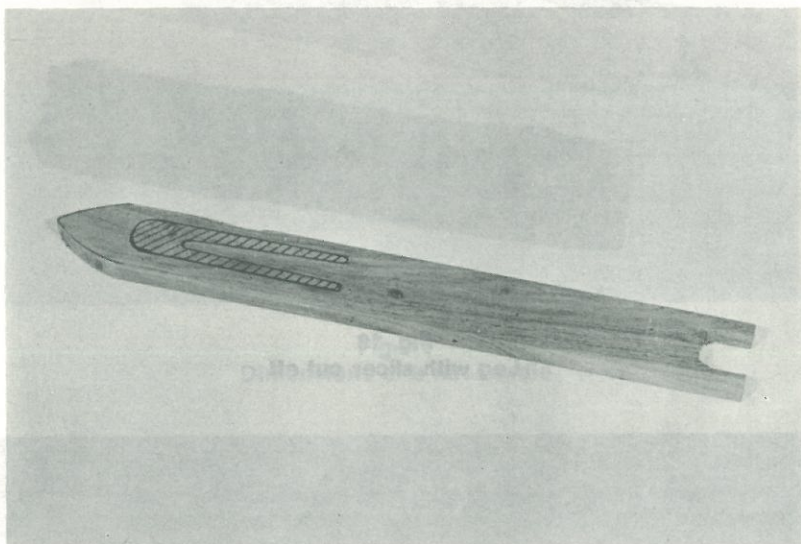


Fig. 20
Needle cut out roughly

- 6) To remove the inside, drill some holes between the lines and with a hacksaw and various files, shape the inner point which receives the twine. Sufficient space should be made to allow easy winding as well as slipping of the twine when the needle is in use. (Fig. 21).
- 7) With sandpaper, round off all the edges and polish them, as well as both surfaces, with a very fine sandpaper.

The needle is now ready for use.

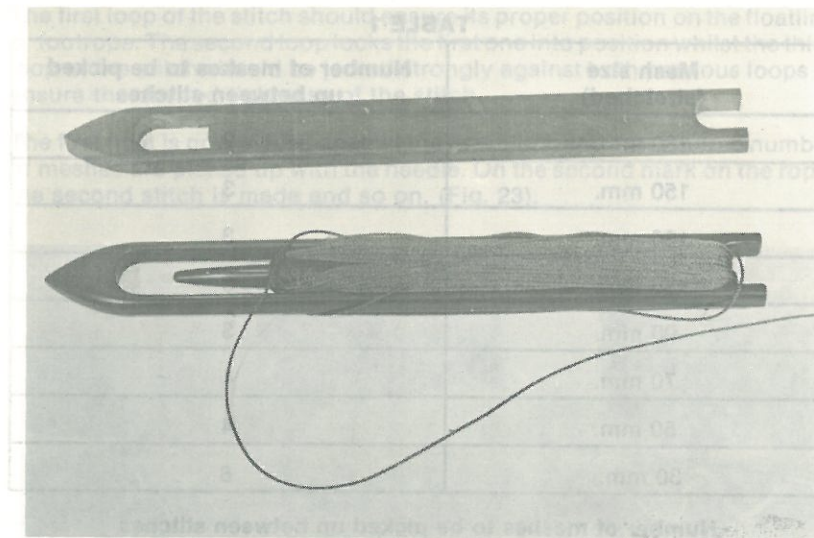


Fig. 21
Completed needle

E. HANGING IN:

In order to obtain a net with proper, diamond shaped meshes, it is necessary to hang the net in on a percentage basis of the stretched mesh size.

Experimental results have shown that hanging in the net at 40% of the stretched mesh size yields the greatest catch per unit effort.

To calculate the distance between stitches the following formula applies:

$$a - \frac{a}{10} \times 4 = b.$$

in which "a" represents the stretched mesh size and "b" the mesh size after the net has been hung in. After a value for "b" has been established the distance between stitches is simply calculated by multiplying "b" by the number of meshes to be picked up between stitches for a given stretched mesh size. (See Table 1).

Both the floatline and the footrope should now be marked off for stitch widths using a measuring board and felt-tipped pen according to the figure obtained from the above calculations.

A number of floats must then be shifted onto the floatline whereafter for

TABLE 1

Mesh size (stretched)	Number of meshes to be picked up between stitches
180 mm.	3
150 mm.	3
130 mm.	3
110 mm.	3
90 mm.	3
70 mm.	4
50 mm.	4
30 mm.	6

Number of meshes to be picked up between stitches

practical purposes it should be hung tightly between 2 points. The first proper mesh must then be stitched onto the first mark on the rope.

The stitches have to be made tight enough to prevent slipping on both the floatline and the footrope. This ensures the constant proper hanging of the net. The type of stitch used by the author is illustrated in Fig. 22.

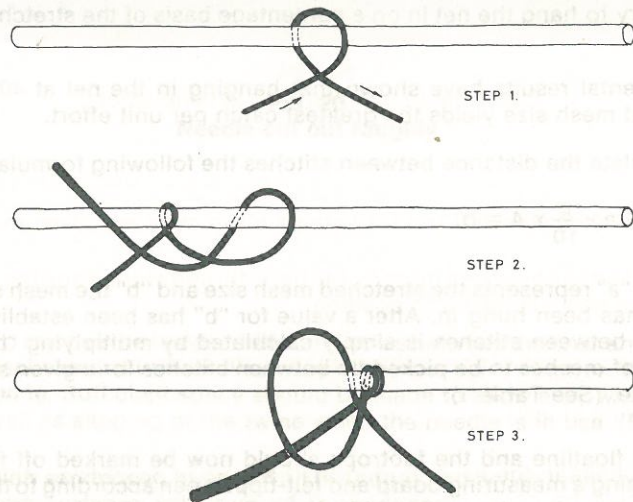


Fig. 22
Type of stitch used

The first loop of the stitch should ensure its proper position on the floatline or footrope. The second loop locks the first one into position whilst the third loop of the stitch should be jerked strongly against both previous loops to ensure the desired tightness of the stitch.

The first float is now placed against the first stitch and the required number of meshes are picked up with the needle. On the second mark on the rope, the second stitch is made and so on. (Fig. 23).

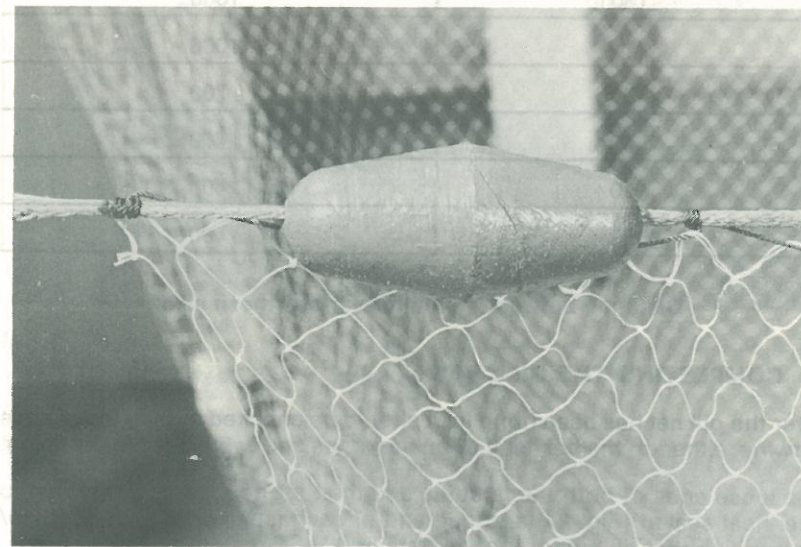


Fig. 23
First float in position with second stitch

The distances between floats for various mesh sizes are given in table 2.

After the floatline has been hung in, the net is turned around and the marked footrope is now stitched into position.

Should the position of one of the weights in the footrope coincide with one of the marks, the weight can either be moved directly in front of or behind the following stitch.

All knots made in the twine during the hanging in process as well as end knots should be carefully worked off by burning the loose ends with a match and rolling them flat between the fingers. This will avoid tangling of the net when in use.

TABLE 2

Stretched mesh size	Distance between floats in mm. (should be not more than:)
180	1000
150	1000
130	1000
110	1000
90	700
70	700
50	400
30	400

Distance between floats for various mesh sizes

F. COMPLETING THE GILL NET:

After the gill net has been hung in, it should be checked for any loose ends of twine, either on the net itself or on the ropes and twine used for hanging.

The loose ends of both the floatline and the footrope are now trimmed to size, heat sealed (Fig. 24) and one end of each is fed back into floatline/footrope so that an eye or loop is obtained.

This is best done by inserting a sharp instrument, e.g. pencil or ballpoint pen, between the strands to obtain a hole into which the burned end is fed until the desired loop size is obtained. (Fig. 25).

Tension should now be applied to the loop by pulling at the point of rope insertion and the end point of the rope inside. The purpose of this process is to ensure that the loop remains firmly in place, moreover, this type of "feed back" will tighten itself during use but can be loosened easily should the need arise.

G. COLOUR CODING:

Another problem frequently encountered by research workers using large quantities of gill nets in the field is remembering which mesh size has been placed where.

An easy method to avoid this is to make use of colour coded nets.

Each net of a given stretched mesh size is equipped with a float of a certain colour at the beginning and at the end of the net. A corresponding list is

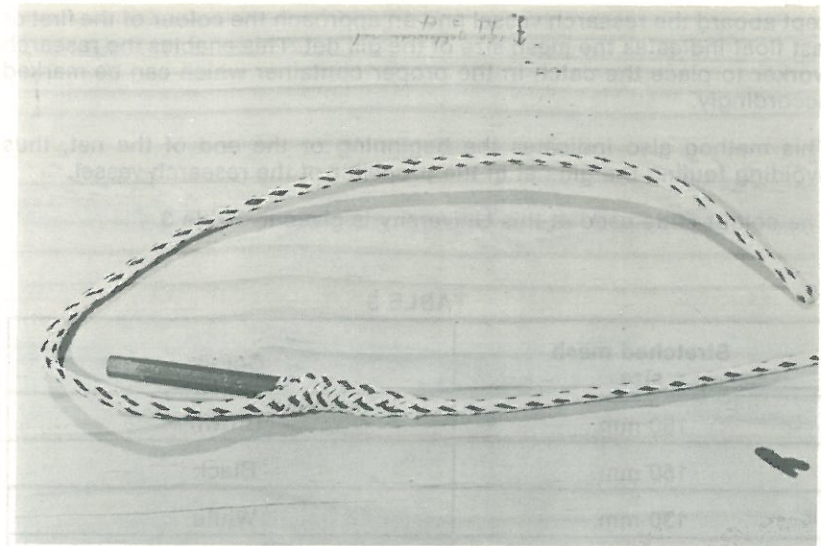


Fig. 24
Start of a loop

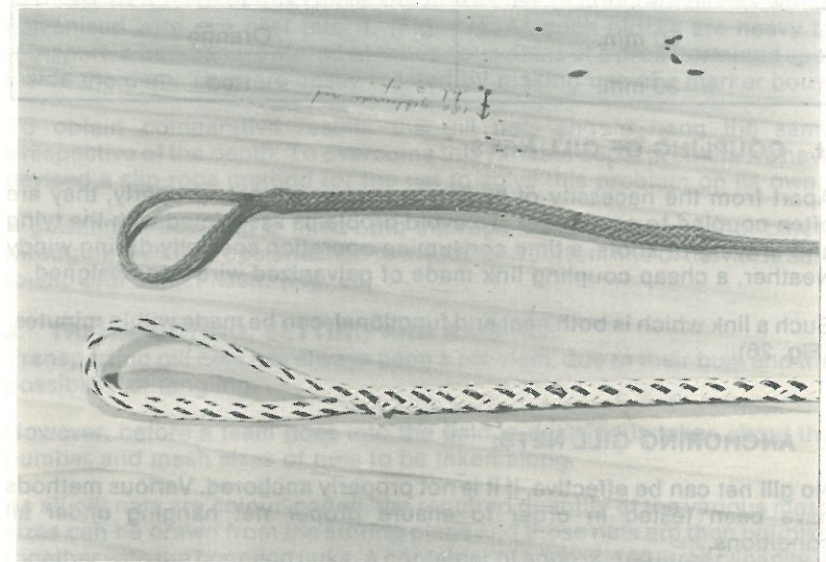


Fig. 25
Completed loop

kept aboard the research vessel and on approach the colour of the first or last float indicates the mesh size of the gill net. This enables the research worker to place the catch in the proper container which can be marked accordingly.

This method also indicates the beginning or the end of the net, thus avoiding fouling the gill net in the propellor of the research vessel.

The colour code used at this University is given in Table 3.

TABLE 3

Stretched mesh size	Colour
180 mm.	Brown
150 mm.	Black
130 mm.	White
110 mm.	Blue
90 mm.	Green
70 mm.	Yellow
50 mm.	Orange
30 mm.	Red

H. COUPLING OF GILL NETS:

Apart from the necessity of having to anchor gill nets properly, they are often coupled to each other. To avoid problems associated with the tying and untying of knots, a time consuming operation specially during windy weather, a cheap coupling link made of galvanized wire was designed.

Such a link which is both neat and functional, can be made within minutes. (Fig. 26).

I. ANCHORING GILL NETS:

No gill net can be effective, if it is not properly anchored. Various methods have been tested in order to ensure proper net hanging under all conditions.

Firstly, wind action or heavy currents can cause the nets to drift causing utter chaos. It is therefore essential that a proper and sufficiently heavy anchor should be used to keep the net in place, even during heavy winds.

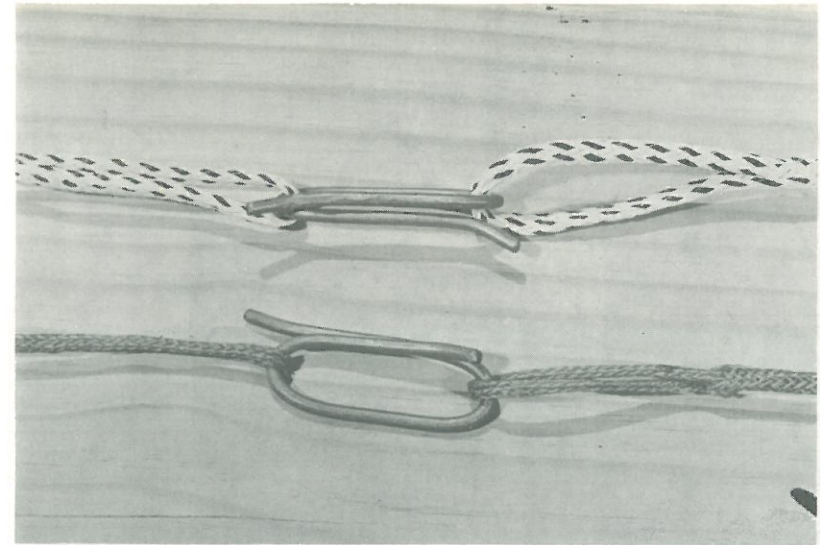


Fig. 26
Coupling link

The research team of this University makes use of concrete blocks with a galvanized wire eye cast into it. (Fig. 27). As such blocks are heavy to transport, a number are stored at the various dams at a predetermined spot inside the dam. They are easily located by making use of a marker bouy.

To obtain comparative results the gill nets should hang the same irrespective of the depth. To overcome this variable depth problem we have devised a slip rope method for the net to solve this problem on its own.

A galvanized iron ring is fixed onto the rope leading to the anchor block, through which the rope attached to the top and bottom line of the net is able to slip and adjust itself. (Fig. 28).

J. TRANSPORTING, SETTING AND RAISING:

Transporting gill nets has always been a problem, due to their bulk and the possibility of tangling.

However, before a team goes into the field, a decision is taken about the number and mesh sizes of nets to be taken along.

As all gill nets are colour-coded, the required quantity of the various mesh sizes can be drawn from the storing place and those nets are then coupled together with the coupling links. A container of approx. 100 litres capacity is now used to receive those nets and it has been found that up to ten mounted gill nets can be stowed in such a container and safely transported over the worst roads without any form of tangling.

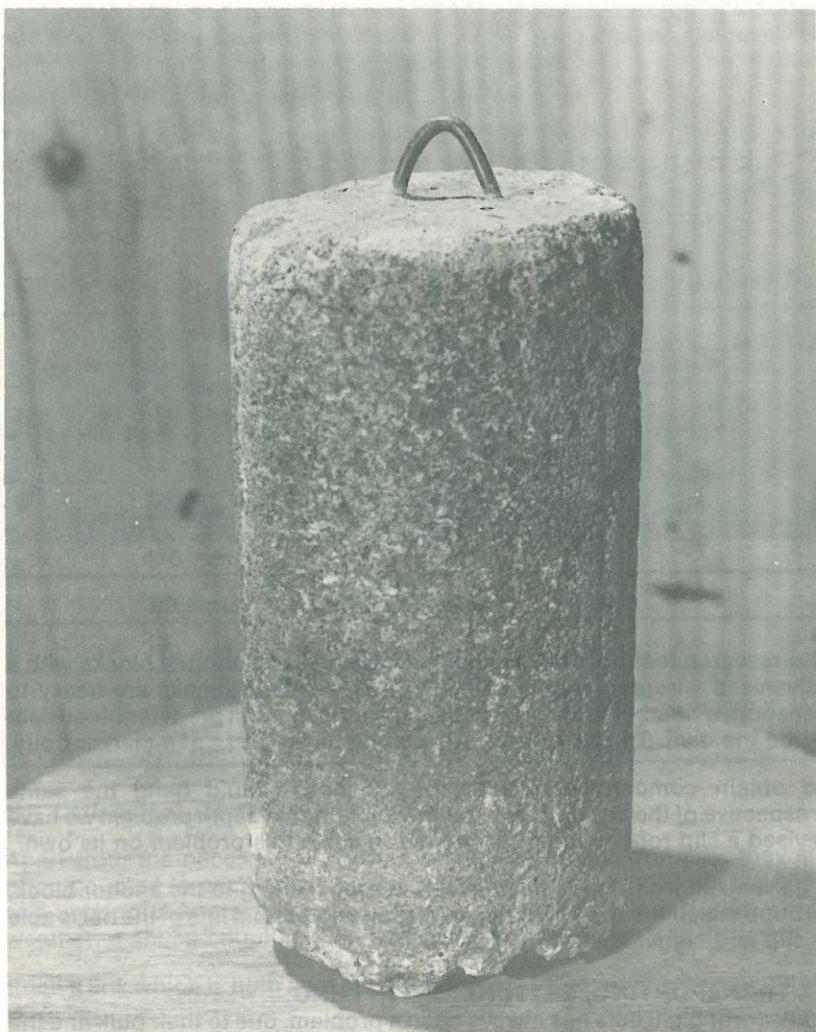


Fig. 27
Anchor block

A second successful method is by making use of rolls, each holding two nets of the same mesh size. The floatline of each of the two nets should be rolled onto the roll at opposing sides.

This method might be found useful for Institutions using large numbers of nets at fixed research places.

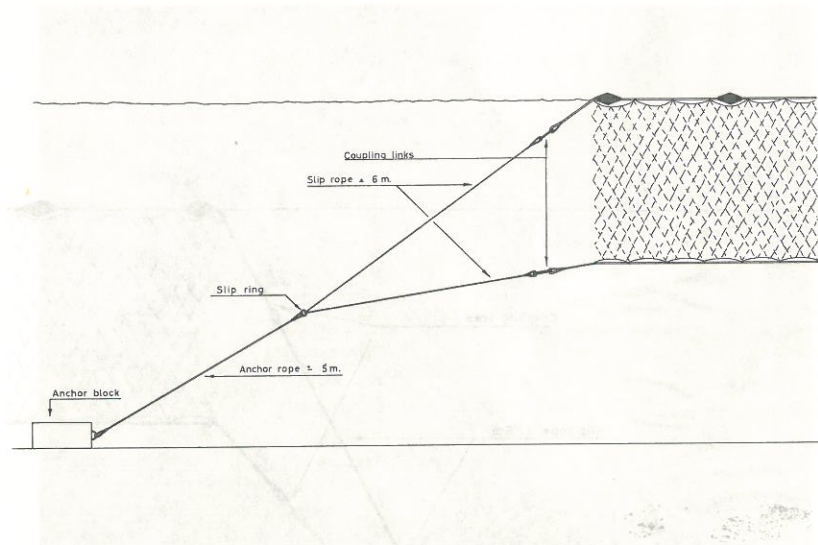


Fig. 28(a)
Diagram of anchorpoint assembly in shallow water

The setting method used is as follows: when the selected netting side has been reached, the first anchorblock is placed upwind and the net set by floating downwind or under power if the wind direction is not in the desired course. The gill net is thus kept under strain and when the end is reached, the second anchorpoint is placed overboard. (Fig. 29).

For greatest effect the net should lie in a straight line.

When raising the net, the down wind anchorpoint is raised first and the net uncoupled. Containers to receive the catch are placed on hand and all fish and debris are removed from the net, which is fed back into the 100 litre container (Fig. 30). A note is made of any damage to the nets, which should be repaired before using such nets again.

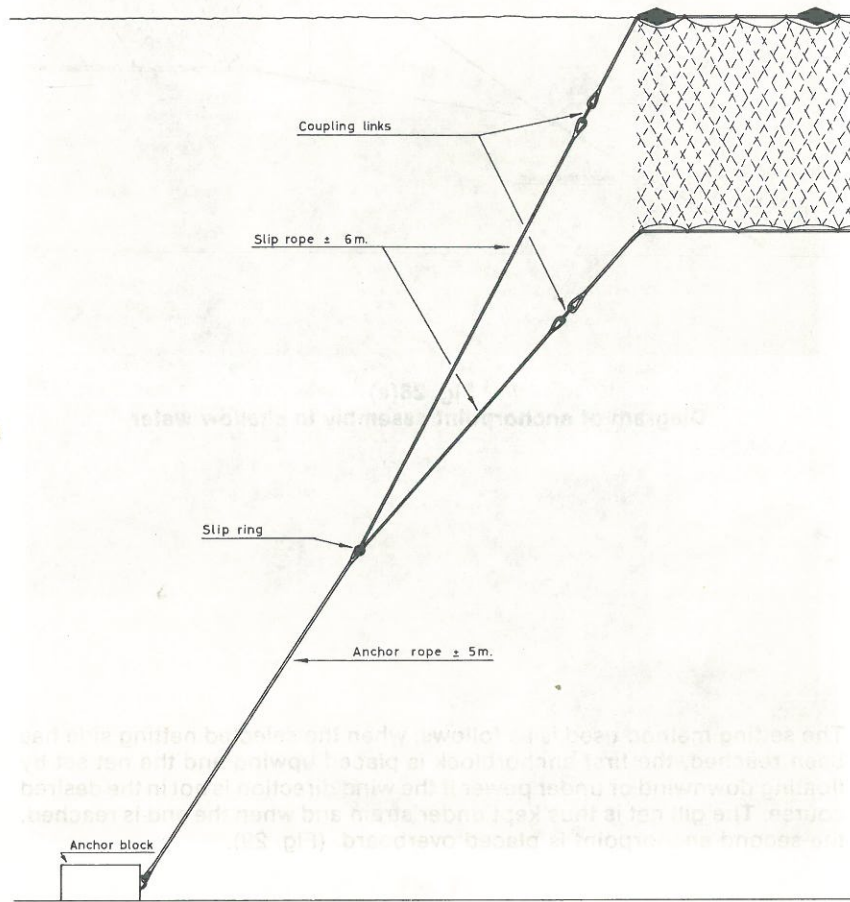


Fig. 28(b)
Diagram of anchorpoint assembly in deep water



Fig. 29
Setting the net

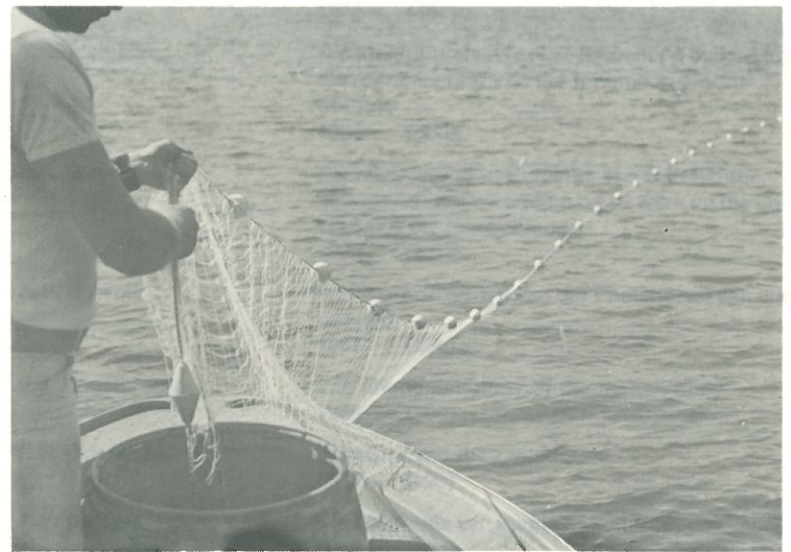


Fig. 30
Raising the net

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Reeks/Series A

Bydraes van personeellede en nagraadse studente
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