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FISHING WITH PASSIVE GEAR IN THE COMMUNITY

The need for management, its desirability and feasibility

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INTRODUCTION

In recent years the use of various types of passive gear has increased in Community waters. If this tendency continues, and assuming no complementary reduction in other types of fishing activity, the exploited stocks might be subject to even greater pressure than is currently the case. In technical terms, this means that fishing mortality rates for various species are likely to increase from the already high and undesirable levels currently estimated.

Furthermore, there are indications that, in some fisheries conducted with fixed nets, the mesh size has decreased in line with the decrease in the average size of fish in the stocks which they exploit. A similar decrease in the size of hooks used in some longline fisheries has also been mentioned.

On the other hand, much of this gear can be highly selective and this property can be used to avoid e.g. capture of juvenile fish provided that the gear is appropriately deployed.

At present, Community regulations as embodied in Council Regulation (EEC) No 3094/86 of 7 October 1986 laying down certain technical measures for the conservation of fishery resources[1] make no reference to passive gear, either fixed or drifting. This is in contrast to the present situation for mobile gear (trawls, demersal seines etc.) where numerous regulations intended to control their activities, and hence the fishing mortality rates generated by them, are currently in force.

In 1991 the Commission annonced its wish to restore balance to the technical measures mechanism, in order to improve the regulations on passive gear. In 1992 the discussion of the Multiannual Guidance Programmes showed that although it did not seem appropriate in the immediate future to reduce the tonnage and/or kW of the fleets using passive gear, the contribution of these methods to fishing effort should be reduced, and where necessary laid down in appropriate measures. The Commission was requested to submit a report to this end. DG XIV therefore organized a meeting in Brussels in February 1993. This meeting made it possible to take stock of the biological and technical data available. The result appear in a was the Commission working paper[2].

In spite of the incomplete information available, it is clear that net fishing poses major problems. Its expansion, as a result of the increase in the number of net vessels and/or the length of the nets used, and in some cases the reduction in the mesh size, requires urgent attention. Therefore, the group of experts' activities and this report concentrate on net fishing, and more particularly on fixed-net fishing. The special case of large drifting gillnets has been

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[1] O.J. No 288, 11.10.1986, p.1

[2] "Biological basis for control of exploitation rate of fish stocks by fixed gears", SEC(93)652, Brussels, 26 April 1993.

examined separately[3]. The other types of passive gear (pots, longlines, etc) will be referred to only under specific points where necessary.

It was expedient to summarize the technical conclusions of the group of experts and to add, where possible, comments on the economic and social aspects, together with a consideration of the monitoring problems specific to passive gear. All these aspects are covered in this report, which concludes with an examination of a possible strategy of action.

1. DESCRIPTION OF PASSIVE GEAR AND ITS OPERATING TECHNIQUES IN COMMUNITY WATERS

The use of passive gear[4] is widespread in Community waters. Most fisheries using these types of gear target a single species or a restricted group of species with sometimes significant by-catches of other species.

Usually, fixed gear is not continuously supervised when it is in operation, but is deployed and subsequently visited at more or less regular intervals of time to remove fish and debris, to haul it for deployment in other areas and for repair. Fixed gear may be used on rough grounds or even on wrecks, where other fishing gear can be operated only with difficulty.

1.1. Fixed gillnets and entangling nets

For reasons explained above it is to this gear that most attention will be given in this report.

1.1.1 General comments

In these types of nets the fish are gilled, entangled or enmeshed in the netting. The nets can be deployed individually but usually many such nets are joined end to end and are deployed as a "fleet".

These nets consist of single or multiple walls of netting, fixed at the top to a headline to which floats are attached and at the bottom to a weighted footrope. The weight of the footrope neutralises the buoyancy of the floats so that, in the absence of currents, the nets hang vertically in the water. (Headline floats may be absent in the case of some tangle nets - Section 1.1.3).

The nets are fixed to the bottom, or at some distance above it, and their geographical position is maintained, by anchors or ballast at each end of a fleet which are marked by an anchor-buoy or "dan" attached to the anchor or ballast. Additional anchors or ballast and associated buoys may be incorporated at regular intervals along the fleet to assist in maintaining position or, more usually, to better indicate the position of the fleet to other navigators, including fishermen using towed gear. Flags, lights or radar reflectors are attached to the dans to facilitate detection and hence retrieval of the nets.

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[3] COM(94)50 final, Brussels, 08.04.1994

[4] See Annex VIII

The dimensions of fixed gear and the number of nets carried by a boat may depend on many factors such as area, species, boat size, etc.

The report SEC(93)652 indicates that in the North Sea single net lengths vary between 55 and 400 metres. The number of nets carried by a boat may vary between 10 and 650. The total length of nets which can be set by a single boat can vary between 950 and 43 000 metres. In other areas nets with a length varying between 5 500 and 26 000 metres are used.

The netting sheets are made of knotted synthetic yarns made from the chemical groups polyamide, polyester or polytethylene. The yarns may be constructed of monofilaments, multifilaments or multimonofilaments. Monofilaments are single filaments which are normally more than 0.1mm in diameter. Those thicker than 0.4mm are strong enough to function alone as netting yarn and are frequently used for the construction of enmeshing gear. Multifilaments are made from a large number of very fine fibres (diameter less than 0.07mm). Multimonofilament yarns consist of a low number of monofilaments loosely twisted together. An important characteristic of gillnets and entangling nets is the hanging ratio. The hanging ratio, denoted by E, is the ratio of the length of the headline to the horizontal stretched length of the netting. The hanging ratio determines the shape of the meshes in the water.

The same concept of hanging ratio may also be applied to the footrope and in some cases different hanging ratios are employed for footrope and headrope within the same gear unit. This phenomenon is referred to as "hanging-in" and is implemented to increase or decrease the probability of capture of, respectively, desired or undesired species.

1.1.2. Gill nets

A gill net consists of a single wall of netting fixed at the top to a headline carrying floats and at the bottom to a weighted footrope.

The hanging ratio usually exceeds 0.5. A hanging ratio of 0.6-0.7 combines the benefit of a wide mesh aperture and a large net area.

In this type of gear, most fish are caught when they become held within a single mesh of the net. There are different positions in which fish become caught. Fish are held securely when the mesh catches under the gill-cover in which case the fish is said to be "gilled".

1.1.3. Tangle nets

Single-wall tangle nets closely resemble gill nets but have a greater amount of slack netting set into the headline, which results in a more loosely hung net. The hanging ratio of these nets may be as low as 0.3 and the headline is not always provided with floats, in which case the nets lie horizontally across the seabed.

Single wall tangle nets are most effectively used to catch organisms with spines such as crawfish and species with a very pronounced demersal (benthonic) behaviour such as monkfish, rays and other flatfish. Different hanging ratios for footrope and headrope (hanging-in) are often employed in the construction of tangle nets.

1.1.4. Trammel nets

The trammel net consists of three walls of netting in which a smaller-meshed inner net is sandwiched between two outer walls of larger-meshed netting. Slack internal netting is ensured both by setting the net loosely on the head and foot ropes and also by having the inner net 1.5 to 2 times the depth of the outer walls. In this way there is always sufficient slack net in which fish can become entangled. The hanging ratio of the inner net is usually of the order of 0.3 to 0.5. The outer net is hung more tightly, the hanging ratio being 0.5-0.7.

In trammel nets the fish are mainly held within a pocket of netting formed by the small-meshed inner net pushed through the large-meshed outer net. However, depending on the species and the mesh size of the inner net, fish may also be gilled or enmeshed.

1.1.5 Some variants of gill and trammel nets

(a) Semi-trammel net

A variant of the trammel net is made of only two walls of netting, one of large mesh and one of small mesh.

(b) Combined gill/trammel nets

In these nets the lower part consists of a trammel net while the upper part is a gill net. The upper part often acts as a barrier leading fish towards the lower section.

(c) Fixed gillnets on stakes

These gill nets are mounted at their ends and at regular intervals along their length on stakes driven into the seabed in inter-tidal areas. Fish are collected from them at low tide. The nets are left for the whole fishing season. Because they are attached to stakes, the shape of these nets when submerged is not greatly affected by currents.

1.2. Other passive gear

1.2.1. Fixed gear

There are a number of other fixed gear types which are not considered in detail in this report. The most important ones within the Community are the stationary uncovered pound nets, the fyke nets, long lines,and various pots.

In various pot or bottom longline fisheries, an increase in the length of the nets or lines has been observed, entailing a corresponding increase in the number of pots and hooks. To a large extent this has been made possible by the development of automatic lifting and/or baiting equipment. However, use of the bottom longline by Community fleets has not increased to the extent it has elsewhere, for example in Norway or the Faroe Islands.

1.2.2 Drifting gear

Beyond large drifnets (more than 1 km) targetting on albacore (north Atlantic), swordfish (Mediterraean) or salmon (Baltic), "traditional" driftnetting has also played a significant part in the catches of some small species, mainly clupeoids (e.g. herring), or small tunids or scombrids (e.g. frigate tunas). Such drift-net fishing, which was of significance in the past, is now practised only marginally.

Floating longlines have been expanding rapidly over the past few years, both in inshore fishing, directed at bass or sparidae depending on the region, and in deep-sea fishing, concentrating in particular on swordfish. Some net vessels have been converted.

2. SELECTIVITY

2.1. Nets

The selectivity of a specified net for a fish of a given species and of a given length is defined as that proportion of fish encountering a net which will be retained. The proportion retained is different for different lengths of fish.

The way in which selectivity changes according to fish-length for gill nets is usually described adequately by a symmetrical, bell-shaped curve generally referred to as the "selection curve" (Annex VIII - Fig. 12).

The catches are taken from only a restricted part of the population and, in this case, the net catches only fish of a restricted range of lengths.

It is in this sense that gill nets are referred to as being highly selective gear. Their construction and mode of deployment can be arranged such that they target a very well-defined sub-group of the target species. This contrasts with the selectivity of, for example, trawls and Danish seines, the two major types of towed gear used to catch fish, where it is possible to construct the gear only to avoid capture of fish of lengths less than some specific value. All fish of lengths greater than this value which enter the codends of this towed gear are retained.

However, the symmetrical bell-shaped selection curve of gill nets is only an approximation to reality. In addition to wedging and gilling fish, tangle and trammel nets also retain by entanglement fish which are much larger than the size range that can be simply gilled or wedged. For this reason, the selection curves of trammels and tangle nets are much more asymmetrical than those of gill nets, the right-hand limb of the curve being extended.

2.2 An example

Commercial fishermen recognize the selectivity of gear types and design and use the appropriate mesh size in particular habitats to capture specific species or sizes of fish.

The report of the expert group presents a number of case studies on this topic of which only one will be presented in this document.

Species: Hake. Country: Spain

The length distribution of hake caught by trawl in Atlantic fishing grounds by Spanish trawlers exhibits a distribution with its mode at 25 cm (Text Table 1 below). There is a pronounced decline in percentage retained from length class 35 cm to length class 55 cm. For length classes in excess of 60 cm there are only a few captures.

For the same stock the length distribution of fish caught by gillnets using a mesh size of 60 mm, shows a mode at 25 cm and a sharp decline until 40 cm. For gill nets using mesh size of 90 mm the mode occurs at 50 cm and the upper length limit is extended to 80 cm. The gill nets select hake from a more restricted length interval than that evident for trawlers. The length distribution taken by longline resembles that of the gillnet of 90 cm with the mode at 40-50cm.

It should also be noted that the size composition of the catches of hake taken by gill nets of 60mm mesh includes many individuals of lengths less than the legal minimum landing size (27cm). This could be avoided by employing a larger mesh size.

Table 1: Mean length composition (percentage) of hake caught by trawl and fixed gear in Atlantic waters.(Div. VIIIc and IXa)

Class (cm)	Trawl	Gillnet 60 mm	Gillnet 90 mm	Longline
10	6	0	0	0
15	11	+	0	0
20	25	12	0	0
25	25	67	3	+
30	50	20	3	3
35	9	1	7	10
40	6	1	12	25
45	3	+	22	20
50	2	0	26	23
55	1	0	17	13
60	+	0	8	3
65	+	0	2	2
70	+	0	1	1
75	+	0	+	+
80	0	0	+	+

From the case presented here and from the others presented by the expert group, it is clear that the gillnet can be, and often is in practice, more selective with respect to fish size compared to trawls. Using an appropriate mesh size, it is possible to catch a narrow size range and thereby avoid catching juveniles.

However, data are often only available for landings which introduce a bias in size distributions, due to the amounts of undersized fish that are caught and discarded. For this reason the frequency distributions taken from trawl and gillnet landings data may be biased since the catches may have included smaller fish which did not appear in the landings.

2.3. Factors affecting selectivity

Two aspects must be distinguished, intra-species selectivity, which is essentially linked to the size of the fish caught, and inter-species selectivity, which distinguishes between fisheries where a single species is caught, and fisheries with mixed catches.

2.3.1. Gill nets and entangling nets

All passive gear is selective for certain species, sizes or sexes of fish. This property depends mainly on the mesh size, flotation of head line and weight of foot rope, material and thickness of twines and hanging ratio.

For gillnets the mesh size has a greater influence on intra-species selectivity, and generally, larger fish are favoured by a larger mesh opening.

Factors which can influence the way in which fish are captured (enmeshing or entangling) include:

- Shape of the fish, which may change as the fish become older.
- Behaviour, which may change seasonally and as the fish become older.
- The hanging ratio of the net
- The degree of hanging-in of the net.
- The amount of vertical slack in the net.
- The direction of shooting of the net in relation to currents which affects the taughtness of the net and, possibly, the probability of interception of fish.

Fish of almost any size may be held by the net if they are caught or entangled on their own jaws, teeth, spines or other projections. Tangle nets are specifically designed to operate in this way, and are often made from multifilament netting which is softer and is generally thought to be more likely to snag the fish than the harder and more springy monofilament yarns.

The species composition of catches obviously depends on the mesh size, but also on the net immersion time and height, and the fishing zones and times. For this reason, bycatches of birds and mammals vary considerably in space and time.

2.3.2. Other gear

Intra-species selectivity (length)

The selectivity of fyke nets and pound nets is directly linked to the mesh sizes used, and in the case of pots, by the gaps in the sidewalls. In all these cases selectivity is similar to that of trawls (retention of animals exceeding a certain size).

The intra-species selectivity of longliners depends on the size of the hooks. It is closer to the selectiviy of gillnets than of trawls since fish that are too large or small are spared. However, longline selectivity is, as a rule, less effective than that of gillnets.

Inter-species selectivity

Essentially, pots capture only scavenger crustaceans and shellfish. Furthermore, in the case of longlines and pots, the type of bait used may affect the composition of catches. However, for all the types of gear referred to in this report it is the conditions of use, and the fishing sectors and times which are of prime importance. For this reason the situation varies from one extreme to the other.

As with fixed nets, drift nets and longlines may, under certain circumstances, create major bycatch problems, in particular with birds, sea mammals and even turtles.

3. EFFICIENCY

The efficiency of passive gear depends on the structure of the gear, its method of deployment and the conditions, both biological and physical, prevailing in the area of deployment.

3.1. Nets

The most important factors are, the dimensions of the gear, yarn characteristics, the soak time (i.e. time spent immersed between shooting and hauling), the weight of the footrope and the size and number of floats on the headline.

Interactions between these factors cause the efficiency of the gear to vary over time and, in particular, to vary within the period of deployment of a fleet of nets.

3.1.1 Dimensions of the netting

Length of netting

The efficiency of a gear is not strictly proportional to its length. Small nets can be laid very precisely. A long net may extend into sectors that are not very workable. It may be difficult to prevent it from looping, thus limiting its effective area. Only in exceptional cases will a large net be as effective as a group of smaller nets with an equivalent aggregate length. Nevertheless net length is the prime factor to be taken into account.

Height

Potentially, there are 3 useful definitions of the height of a fixed netting wall.

1) Total length of netting stretched in the vertical direction.

2) Distance of the headline from the footrope when the gear is fishing.

3) Distance of the headline from the seabed when the gear is fishing.

Definition 3 does not apply to drift nets.

The height of the wall of netting has a complex relationship with efficiency. Assuming that a net catches only one species, the efficiency of the net will vary over time according to the quantity of that species retained at any given time. As the quantity retained increases, headline height, and hence the area of the net capable of retaining fish, will decrease.

In addition, the inter-species efficiency may be altered in that higher nets may encounter a different species composition compared to lower nets since some species potentially available to the net are pelagic, while others are demersal, benthic or semi-pelagic.

Furthermore, the action of currents can cause the headline height to vary. Headline height is reduced in strong currents and is maximum in the absence of currents. Essentially, the orientation of the nets with respect to the currents is a compromise between maximising the probability of intercepting fish and minimising loss of efficiency as a result of the action of the currents.

The distance between the seabed and the footrope is also of importance for fixed nets. In general, fishermen wish to set the footrope as close as possible to the seabed. However, in some areas there is high probability of fouling with debris or taking a large by-catch of undesired species. In such cases the footrope is set at some distance from the seabed. Similarly, and particularly to avoid undesirable by-catches, the depth of the headline below the surface may also be adjusted.

3.1.2. Soak time (Immersion time)

Within limits, increased soak time will result in increased catches. However, for each type of gear there is a maximum quantity of fish which can be retained so that extending soak time beyond these limits does not result in appreciable increase in catch. The gear increasingly approaches saturation with retained fish, other organisms and debris, the presence of which may deter contact with the gear by other fish. Alternatively and/or additionally the quantity of fish etc. retained may be such that the headline height of the gear and hence the efficiency decreases, potentially to the point at which the gear becomes ineffective.

If immersion continues for a long period, the initial catch may deteriorate in the net as a result of simply "rotting" or the action of various scavengers, in particular small crustaceans. As a rule, immersion for too long makes it impossible to market an increasing portion of the catch, and therefore leads to an increase in discards. In some fisheries this phenomenon becomes apparent after 24 hours, whereas in others immersion can last for several days before real problems are encountered.

The optimal soak time depends on the target species and should take into account the quantities both landed and discarded of each species retained by the gear.

3.1.3. Type of gear

The hanging ratio can affect the gear efficiency both within species and between species. Nets mounted with a hanging ratios of less than 0.5 operate to a greater degree by entanglement and catch a greater number of species (if available) than nets with higher hanging ratios.

Intra-species efficiency is also changed in that such gear retains a greater size range of individuals of each species.

The number of walls of netting can also influence efficiency. Experimental evidence indicates that for the same mesh size, and for a specified hanging ratio of the central net wall, a trammel net is usually more efficient than a gillnet of the same hanging ratio.

3.1.4 Yarn specification

The type of yarn used to construct the net may also influence efficiency. The factors of most importance are:

- Texture - The choice between different textures provided by e.g. monofilament, multimonofilament and multifilament yarns depends on the perception of the fishermen of the visibility and retention capability of the netting material. (In addition, the cost and durability and the ease of handling and removal of debris from the various materials also affects their choice.)

- Thickness - The diameter of the yarn affects the visibility of the net for the fish, determines the strength of the net and the elasticity of its meshes and hence, in part, its capacity to retain fish. The diameter employed is a compromise between low visibility to fish and high strength.

- Colour - The colour of the net also affects the visibility by the fish. Contrast between the colour of the seabed and the colour of the background scattered light and that of the net have been reported as a factor affecting efficiency. For these reasons, different net colours are used in different areas and/or for different species.

- Chemical composition (e.g. polyamide, polyester, polyethylene) acts indirectly on efficiency since different chemicals permit the creation of yarns of various thicknesses, elasticities, breaking strains and textures.

3.2. Other passive gear

In the case of pot fishing the essential element is the number of pots, and in the case of longline fishing the number of hooks. However, as is the case with net length, as a rule there is no simple relationship between the number of pots or hooks and fishing effort. Where lines of several tens of pots are used they will not be as efficient as individually laid pots, since the latter can be immersed in very carefully selected places.

The second element influencing efficiency is the bait used, although it is very difficult to quantify its effect.

Finally, the soak time may also play a role, but even more so than for nets the efficiency decreases with time due to deterioration of the bait.

4. MORTALITY RATES CURRENTLY GENERATED BY FIXED GEAR

Little information is available on estimated values of mortality rates generated by fixed gear. Therefore, it is not yet possible to present estimates of the numerical proportion of the stocks removed each year from the sea by fixed gear for comparison with other types of gear. (In principle, it is possible to calculate these rates for stocks where analytical assessments and appropriate catch-at-age data exist).

Some incomplete information is available for landing weights for fixed gear relative to the total landings within a number of Member States.

4.1. Percentage of landings using fixed gear

Text-Table 1 gives landing weights for the years 1985-1990 from enmeshing gear compared to the total landings by species, nation and catch area. (These data should be regarded as preliminary and therefore perhaps subject to modification).

From Text-Table 1, it is obvious that there is an immense variation in the importance of enmeshing gear landings between nations for the same species and catch area (ICES management area). The table reflects both the availablity of a species with respect to enmeshing gear and the structure of the national fishing fleets. As an example, the Danish gillnet landings of cod and turbot from the North Sea comprised (in 1989) 18% and 71% respectively of the total national landings while the Scottish gillnet landings were less than 1% of the national total for both species.

The table also indicates the tendency for the relative landings from enmeshing gear to be greatest for high valued species such as monkfish, bass, sole and turbot.

Table 2: Landings from enmeshing gear as a percentage of total landings by country and species. (Data are incomplete and may be subject to amendment).

	COUNTRY					
SPECIES	DK	UK	F	IRL	POR	ALL
Monkfish	.	13	6	37	30	11
Bass	.	40	28	.	20	27
Cod	18	10	25	.	.	13
Hake	27	46	20	16	8	21
Mullet	.	89	19	.	30	30
Plaice	6	3	9	.	.	5
Saithe	6	9	.	.	.	4
Sole	58	10	43	.	.	36
Turbot	71	24	40	.	.	50
ALL	16	9	21	30	28	13

Source: Document SEC(93)652, 1993

In ICES Divisions VIIIc and IXa several multispecies fisheries are exploited by various fleets. The contribution to the total fishery production by gillnets, longlines and other artisanal fleets is 4%, 9% and 7% respectively.

Gillnets contribute 27% to the Spanish landings of hake in ICES Divisions VIIIc and IXa and 69 % to the total Portuguese landings of hake. For monkfish the percentage is 54 % and 78% respectively for each country.

This kind of data appears to be entirely lacking for the Mediterranean area.

A detailed data set on landings from enmeshing gear is available for England and Wales. The percentage catch due to gill net and tangle net is more than 70 % for salmon, seatrout, grey mullet and pollack and more than 50 % in the case of hake and ling. Of the total landings, 9% are caught by enmeshing gear.

4.2. Percentage of landings using other gear

As already mentioned, catches by small drift nets are marginal. Large drift nets will be dealt with elsewhere.

Surface longlines account for a small but not inconsiderable part of some fisheries (bass, red sea bream). Large surface longlines catch mainly swordfish; in the Atlantic almost the entire catch consists of this fish.

4.3. Mortality not reflected in landings

4.3.1. Ghost nets

Some fixed nets are lost at sea and may continue to fish thereafter. The text below reproduces the comments of the Study Group of ICES on ecosystem effects of fishing activities (1992).

It is known that gillnets, tangle nets and traps may continue to fish for some time after being lost or discarded. The term "ghost fishing" is used to describe this phenomenon.

The length of time that such gill and tangle nets continue to fish depends on a number of factors such as the current speed, the amount of fouling weed in the water, the rate of other marine fouling, the amount of fish caught and the presence of crabs; all things which cause the nets to collapse to the bottom and cease fishing (Millner, 1985). In areas relatively free of fouling the nets may continue to fish at some reduced level of efficiency until the build-up of fish and crabs forces this collapse. Once on the bottom, multifilament nets may, once clear of fish remains and crabs, disentangle, return to an upright position and resume fishing. Over the longer term, such nets gradually build up an encrusting layer of marine organisms and become more visible to fish.

The Study group had only limited information on the occurrence of lost or "ghost" fishing gear and none on mortalities resulting directly from such gear in the North Sea. Some information on both occurrence and related mortalities was, however, available for areas off Norway and eastern Canada. This information came from three unpublished reports of the Norwegian Directorate of Fisheries (NDF) and a summary report of as yet unpublished

Canadian Department of Fisheries (DFO) data. While the degree to which such information may relate to conditions in the North Sea is uncertain, the findings do provide some insight into the occurrence and fishing behaviour of "ghost" fishing gillnets.

The Norwegian reports indicate the capture, using towed grapnels, of large numbers of "ghost" gillnets in two separate areas off the Norwegian coast. It was observed that old nets were still fishing and that in some areas there was "a relatively large amount of fish". Nets lost in 1983 continued to fish, as evidenced by bony remains and recently caught fish. More fish were observed in nets found on soft bottom than in those over harder substrates. Nets found in deeper water also contained more fish.

In the Canadian study an area along the 50 fm isobar [this should read isobath] on the northern edge of Georges Bank was fished using grapnels. Long-liners and trawlermen had complained of ghost-fishing gillnets in this area. Eight percent of the 236 tows resulted in the recovery of 19 gillnets. The remains of 94 fish (cod, hake, dogfish and unidentified skeletons) were found in the nets.

The Canadian study also provided preliminary information into the length of time various types of fish remain in gillnets once caught. Two experiments were carried out. The first indicated that the time required for scavengers to consume all the flesh of entangled fish (residence time) ranged from 1-5 days (average=2). In the second, residence time ranged from 2-12 days (average=6). No correlations were evident between residence time and water temperature or with location in the nets. A further experiment will explore the apparent relationship between amphipod densities and residence time of captured fish.

The Commission expert group noted with respect to this text:

(i) The work by Millner (1985) was carried out under essentially experimental conditions and the results do not necessarily reflect events occuring following the loss of nets from commercial fishing vessels.

(ii) The Norwegian report does not indicate how long recovered ghost nets had continued to fish.

4.3.2 Discards

The problem of discards has already been mentioned in connection with catches by drift nets immersed for long periods. Obviously these are not the only cases. Catches of sea mammals by drift nets are frequently mentioned. This is not the only phenomenon worthy of attention. Seals are sometimes caught by nets, but they are also blamed by some fishermen, particularly in Ireland, for eating the fish caught in the net and damaging those they do not eat completely.

The difficulties are restricted neither to species of particular interest to the public at large (mammals, birds, turtles) nor to nets. Birds or sea turtles caught by longlines have been reported and special studies have been financed by the Commission on the specific problem of Mediterranean turtles. Furthermore, discards also include fish and invertebrates which are difficult to market. In the case of crustaceans, some are even crushed directly because it is too difficult to remove them from the net.

However, discards vary considerably from one fishery to the next. No particular gear can be blamed for them, and a major effort will have to be made to gather the necessary information, leading to regulations as and where appropriate.

5. FISHING EFFORT

Reports on fixed gear fishing activity (Northridge et al, 1991) give an overview of fleet characteristics and an indication of effort which is quoted here.

"The vast majority of the fishing vessels involved are small, coastal vessels which, in many cases, take relatively modest amounts of fish. Official statistics, which are often deficient, are usually based on the quantity of fish landed, and do not adequately reflect the extent to which fixed gear is employed by tens of thousands of vessels throughout Community waters.

In addressing the overall nature and scale of gillnet fisheries in the European Community, it would ideally be useful to have some idea of the relative quantities of netting being used in different parts, as this would provide an index of their intensity. This would require not only data on the numbers of vessels deploying fixed gear, but also the amounts of netting deployed by vessels of different size in different fisheries, and the number and duration of sets made by these vessels. The available data fall a very long way short of this ideal for most of Europe, so that much cruder indices of relative fixed gear effort must be used on an ad hoc basis, if any idea of the distribution and density of gillnets is to be obtained."

In terms of fishing capacity, it must be stressed, as the Commission did during discussions on the MGP, that the usual tonnage and power criteria have no precise bearing on fishing effort. For example, in the case of trawlers, factors that are difficult to quantify (skill of the crew, manoeuvrability of the vessel, etc.) play a role. However, there are also specific problems in addition to the common difficulties.

The tonnage may play an indirect role to the extent that the size of a vessel influences the size of its crew, and the number and/or size of the gear that it can transport and handle. However, the possibility of leaving some gear in the sea, either permanently or in rotation, makes it difficult to quantify the influence of the size of working and storage areas. Furthermore, catamarans provide much greater working areas than single-hull vessels of the same tonnage.

Similarly, engine power plays only an indirect role, governing the speed, which reduces transit times and increases range.

Vessel equipment, the gear, and the way it is used are of prime importance. Automatic hauling, and even baiting, devices are of major significance. However, at present the data on European fleets fall far short of providing a complete picture of these appliances.

In examining fishing effort, it is better to look directly at the gear and its use rather than the vessels themselves.

Fahy[5] tried to standardise effort using a "km days fished per annum" measure. This effort measure was calculated as the product of number of vessels, number of nets aboard, length of each net, soak time, frequency of lift per day and days fished by vessel. Undoubtedly, more work should be done to define fishing effort measures, which can be related to fishing mortality rate.

The same comments apply to drift nets. They are also valid for longliners and pot vessels, by substituting the number of hooks or pots for the length of the nets.

6. SOCIO-ECONOMIC ASPECTS

The debate on the place of passive gear in the development of the CFP cannot be restricted to biological and technical considerations. This is why, in spite of the restricted information available, the following is devoted, to a comparison of prices depending on the various fishing methods, and to a discussion of comparative price formation, in addition to a consideration of jobs at sea generated by the various types of fishing.

6.1. Influence of the fishing method on the value of fishery products

6.1.1 General

In the case of crustaceans, the essential choice is between net and pot vessels, the latter having an inherent advantage since they preserve the catch best. However, we shall not go into this any further, since this report is primarily intended to examine the relationship between passive gear and other types of gear.

There is little point in comparing passive gear and seiners in terms of the commercial value of catches since seiner catches and catches by the passive gear referred to here are not very similar.

Therefore, the most important point is to compare passive gear and trawlers in terms of the marketing value of the catch.

The intrinsic quality of a catch depends to a large extent on the fishing method. Maximum quality is obtained by processing fish as quickly as possible after they die, the most favourable situation being where the fish are brought on board alive and where possible bled immediately. This is possible for pole-and-line and troll fishing, but is generally not possible for longlines and nets. Fish caught with these drown in the water and as a rule cannot be processed very quickly. As indicated in the previous discussion on discards, the soak time plays an essential role.

By contrast, as a rule trawlers process fish more quickly than longliners or net vessels. However, trawler catches may lose commercial value in particular by fish breaking up or as a result of friction and compression in the bottom of the trawls. The problem is even more serious when the catch is large or made up of "sharp" species (horse mackerel, Nephrops,

[5] Fahy, E. 1993. "Inventory of enmeshing gears in European waters". Document XIV/87/94-EN. CEC, DG XIV, Brussels

etc.), and where the trawl is pulled for a long time. There is a big difference between small trawlers pulling bottom trawls for short periods and, for example, large pelagic trawlers.

The debate on the comparative quality of trawler and passive gear catches is complicated immediately, in particular by the duration of fishing operations. Account must also be taken of processing and preservation on board. In this respect the duration of trips plays an essential role, at least if freezer vessels are excluded. The two phenomena (duration of operations/length of trip) may have a similar effect, but not necessarily: net soak times are frequently shorter on shelfs than in coastal waters as a result of scavenger activity.

Another essential aspect further complicates the debate - the influence of the selectivity of the various types of gear. For many fish the price per unit weight varies considerably with size. In this case the differences in price observable between longliners or net vessels and trawlers is above all a reflection of the various size categories involved. The biological arguments justifying the use of techniques providing better selectivity dovetail perfectly with the rationale of the economic exploitation of catches.

6.1.2 An example

Examination of the data obtained from six Member States suggests that the species captured using passive gear achieve better prices, with a few exceptions, in particular monk (see Annexes I and II). Nevertheless the exceptions (France/cod/gillnet; France/whiting/gillnet; Portugal/bass/trammel) illustrate the influence of other factors: the mere fact of fishing using passive gear does not guarantee a better price. Irrespective of the causes previously discussed (duration of operations, length of trips, size categories), the high price of FF 57.4 per kg obtained for monk by beam trawlers in France may be explained by the fact that beam trawlers are used almost exclusively on the eastern Channel seaboard, where monk catches are low and prices are better than elsewhere.

Therefore, more detailed information is required to determine the various factors influencing landing price formation. Unfortunately this is available only in exceptional cases. The best example which has been found is for hake, which has been examined in detail by the ICES Working Group for Fishery Units in subareas VII and VIII. Table 3 is taken from this group's 1990 report.

Table 3: Values at age for hake (ECU/kg) by fishery unit

FISHERY UNIT* AGE	0	1	2	3	4	5	6	7
WESTERN APPROACHES								
Long line in medium to deep water	-	-	-	-	10,0	10,1	10,1	10,1
Long line in shallow water	-	-	1,2	1,2	1,7	2,3	2,3	3,8
Gillnet	-	-	2,3	2,3	2,3	2,3	2,3	4,0
Non-nephrops trawling in medium deep water	-	2,7	2,7	2,7	2,7	2,9	2,9	3,5
Non-nephrops trawling in shallow water	-	-	3,9	2,5	2,7	3,2	3,5	5,0
Beam trawling in shallow water (B/T)	-	-	1,2	1,5	1,7	2,0	2,3	2,8
Nephrops trawling in deep water	2,7	2,7	2,7	2,7	2,7	2,9	2,9	4,0
Nephrops trawling in medium depth	1,8	1,8	1,8	2,0	2,2	2,7	3,1	4,5
BAY OF BISCAY								
Nephrops trawling in shallow to medium depth	-	2,1	2,1	2,5	3,0	3,7	3,5	4,5
Trawling in shallow to medium depth	-	2,4	2,5	2,8	2,9	3,0	3,7	4,5
Long line in deep and medium depth (DM)	-	3,3	3,3	3,3	3,7	4,3	4,3	5,0
Gillnets in medium to shallow depth (MS)	-	2,1	2,1	2,8	3,3	3,4	4,1	5,4
Trawling in deep to medium depth (DM)	5,5	5,5	5,5	5,5	5,5	5,5	5,5	6,0
Miscellaneous	-	2,1	2,1	2,5	3,0	3,6	3,5	4,5
Outsiders	-	1,2	2,2	2,3	2,3	2,6	3,0	4,5

*See ANNEX II for details.
Source: ICES Working Group for Fishery Units in subareas VII and VIII; 1990.

This table highlights the following facts:

Firstly, the age of specimens and consequently their size is a factor which determines the price, no matter which fishing methods are used, with the sole exception of unit 14, the data for which should perhaps be verified.

There are also major differences within both passive gear and trawlers. Longliners are linked to the best prices (unit 1) and to the worst (unit 2). The fishery sector, in this case linked to depth, has a considerable impact.

6.2. Comparative cost formation

Only the main costs likely to vary from one fishing method to the next have been examined, and only to the extent that sufficiently disaggregated information was available. Therefore depreciation and insurance costs for fishing gear have not been examined due to the lack of information.

6.2.1 Fuel costs

Fuel consumption depends mainly on the engine power of the vessel and the length of time the engine is running. Vessels using towed gear consume more fuel than vessels using passive gear.

Table 4: Comparison of fuel costs

	Gillnet Danish seine	Trawler <50 GRT	Trawler 50-120 GRT	Trawler >120 GRT
Fuel and lube oil/ Total earnings	4.9%	12.5%	16.1%	19.2%
Fuel and lube oil/ Total costs-expenses	6.2%	15.3%	19.2%	22.4%

Source : Annex IV

The available data (see Annexes IV, V and VI) confirm this trend for the zones and vessels concerned, since as a rule fuel costs are lower for gillnets or the Danish seine than trawlers. The data for Denmark (Annex V) indicate that fuel costs represent approximately 5% and 6.2% of earnings and total costs respectively of vessels using the gillnet and the Danish seine, whereas they represent between 12% and 19% of earnings and between 15% and 22% of total costs for trawlers. A similar trend is apparent from the data in Annex VI, which distinguishes between net vessels and seiners.

6.2.2 Fishing gear costs

Fishing gear costs vary with a large number of parameters (weather, risks taken, fishing zones, etc). As a rule towed gear is subjected to greater direct damage (fouling and tearing on rocky sea beds, etc.) than fixed gear[5]. Nevertheless fixed gear is more susceptible to the conflicts between the various types of fishing, including theft and loss (more particularly in the case of pot vessels).

The ratios calculated from the Danish data indicate that net vessels allocate more of their expenditure to fishing gear than trawlers do. However, the difference is not great.

Table 5: Comparison of expenditure by gear type

[5] Danish and Scottish seines are an isolated case, since they are towed slowly and are much less exposed to damage.

Table 5: Comparison of expenditure by gear type

	Gillnet 18-43 GRT	Danish seine <30 GRT	Danish seine > 30 GRT	Trawler 0-50 GRT
Gear expenses/ Total earnings	9.4%	3.4%	4.1%	7.4%
Gear expenses/ Total vessel costs	34.2%	17.4%	19.9%	31.3%
Gear expenses Total costs-expenses	11.0%	4.3%	5.0%	8.4%

Source : Annex V

6.2.3 Labour costs at sea

As a rule, the share of earnings taken up by the crew decreases as the power and tonnage of the vessel increases, the fuel and ice costs being proportionally higher. Furthermore, in the case of inshore fishing, the share taken up by the crew may be reduced by the cost of damage suffered by the fishing gear. The figures in Annex IV indicate that labour expenses represent a higher proportion of earnings for net vessels than for trawler fleets, for which the percentage decreases as the tonnage and power of the vessels increase.

Table 6: Comparison of on-board labour costs

	Gillnet Danish seine	Trawler <50 GRT	Trawler 50-120 GRT	Trawler >120 GRT
Labour share, wages/ Total earnings	36.0%	35.2%	33.2%	29.3%
Labour share, wages/ Total costs-expenses	45.8%	42.8%	39.7%	34.2%

Source : Annex IV

To assess any disparity between fishing methods as regards on-board job creation, it is possible to refer directly to the size of the crew or the ratio between the number of men on board and the fuel consumption. For example, Annexes III, VI and VII contain data on Denmark and Italy. This approach indicates that the labour share for net vessels and longliners is more favourable. However, an overall analysis must still be made. This should pay particular attention to automation equipment, which is exceptional on smaller vessels, but more common on larger vessels, if not systematically present. Although in most fisheries the substitution of capital for labour has taken the form of the replacement of crew by kW, as a rule the development of automation provides potential advantages in terms of the use of passive gear.

6.3 Preliminary conclusions

The socio-economic information available on the issues broached here is too incomplete and the studies too specific to allow overall conclusions to be drawn. The use of some types of passive gear is likely to provide higher unit prices for catches, and a greater number of jobs at sea than trawling. However, it would be completely wrong to deduce from this that passive gear should be promoted in future for the sake of jobs.

It would be very useful to analyse in depth the consequences of the policies relating to fishing fleets, the economic development of resources, and employment. A flotilla of small longliners with little or no automatic equipment would probably provide, for a given stock, a considerably greater number of on-board jobs than a smaller number of large trawlers. However, this is no longer so apparent if large, automated longliners or net vessels are considered. At the same time the requirements of productivity could make automation indispensable, just as fishing in some sectors and seasons makes it necessary to have vessels of sufficient size.

7. INTERACTIONS BETWEEN FIXED GEAR AND OTHER FISHING METHODS

Fisheries employing fixed gear are often carried out in coastal waters, in areas under the jurisdiction of the various Member States. Many problems arising between fixed and other gear are, therefore, of a "national" character. However, in certain cases conflicts can arise between fishermen of Member States or between Community fishermen and those of third countries.

Beyond commercial ones there are two types of competition: for the resource(s) and for space

7.1. Competition for the resource

Each specified fishing method competes with all other methods which exploit the available resource. An increase in fishing by static gear therefore implies that, on average, there are fewer fish available for each gear unless the deployment of some other type of gear diminishes. This is one of the fundamental causes for potential conflict resulting from the reported increase in fishing with static gear in recent years.

In this context it is appropriate to differentiate between competition between fixed gear, between fixed gear and other fishing methods and, as a special case of the latter, between fixed gear and recreational fishing.

Competition for a resource can occur between different types of fixed gear (e.g. enmeshing gear and lines) or within the same gear where different groups of fishermen employ different deployment of that gear. Similarly, fixed gear and mobile gear often compete for the same resource. Usually, the consequence of this competition is an augmentation of fishing intensity on some or all age groups of the stock.

National legislation within Member States may permit (or not prohibit) the use of various (or any) types of fixed gear for recreational purposes. However, the use of prohibited gear and/or an excessive number of units of such gear exists. Again, the effect is to compete with other gear, in this case those employed for commercial gain. Recreational fishermen preceive the problem from a diametrically opposed position and feel that commercial fishing is depriving them of leisure opportunities. The occurrence of such problems is largely confined to coastal waters but it may occur farther offshore in cases where both anglers and commercial fishermen fish on or close to wrecks.

7.2. Competition for space

Most of this type of interaction occurs between fixed gear and mobile gear, when both types are deployed in the same geographical area, and usually take the form of mobile gear deliberately or inadvertently towing through fixed gear. In such cases the effects of the collisions between the two types of gear is much greater on the fixed gear than on the trawls. The fixed gear tends to be lost and unrecoverable whereas the trawls are usually recovered by their parent vessel and often are reparable.

This competition often results in fleets employing fixed gear tending to confine their activities to restricted areas and/or to seasons when they seek to catch a limited range of species.

Competition of this type has probably increased as vessels with mobile gear have adopted techniques which permit them to tow over parts of the sea bed previously inaccessible to them and as the utilisation of fixed gear has itself increased.

Competition for space may also exist between fixed gear in cases where attempts are made to deploy large numbers of fleets of gear in some finite area. Sometimes, fixed-gear fishermen attempt to reserve space for themselves by leaving gear, usually old and relatively ineffective, in positions where they wish to fish at some later date.

One solution to this kind of problem lies in the definition and observance of areas to be permanently or seasonally exploited only by fixed gear. Another solution consists of time-sharing where one type of gear fishes exclusively in a specified area for a number of days, after which the other type of gear has exclusive access. Both systems are embodied in national legislation in Spain and Italy while UK operates a number of static gear reserves.

Additionally, informal agreement has been obtained in some areas between potentially or historically conflicting fishermen. Such agreements are usually most easily obtained between fishermen from the same port or the same area. However, in some instances, voluntary agreement has been reached between fishermen from different nations. The agreements have involved separation of the available fishing grounds between mobile and fixed gear, sometimes taking into account factors related to tidal conditions and there may also be a rotation of the use of various sea areas by the various types of gear throughout the year.

Recreational anglers also experience a form of competition for space in circumstances where the deployment of commercial fishing gear hinders or prevents them from pursuing their activities. This conflict also causes problems for commercial fishermen who risk injury from hooks lost by anglers and embedded in their gear.

8. MONITORING PROBLEMS

A non-technical account of national regulations referring to fixed gear is provided in Annex 2 of the report of the expert group. It should be emphasised that it cannot be guaranteed that the account provided is absolutely correct and that national regulations have been correctly interpreted.

Nevertheless it is essential for provision to be made for the monitoring of passive gear to be tightened up. It must also be possible to monitor compliance with the decisions taken. This is practicable for some (mesh sizes), but is more difficult for others (soak time).

8.1. Factors linked to selectivity

8.1.1 Selection of length

Nets

Monitoring mesh sizes does not present any technical problems. The hanging ratio could also be monitored. However, in both cases provision has to be made for checks at sea, when the nets are hauled in, if necessary without prior warning: unlike trawls, the fishing gear is not necessarily on board.

Longlines

In principle it is possible to monitor the hooks.

Pots

The spacing between bars, and more generally the mouth size do not present a problem.

8.1.2 Inter-species selectivity

The factors affecting selectivity which are easiest to monitor are boxes, or a ban on fishing with and keeping certain gear which is not selective enough. It is technically possible to monitor the immersion of the headline, but this would require a major presence at sea.

If various mesh sizes are laid down for target species, the catch composition rules bring us straight back to the current debate on this subject in respect of trawler mesh sizes.

8.2. Factors linked to the fishing effort

The problem revolves around distinguishing between the total fishing capacity of a vessel and the capacity of an individual piece of gear, i.e. a net, a longline or a line of pots. In the case of very large gear, this can be solved by authorising the use and keeping of only one net, for example. However, this would not be possible in other cases.

Monitoring restrictions on the physical characteristics of specific gear (length or height of the nets, number of hooks, number of pots) is conceivable. This would require maintaining vessels at sea for monitoring, as mentioned in the case of mesh sizes. Monitoring a restriction on soak times would be extremely difficult.

Regulating the cumulative capacity of all a vessel's gear would make it necessary to have, in addition to the capacity for monitoring each individual item of gear, the resources to register all the gear at sea and on land used by boats.

8.3. Rules for use

It would be very difficult to monitor the setting of the footrope, or the vertical distance between the headline and footrope.

The rules on the minimum distances between different gear can be monitored only if major supervision resources are kept at sea.

8.4 Identification

The capacity to identify each item of gear at sea, and to link it to a registered vessel, is the keystone of any control system. Community regulations exist providing for the identification number of the vessel to be indicated on each item of gear. It is not inconceivable, at least in certain cases, to go as far as giving each individual item of gear its own additional identification. It is also conceivable to require the use of more effective marking and/or identification methods, in particular radar reflectors.

Strict identification rules make it possible to deem any unidentified gear to be wreckage. However, technical progress, in particular in positioning, obviates the need for fishermen to have surface-floating markers. This could seriously increase difficulties in policing unmarked gear.

9. GUIDELINES FOR A STRATEGY OF ACTION

Action does not necessarily imply a Community regulation covering all the problems. Fishing in Europe using passive gear is even more diverse than trawling. This is why Community decisions can only serve as a basis to be built on pursuant to the principle of subsidiarity. This is particularly true for inshore fisheries where they are directed at strictly coastal resources, the corresponding stocks being exploited by fishermen from only one Member State. Community intervention is not justified in such cases. By contrast, in the case of straddling resources, undersized fish must be protected (selectivity), and quotas respected. However, where compliance with these regulations is ensured, a Member State must be able to govern the size of competing types of gear by adjusting restrictions imposed on them, without a Community regulation standardising the balance between these types of gear.

Furthermore, since the urgency with which decisions must be made and the availability of the information required vary depending on the problems involved, an action timetable must be drawn up. In cases where an immediate decision cannot be proposed, but the question must be resolved in due course, provision must be made for the relevant information to be gathered as soon as possible.

Action must be based on four priorities: selectivity, fishing effort, "cohabitation" and monitoring.

9.1 Ensuring the selectivity of nets

Although Community action on other types of gear (long lines, pots, etc.) is neither urgent nor indeed possible, measures should now be taken to ensure the selectivity of nets.

The technical knowledge for the definition of rules on the materials used (monofilament, biodegradable materials, etc.) is not yet adequate for the drafting of an effective Community regulation. Steps should therefore be taken to promote the specific research necessary for any future decisions.

However desirable the limitation of the soak time of gear might be in theory, monitoring compliance would appear to be too difficult for regulation, at any rate Community regulation, to have sufficient short-term impact. Amended log-books could, nevertheless, provide useful information.

Regulation of the height of nets on the basis of sea depth and immersion depth would be useful, particularly in order to avoid certain by-catches and so to guarantee inter-species selectivity. It would not necessarily be possible, however, to lay down general Community rules in the short term. A few basic rules could prohibit the use of over-high nets in shallow areas. Given that the problem is particularly severe in shallow waters, the most appropriate short-term solution would probably be local regulations adapted to local circumstances. It should be noted that the lack of tides makes the problem easier to overcome in the Mediterranean. Certain types of mixed-geometry nets enabling the bottom part of the gear to act as a trammel net and the top part as a gillnet should perhaps be prohibited.

For driftnets, making the immersion of the float line compulsory would give advantages in terms of selectivity and safety for shipping.

In order to improve inter-species selectivity and, in particular, to reduce catches of protected species, permanent or temporary boxes could be introduced in which the use of certain types of passive gear, especially nets in certain sectors, was prohibited. Again, the necessary information is not available and must therefore be gathered as soon as possible.

There is, however, one area where rapid decisions can and must be taken and that is on the question of mesh sizes. For trammel nets it is more precisely the size of the interior webbing that must be regulated. The number of different types of fishing with nets makes it impossible to lay down a standard mesh. A minimum size should be laid down for the very large meshes used for crustaceans or even monk fish to prevent any risk of smaller nets being used in the future. On the other hand, no rules should be fixed as regards the composition of catches using such nets.

Table 7 : Mesh sizes (cm) employed in Member States to catch designated species by fixed nets in Region 2. (The mesh sizes apply to gillnets, tangle nets and the internal netting of trammel nets)

Species	Country							Most used range
	BEL.	DK	FR	GER.	IRL.	NL	RU	
Sprat							2-3	2-3
Herring				5-7B	4-7		4-7	
Mackerel			2-5				4-7	4-7
R. Mullet			4-7					
Bass			7-13				9-13	
G. Mullet			8-12		9-12		9-11	8-12
Sole		9-14	8-12	9-11	8-13	9$	8-13	
Plaice		12-18	12-17	12-16			10-15	
Cod	15-18	11-20	12-18	11-16	8-9	18$	12-14	
Gadoids*					8-9		15-20	11-18
Spurdog					11-13		12-15	
Hake		13-18	11-12		11-13		12-14	
Flounder				11-14B				
Crawfish			24-32		41-46		20-30	
Lobster							20-30	
Sp. Crab			24-32					25-33
Anglers			26-32		27-31		27-33	
Rays			22-32		26-31		25-33	
Turbot		13-27	27-32	22-27	25-31		27-33	
Turbot				19-22B				
Brill			27-32					

Notes: B - For fisheries in the Baltic.
* - Gadoids other than cod including pollock, ling, saithe.
S - Netherlands uses only tangle nets

Source: Table 1, Document SEC(93) 652, 1993

Table 8: Mesh sizes (mm) employed in Member States to catch designated species by fixed nets in Region 3

		Country	
Species		Spain	Portugal
Hake	T	90	80-120
Pollock	B	x	(usually,
Horse Mac	B	x	but may be as low
Mackerel	B	x	as 65.
Forkbeard	B	x	By-catch unknown)
Red Mullet	B	x	
Gurnards	B	x	
Angler	B	x	
Hake	T	60	
Gurnards	B	x	
Red Mullet	B	x	
Horse Mac	B	x	
Mackerel	B	x	
Sole	T	40/280	
Gurnards	T	Trammel	
Wrasse	T	net	
Rays	T		
Pouting			60
Other Spp			60-80
Meagre	T	160	
Rubberlip Grunt	T	(Canary Island))	

Notes : T - Target species
B - By-catch species (x denotes known by-catch
Rubberlip grunt = Plectorhincus mediterraneus
Meagre = Argyrosomus regium

Source: Table 2, Document SEC(93)652, 1993

Tableau 9: Mesh sizes (mm) employed in Member States to catch desingated species by fixed nets in Mediterranean

a) Greece

	Mesh Size		
Target Species	Gillnet	Trammel Net	
		Inner.	Outer
Mullus barbatus	17-22	18-28	110
Mullus surmuletus	18-24	18-26	110
Mugil Sp.	22-28	24-40	120-200
Trachurus Sp.	28	22-26	110-130
Meluccius merluccius	24-40	24-28	110-140
Boops boops	20-22	20-26	110
Pagrus pagrus	32-110	32-40	180-200
Oblada melanura	22-32	26-28	110-120
Lithognathus mormyrus	22	28	110
Dentex dentex	32	32-46	140-180
Spicara smaris	16	20	110
Scombroidei	36-45	46	140
Sepia Sp.		26-42	110-170
Homarus Sp.		32-40	180-200
Shrimps		22-28	110-140
Nephrops norvegicus		30	180
Solea Sp.	45		

(b) Italy

Target species	Mesh size
Amberjack	110-130
Atlantic bonito	80-90
Bass	90-140
Common pandora	60-80
Cuttlefish	68-74
Frigate mackerel	70-80
Lithognathus	64-72
Mackerel	50-60
Mullus Spp.	40-50
Shrimps	40-50
Sole	52-70
Spiny Lobsters	50-70

(c) Espagne

Espèce cible	Maillage
Sepia officinalis *Pagellus acerne*	70/400 Trémail
Mullus surmuletus *Solea Spp.*	28/300 Trémail
Penaeus Kerathimus	20/125 Trémail
Lithognathus mormyrus *Pagellus erythrinus*	70 Filets maillants
Trachurus trachurus	50 Filets maillants

Source: Table 3, Document SEC(93) 652, 1993

Smaller meshes, suitable for catching particular species, are also used. These types of specialist fishing should be recognized and rules laid down for mesh sizes and catch composition. To prevent the rules becoming over-complex, the number of mesh sizes should be limited by grouping the target species concerned by category. By laying down minimum mesh sizes, any future tendency towards smaller meshes can be prevented. In cases where this trend has already started, the mesh sizes laid down will have to be larger than those currently used.

Two methods could be used for choosing a minimum mesh size for each species:

(1) A solution could be chosen which aims at producing first catch sizes similar to those taken by trawlers under the existing rules.

(2) More ambitious selectivity criteria could be set for nets than for trawls. There are two reasons for this: to maintain the benefits of selectivity and to compensate for the difficulty of developing, at least in the immediate future, a tight management system for passive gear. The simplest option would be a solution based on the size at sexual maturity.

Having defined a minimum mesh size for one or more target species, it might be useful to lay down a maximum. The objective would be to avoid the temptation to use one range of mesh sizes to catch species usually taken with the range above. Such a maximum should be set so as not to create unnecessary difficulties for fishermen.

Finally, consideration should be given to supplementing the rules on meshes with provisions on the hanging ratio.

9.2. Preventing an uncontrolled increase in fishing effort.

In view of the need to prevent an uncontrolled increase in the fishing effort using passive gear but also bearing in mind the fact that an immediate reduction was not necessary given the advantages of such gear in terms of selectivity, the MAGP decisions set the aim of stabilising the capacities of vessels carrying out such fishing activities.

To prevent such an uncontrolled expansion, however, account must be taken of the number of units in use and the relevant characteristics of each vessel such as the number and size of the fishing gear it uses.

There are, however, at least three reasons for not immediately introducing complete Community regulation of the size of gear:

(1) A Member State might prefer to give priority to maintaining employment at sea by linking the authorised length of the net to the size of the crew whilst another might encourage increases in productivity by only taking account of the tonnage of the vessel.

(2) The introduction of a maximum size would raise the following dilemma: if it were much less than the size currently used by a large number of vessels, it would potentially be very useful in terms of the conservation of resources but could have very serious short-term economic consequences; were it much greater than the lengths currently used by the overwhelming majority of vessels, its impact would be small and could encourage some vessels to increase their capacity up to the authorized maximum.

(3) Vessels using several types of gear (nets, long lines or lines of pots) immediately raise the question of the combination of rules (should they be applied by type of gear, cumulatively etc.).

Initially, it would therefore appear sensible to stabilise the number of units fishing with the various types of passive gear rather then to set, by means of a Community regulation, the fishing capacity of each vessel using the authorized gear. That would not rule out the introduction of a few initial measures to safeguard against the risk of uncontrolled increases, for example, laying down that vessels above a certain size or using gear above a certain length must use only that gear.

The current MAGP offers a certain level of protection against any unplanned growth in the number of vessels fishing with passive gear. Given the composite character of certain areas in which fleets using fixed gear fish, that protection is inadequate. Therefore, taking up a proposal put forward by the STECF (or rather its predecessor the STCF), licences should be introduced to regulate the use of passive gear, beginning with nets. This would not mean a Community licensing system. Each Member State would supplement its MAGP with a national licensing system permitting the use of the various types of passive gear. Systems could contain provisions specific to a Member State although these would have to be made known to the other Member States. Within the quotas allocated to it and in line with the objectives laid down in its MAGP, a Member State could decide on the balance it wished to strike between the various types of fishing. There would have to be slightly different arrangements, however, for those fisheries where the inexistence of effective guidelines for deciding on the output from various types of fishing implies the need for tight, direct management of the fishing effort of the Member States, namely fisheries not subject to TACs or those for which the TACs are too large to be effective management tools (precautionary TACs).

Although there seems to be no urgent need to go beyond measures to prevent an uncontrolled increase in fishing efforts, account must be taken of future needs. Much more information must be gathered on fishing using fixed gear and the bioeconomic analyses necessary must be carried out so as to gain an understanding of the role of the various aspects of the fishing effort.

9.3. Encouraging "cohabitation"

It is unlikely that the introduction of rules, and particularly Community rules, will be a suitable response to the problem of competition for space between passive gear and trawls or even that between different types of passive gear. Generally speaking, a strict system of management is required which can only be introduced where wide acceptance from those concerned permits a level of self-discipline within the industry. The concept of subsidiarity must be fully applied. The Commission must in no way become involved in disputes which can be resolved locally provided the necessary mediation is provided.

A certain number of disputes have nevertheless acquired an international dimension. To help find solutions, the Commission could organize meetings between industry representatives and the authorities concerned as an attempt at arbitration designed to encourage the emergence of codes of good conduct.

9.4. Control

The adoption of the new regulation on monitoring necessitates a revision of the rules of application. The opportunity must be taken to lay down the provisions necessary for ensuring compliance with the rules on mesh sizes and all aspects of the identification and location of fixed gear. Furthermore, log books must be revised to take better account of the situation in the various fisheries, particularly in the case of fishing with passive gear. Revised log books will be extremely useful for providing the information which is now lacking and which will be indispensable for carrying out the bioeconomic analyses referred to above.

CONCLUSION

Compared to towed gear, passive gear has a real advantage in terms of selectivity and therefore in terms of the economic exploitation of resources. It may even generate more direct employment. It is generally responsible for a minority of catches but recent developments call for vigilance. Trends towards catching smaller fish have been recorded for several fleets using passive gear (essentially due to smaller mesh sizes). The fishing effort has been increased, sometimes massively, by converting of a number of ships to passive gear and by increasing the size and number of gear. This has been facilitated by automatisation. This increase in the fishing effort has led to an increase in the contribution made by passive gear to the exploitation of resources and to an intensification in the disputes over space. At the same time, questions have been raised about the use of passive gear and the capture of non-commercial species (marine mammals, birds). Action must therefore be taken, starting with nets, where the problems are particularly serious.

"Local solutions" can be found to many of the problems linked to the use of passive gear. Member States must not seek to involve the Community simply because they are unwilling to mediate between their own fishermen. There is, however, one level at which the Community has a natural role.

In the immediate future, priority must be given to drafting a regulation on net meshes and provisions to prevent an uncontrolled increase in fishing effort. Vessels fishing either full or part time should be subject to special licensing procedures. To ensure compliance with the rules, special control measures should be adopted when the rules of application for the new regulation on monitoring are adopted. Finally, consultation procedures should be set up to enable rules on cohabitation to be drafted.

In the medium term, consideration must be given to additional technical measures or even to the possibility of the strict management of fishing effort. This can only be done if the necessary technical, biological and economic analyses have been carried out and, first and foremost, if the required information has been collected. An amendment of the log book could play an essential role. The research bodies concerned must adopt the programmes required and provide the necessary resources. The Commission must play a coordinating and supporting role.

ANNEX I

<u>Comparative prices of various species according to type of gear used</u>

	GEAR OTHER THAN PASSIVE GEAR					PASSIVE GEAR			
Gears/species	Bottom trawl	Pelagic trawl	Beam trawl	Large seine	Small seine	Gillnet	Trammel	Longline	Pots
Cod	(FB/Kg) 77.89 (FF/Kg) 15.18 (DkK/Kg) 10	17.99	68.66 16.34			115.93 13.25 15.00	21.13	17.35	
Mackerel	(Esc/Kg) 79 (FF/Kg) 4.06	3.63	4.63			---------------- 4.72	-------85------- 5.81	---------------- 8.08	----------------
Hake	(Esc/Kg) 700 (FB/Kg)122.98 (Pts/Kg) 700 (FF/Kg) 25.20	29.50	75.30			---------------- 31.74	-------788------ 31.60	---------------- 1.400 52.20	----------------
Whiting	(FB/Kg) 41.53 (FF/Kg) 7.74	7.84	35.69 7.35			62.60 6.14	12.15	18.77	
Saithr	(FB/Kg) 33.58 (FF/Kg) 6.77	30.22	36.13				11.89	11.76	
Monk	(Esc/Kg) 780 (FB/Kg)387.92 (FF/Kg) 30.50	30.09	334.86 57.40			---------------- 25.22	------780------- 37.33	---------------- 29.58	----------------
Bass	(Esc/Kg) 2000 (FF/Kg) 68.15	97.51	56.74			---------------- 104.06	------1900------ 68.63	---------------- 100.25	---------------- 104.79
Sole	(FB/Kg)261.47 (Pts/Kg) 330		266.08			284.25 -------800-------	----------------		
Plaice	(FB/Kg) 48.10		53.11			68.58			
Cuttlefish	(Pts/Kg) 260					-------500-------	----------------		
Bream	(Pts/Kg) 200					-------330-------	----------------		
Molluscs	(LIt/Kg) 5313					----------------	------8690------	----------------	----------------
Crustaceans	(LIt/Kg) 11882					----------------	-----22374-----	----------------	----------------

Source: DG XIV-A-3

ANNEX II

y of the characteristics of each of the demersal fishery units fishery in area VII and VIII a, b

Fishery unit	Country	Number of boats	KW	GRT	Target species	By-catch
pproaches						
Long line in medium to deep water	France	18	110 300	50	skate, dogfish, ling	
	Ireland	1	428	130	Hake	Ling, greater forkbeard, cod
	Spain	41	560	202	Hake	Monk, ling
	U.K.(1)	30	537	201	Hake, link, cod	Whiting
Long line in shallow waters	France	11	184	12	Pollack, ling, dogfish	Skate
	U.K.	12	118	24	Gadoids, skates, spurdogs	
Gill net	France	10	190	43	Hake	Pollack
	U.K.	110	107	19	Hake, monk, cod, pollack	Spurdog
Non-nephrops trawling in medium to deep water	France	121	442	96	Monk, megrim	Hake, skates, gadoids
	Ireland	13	760	240	Hake, megrim, monk	Cod, witch
	Spain	127	596	208	Hake, megrim	Cod, nephrops
	U.K.(1)	39	631	202	Hake, monk	megrim
Non-nephrops trawling in shallow water	France	98	468	128	Gadoids	Monk, skates, dogfish
	Ireland	<130	230	65	Gadoids	Megrim, monk, rays
			.	(50-175)	Gadoids	Plaice, sole
	U.K.	221	143	33	Monk, gadoids	Skates, flatfish
Beem trawling in shallow water (B/T)	Belgium	15	740	-	Sole	Plaice, rays
	U.K.	91	431	56	Monk, sole	Megrim
Nephrops trawling in deep water	France				Nephrops	
	Spain	8	422	296	Nephrops	Hake, monk, megrim franche
Nephrops trawling in medium depth	France	63	324	52	Nephrops	Hake, gadoids, monk, megrim
	Ireland	<25	330	± 70	Nephrops	Whiting, hake, monk, megrim
		<17	400	±110	Nephrops	Unknown
		<20	330	± 60	Nephrops	Hake, monk, whiting, megrim
cay						
Nephrops trawling shallow to medium depth	France	330	208	26	Nephrops	Hake, monk
Trawling in shallow to medium depth	France	174	269 180	45 30	Sole, hake, monk cephalopods	Whiting, gurnards Bib, red mullet
Beam trawling in shallow water (B/T)	Belgium	7			Sole	
	Netherlands	±6	1470		Sole	Mixed demersal
Longline in deep and medium depth (DM)	Spain	81	380	134	Hake	Scad
Gill nets in medium to shallow depth	France	55	250	50	Hake	Pollack
'n deep to medium l)	France	67	308	51	Monk	Skates, hake, megrim
	Spain	76	615	242	Hake,	Scad, bib, monk, cephalopods

These vessels fished only in the 1st quarter of 1989
ICES Working Group for Fishery Units in Subareas VII and VIII - 1990

ANNEX III

Breakdown of costs and manpower according to type of gear used

Gears/Variable and semi-variable costs	GEAR OTHER THAN PASSIVE GEAR					PASSIVE GEAR			
	Bottom trawl	Pelagic trawl	Beam trawl	Large sein	Small seine	Gillnet	Trammel	Longline	Pots
(1) Fuel	(LIT) 43.665 (DK) 11 % for 2075 T	43.877	25.000	32.041	9.500	3.200 4 % for 1255 T	3 .200	26.500 *	
(2) Purchase and repair of fishing gear	(DK) 9 %				13 %				
(3) Maintenance of vessels	(DK) 15 %				14 %				
(4) Labour costs	(LIT) 129.000 (DK**) 46 % for 2075 T	180.446	70.000	315.400	59.000	26.000 47 % for 1255T	26.000	153.000	
(5) Number of fishermen	(IT) 4.5 (DK) 3.5	5.6	4.1	11.5	5.6	2.2 4	2.2	5.2	
(6) : (4) / (5)	(IT) 28.666.6	32.222.5	17.073.17	27.426.0	10.535.7	11.818.2	11.818.2	29.423.0	

*These figures are for an homogenous group of vessels, the sicilian longliners, of above-average size (35/40 GRT)
**Including the skipper.

Source: DG XIV-A-3

ANNEX IV

Average costs and earnings of fishing vessels in Denmark in 1990

Fishery unit	Gill net	Trawler	Trawler	Trawler
Size group	Danish seine	< 50 GRT	50-120 GRT	> 120 GRT
GRT	19-45	19-38	55-98	149-188
Metres (m)	13-18	14-17	20-26	34-35
kW	104-201	138-272	298-386	585-802
		(amount in ECU)		
Days at sea	.	.	.	.
Earnings				
Réduction	0	11 579	61 625	176 361
Consumption	136 485	87 591	293 934	316 585
TOTAL	136 485	99 170	355 559	492 946
Running Costs				
Fuel and lube oil	6 634	12 442	57 275	94 456
Harbour Dues a)	3 344	2 430	8 711	12 077
Boxes ice b)	*	*	*	*
Food c)	*	*	*	*
Other costs of crew c)	*	*	*	*
Costs of selling fish	12 861	5 822	30 029	43 687
Other running costs	*	*	*	*
TOTAL	22 839	20 693	96 016	150 220
Labour share,				
Wages	49 120	34 891	118 163	144 177
Social insurance c)	*	*	*	*
Vessels costs				
Gear expenses	6 966	4 940	20 352	33 517
Vessel repairs	11 285	7 168	30 025	34 153
Equipt. Hire and maintenance	2 062	1 802	6 075	9 036
Vessel insurance	5 469	5 398	13 480	24 809
Other vessel costs	2 038	958	4 691	10 399
General expenses	8 396	6 655	16 882	25 024
Special earnings d)	863	988	8 002	9 428
TOTAL	35 354	25 932	83 503	127 509
TOTAL COSTS/EXPENSES	107 314	81 516	297 681	421 906
CASH FLOW BRUT	29 171	17 654	57 878	71 906
Dépréciation e)	15 214	14 310	44 576	107 052
Interest e)	2 395	5 169	10 558	38 266
NET PROFIT or LOSS	11 562	- 1 825	2 744	- 74 278

. : Figure is not available
a) : calculated as 2.45% of total earnings
b) : Included in fuel and lube oil
c) : Included in General expenses
d) : Special earnings: Capital gains, oil bonus
e) : Common method, described in section 7.4.1. and Appendix 7

Source: Davidse W.P. et al. 1993. Costs and earnings in four EC countries. Agric. Econ. Res. Inst. (LEI-DLO)

ANNEXE V

Average Costs and Earnings of Fishing Vessels in Denmark in 1990

Fishery Unit			Senne danoise	Chalutier
Size group	Gill net	< 30 GRT	> 30 GRT	0-50 GRT
GRT	18-43	28-29	33-43	37-43
Metres (m)	14-18	15	16-18	17-18
kW	95-172	82-128	127-172	257-326
		(amounts in ECU)		
Days at sea	.	.	.	.
<u>Earnings</u>				
Reduction	0	0	0	0
Consumption	203 125	161 625	211 625	185 250
TOTAL	203 125	161 625	211 625	185 250
<u>Running Costs</u>				
Fuel and lube oil	7 125	5 125	8 500	18 375
Harbour Dues a)	4 977	3 960	5 185	4 539
Boxes Ice b)	*	*	*	*
Food b)	*	*	*	*
Other costs of crew	625	500	625	250
Costs of selling fish	15 023	17 665	20 565	15 961
Other running costs	3 750	1 250	3 125	5 625
TOTAL	31 500	28 500	38 000	44 750
Labour share				
Wages	83 500	65 750	87 500	72 625
Social insurance	2 875	2 875	4 125	3 375
<u>Vessel costs</u>				
Gear expenses	19 125	5 500	8 625	13 750
Vessel Repairs	23 125	17 625	23 375	16 625
Equpt. Hire and Maint c)	*	*	*	*
Vessel Insurance	5 000	4 375	8 000	8 375
Other Vessel costs	3 375	1 375	1 250	1 875
General Expenses	5 875	4 000	4 375	5 375
Special Earnings d)	625	1 250	2 375	2 000
TOTAL	55 875	31 625	43 250	44 000
TOTAL COSTS/EXPENSES	173 750	128 750	172 875	164 750
CASH FLOW BRUT	29 375	32 875	38 750	20 500
Depreciation e)	12 554	9 165	13 076	29 564
Interest e)	1 686	2 634	4 401	5 616
NET PROFIT or LOSS (-)	15 135	21 076	31 273	- 14 680

. : Figure is not available.
a) : Calculated as 2.45% of total earnings
b) : Included in Other Running Costs
c) : Included in Vessel Repairs
d) : Special earnings: Capital gains, a.o.
e) : Common moethod, described in section 7.4.1. and Appendix 7

Source: Davidse W.P. et al 1993. Op. Cit.

ANNEX VI

Imputing the crew's share based on cost and earnings studies fromthe districts of Skagen and Hjørring (1990)

	Crew size (1)	Actual income to skipper	Crew's share (2)	Total earnings (3)	Landing costs + fuel and lube oil	Imputed crew share (4)
		(amounts ECU)				%
Skagen						
Trawler : 15 à 19,9	2,1	24.500	28.125	127.875	20.250	26,1
Trawler : 20 à 49,9	2,9	24.500	48.625	181.500	32.000	32,5
Trawler : 50 à 99,9	3,5	28.750	64.875	250.625	53.500	32,9
Trawler : > 100	4,9	30.250	117.875	465.125	117.000	33,9
Hjørring						
Gill net and seiners	1,9	11.706	37.414	136.485	22.875	32,9
Trawler : < 50	2,2	15.144	19.747	99.170	20.750	25,2
Trawler : 50 à 120	3,8	21.310	96.853	355.559	96.000	37,3
Trawler : > 120	4,9	29.796	114.381	492.946	150.250	33,4 31,8

(1) Crew size is including skipper
(2) Crew's share exclusive social insurance
(3) Total earning = Landings for human consumption and fishmeal production
(4) Imputed crew share is defined : [total earning - landing costs - fuel and lube oil], which give an average per crew of 3,8 %.

Source:Davidse W.P. et al 1993. Op. Cit.

ANNEX VII

Imputation of crew's and owner's share in Lemvig (1990)

	Crew size	Total wage	Total earnings	Landing osts + fuel lube oil	Estimated crew's share (1)	Estimated owner's share (2)	Estimated share per crew (3)
Lemvig							
Trawler : 0 - 50	2,2	72.625	185.250	38.875	46.547	26.078	38.789
Trawler : 50 - 120	3,7	108.750	284.625	61.625	70.914	37.836	26.264
Trawler : 120 - 200	4,5	132.750	446.375	124.750	102.277	30.473	29.222
Trawler : > 200	5,2	243.125	825.500	239.750	186.269	56.857	44.350
Danish Seine : < 30	3,1	65.750	161.625	26.750	42.890	22.860	20.424
Danish Seine : > 30	3,2	87.500	211.625	34.250	56.405	31.095	25.639
Gill net	2,7	83.500	203.125	27.125	55.968	27.532	32.922

(1) The crew's share is estimated by using the imputed average percentage of 31,8 % : 31,8 % of [total earning - landing cots - fuel and lube oil]
(2) Owner's share is calculated like : total wage - est. crew share.
(3) Estimated share per crew member is calculated like : est. crew share/(crew size less skipper).

Source: W.P. Davidse et al. 1993. Op. Cit.

ANNEX VIII

Figure 1: Hanging Ratio (E) and Shape of Meshes in the Water

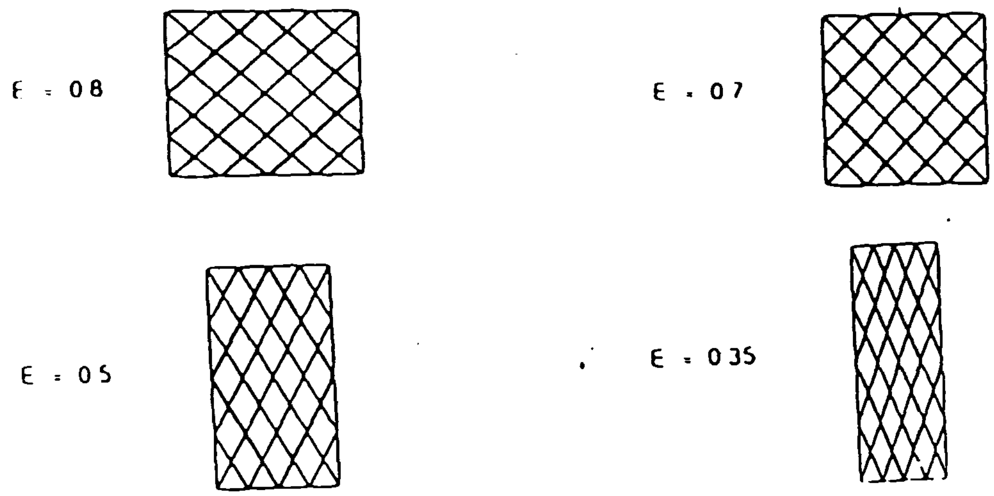


Figure 2: Typical Rig Used in Fishing with Anchored Gill or Tangle Nets

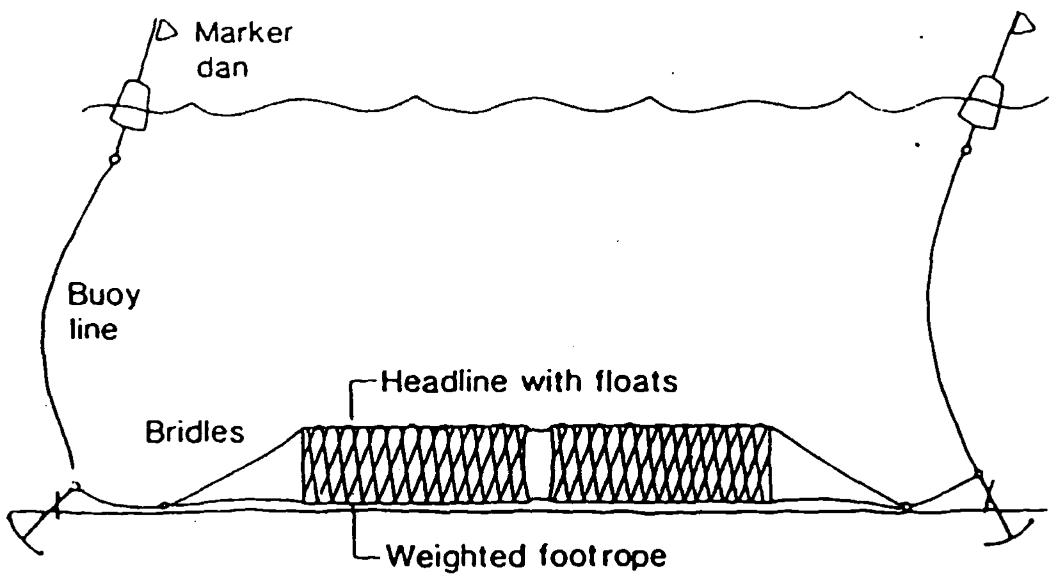


Figure 3: Methods of Capture of Fish in Gill Nets

(a) Fish wedged around the snout
(b) Fish wedged at maximum girth
(c) Fish gilled

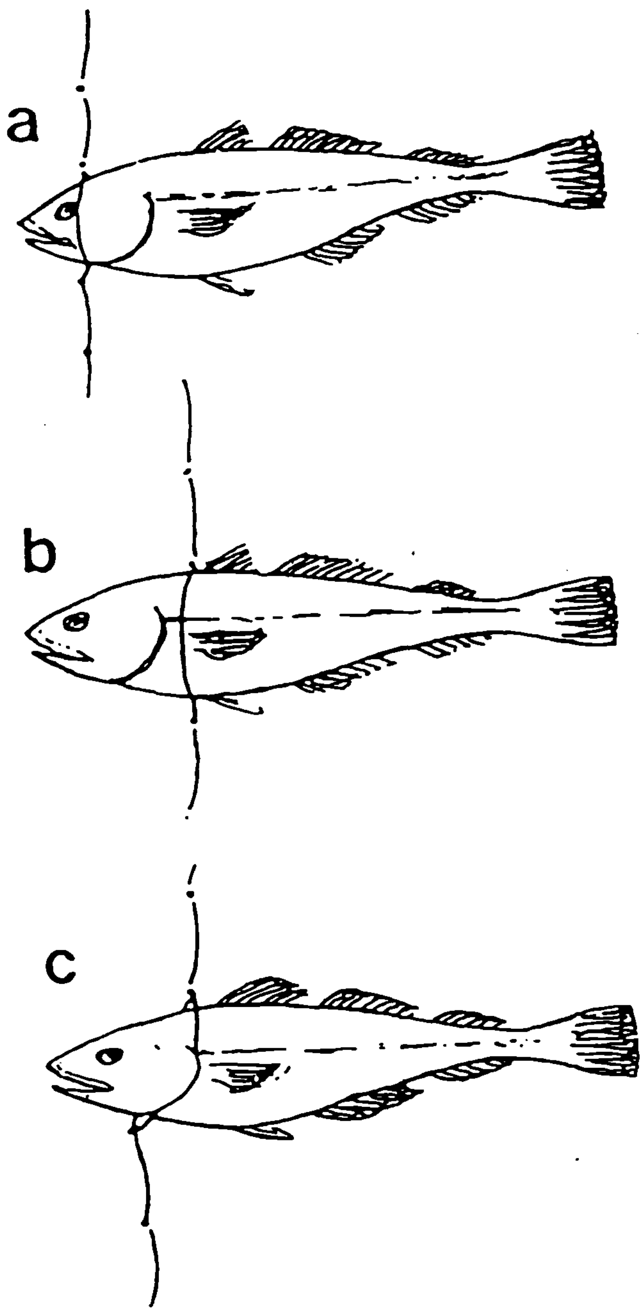


Figure 4: Trammel Net

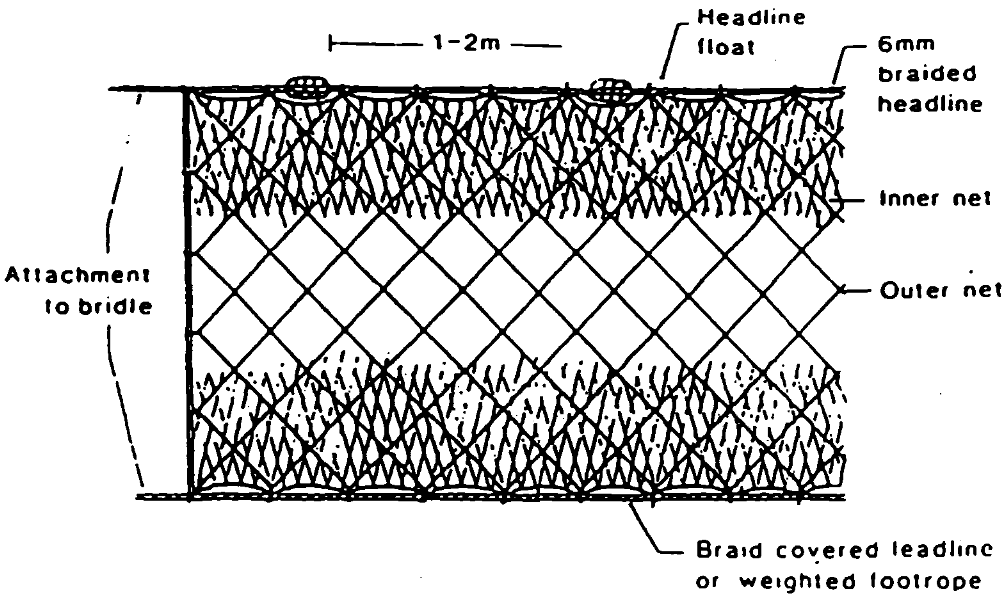


Figure 5: Method of Capture of Fish in a Trammel Net

A pocket formed by the small meshed net is pushed through a mesh of the outer net

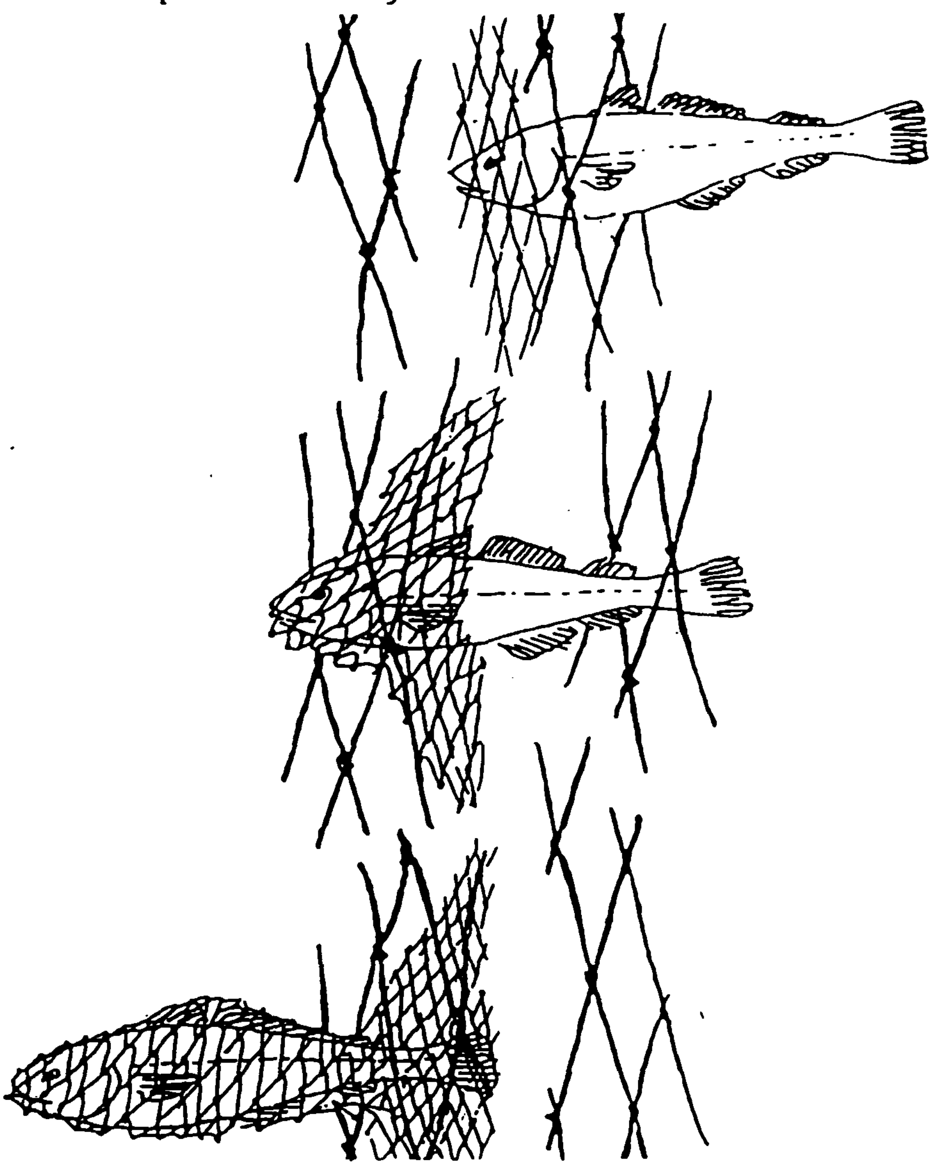


Figure 6: Combined Gillnet/Trammel Net

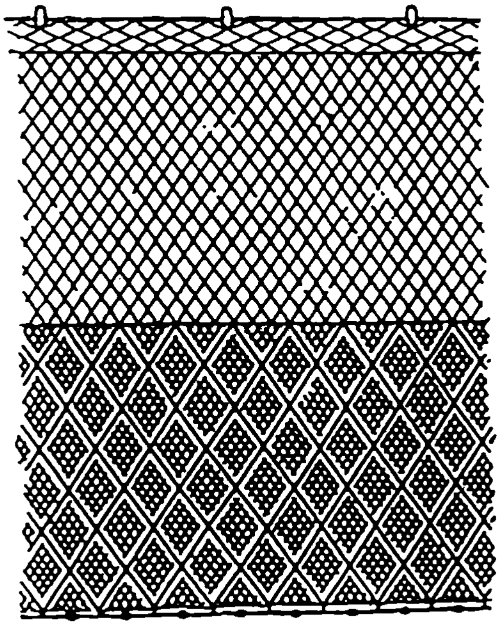


Figure 7: Fixed Gillnet on Stakes

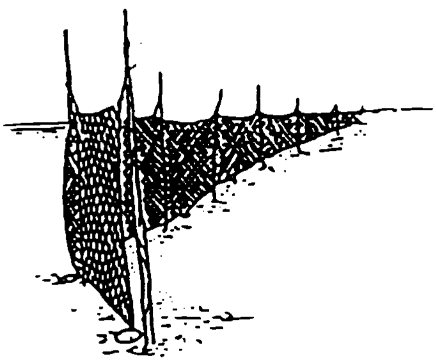


Figure 8: Stationary Uncovered Pound Net

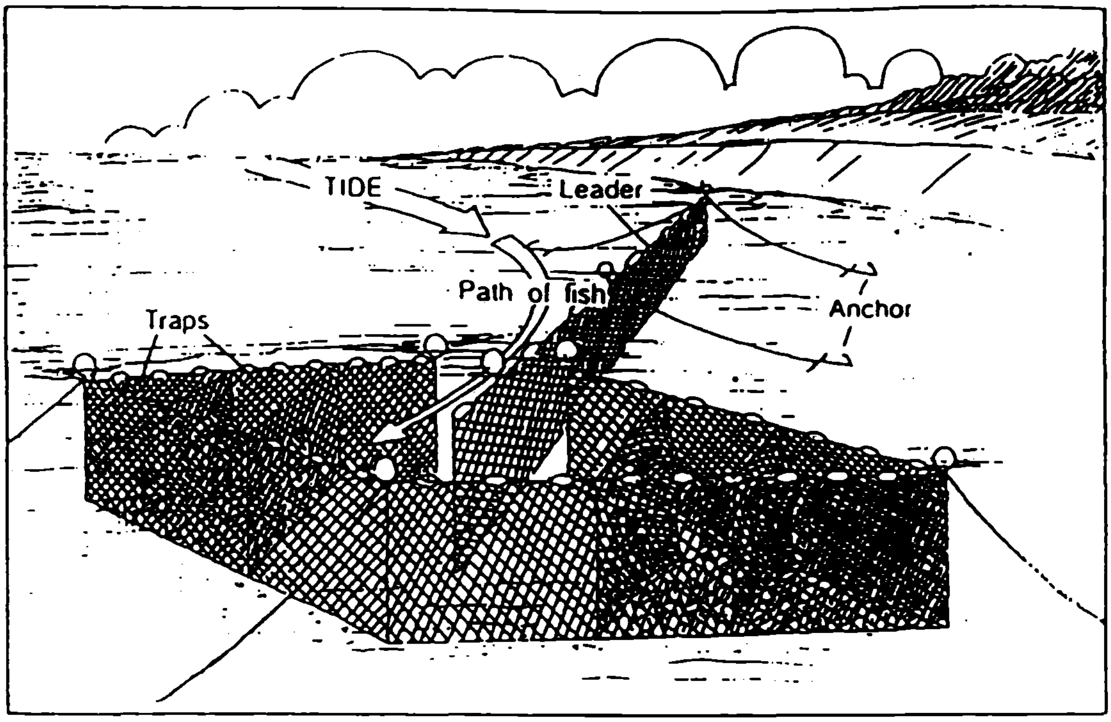


Figure 9: Fyke Net

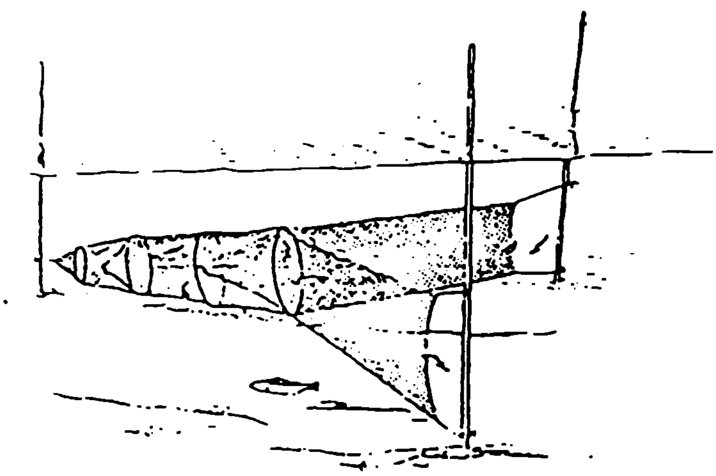


Figure 10: Bottom Long Line

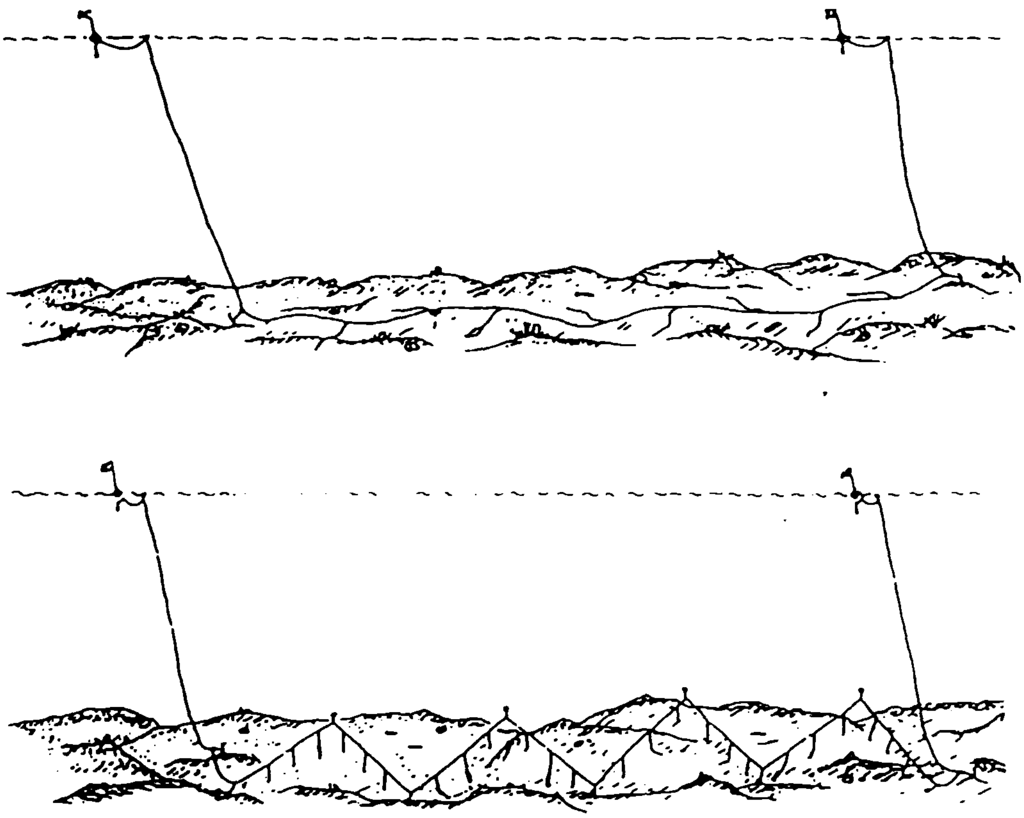


Figure 11: An Example of One of the Many Types of Pots

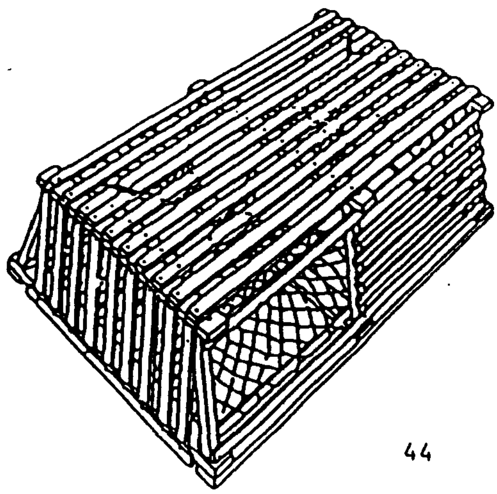


Figure 12: Selectivity (a) of a Gill Net, with a Stretched Mesh Size of 89mm, in Catching Bass from a Population (b) with a Wide Size Distribution, and the Resulting Catches (c) of Retained Fish.

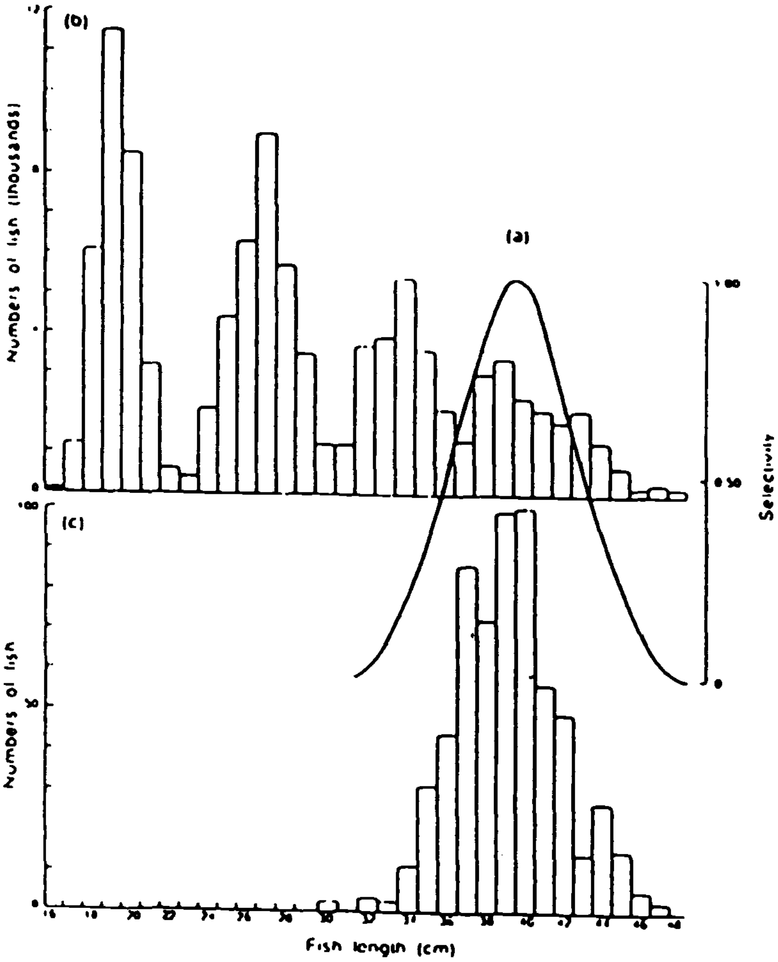


Figure 13: Retention Curves of Sole in Gillnets of Four Different Mesh Sizes.

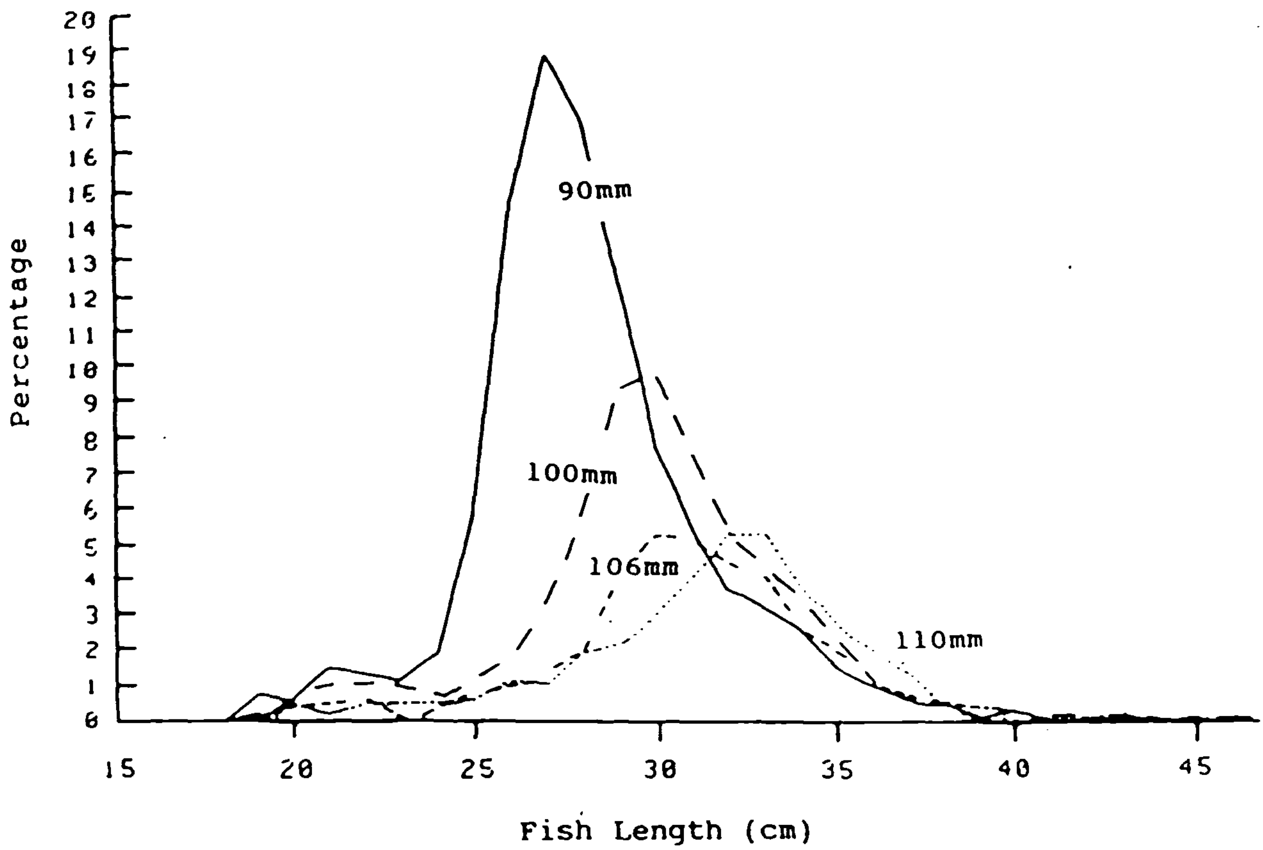


Figure 14: A Gill Net - Showing that small fish can pass through while large fish might bounce off without becoming firmly wedged.

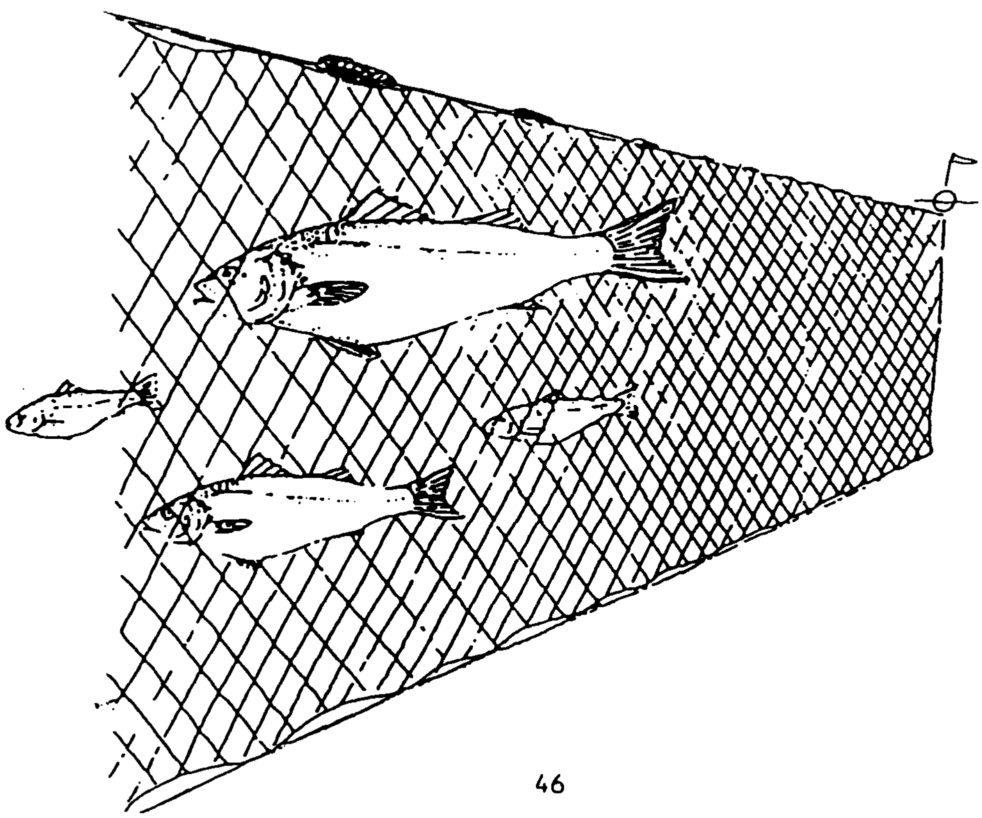
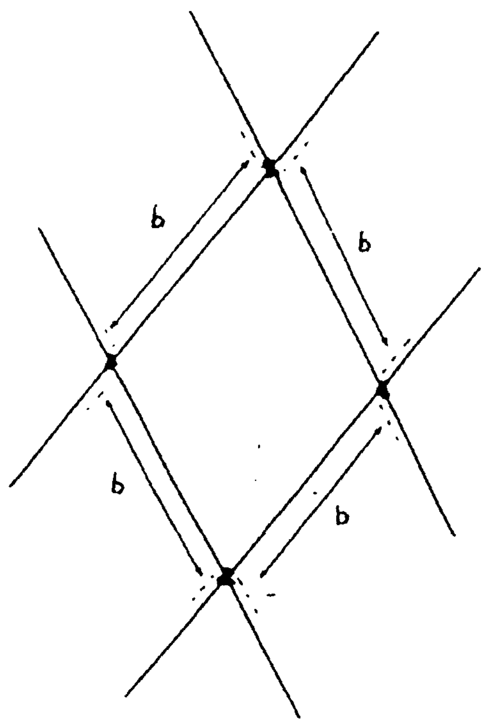


Figure 15: Mesh Size Measurements

b - Bar Length



s - Stretched Mesh