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The use of  
anchored gill and tangle nets  
in the  
sea fisheries of England  
and Wales

R.S. Millner

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The author:

R. S. Millner, B.Sc. Ph.D., is a Higher Scientific Officer in Fish Stock Management Division 1 of the Directorate of Fisheries Research and is based at the Fisheries Laboratory, Lowestoft.

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THE USE OF ANCHORED GILL AND TANGLE NETS IN THE SEA FISHERIES OF ENGLAND AND WALES

by R. S. Millner

1. INTRODUCTION

Fixed or anchored nets have been used as a means of catching fish for centuries and a wide variety of traditional nets have developed to suit local conditions. Although some of these nets are still fished they declined considerably in popularity following the development of efficient trawls and the widespread use of petrol or diesel engined boats. The introduction of synthetic netting materials and the relatively great increase in marine fuel prices in recent years has led to a revival in the use of fixed nets. This has included offshore fisheries but particularly small boats working on inshore fishing grounds which are those within a 24 h return journey of a local port.

There is considerable confusion over the terms used to describe fixed nets. Any net which is held stationary rather than being towed by a boat or allowed to drift in the current can be called a fixed net. Usually such nets are attached to anchors but in shallow water they may be fixed to posts or any other suitable objects driven into the sea bed. Gill and tangle nets are the two most widely used fixed nets in coastal waters around England and Wales and in this leaflet, for convenience, the term fixed net will refer to these gears only.

Both gill and tangle nets are classified as enmeshing gear which indicates that the fish are captured as they try to move through the netting rather than being enclosed and contained by the walls of the net as in the trawl. The main difference between the two types is in the way in which fish are caught. In gill nets most fish become wedged within a single mesh of the net whereas in tangle nets (which include trammels) fish are caught by becoming entangled in several of the loose meshes of the net.

A major advantage of gill and tangle nets over trawls is that they can be worked from smaller and less powerful vessels. It has been estimated that the offshore gill netters operating on wrecks in the North Sea use approximately 30-40% less fuel than the same boats trawling. As the price of fuel continues to increase faster than the sale price of fish, any fishing method which reduces fuel requirements will be at a competitive advantage. A second factor which has increased the popularity of fixed nets is the ability to use them on rough grounds where it had previously been impossible to fish with conventional trawls. This has led to the development of an important fishery around wrecks in the North Sea and to an expanding fishery on wrecks and rough ground in other areas.

Gill and tangle nets have proved effective at catching a wide variety of species and, because the nets are selective of the size range of fish caught, few undersize fish are taken by commercial netmen. In some areas where either bait is expensive or the labour to bait the hooks is no longer available, fixed nets have been tried instead of longlines. Similarly, in

many areas where potting for crabs has been declining steadily, fixed nets have offered either an alternative or supplementary means of fishing.

Fixed nets have also been widely adopted by part-time fishermen. The nets are popular because they are relatively cheap and easy to use and can be stored for long periods without rotting. The use of fixed nets by both full- and part-time fishermen has increased so rapidly that it has led to calls for licensing or the banning of nets in some areas where fish stocks are thought to be overfished.

The terms full-time, commercial and professional are here used to describe fishermen whose main income is derived from fishing; part-time describes fishermen who are not totally dependent on fishing for a livelihood even though many of them may fish regularly throughout the year.

This leaflet in the main describes only general features of the construction and operation of fixed nets, details of which have been published elsewhere (see Section 7 of this leaflet); its primary purpose is to examine the relation of fixed net fisheries to other fisheries, particularly in the context of stock conservation and fisheries management.

## 2. DESCRIPTION AND OPERATION OF FIXED GILL AND TANGLE NETS

There is wide variation in the design and rigging of gill and tangle nets in use around the coast, and details of some of these are mentioned in the section on regional fisheries. The basic features of typical gill and tangle nets are described below.

### 2.1 Gill nets

The net consists of a single wall of netting weighted at the bottom and supported at the top by floats attached to a headline so that it hangs vertically (at slack water) in the water column. Figure 1 shows a typical rig for bottom fishing. Most bottom set gill nets use a braided synthetic

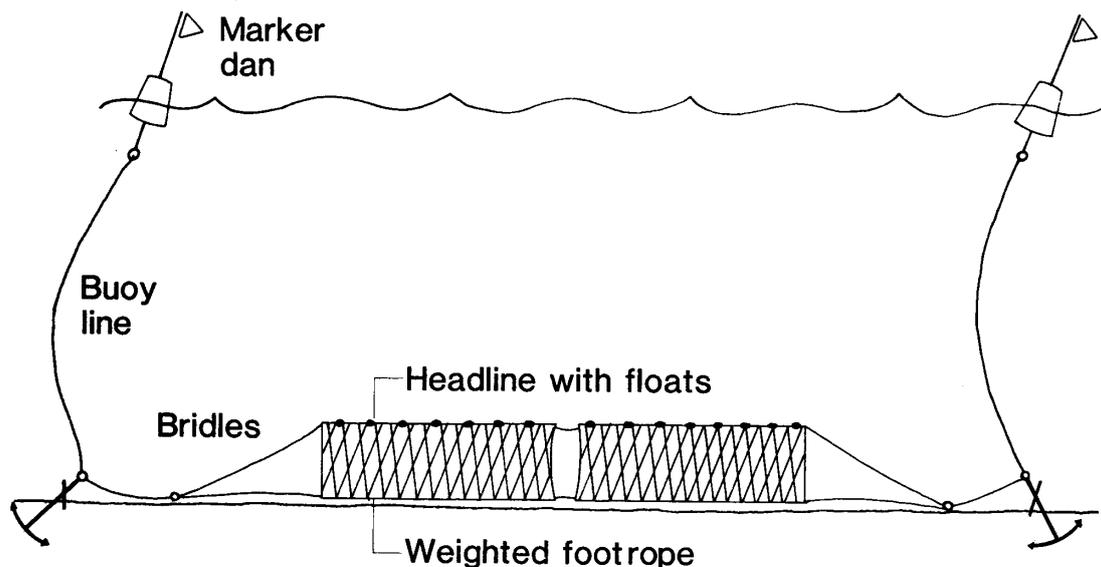


Figure 1. A typical rig used in fishing with anchored gill or tangle nets.

rope headline with floats attached every 1-3 m apart. The greater the buoyancy on the headline the more stiffly the net will hang in the water. Braided rope is preferred to a twisted netting rope because it does not cause the net to become wound around it during fishing. When the weight of the catch is expected to be particularly heavy, a double braided rope is used.

The footrope is weighted by individual lead weights or (in wreck fishing) by steel rings, or by a continuous leadline consisting of lead pieces threaded onto a fine twine and held within a continuous braided sheath; a light or medium leadline containing, respectively, 3.5 or 7.3 kg/100 m is usually sufficient.

## 2.2 Tangle nets

**Single-walled nets:** In areas where single walled tangle nets are in use, as in fisheries for rays, the nets closely resemble gill nets in their design. The main difference is in the greater amount of slack netting set onto the headline which results in a more loosely hung net. The single walled tangle nets are most effective against fish with spines such as crawfish and rays.

**Three walled nets:** A more efficient tangle net for general use against a wide variety of fish is the trammel net (Figure 2). This consists of three walls of netting in which a fine-meshed inner net is sandwiched between two outer walls of large-meshed netting. The three sheets of netting are attached to a floated headline and weighted footrope so that all three hang vertically in the water. Slack netting is ensured both by setting the net loosely on the head and foot ropes and also by having the depth of the inner net nearly twice the depth of the two outer walls. In this way there is always sufficient slack net in which fish can become entangled.

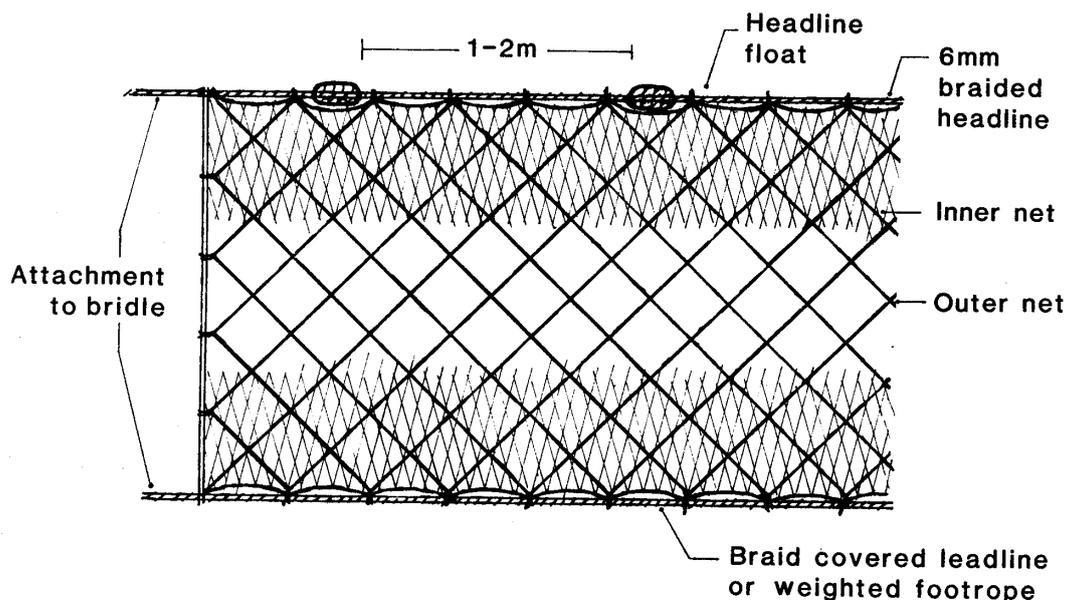


Figure 2. A section of trammel net showing the inner and facing outer net.

### 2.3 Rigging of gill and tangle nets

The behaviour of fixed nets is determined by the way in which the net has been rigged, since this influences the shape of the meshes in the water. When fully stretched each mesh in a sheet of netting becomes completely closed and the distance between one pair of opposite knots is at its greatest while the other pair are touching. If an appropriate force is used to fully extend the mesh lengthways, the distance between inside edges of opposite knots is taken as a measure of the size of the mesh. The shape of the mesh aperture can be altered to suit a particular fishery by the way it is mounted on the head rope and foot rope. The meshes are open widest when the ratio of the length of headrope to the length of the fully extended netting attached to it is approximately two-thirds. The total area of net is also at its maximum in this position. The ratio is termed the hanging ratio or hanging coefficient, denoted by the letter E, and is usually expressed as a fraction or as a percentage of the length of headline over the length of stretched netting. Gill nets are usually set along the headline with a hanging coefficient of two-thirds ( $E = .67$  or 67%) to obtain the benefits of both a wide mesh aperture and large net area. Trammel nets require more slack in the netting in order to tangle effectively and these nets are usually rigged with a hanging coefficient of about a half ( $E = .5$ ), for the inner net. In some single-walled tangle nets E may be as low as 0.3. Numerous variations on these settings are possible to suit specific fisheries or the preferences of the individual fishermen. In addition to varying the hanging coefficient on the headline, trammel nets can increase the amount of slack in the net by altering the depth of the inner net in relation to the depth of the outer walls.

### 2.4 Method of fishing

The procedure used when fishing fixed nets is similar whether gill or tangle nets are being used. The nets are usually fished in groups or fleets and the end of each fleet is attached by bridles to a heavy weight or anchor on the sea bed (Figure 1). Each weight is secured to a marker dan on the surface by a length of rope equal to about 1.5-2 times the depth of water. Occasionally a length of wood known as the 'bat' is placed between the bridles where they join the net in order to hold the net open. However, the length of net affected by the 'bat' is very small and it is rarely used by professional netsmen.

The nets are shot while steaming slowly into the tide and are usually fished along the direction of the tide rather than across it. This reduces the risk of the nets being swept over or tangled in strong tidal currents. The dan is first lowered over the side followed by the weight which will anchor the net to the bottom. The weighted groundrope is then paid over the side while the headline is pulled out automatically by the sinking net. When the full length of the net has run out, the second weight is released followed by the final dan. The nets are usually left to fish for between 24 and 48 h but occasionally nets may be retrieved after a single 6 h tidal period or less. The time period depends on the species fished. Roundfish such as cod and whiting begin to deteriorate quickly after being meshed and it is therefore inadvisable to leave nets for more than 24 h when these species form the bulk of the catch. Flatfish are less affected and even after 48 h most flatfish are alive when the nets are hauled.

Hauling the net by hand is still carried out on many of the small inshore boats but most professional netsmen use a net hauler. Various types of hauler are available but a basic design consists of a rotating

drum with rubber surface driven by an hydraulic system which is run off the main engine. The friction between the net and the drum takes the strain of the net, thus allowing one crew member to haul the net in with relative ease even in strong currents (Figure 3). Two or more men are usually involved in hauling and clearing the nets, although recently automatic hauling systems have been developed. One man operates the net hauler and throws entangled crabs to one side as he pulls the net over the drum.

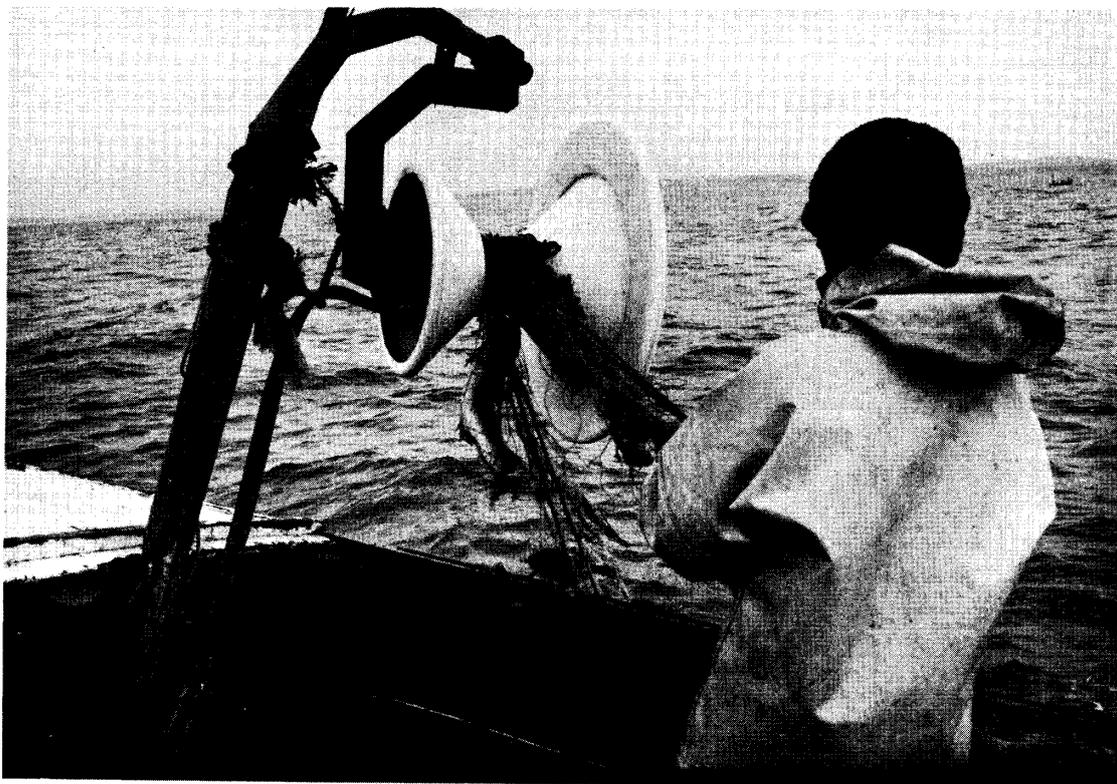


Figure 3. A fleet of trammel nets being hauled.

Other crew remove as many crabs and fish as possible while the nets are being hauled. When there are too many fish to clear as the net is hauled, the net is bundled to one side and cleared later. Figure 4 shows a haul of cod waiting to be cleared. In some boats the net is spread over a metal or wooden bar and cleared before being stowed in a pile ready for shooting again.

All of the weed and other debris as well as any animals entangled in the nets must be removed otherwise the net tends to tangle as it is being shot and fishing is consequently impaired. The amount of unattached weed present in the water is one of the factors limiting the use of fixed nets in coastal waters. Another is the presence of crabs, particularly the many commercially unusable species, caught in the nets. In their attempts to escape from the net, the crabs cause extensive damage to the fine nylon meshes. They also increase the time taken to clean each net and can reduce the amount of net which can effectively be hauled, cleaned and shot each day. Edible crabs are so firmly entangled that they are only freed whole when an exceptionally large animal is caught. Smaller animals are removed by breaking their limbs off. Only the claws are retained, the rest of the body and legs being discarded.

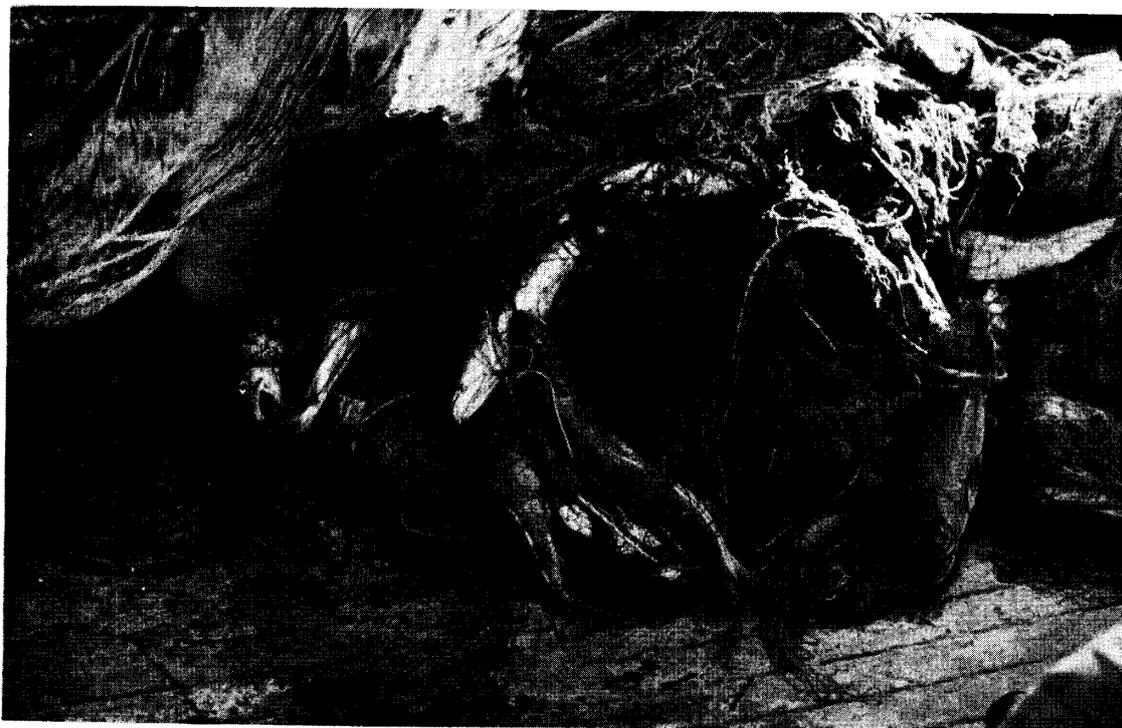


Figure 4. A haul of cod waiting to be cleared.

### 3. MODE OF ACTION AND SELECTIVITY OF GILL AND TANGLE NETS

#### 3.1 How they catch fish

In a gill net most fish are caught when they become held within a single mesh of the net. Figure 5a and b shows the two main positions in which fish become wedged. Wedging occurs when the opening of the mesh is larger than the girth of the fish's head but smaller than the maximum diameter of the body. Fish are held securely when the mesh catches under the gills (Figure 5c), in which position the fish is said to be gilled.

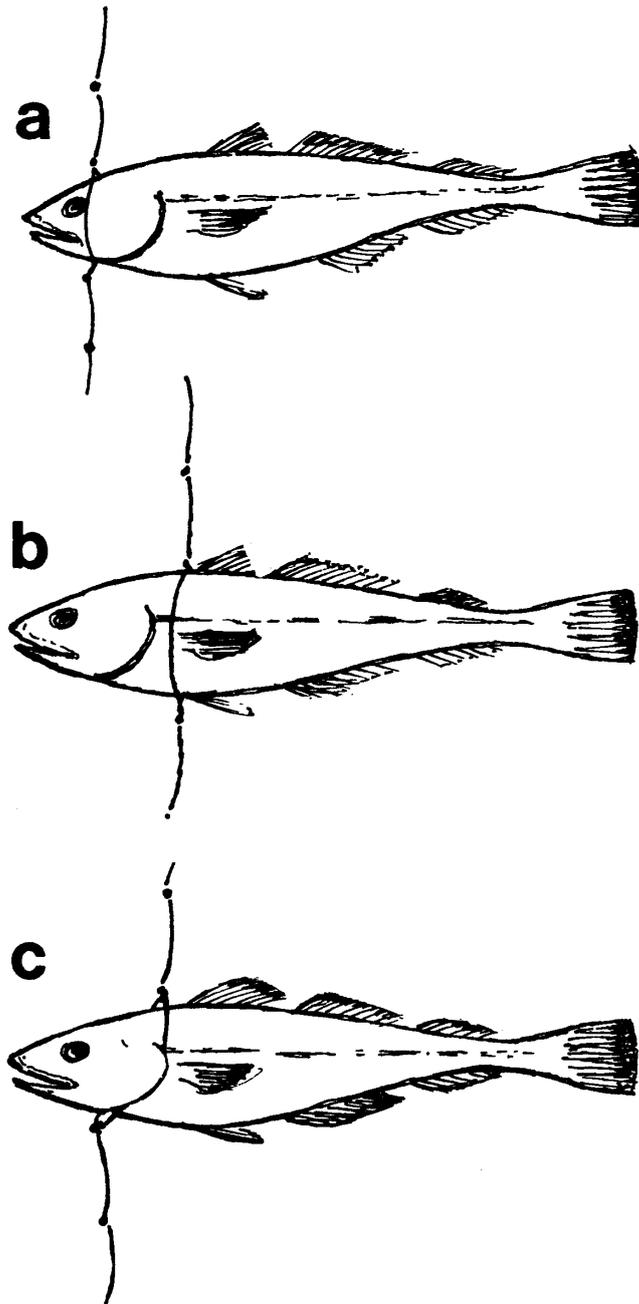


Figure 5. Methods of capture of fish in gill nets: (a) fish wedged around the snout; (b) fish wedged at the maximum girth; (c) fish gilled.

Fish held by the net around the snout often drop out as the net is being hauled. Occasionally some part of the fish snags against the gill net material and the fish is caught by tangling. Whiting, for instance, are often caught in gill nets by becoming tangled around the mouth.

In single-walled tangle nets the meshes are deliberately rigged loosely so that fish can become ensnared in several meshes. Trammel nets work mainly by holding fish within a pocket of netting formed by the forward movement of the fish hitting the loose, small-meshed, inner net

and pushing it through a mesh of the large-meshed, outer net (Figure 6). Fish that are too large to become pocketed can still be caught by entangling.

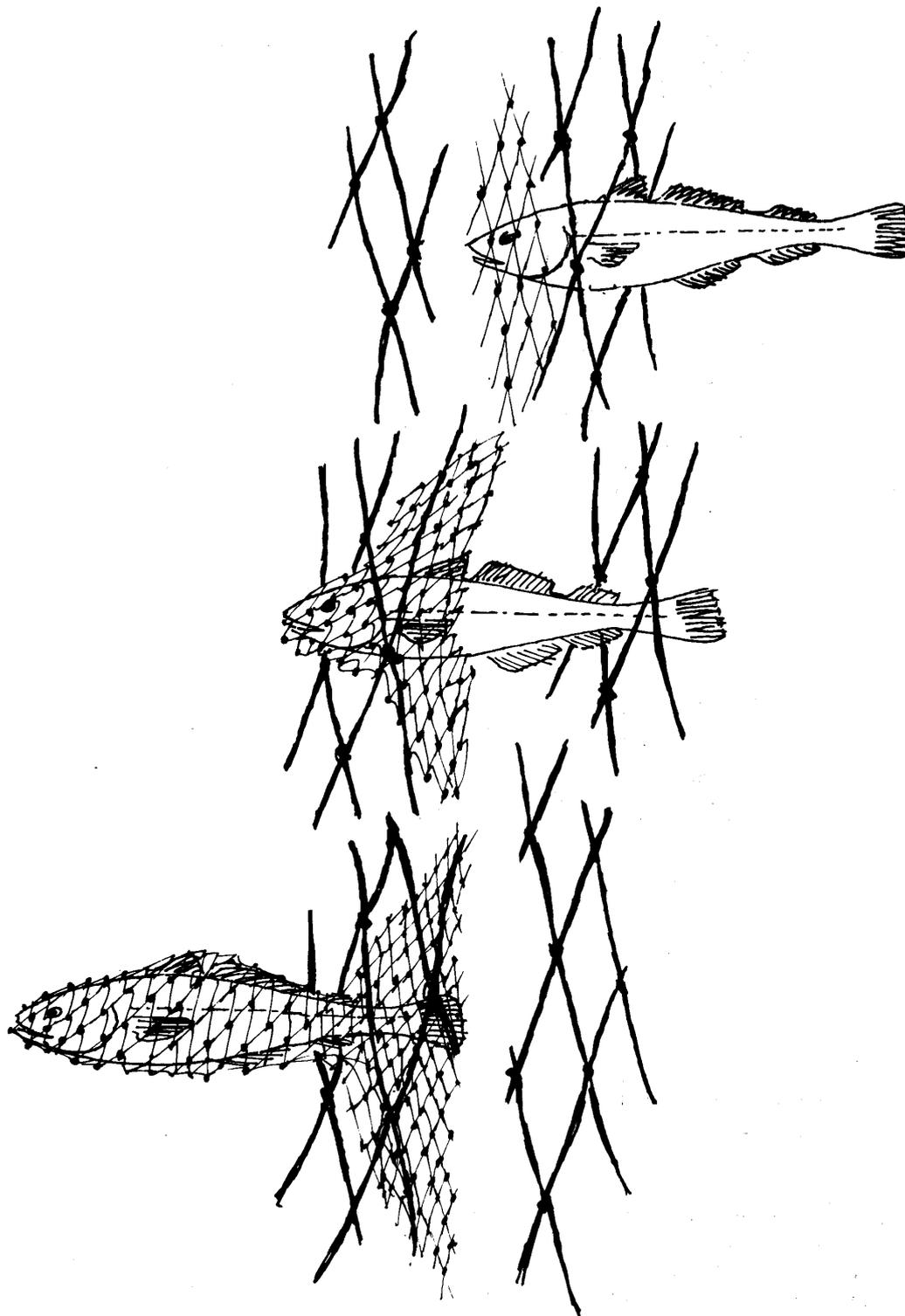


Figure 6. Method of capture of fish in a trammel net. A pocket formed by the small meshed net is pushed through a mesh of the outer net.

### 3.2 Selectivity

The population of any fish species on a fishing ground is made up of individuals which differ in a number of characteristics such as age, length, sex and behaviour. If this population is sampled using a trawl or gill net some of the fish will be caught more efficiently than others. As a result, the catch will not be a representative sample of the population. This process is termed gear selection and selectivity is the quantitative measure of the amount of selection taking place.

In trawl selection, a proportion of the small fish which enter the net escape through the meshes of the cod-end but all fish above a certain minimum size are retained in the net and so caught. This differs from the selection in gill nets where both the large and the small fish escape and only fish within a narrow size range are retained. Within the size range that are caught, one length group will be sampled most efficiently. As the length of fish increases or decreases away from that optimum length fewer are caught. As a general rule, fish that differ from the optimum length by 20% or more are likely to escape. Selection in a tangle net is slightly different from that in a gill net.

Figure 7 gives length frequency distributions for the catch taken in a gill net and in a tangle net. The bell-shaped gill net curve is typical of catches of smooth bodied fish which are held by gilling or wedging. The proportion of fish caught either side of the optimum length falls abruptly and only a few fish are taken which are greater than 20% of the optimum length. In the tangle net the length range of fish taken is wider than in the gill net and although the basic bell-shape of the length distribution is present both arms of the curve are flatter. On the right-hand side the curve extends along the length axis for a considerable distance, indicating that large fish are probably entangled in several different ways.

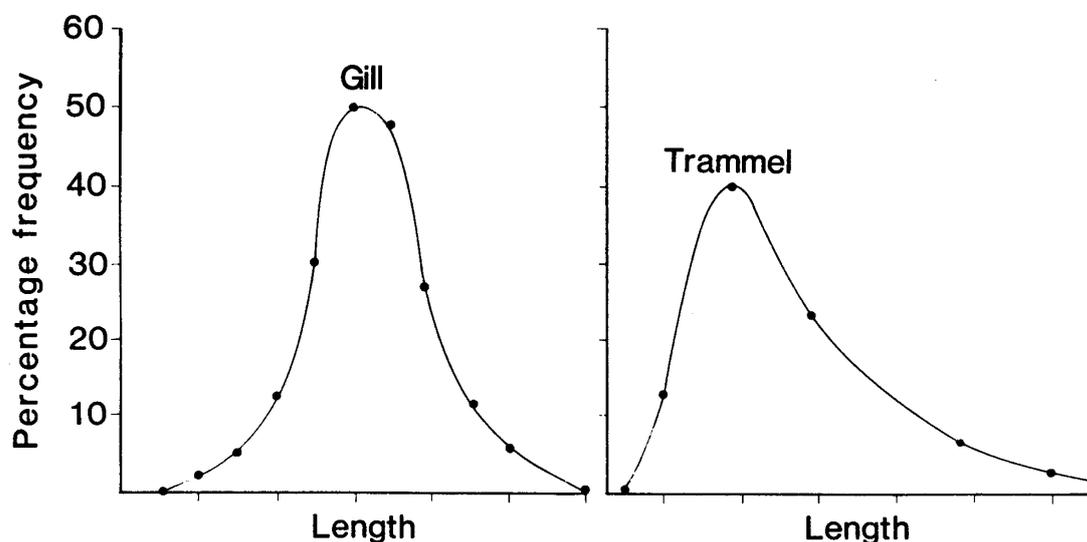


Figure 7. Typical length frequency distributions for a fish such as cod caught in gill or trammel nets.

Length frequency curves can be used to obtain estimates of net selectivity provided that a range of nets are fished together or that some information is available on the fish population in the area. Such information can be obtained by studying the catches from relatively unselective gear such as purse seines or trawls fitted with a fine-meshed liner.

Once the selectivity of a particular series of gill or tangle nets has been established, it can be used in fishery management; for instance, the discarding of damaged undersize fish can be avoided by choosing a mesh size which takes few fish below the minimum landing size.

### 3.3 Factors affecting the catch and selectivity

#### 3.3.1 Netting material

The nature of the netting material has an important effect on the efficiency of both gill and tangle nets. Around the coast of England and Wales most gill and tangle nets are made up of synthetic monofilament or multifilament twines. The main characteristics of each are given below:

**Monofilament:** Each strand consists of a single monofilament similar to that used by rod and line anglers and varying in thickness from 0.20 mm in light bass and mullet nets to about 0.70 mm in heavier cod and dogfish nets. Monofilament is stiffer and less flexible than multifilament yarns and when individual strands break, they leave jagged ends which tend to snag against other meshes of the net, leading to tangling as the net is shot. An important feature of monofilament nets is that they are nearly transparent in water and are therefore less easily avoided by fish when used in clear water.

**Multifilament:** Each strand consists of a number of silk-like filaments spun into individual or single yarns, two or more of which are twisted together to form the required thickness of netting yarn. Fixed net multifilament twine is soft to the touch, more flexible than monofilament and does not stretch as much. It has a shiny, lustrous appearance and is more easily seen by fish: this has led to replacement of multifilament by monofilament in many gill net fisheries.

A slight modification of the usual monofilament gill net yarn is known as multi-mono or monopoly and consists of three, eight or ten strands of thin monofilament twisted together. A monopoly net has the same general characteristics as the monofilament net with the exception that the additional strands give greater strength with some loss of transparency in water.

Trammel nets usually have the inner net made from thin multifilament nylon and the two outer walls of netting made from a thicker multifilament nylon, but less flexible synthetic materials such as polythene twine are also commonly used, for the outer walls.

#### 3.3.2 Mesh size

The mesh size used is the most important factor influencing the selectivity and catch of gill nets although it is less important in tangle nets. The size of mesh varies depending upon the main species being caught. Few commercial fishermen use nets with a stretched mesh size below 83.5 mm although bass and mullet are caught by part-time fishermen in brackish water using nets as small as 63.5mm. Table 1 gives the mesh size of nets commonly in use.

The optimum mesh size is dependent upon the size distribution of fish in the area being fished. If the spread of fish sizes is small, a single mesh size may be sufficient to provide maximum catches. In areas where the size range of fish is broad several mesh sizes need to be fished together.

Table 1. Mesh size of gill and tangle nets used in fisheries around the coast of England and Wales

Stretched mesh size		Net type	Species caught	Areas fished
(mm)	(in)			
63.5- 82.5	2½-3½	Monofilament gill nets	Bass, mullet and sea trout	Shallow inshore and brackish water areas
82.5-127	3½-5	Monofilament gill nets	Bass & mixed by-catch	Inshore & offshore
82.5-102	3½-4	Trammel nets	Soles & mixed by-catch	Widespread inshore & offshore
102 -165	4-6½	Monofilament & multifilament gill nets	Cod, dogfish, hake & mixed by-catch	Widespread inshore & offshore
160 -190	6½-7½	Multifilament & some monofilament gill nets	Cod	Wrecks in North Sea
203 and above	8	Monofilament & multifilament tangle nets	Crawfish, rays and turbot	Cornwall(crawfish); widespread(rays, turbot)

Although the most appropriate larger mesh size is determined by only one factor, the amount of fish taken, the smallest mesh which can be used is restricted by a number of factors such as the number of fish which are caught below a legal minimum size and the time taken to clear each net of fish and weed. Since the length of time needed to clear a net rises steeply as the size of the mesh decreases, the amount of saleable fish caught needs to be high to justify using small meshed nets commercially.

### 3.3.3 Yarn thickness

The diameter of netting yarns used in gill and tangle nets affects their selectivity and catch efficiency. For a given mesh size, thin yarns will generally catch more fish than thick ones because they are less visible in water and give less reflection of the pressure waves caused by an approaching fish which could warn and frighten the fish away. In clear water visibility is the more important factor but at night the reflected pressure waves may help some fish to avoid capture.

Thin yarns also stretch more than thick ones of the same type, allowing a greater size range of fish to be held in each mesh in gill nets and ensnaring fish more readily in tangle nets. The catching efficiency of nets can be improved by using fine diameter yarns or monofilaments. In practice, the reduction in thickness is limited by several factors. One consideration is the breaking strength of the netting yarn which must be sufficient to prevent fish escaping during capture and be able to take the high strains imposed when the gear is hauled. Fine netting yarns are also more easily broken when fish are being cleared from the nets and this reduces their working life.

The use of thin netting yarns may also be limited by the problem of damage to the fish. Thin strands bite more deeply into the body of the captured fish causing internal bleeding and may damage the appearance and hence saleability of the fish.

#### 3.3.4 Tide

Fixed nets do not fish uniformly over the course of the tidal cycle partly because the behaviour of fish varies with the state of the tide and partly because the net itself is affected by the current. At low current speeds, a net which is fished in line with the direction of the current will remain upright, held by the weighted footrope on the sea bed and by the floats along the headline. As the tidal current increases, friction between the moving water layer and the net gives rise to drag forces on the netting. As the drag builds up it, the headline is pulled downwards reducing the height of the net and if the current strength is sufficiently strong, the whole net may be pushed onto the ground during part of the tidal cycle. The current speeds necessary to cause a decrease in net height depends on the material of the net and on the mesh size but speeds as low as one knot can reduce the height of small meshed nets. Any factor which increases the resistance of the net in the water or reduces its buoyancy will aggravate the tidal effect. Thus, in areas where floating weed or other debris is abundant, it may be necessary to lift the nets after only a few hours fishing. Setting nets across the tide aggravates tidal effects.

### 4. IMPACT OF FIXED NETS ON TRADITIONAL FISHERIES

The adoption of new fishing methods can be the cause of friction between individuals who are using the new techniques and those continuing to fish with more traditional methods. This has been particularly noticeable in areas where the use of fixed nets has led to increasing fishing effort on fish stocks which are already heavily exploited.

#### 4.1 Interference between trawlers and netters

When netters and trawlers are working in the same area, there is always the possibility that anchored nets might be inadvertently damaged or towed away by the activity of the trawlers. For this reason netsmen are reluctant to work on well used trawling grounds and concentrate around rough ground where trawlers are unlikely to work. Occasionally a separation of this nature is not possible and under these circumstances the two groups have no alternative but to work together. A particular example of this is the fishery for sole in the eastern English Channel. Here nets were repeatedly subject to loss as a result of boats trawling over the same ground. Consequently a voluntary agreement was reached, limiting the netsmen to specified zones off the coast (Figure 8) and requiring trawlermen to avoid fishing within the area of the fixed net zones. Despite such arrangements as these, net damage continues to occur periodically as trawlers follow the sole inshore, or netsmen move out of the zone in an attempt to obtain better catches.

Similar problems have arisen more recently in the cod fisheries in the North Sea. Danish boats had successfully used gill nets to fish over wrecks and other rough areas not accessible to trawling. However, since they have begun to extend their activities away from wrecks, they have found themselves competing for the same grounds as those used by the

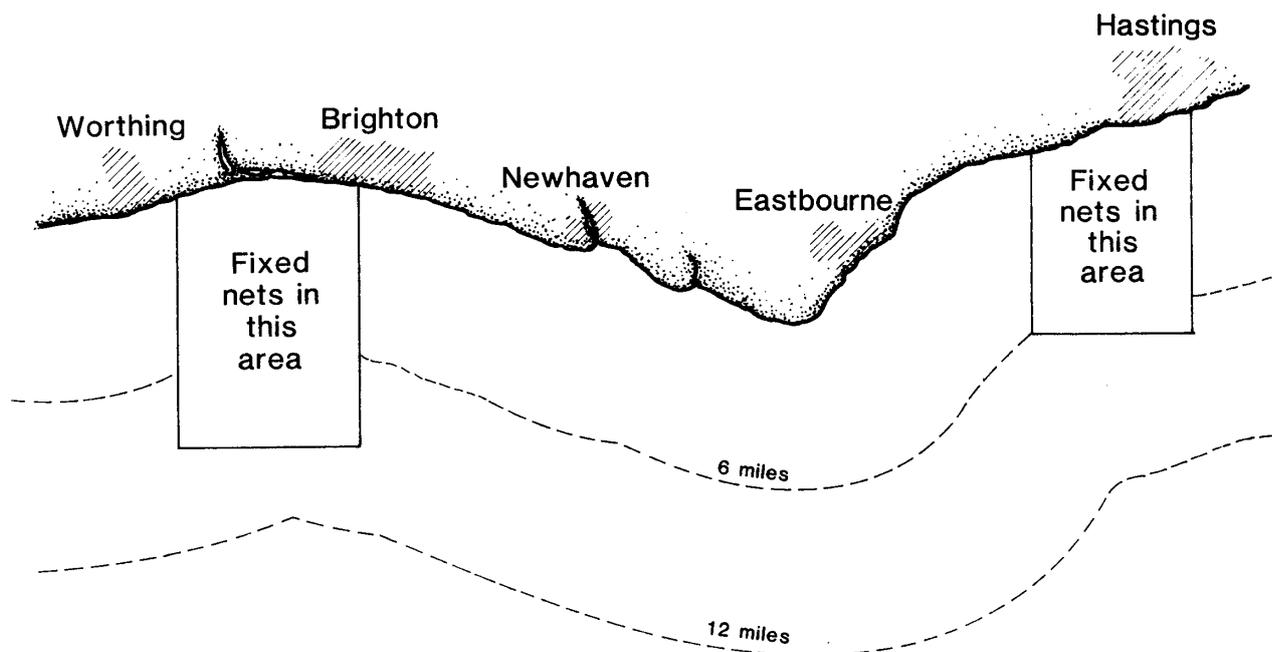


Figure 8. Areas set aside for fixed nets off the Sussex coast.

trawlers. This has brought complaints that trawlers would either have to alter their usual tows or risk towing through the Danish fixed nets.

Such problems are likely to become more frequent as more boats take up netting and as the amount of nets used per boat increases.

#### 4.2 Effects of unlicensed nets on salmon fisheries

In order to conserve salmon stocks, the numbers of all types of nets permitted to take salmon are limited and all netsmen are licensed by the appropriate Regional Water Authority. Most licensed netting for salmonids occurs close inshore, either directly within rivers and estuaries or, as in the north-east of England, in certain defined areas off the coast. By contrast the majority of gill and trammel nets used by commercial fishermen for fish other than salmon are fished in areas where there is sufficient fish to provide an economic return: there is no evidence that migratory salmon or sea trout are taken in these nets.

A problem does arise, however, when small-meshed gill and trammel nets are fished close inshore. Most of these nets are worked by part-time or casual fishermen and surveys carried out along the Welsh and Cornish coasts suggest that, during the summer when salmon and sea trout are moving along the coast and into estuaries, the nets are aimed primarily at these fish. For instance, many of the nets examined in the surveys were being fished at right angles to the beach in order to increase the likelihood of trapping migrating fish, whereas nets aimed at non-migrating species are usually fished parallel to the coast in the direction of the prevailing tidal currents. Similarly, netting activity was found to increase during periods when salmon were most abundant, and when these catches were examined the proportion of saleable fish other than salmonids in them was low.

The illegal netting of salmon on the Welsh and Cornish coasts is of concern to the Water Authorities because it increases the total fishing effort on salmon stocks at a time when stocks are already under considerable pressure.

#### 4.3 Impact of fixed nets on angling

Fishing as a leisure activity rather than primarily as a means of earning a living has increased rapidly in the last twenty years. A national angling survey reported that in 1980 there were 3.4 million anglers who fished at some time throughout the year and at least 53% of these had been sea fishing.

Sport anglers and commercial fishermen usually fish different grounds so that there has been little interference between them in the past. However, the increase in the use of fixed nets has coincided with a rapid expansion in charter boat angling offshore and this has led to competition between the two groups for the use of some restricted grounds such as the areas around wrecks and other underwater obstructions. These sites had not previously been accessible to commercial fishing methods and many wrecks were fished exclusively by anglers. Recent developments in wreck fishing techniques have allowed commercial netmen to lay nets around and over wrecks. Declining catches by anglers on offshore wrecks are often attributed to the activities of the netmen and in some cases the presence of nets around offshore marks has made them inaccessible to visiting angling parties.

A second area where anglers and commercial fishermen have come into competition is in the fishery for bass which are regarded as second only to cod in their importance to anglers. Within the last five years, the market value of bass has risen dramatically to make it comparable in price to such expensive fish as turbot, sole and salmon. As a result the commercial effort on bass has intensified and monofilament gill nets have been used increasingly to take both mature bass offshore and small immature fish in shallow estuaries and bays. Anglers have become concerned at the heavy exploitation of bass. Although monofilament gill nets take less than 40% of the reported catch of bass, their effectiveness and the fact that they can be fished in areas previously used exclusively by anglers has singled them out for particular emphasis and has resulted in repeated calls within the angling press for a ban on the use of gill nets.

The bass fishery probably represents an extreme example of the impact on anglers of fixed nets, but other fisheries are likely to be involved as the number of anglers and fishermen competing for a limited resource continues to increase.

#### 4.4 Lost nets and 'ghost fishing'

In all types of fishing activity there is the possibility that gear may become snagged on some seabed obstruction and lost. When this happens with gill or tangle nets, problems could arise if the nets continue to catch fish. The term 'ghost fishing' is sometimes used to describe nets which behave in this fashion. The length of time that they continue to fish depends on a variety of factors such as the current speed, amount of weed in the water, the weight of fish already caught in the net and the presence of crabs.

In areas where the amount of loose weed in the water is high, the nets rapidly become fouled with floating weed and debris. In this condition they cease to fish properly and begin to sink to the bottom. Nets which have torn free of one anchor soon become wrapped in a tight ball round the remaining anchorage point: the condition of a multifilament gill net retrieved after 72 hours attached to a single anchor is shown in Figure 9. When both ends remain anchored, as might happen if the nets are abandoned in rough weather or if the floats marking the position of the nets are lost, the nets may remain untangled for a time but clogging weed will cause them to stop fishing and to sink to the bottom where they pose no threat to fish in the area.



Figure 9. A badly tangled trammel net after several days in the sea with only one anchor in place.

In areas relatively free of floating weed the nets will continue to fish at a low level of efficiency until the build up of fish and crabs forces them onto the sea bed. Diver observations in shallow water (less than 15 m) off the coast of Devon have shown how the collapse occurs. As fish are caught, crabs are attracted to the nets where they cause extensive tangling and eventually result in the headline sinking towards the sea bed. Once on the bottom, multifilament nets remained tangled but the monofilament nets may shake clear of fish and return to an upright position. A similar cycle of declining efficiency has been found for nets fished in water depths of 300-350 m off the Newfoundland coast of Canada. Once again the presence of crabs was a major factor leading to the collapse of nets, but where they were present in small numbers, nets appeared to fish at a low efficiency for up to two years.

In the long term, nets left unattended in shallow or deep water will gradually build up an encrusting layer of marine organisms which will make them highly visible to fish. Around the coast of England and Wales, the presence of strong tidal currents, floating weed and the abundance of crabs means that lost nets may be a temporary nuisance but pose no threat to fish stocks.

#### 4.5 Mesh size regulations

In sharp contrast to the national and local mesh size regulations controlling trawls, there are few restrictions governing the mesh size of fixed nets. Off the coast of South Wales, on the Severn estuary as far west as Cardiff, nets with a mesh size of less than 100 mm are prohibited, while further west and along the Irish Sea coast, between Cardiff and Haverigg Point in Cumberland, set and stake nets are restricted to meshes of 89 mm or larger unless used for some particular species such as herring or mackerel. A third area where local restrictions have been introduced is around the Manacles and Runnelstone reefs off the coast of Cornwall. Here the imposition of a 250 mm mesh size regulation is designed principally to prohibit netting for bass and thus give protection to an important angling fishery for that species.

The absence of national legislation does not mean that fixed nets are free to take large quantities of small fish, since the more important commercial species are protected by restrictions on the minimum size which can be retained. Problems may arise where small meshed nets are regularly used in estuaries and other fish nursery areas. Here, large quantities of juvenile fish may be caught and most will die after being released. In such areas some form of mesh size regulation may help to protect the young fish.

#### 5. REGIONAL FISHERIES

The total landings in England and Wales of demersal fish caught by gill and tangle nets in 1982 was 5.3 thousand tonnes worth approximately £3.6 million. Figure 10 shows how gill and tangle net landings have compared with those by all other types of gear over the past 10 years. Although the proportion of the landings coming from gill and tangle nets has increased substantially since 1973 it still represents less than 5% of the total weight and value of demersal fish landed in England and Wales by all vessels. However, this low figure underestimates the importance of gill and tangle nets to the smaller inshore boats, many of which depend on fixed nets for their living at some time of the year. If just the landings of vessels less than 40 feet in length are considered, then gill and tangle nets contribute nearly a third of their total catch by weight.

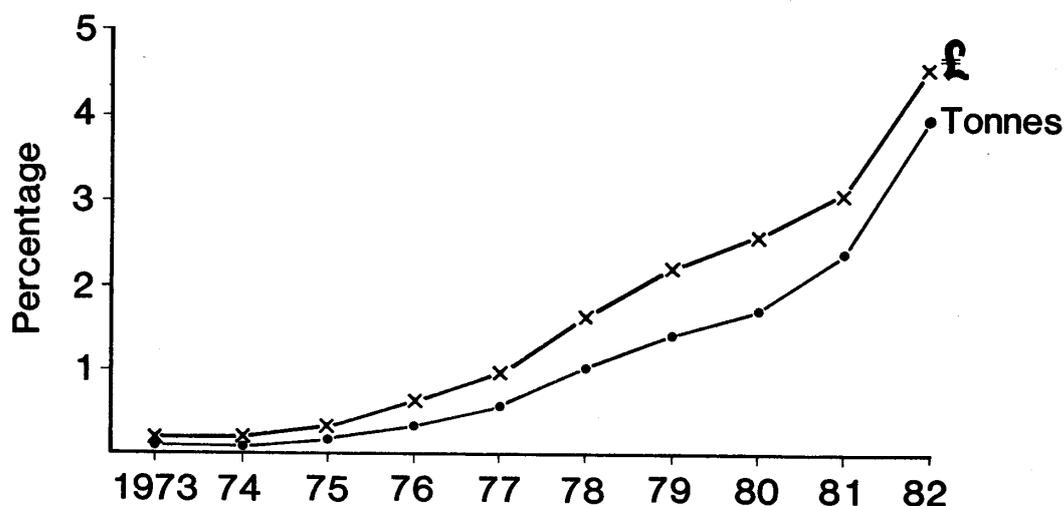


Figure 10. Landings by gill and tangle net as a proportion of the total demersal landings in England and Wales.

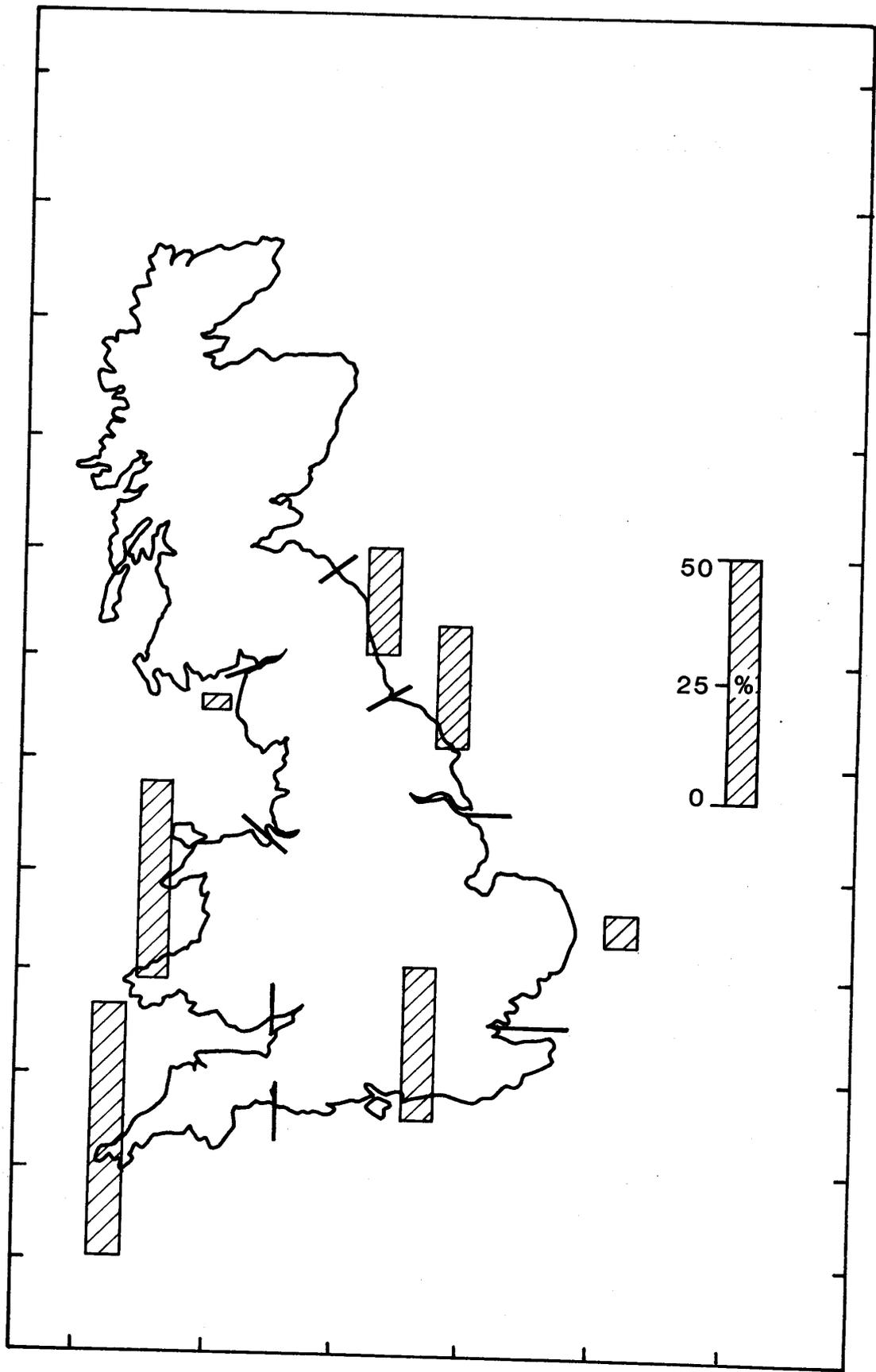


Figure 11. Gill and tangle net landings by vessels less than 40 feet in length in each coastal district. The weight of fish landed by gill and tangle nets is shown as a proportion of the demersal catch by all types of gear combined.

Figure 11 shows how the proportion of the catch taken by gill and tangle nets from under 40 foot boats varies in seven coastal districts. Along the English Channel coast, fixed net catches amount to between 38 and 50% by weight of the fish landed. Elsewhere the proportion is over 20%, except on the east coast between the Humber and Thames and along the Lancashire and Cumbrian coasts where it falls as low as 5%. The weight and value of the landings by small vessels, in each of the seven districts in 1982, is given in Table 2.

Table 2. Gill and tangle net landings of demersal fish by under 40 foot vessels in 1982

	Tonnes	£
Berwick-Tees Bay	152	96 000
Tees Bay-Humber	527	308 000
Humber-Wash	4	2 000
Wash-Thames	84	80 000
Thames-Lyme Bay	631	720 000
Lyme Bay-Bristol Channel	2353	1346 000
Wales	114	47 000
Liverpool Bay-Solway Firth	15	11 000
<b>Total all areas</b>	<b>3879</b>	<b>2610 000</b>

The relative importance of the species caught in gill and tangle nets varies around the coast and this is illustrated in Figure 12. Each block represents the total value of fish landed in the district, within each block the importance of various species is indicated by the size of their segments. Between Berwick and the Humber cod is the single most important fish landed, contributing over 90% of the catch. In the Thames and the eastern English Channel, cod are still caught in the winter but fish with a high first sale value, such as sole and bass, become more important and are specific targets for netsmen during the summer. In the western English Channel, from Lyme Bay round to the Bristol Channel, where over half the total small boat landings by gill and tangle net are made, a wide variety of species are landed. In this area the fishery for dogfish has developed rapidly over the last three years, as also have wreck net fisheries for species such as pollack and ling. Along the Irish Sea coast bass and flounder are the mainstay of the fishery with cod, rays, and mullet also being taken.

The range of species caught around the coast is an indication of the number of different gill and tangle net fisheries taking place. In each district there are local variations in the gear used or in the way the nets are fished. It is not possible to give details of them all here, but some of the main fisheries are described below. Districts in which the fisheries are broadly similar have been combined; thus, on the east coast the area from Berwick to the Humber has been treated as one district and from the Humber to the Thames as another, although the wreck-net fishery out of Grimsby has been described separately.

### 5.1 The north-east coast (Berwick to the Humber)

The use of anchored gill and trammel nets is a recent development along the north-east coast of England. Before the winter of 1976 few nets were

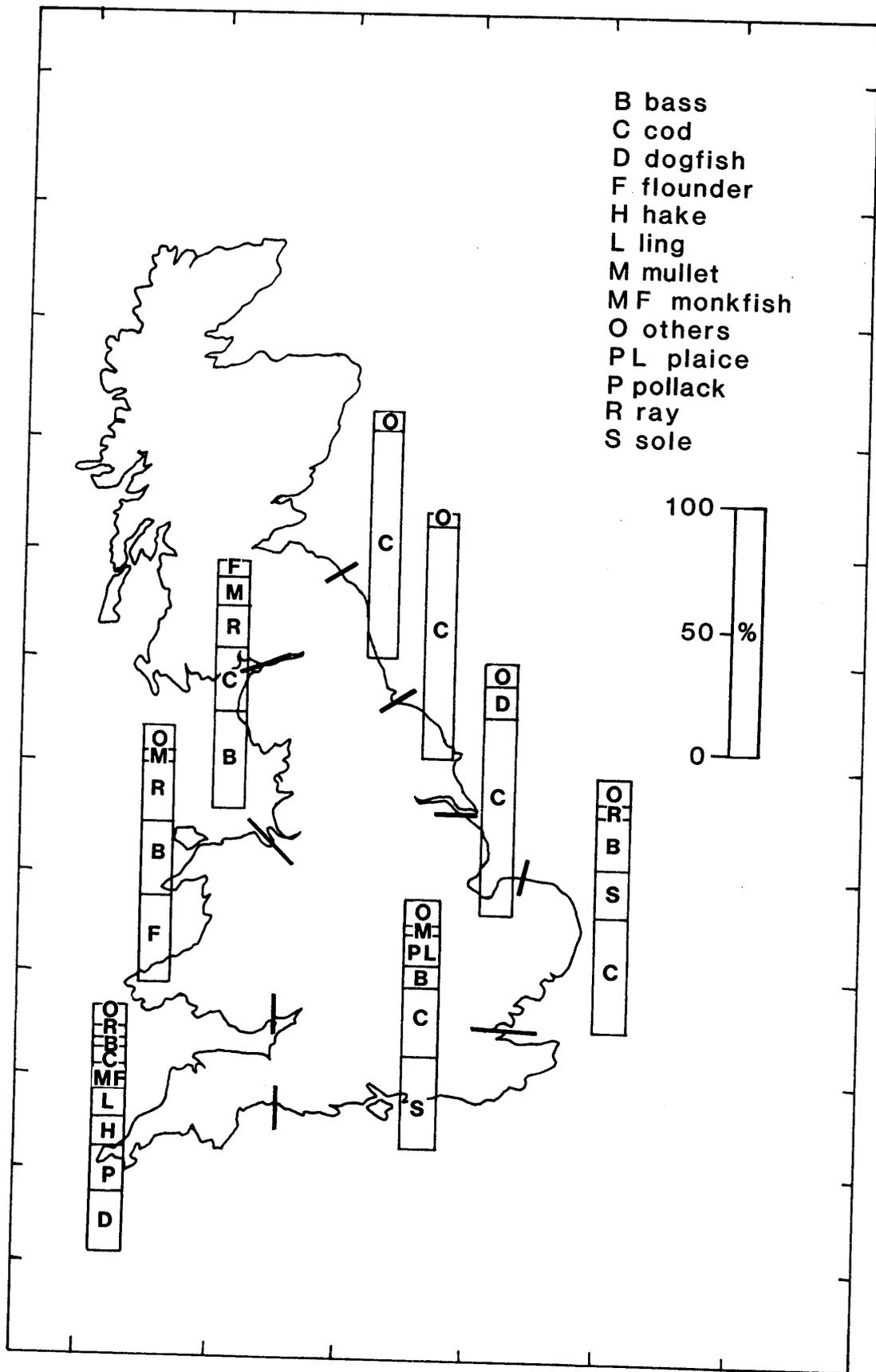


Figure 12. Value of the landings of each species as a percentage of the total value of gill and tangle net catch in each district.

in use and most of the inshore fleet fished with longlines, crab pots or trawls. However, for those who were working nets, the winter season of 1977 was extremely successful and on the strength of this many fishermen invested in fixed nets. Over the next few years, as the fishery fluctuated, the number of fishermen using fixed nets increased more slowly but by 1980 fixed nets were being used by either full-time or part-time fishermen at most ports between Berwick and the Humber.

Although there is some local variation in the specifications of nets used, most gear is standardised in design. Trammel nets commonly have the inner net with a mesh size of 102-114 mm although smaller mesh nets (down to 89 mm) are used by casual fishermen. The inner net is made of fine multifilament nylon, usually 30 meshes deep and set with a hanging coefficient of 0.5 or 0.6. The outer walls of the net have mesh sizes of either 432 or 610 mm and are made of nylon or polythene. The gill nets used to take mainly cod are also made from multifilament synthetic twine with a mesh size of from 127-152 mm. They are usually set with a hanging coefficient of 0.67 and can be either 30 or 50 meshes deep. Both gill and trammel nets are rigged to fish approximately 100 m long and are set in fleets of up to 6 nets. The nets are usually left to fish overnight before clearing and shooting again.

In addition to the recent fixed net fishery for cod and other species, there is a traditional fishery for salmon and sea trout using both fixed and drifted gill nets and fixed trap nets. Unlike the unrestricted fishery for cod, the number of salmon nets, period of operation and specifications of rigging are limited by a licensing system operated by the Northumbrian and Yorkshire Water Authorities.

The main gill and trammel net fishery is from November to May. Codling form the largest part of the catch early in the season, supplemented later by ling, pollack and saithe and towards the end of the season by turbot. During the period 26 March to 31 August, licensed netsmen can also take salmon.

## 5.2 Grimsby wreck-net fishery

The development of small precision sonar equipment capable of indicating the position, shape and orientation of seabed obstructions has led to a rapid expansion of a fishery using gill nets laid around and on top of wrecks in the North Sea. Wreck netting carries on throughout the year with cod being the main species caught.

A description of wreck-net gear and its use has been given in field reports of the Sea Fish Industry Authority (e.g. Nos 304, 324 and 332). The net consists of a single sheet of thin multifilament or occasionally monofilament nylon; it is 19 meshes deep, about 1000 meshes long and is attached to a 53 m long headrope consisting of two 6 mm braided nylon ropes with floats at 1 m intervals. The bottom of the net is attached to a single footrope which is less robust than the headline. If the net snags, when strain is put on the net during hauling the footrope will part allowing the rest of the net to be retrieved. For the same reason galvanised steel rings 22 cm in diameter are used instead of a headline to weight the net: the rings are whipped on at approximately 1 m intervals using a natural fibre twine which will allow the net to be pulled free if a ring becomes trapped. It has the additional advantage that if the net is abandoned the twine will rot in time, allowing the net to drift clear of the wreck. Another adaptation to wreck fishing is to leave each end of the

panel of net bare with no strengthening selvage so that the net can be torn free if caught on the wreck. In some rigs a float is placed on the dan rope about 2 m above the anchor with another about 4 m along the bridle at the end of the fleet of nets. Both floats help prevent the ropes becoming entangled on the wreck. Unlike conventional gill nets, in which the bridle is attached to both the headline and groundrope, on wreck nets there is only a single bridle, and that runs from the anchor to the headrope, to reduce the chance of snagging.

In cod fishing the majority of multifilament wreck gill nets have a stretched mesh size of 190 mm but in some cases 180 mm nets will also be used. Monofilament wreck nets tend to be slightly smaller with a stretched mesh size of 160 mm. The position of the wreck is known from charts or from previous trips and is relocated approximately using Decca Navigator. At the same time a sonar is used to search the sea bed until the wreck is found. Usually the skipper will make several runs over a wreck which is new to him to see how it is lying on the sea bed before deciding to shoot his nets and will aim to lay the fleet with the middle net stretched across the wreck.

The nets are fished in fleets of three to five nets and up to four fleets may be placed over and around a single wreck. They are left for two tide changes or for up to 18 h at the longest and as many as six to nine wrecks may be worked at the same time. Most of the boats larger than 15 m will carry 150-300 nets and will work less than half of these at any one time. Hydraulically driven net haulers are used to retrieve the nets and as many fish as possible are cleared as the nets come aboard. If the catch is large, the net is set aside and cleared later. On a productive wreck, the nets may be shot again as soon as they have all been cleared. Although repeated fishing on the same wreck will result in reduced catches unless the wreck is left for a period to recover.

### 5.3 The east coast (Humber to the Thames)

There is little organised netting off the coasts of Lincolnshire and Norfolk except by part-time fishermen, fishing off local beaches or in creeks and estuaries. In these areas small mesh multifilament or monofilament nylon nets are used with mesh sizes 63-76 mm. Catches of mullet and some sea trout are made in addition to small amounts of demersal fish species. Off much of the Suffolk coast strong tidal currents and abundance of weed reduces the effectiveness of fixed nets along the coast. Netting is mostly confined to sheltered inshore areas such as around the rivers Stour, Orwell, Deben and Ore.

Along the coast of Essex and in the Thames estuary, a wide variety of gill and trammel nets are used to take mainly cod and dogfish in the winter, with soles, rays, mullet and bass being caught during the summer. The fishery for bass relies mainly on mature fish which move into the Thames estuary in late spring, although immature bass are also caught in the estuaries and creeks along the Essex coast during the summer.

Few fixed nets were in use until 1974 when small catches of bass and mullet were taken in nylon gill nets. Over the next three years there was a rapid increase in netting activity and in 1977 it was estimated that the total length of fixed netting in use off the Essex coast during the summer amounted to about 24 km in a fishery involving some 26 boats and employing 54 full-time fishermen. Since 1977 the total landings of mullet

have declined whereas catches of bass have remained fairly stable, but the proportion of both species in fixed net catches has decreased consistently each year and netsmen have concentrated more effort on taking soles, ray and cod.

#### 5.4 The south coast (Thames to Lyme Bay)

Widespread trammel net fisheries occur along the Kent and Sussex coasts for sole in the spring and cod during the winter. At many ports fixed net catches contribute more than half the total demersal catch. The fishery for soles starts in March and usually continues until mid-June when the inshore movement of spider crabs and dispersal of the soles cause the fishing effort to be reduced.

The most intensive trammel net fishery occurs along the Sussex coast with boats from Hastings, Brighton, Newhaven and Eastbourne heavily involved in the fishery. The larger boats from Brighton and Hastings will work up to 60 nets each day. The nets are fished in fleets, varying locally from three or four nets in a fleet at Whitstable to eight at Hastings and up to fifteen or more at Brighton and Newhaven. The majority of trammel netsmen fish for soles using nets with an approximately 114 mm inner mesh. Studies carried out off Hastings have shown that this is an efficient size for the area because less than 1% of the soles caught are under the legal minimum size of 240 mm. In comparison, although nets with a smaller mesh size of around 89 mm took a larger number and weight of soles, 10% of them were undersize and a further 38% were below the size accepted on the market and had to be discarded. Another feature of the larger mesh nets was the relative ease with which they were cleared of fish and weed: the small meshes of the 89 mm nets became badly tangled with weed and crabs and the time spent cleaning the nets made them less economical to use.

The heavy concentration of nets along this stretch of the coast restricts trawlers working the same ground and considerable damage or loss of nets has inevitably taken place. In order to reduce the loss, two large areas off Hastings and Brighton (Figure 8) were set aside for trammel netsmen and trawlers were asked to avoid these areas throughout the year.

Along the Hampshire and Dorset coasts there is less netting activity compared to further east. While trammel nets are still used for pollack, sole and plaice, there is an increasing use of gill nets especially in fisheries for mullet and bass.

Since 1978 an important fishery for bass using monofilament gill nets has developed in inshore waters between Selsey Bill and Swanage and especially within the Solent and Southampton Water. The fishery relies heavily on immature bass which move in shoals along the coast and enter the shallow water harbours, creeks and inlets of this part of the coast during the summer. Fine monofilament gill nets with a wide variety of mesh sizes from 64 to 127 mm are used, but the most common size used by full-time netsmen is 83 mm which rarely takes bass below 320 mm in length. Weed is a serious problem during the summer and nets may need to be lifted within half an hour of being shot.

In addition to the nets set by the commercial netsmen, large numbers of part-time and leisure fishermen use trammel and gill nets. The catch and effort put in by the part-time fishermen is not known precisely but along the Sussex coast alone it has been estimated that there are at least

160 boats used by weekend and part-time fishermen who between them have the capability of shooting around 84,500 m of net in the winter for cod.

The use of fixed nets by part-time fishermen occurs along the whole length of the eastern English Channel coast but is particularly heavy on parts of the coasts where high population density coincides with easy access to sites for launching small boats. Although the catch of an individual part-time fishermen may not be great, the fact that large numbers are operating regularly along the coast represents an additional pressure on fish stocks.

#### 5.5 The south-west (Lyme Bay to the River Severn)

Many of the boats working out of ports in Devon and Cornwall use a variety of gears including trawls, pots, longlines and fixed nets at different seasons of the year so as to maintain their catching power. Anchored trammel nets are used to take rays, pollack, ling, plaice and sole and, as elsewhere, the development of small sonar units has led to an increase in the amount of netting around wrecks using monofilament and multifilament gill nets. This fishery is particularly aimed at pollack and ling and nets with mesh sizes of 127 to 152 mm are commonly used. The main fishery takes place in winter off the south coast of Devon, followed by spring and summer fisheries around Cornwall. The wrecks are fished on neap tides only and nets are laid close to or over the wreck and left for 24 h before being hauled and cleared. Nets are usually fished in fleets of three to five nets, each net being 50 m long by 30 meshes deep.

Fixed nets are also used in fisheries directed specifically at certain species. Over the last 3-4 years a gill net fishery for spurdogs, has developed in the Mounts Bay area and elsewhere off Cornwall. This has become a major winter fishery with landings of nearly one thousand tonnes in 1982. Both monofilament and monopy nets are used with mesh sizes varying from 140-152 mm. Hake gill nets with a mesh size of 121 mm are also used at times to catch spurdogs and although successful take many more smaller fish than the large-meshed nets. Before shooting the nets the skipper usually steams over a likely ground looking for fish marks or traces on the echo sounder. These traces could indicate the presence of fish on which spurdogs feed. With colour display echo-sounders it is now possible to distinguish spurdogs from fish with air bladders. When a possible mark is found, a small length of net is shot away and left for about 20-30 minutes. If on hauling it contains some spurdogs the full complement of nets is fished. The nets are set in fleets approximately 800-1000 m long and usually left down for several hours before being lifted. The smaller boats fish around three fleets and larger boats up to six. The strong tidal currents in the area restrict fishing to periods of neap tides. Spurdogs can become tightly tangled in the nets as well as being securely gilled, so, if a good haul is made, the nets will be cleared while steaming back from the fishing ground or in the home port. If fishing has been poor, the nets may be cleared at sea and shot again.

Off the Cornish coast, traditionally there has been a tangle net fishery for crawfish, though as catches have fallen the by-catch of rays and angler or monkfish have become more important in maintaining adequate returns from the fishery.

The tangle net is made from monofilament or monopy netting. Typically, the stretched mesh size varies between 203 mm and 305 mm although a 457 mm mesh is also used to catch rays and monkfish rather than

crawfish. Each net is approximately 3.5 m high and has a stretched mesh length of 110 m but is rigged onto a 55 m headrope at a hanging coefficient of 0.5 to assure plenty of slack in the net. The nets are fished in fleets of 8-20 nets although most commonly there are 10 nets in a fleet. The advantage of the larger fleets of nets is the saving in the time taken to retrieve and haul the nets, but this must be weighed against the possibility of losing the gear if trawlers are working in the same vicinity. The inshore boats usually work between 140 and 180 nets each, while some of the larger vessels can fish as many as 30 fleets of ten nets, of which the total length is over 16 km. Over the past 5 years, the mesh size of nets has tended to decrease from about 406 mm to the present size of 203 mm or 305 mm, while the number of nets used has doubled.

The tangle nets are normally fished for 3-4 days before being retrieved. On neap tides, nets can be hauled at most states of the tide as the dan remains visible on the surface. During spring tides the dans are only visible for a short period during slack water so that the period available for hauling the nets is greatly reduced.

A considerable number of edible and spider crabs are caught and become tightly entangled in these nets. Usually the claws are broken off the crab and kept for sale but the rest of the body is discarded. Crawfish are removed alive and are stored in tanks with a pumped supply of sea water.

The tangle net fishery for crawfish extends from March through to September with peak catches usually obtained from the end of June to August. Between February and May monkfish form an important part of the catch and tangle nets may be set on sandy ground specifically for this species rather than on the rough rocky ground where the best crawfish catches are taken.

A more recent net fishery off the Cornish coast is that for bass. Between November and March mature bass concentrate around the Cornish peninsula in large feeding shoals and are fished by rod and line and trolled hand line at offshore marks such as the Runnelstone and Manacles, and occasionally closer inshore in areas like St Ives Bay. In September 1978 monofilament gill nets were first used to take bass in St Ives Bay and by January 1980 nets were in regular use although trolled hand line remains the most common method of fishing.

Another fishery directed specifically at bass is that off the Eddystone Reef. In autumn, bass shoals move westwards past the Eddystone to overwinter off Cornwall where they feed on sprat and small mackerel. As the water temperature rises in spring the fish move eastwards along the English Channel coast, again passing the Eddystone. Sport anglers and commercial troll line fishermen have made use of this seasonal movement for many years and in 1978 one full-time fisherman who had previously trolled for bass began using monofilament gill nets with considerable success. The following spring three other full-time and some part-time netsmen began netting for bass around the Eddystone. The nets used by the commercial fishermen have a 127 mm mesh and are at least 120 m long by 50 meshes deep.

The Eddystone fishery rarely takes fish under 400 mm in length but close inshore and especially within the estuaries along the coast of Devon monofilament gill nets with a mesh as small as 64 mm are used to take mullet and small bass. Although mullet is the primary target, a substantial number of small bass are killed.

At a number of sites along the south coasts of Devon and Cornwall gill and trammel nets are fished in estuaries or close inshore, often with one end attached to the beach. Surveys by the South West Water Authority of the catches taken in these nets have shown that in many cases, the nets are being used by part-time fishermen to catch salmon and sea trout. Although the numbers of salmonids found in an individual net during the surveys were low, the total catch by unlicensed nets over the period of the survey was thought to represent a significant proportion of the total catch of salmonids in the area. In the years 1973, 1974 and 1977, for instance, the catch by unlicensed netmen in the vicinity of the Teign estuary was estimated to be about one third of the catch taken by licensed netmen within the Teign itself.

The problem of illegal salmon netting on the coasts of Devon and Cornwall stems from the activities of part-time fishermen who make use of the efficiency of modern gill nets and the ease with which they can be fished. Although such netting activities are of concern to the regional Water Authorities they are on a small scale when compared to the widespread use of the method to take other saleable species of marine fishes.

#### 5.6 The Irish Sea coast (River Severn to Solway Firth)

The amount of gill and tangle net fishing from boats working out of ports around the Welsh coast is small in comparison to the effort put in by part-time fishermen using fixed nets (mostly stake or anchored gill nets) from the beach or set wherever there is access to suitable sand and mudflats. In their simplest form the stake nets consist of a multifilament or monofilament nylon gill or tangle net 50 to 400 m long held in position by wooden posts staked into the sea bed about 12 m apart. The nets are set either across the current or along it depending upon local conditions and topography and a mesh size of 89 to 114 mm is commonly used. Fish are caught on either the ebb or flood tide and the nets are cleared at low water. Although a wide range of species are caught, the nets are not particularly efficient and can become heavily tangled with weed if left unattended for more than 24 h.

Along the southern coast of Wales, the heaviest concentration of fixed nets occurs in the area between Cardiff and Laugharne and on Pendine Sands in Carmarthen Bay where part-time fishermen set stake and other nets. The main catches are taken between April and November and consist of flounder, mullet, bass, plaice and dabs. Another fixed net fishery on the South Wales coast is a seasonal one for herring in the Cleddau estuary during February, March or April. Up to 70 part-time and a few full-time fishermen set bottom fishing gill nets over the period of slack water at low tide. The fishery is dependent on a local spawning stock and a catch of around 200 tonnes is taken during the season.

On the west coast of Wales, netting activity is at a fairly low level with small numbers of staked or anchored trammel and gill nets being fished from accessible beaches. Netting activity increases around Anglesey and in the Menai Strait especially during the summer months. In the Dee estuary over 100 boats fish with gill and trammel nets although most of the former are drifted rather than anchored on the sea bed. Flounders form the bulk of the catch in the shallower areas of the Dee especially during September to December. Mullet are also common in the estuary and bass and pollack are less frequently taken. Licences are issued for four fishermen to use drifted trammel nets to take salmon and sea trout. However, it is inevitable that the large number of unlicensed netmen working in the estuary

also take salmonids, particularly as netting activity increases during the summer when salmon are moving into the Dee. There are similar problems on other parts of the coast such as in the Usk and Clwyd rivers where licensed gill net fishermen work alongside many unlicensed netmen using gill and tangle nets.

Around the Welsh coast, only a small amount of netting is carried out by the commercial fleet. This is mainly restricted to netting for rays using tangle nets with a 305-457 mm mesh.

The fixed net fisheries along the Lancashire and Cumberland coasts are almost exclusively worked by part-time fishermen, many of whom do not have boats and gain access to their nets at low water by tractor or on foot. This is especially characteristic of Morecambe Bay where, in addition to the anchored gill and trammel nets worked from boats, a variety of more traditional nets are fished in the intertidal zone and the fish collected from the beach at low water. These nets are particularly successful at catching flounders. The majority of gill and trammel nets are worked north and south of Morecambe Bay and the effort is highly variable, increasing at weekends and during the summer. The main species taken are bass, codling, rays, mullet and flounders.

## 6. THE FUTURE OF GILL AND TANGLE NET FISHERIES

The expansion of fixed net fisheries in the UK has largely been confined to vessels less than 19 m in length, fishing the inshore waters around the coasts of England, Wales and Scotland. Only the wreck-net fisheries for cod in the North Sea and some lesser fisheries by a limited number of vessels in other areas have attracted larger boats. Yet the experience of other countries has shown that fishing with fixed nets can be competitive with trawling even for vessels over 20 m. Provided that the operating costs of fixed nets remains lower than for conventional trawls, their use by larger UK vessels is likely to increase in the future.

Fixed nets are already a well established means of fishing by the smaller inshore boats. However, here too there could be a steady expansion in the future. Many small boat operators in inshore waters have found that it is no longer possible to obtain a living using only one fishing method throughout the year. Tangle and gill nets provide a means of extending the range of grounds and species exploited and are likely to be widely adopted for this reason.

Finally, the ease of use and relative cheapness of fixed nets has led to their widespread use by part-time and leisure fishermen and this pattern may be expected to continue.

## ACKNOWLEDGEMENTS

I would like to thank the many people who provided the information on which this leaflet is based. In particular I am grateful to staff of the Ministry's Sea Fisheries Inspectorate, members of Sea Fisheries Committees, Water Authorities and skippers for their detailed information about local fisheries.

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- No. 51 The scallop and its fishery in England and Wales. 1980
- No. 52 A review of development of the Solent oyster fishery, 1972-80. 1981
- No. 53 Prospects for fuller utilization of U.K. fish meal capacity. 1981
- No. 54 Background to scientific advice on fisheries management. 1982
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many areas where potting for crabs has been declining steadily, fixed nets have offered either an alternative or supplementary means of fishing.

Fixed nets have also been widely adopted by part-time fishermen. The nets are popular because they are relatively cheap and easy to use and can be stored for long periods without rotting. The use of fixed nets by both full- and part-time fishermen has increased so rapidly that it has led to calls for licensing or the banning of nets in some areas where fish stocks are thought to be overfished.

The terms full-time, commercial and professional are here used to describe fishermen whose main income is derived from fishing; part-time describes fishermen who are not totally dependent on fishing for a livelihood even though many of them may fish regularly throughout the year.

This leaflet in the main describes only general features of the construction and operation of fixed nets, details of which have been published elsewhere (see Section 7 of this leaflet); its primary purpose is to examine the relation of fixed net fisheries to other fisheries, particularly in the context of stock conservation and fisheries management.

## 2. DESCRIPTION AND OPERATION OF FIXED GILL AND TANGLE NETS

There is wide variation in the design and rigging of gill and tangle nets in use around the coast, and details of some of these are mentioned in the section on regional fisheries. The basic features of typical gill and tangle nets are described below.

### 2.1 Gill nets

The net consists of a single wall of netting weighted at the bottom and supported at the top by floats attached to a headline so that it hangs vertically (at slack water) in the water column. Figure 1 shows a typical rig for bottom fishing. Most bottom set gill nets use a braided synthetic

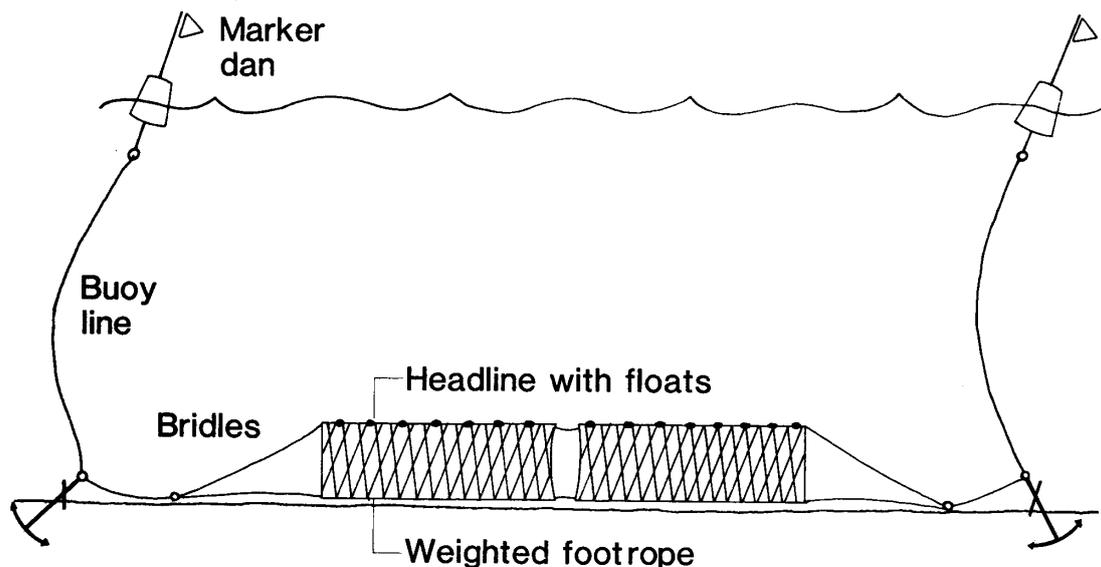


Figure 1. A typical rig used in fishing with anchored gill or tangle nets.