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WHY INCREASE MESH SIZES?

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1. INTRODUCTION

This leaflet traces the history of mesh regulations and explains how mesh selectivity is measured. It goes on to discuss some factors which can affect mesh selection and some anomalies both in experimental results and in regulations. The effects on catches and on fish stocks of increasing minimum size of mesh are explained first in general and then with particular reference to the proposed increase to 90 mm for the North Sea.

2. BRIEF HISTORY OF MESH REGULATIONS

In 1376 King Edward III's parliament complained about the use of "the wondyrchoun (a beam trawl) with meshes the length and breadth of two thumbs" with which "... the fishermen take such quantity of small fish that they do not know what to do with them; and that they feed and fat their pigs with them, to the great damage of the Commons of the realm and the destruction of the fisheries, and they pray for a remedy." This appears to be the first record of the use of small-meshed nets and of an 'industrial fishery' for animal feeding stuffs. The fishery was investigated but no legislation appeared, although later on trawling was prohibited in many private fisheries.

It was in the reign of Elizabeth I, nearly 200 years later, that the first Act of Parliament was passed which introduced a mesh size limit of "two inches and a half broad" and minimum landing sizes for pike, salmon and barbel. In 1605, James I extended mesh regulation to sea fisheries for which, except for herring, pilchard, sprat and sandeel nets, was set a minimum mesh size of one and a half inches knot to knot. Either because this mesh size was still too small, or more likely because of lack of enforcement, another Act was passed in 1714. This "enacted that, as the breed and fry of sea fish has been of late years greatly prejudiced and destroyed by the using of too small size of mesh, and by other illegal and unwarrantable practices, no one shall use at sea, upon the coast of England, any trawl-net, drag-net, or set-net for catching any kind of fish except herrings, pilchards, sprats, or lavidnian (sandeels), which has any mesh less size than three and a half inches (i.e. 90 mm) from knot to knot, or which has any false or double bottom, cod, or pouch." At the same time minimum landing sizes (measured "from the eyes to the utmost extent of the tail") were introduced, as shown in the following table which also gives the present day minimum landing sizes internationally agreed and currently in force:

	1714		1985
	inches	cm	cm
Turbot	16	40.6	30
Brill	14	35.6	30
Codling)			30
Bass)	12	30.5	32 (national)
Mullet)			none
Sole)			24
Plaice)	8	20.3	25
Dab)			15
Flounder	7	17.8	20 (in Skagerrak and Kattegat only)
Whiting	6	15.2	27

Various Acts passed during Queen Victoria's reign specified minimum mesh sizes for use in trawls and other fishing gear, and an Act of 1888 authorized the setting up of country or regional sea fisheries committees with power to impose mesh restrictions and other limitations on fisheries inside territorial waters.

In spite of the legislation, the state of the commercial fish stocks in the North Sea was giving cause for concern before the end of the nineteenth century. Scientists in Britain and other European countries had started investigating the North Sea fisheries in the 1890s, and these studies were some of the factors leading to the setting up in 1902 of the International Council for the Exploration of the Sea (ICES), whose function was to co-ordinate the scientific research and to make recommendations for regulatory measures designed to maintain profitable fisheries in the North Sea.

As early as 1903, fishing experiments were being conducted to compare catch rates of the different trawls used by research vessels in international and national investigations. In 1904-05 both England and Belgium conducted research with large and small beam trawls to determine the relative quantities of the different sizes of fishes which escaped through the meshes of the different parts of the net, e.g. square, batings, cod-end, etc.

During 1906-08, Todd, a member of the Marine Biological Station at Lowestoft (later to become the MAFF Fisheries Laboratory), conducted an extensive series of investigations on both otter and beam trawls to determine the actual proportion of fish at each size which escape through the meshes of ordinary commercial trawls. These experiments showed that the meshes were open under fishing conditions and that small fish could escape through them. He showed that it was also possible to quantify the numbers of each size escaping in relation to the cod-end mesh size (Todd, 1911).

One of the first discussions at an international level on the use of mesh regulation as a method of fish conservation arose in connection with restrictions imposed on certain United Kingdom vessels fishing in the

Moray Firth. This area had been closed to UK trawlers since 1892 because of their habit of concentrating on spawning plaice and their damaging fixed gears. They also took large quantities of juvenile haddock and whiting of below marketable size. In 1927 a Special Meeting of the International Council for the Exploration of the Sea was held, to discuss whether foreign trawlers should also be excluded. In 1928, Bowman, a Scottish scientist, showed clearly that large quantities of haddock below 21 cm in total length could be allowed to escape if a cod-end mesh of the order of about 70 mm between opposite knots when fully stretched were to be used. However, the ICES group noted that the problem posed to them was a social problem of conflict between different fishing gears rather than a scientific one, and suggested that it was outside their competence. Nevertheless, the use of a larger mesh size to reduce the juvenile catch was recommended. Thus, at this early stage the principle was established that scientific recommendations should be limited to a scientific appraisal of a problem: implementation was an administrative matter, but scientists could advise on the likely effects of any administrative decision.

As a result of the national and international studies of trawl selectivity, on 1 August 1933 the United Kingdom Government introduced minimum mesh sizes under the provisions of the Sea-Fishing Industry Act, 1933 (Gt Britain - Parliament, 1933). The regulation covered all towed nets whether trawl or seine and all methods of construction. It required that the minimum meshes should be:

	Rows per yard
Unused and untreated	21
Unused and treated	22
Any other condition	24

Depending upon net construction, the mesh size in use at sea would be of the order of 70-75 mm.

In June 1934 a Special Meeting of the International Council for the Exploration of the sea was held, to discuss size limits for fish and regulation of the meshes of fishing nets. It recommended that regulations not less than those of the UK, for both minimum sizes of fish and mesh size in cod-ends, be adopted by all member countries. If this recommendation had ever been adopted generally, then the mesh of all trawls and seines would have been about 75 mm. Additionally, a mesh size equivalent to about 100 mm was recommended for the Barents Sea and Newfoundland fisheries.

These measures were embodied in a Convention which was adopted in 1937 but never activated by most countries due to the 1939-45 World War. The United Kingdom revised the 1933 Act with the Sea Fish Industry Act, 1938 followed by the Sea-Fishing Industry (Fishing Nets) Order, 1938, (Gt Britain - Parliament, 1938) to cover seine nets and pair trawls (parejas).

The revision was as follows:

Trawl nets	Rows per yard
Unused and unpreserved	21
New net, unused but preserved	22
Used, any condition	24
Seine nets (Danish)	
Any condition	26
Pair trawl (pareja)	
Any condition	24

Again it should be noted that the used mesh sizes refer to nets in any condition irrespective of material (then mostly manila, cotton or hemp) or type of braiding (i.e. whether single or double twines).

After the war the United Kingdom initiated the international discussions which led to the International Overfishing Convention being drawn up in 1946. Its regulations were due to come into force two months after ratification by all the governments which signed the Convention. Among these regulations was the requirement that, irrespective of materials, the minimum mesh size in "trawls or seines or other nets towed or hauled at or near the bottom of the sea" should be 80 mm (measured wet) in near waters and 110 mm in distant waters. Near waters in this sense referred to sea areas between 48°N and 62°N; distant waters referred to areas north of 62°N, e.g. Iceland, Barents Sea, etc. This regulation required that the mesh should be measured with a gauge 2 mm thick inserted into the lumen of the mesh to measure the distance between inside edges of opposite knots when the mesh was extended lengthways.

In 1953, seven years after the drawing up of the Convention, the regulatory body, the Permanent Commission (later to become the North East Atlantic Fisheries Commission - NEAFC) came into existence. Even then the recommended mesh size was not implemented by all countries. This state of affairs came about both by special pleading in relation to national short-term losses, generated by moving to a larger mesh size and by involved scientific discussions on the relative behaviour of different materials and twines used in the manufacture of nets.

In response to the Commission's proposed Regulations, the United Kingdom published the Sea-Fishing (Fishing Nets) Order, 1954 (Gt Britain - Parliament, 1954) setting minimum mesh sizes in near waters of 70 mm for seine nets and 75 mm for other towed or hauled nets; the latter was to be effective up to 4 April 1956 after which the legal trawl mesh size would be 80 mm. However, in 1956, under the Sea-Fishing (Fishing Nets) Order, 1956 (Gt Britain - Parliament, 1956), the trawl regulation was again modified following further argument in the Commission and the date for introduction put back. The proposed regulation was:

		Minimum mesh size (mm)
1.	Any trawl in single twine not made of sisal or manila	
	Up to 1 April 1958	70
	After 1 April 1958	75
2.	Any trawl made in other twines	
	Up to 1 April 1958	75
	After 1 April 1958	80

At that time the net materials used were predominantly still of natural fibres, e.g. manila, sisal, cotton, hemp.

In the following years the delays continued, until at last on 1 June 1964 (with certain exemptions) a mesh regulation, without time limit, was introduced for the whole near-waters area north of 48°N. The relevant portion of the UK Sea-Fishing Industry (Fishing Nets) Order, 1964 (Gt Britain - Parliament, 1964) reads:

All other waters in relation to which this Order has effect	Seine net, or such part of any trawl net as is made of single twine and contains no manila or sisal	70 mm
	Such part of any trawl net as is made of double twine and contains no manila or sisal	75 mm
	Such part of any trawl net as is made of manila or sisal.	80 mm

By 1964 most nets were constructed with synthetic fibres and in 1965 little or no manila or sisal was in use. Thus after 17 years the regulation introduced following international agreement was less stringent in effective conservation terms than that proposed in 1946, or even in 1933. Those early proposals required the same mesh size to be used irrespective of material and in the 1946 proposal set a minimum mesh size of 80 mm.

With the high level of exploitation of the near-water fish stocks, scientific advice has regularly pointed out the benefits in long-term yield of increasing the current mesh size in use. ICES (1971) summarised the results of many mesh experiments with a variety of trawls and of netting materials.

The ICES Advisory Committee on Fishery Management in its Report of May 1978 (ICES, 1979) recommended:

(a) that, as advised by the Liaison Committee Report to the 15th Annual Meeting of NEAFC, "the Advisory Committee on Fishery Management recommends that the minimum mesh size in Sub-area IV (i.e. North Sea) ... should be increased to 90 mm for trawls and Danish seines, irrespective of twine type";

(b) that "the minimum mesh size ... in the remainder of Region 2 (i.e. near waters), excluding Division VIIa (Irish Sea), should be increased to 80 mm from 1 January 1979 for all trawls and Danish seines, irrespective of the type of twine used";

(c) that "in the Irish Sea (Division VIIa) the Recommendation 1 mesh size should be maintained at 70 mm single twine, 75 mm double twine, pending further assessment of the effects ... of the increase in mesh size for Nephrops recommended below";

(d) that "in Sub-area VIII (Biscay) and Division IXa (Iberian shelf), the current mesh size of 65 mm double twine and 60 mm single twine should be strictly enforced as a first step in improving the exploitation pattern";

(e) that, "for Nephrops fisheries, a minimum mesh size of 70 mm should be introduced from 1 January 1979 throughout the whole of Region 2 (near waters) and of 60 mm throughout the whole of Region 3 (south of 48°N), irrespective of twine type".

In addition it comments:

> "... there are no significant differences in selectivity between codends made of single or double twine. On this basis, all the recommendations given above for changes in current mesh size refer to all nets irrespective of their material or construction."

The ICES Sub-areas and Divisions, and the NEAFC Regions, referred to above are indicated in Figure 1.

Those 1978 recommendations have been considered by the European Commission in drawing up its Technical Measures under the Common Fisheries Policy. The European Commission, because of its wider geographical responsibilities, has defined its management areas as in Appendix 1. As some of the areas are subject to joint management with non-European Economic Community members, the mesh sizes in force represent those agreed under international negotiation.

The current amended Council Regulation (EEC) No. 171/83 is given in Appendix 1.

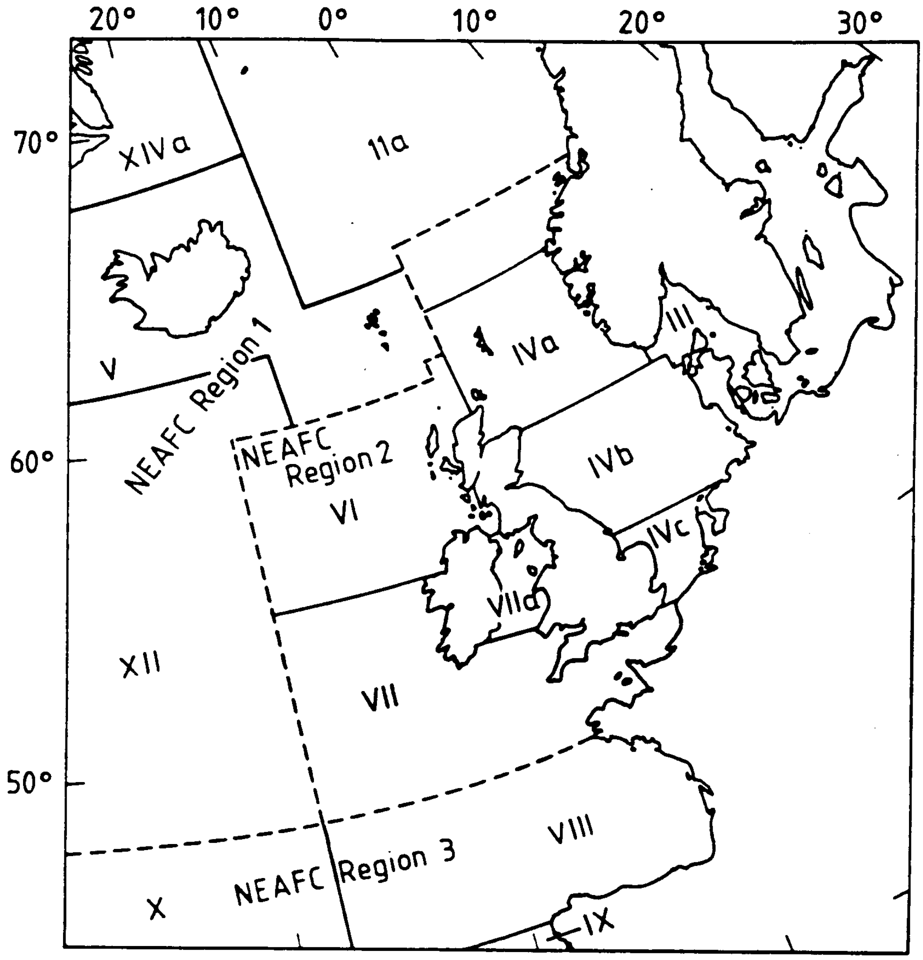

Figure 1. NEAFC and ICES statistical areas: NEAFC regions are indicated by the pecked line; ICES Divisions and Sub-Areas are indicated by Roman numerals.

3. MESH SELECTION EXPERIMENTS

As might be deduced from the history of discussion on mesh regulations outlined above, there has been much room for dispute about quantifying the effects of mesh regulation in commercial practice. For example, many fishermen and some scientists were doubtful about the survival of small fish which escaped through the meshes of the trawl, and other fishermen maintained that the meshes were closed during the tow so that no fish could escape until the trawl was hauled. Research work during the 1920s and early 1930s was directed at these problems.

Experiments carried out using small-mesh covers fitted on various parts of the trawl showed that most fish escaped through the cod-end meshes. A most important and ingenious experiment, designed by the Lowestoft scientist F M Davis (1934), showed that most small fish did escape while the trawl was being towed and not just in the hauling period.

He fitted the cod-end with a small-mesh cover having a throttling noose activated by a heavy weight (Figure 2). On shooting, the cover streamed in the normal manner and was free to retain all fish which passed through the meshes of the cod-end. After a certain period the release mechanism was activated, which caused the heavy weight to pull the throttle tight, thus closing off the after-part of the small mesh cover, so that the cover's contents, which consisted of a lot of small fish, must have passed through the cod-end meshes while the trawl was fishing. Davis' results refuted the fishermen's contention that meshes were closed under towing and open only during hauling the trawl.

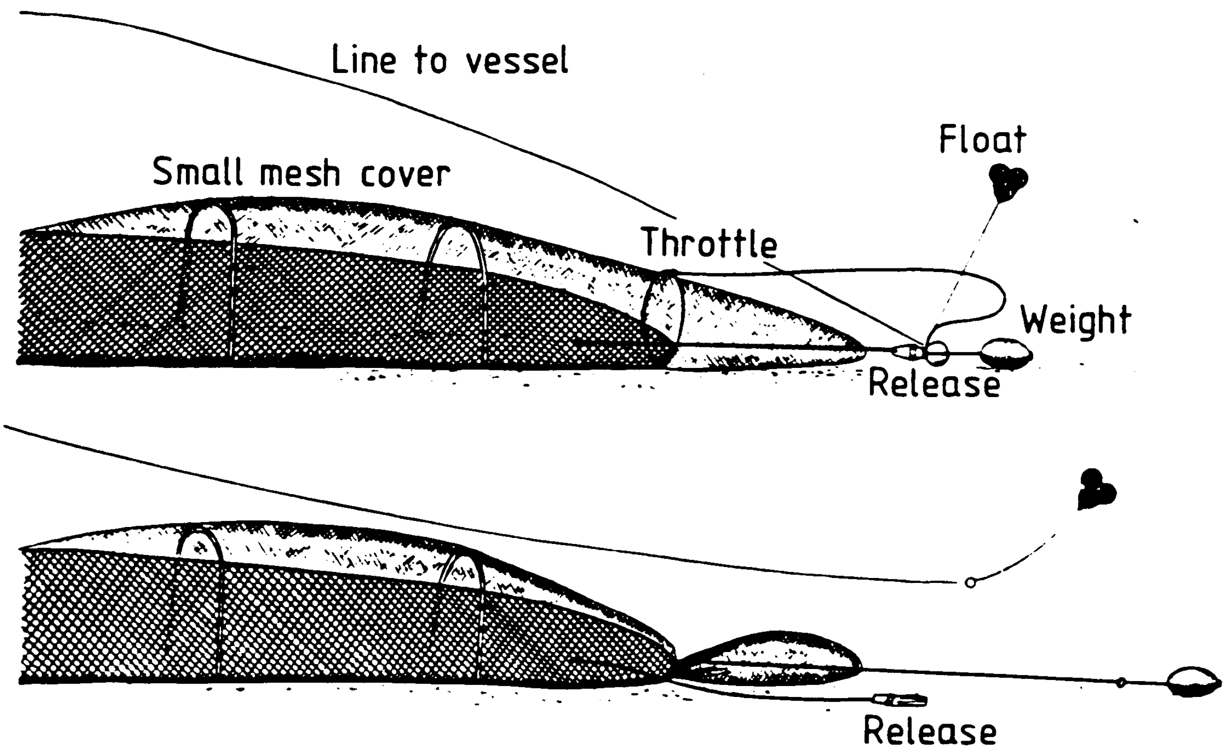

Figure 2. Cod end escape experiment (see text for explanation). (Redrawn from, Davis, 1934.)

This experiment implied that the fish swam through the meshes, but did not prove that they would be fit enough to survive to grow to a larger size. The evidence showing that escaping fish were viable and apparently unharmed was not obtained until the early 1950s when the escape of fish from nets was observed by divers and recorded by ciné cameras; subsequently, recordings have also been made by television cameras.

Another feature shown from early experiments on the use of gears with different sized cod-end meshes was that the larger mesh size often caught a greater number of larger fish than the smaller mesh. In 1933 the Ministry of Agriculture and Fisheries sponsored a mesh experiment under commercial conditions. Two steam trawlers (sister ships), fitted with trawls which were identical except for their cod-end mesh size, carried out twelve simultaneous voyages on the same grounds. Normal commercial fishing practice was maintained but Fisheries Laboratory staff made extensive observations on the catches. The cod-end mesh sizes when fishing were (a) 24 rows per yard, i.e. the then current legal mesh of about 70 mm, and (b) 21 rows per yard, i.e. about 85 mm. The use of the small and large mesh cod-ends was alternated between vessels between trips. Thus each vessel used each net six times. The total gross value of the trips with large mesh was slightly higher than that with smaller mesh, even though many more smaller fish were taken in the latter net. As regards haddock, the large mesh net took 35% less fish by weight below 29 cm and 11% more fish by weight above this length. Davis (1934) also noted that the larger mesh took 60% less unmarketable haddock than did the normal net and 26% less 'scruff' (invertebrates, small stones and other rubbish). This point has proved to be particularly relevant in very recent studies on the behaviour of beam trawls.

The experiments in the 1920s and 1930s established the facts that otter trawl meshes were open under fishing conditions, and that small fish could escape apparently unharmed. It is reasonable to suppose that anything obscuring the mesh opening could have the effect of reducing escape. For example, in large catches, meshes can be blocked; the presence of scruff in quantity could have the same effect. Davis' two-trawlers experiment also indicated that a larger mesh could increase the catches of larger fish, suggesting that the net was somewhat more efficient.

During the 17 years which passed between the drawing up of the International Overfishing Convention in 1946 and the introduction of an internationally-agreed mesh regulation regime in 1964, further research work was conducted on the effects of different twine types on the escape of fish from trawls of similar mesh sizes. The definition of these 'differentials' demanded considerable research effort and results were slow to accumulate (ICES, 1971).

The introduction of midwater trawls led to further discussion on whether or not the principles and the measures of escapement calculated from bottom otter trawls were applicable to these nets. A controversy arose when high-powered beam trawlers designed for catching soles joined in the near-water bottom trawl fisheries. Fishermen claimed that these vessels dislodged rocks partly buried in the bottom and their activity could make a ground previously fished by otter trawls unworkable by this gear. It was also claimed that for the same mesh size, a beam trawl took more small fish than an otter trawl.

Since 1977, some experiments on beam trawlers of various sizes have been carried out by England, Belgium, Holland and the Federal Republic of Germany. The main purpose of these experiments was to determine whether the nature of the beam trawl required the specification of its minimum mesh sizes to be different from those based on otter trawl experiments.

Between August 1977 and 1979 inshore beam trawlers of about 400 hp were chartered by MAFF, both out of Lowestoft and out of Fleetwood. The ships normally worked two beam trawls identically rigged with tickler chains and identical nylon nets. The purposes of the charters were to examine the selectivity of cod-ends of 75 and 90 mm mesh size and to investigate the possibility of interference in the escape of small fish due to blinding of cod-end meshes by the retention of quantities of scruff. The two different mesh sizes were used simultaneously, one on the port side and one on the starboard side trawl. Apart from the different cod-ends covered with small-meshed net, no alteration was made to the normal rigging of the trawls and commercial operation of the vessels.

For the North Sea experiments, the effect of the retention of scruff (i.e. unusable animate and inanimate bodies) in the cod-ends on masking the meshes, and so limiting escape of soles, can be assessed in the following table:

Large mesh (90 mm)		Small mesh (66 mm)	
Scruff (baskets/haul)	Average length of sole (cm)	Scruff (baskets/haul)	Average length of sole (cm)
11.2	25.0	16.6	19.9
4.8	27.1	4.0	21.1
3.0	28.3	2.7	22.1

For soles, the retention of a substantial quantity of rubbish on 'dirty' grounds reduced the average length of fish retained by about 2-3 cm in the case of both mesh sizes. In the case of the 90 mm mesh net, this would be equivalent to using a net of 80 mm and in the case of the 66 mm net, equivalent to the use of a 60 mm cod-end.

Very similar results were obtained from the Irish Sea experiments. From a comparison of the fish which escaped through the cod-end meshes into the covers and those trapped in the cod-end among the scruff, it was clear that those fish trapped had little chance of surviving, being badly scaled and bruised, and moribund when landed on deck. In contrast, those in the cover were generally more lively, and covered in mucus - a sign of a healthy fish.

During 1979-81 Dutch scientists carried out a series of experiments on large beam trawlers of over 1000 hp (van Beek et al., 1981a,b). These experiments took place both in the North Sea and in the Irish Sea. The results showed that there was no reason to suppose that there was anything inherently different in this gear from an otter trawl as far as the escape of small fish was concerned.

In this section we have examined the evidence that fish do escape through cod-end meshes and that those which do escape are viable. Escape can be considered simply as a mechanical feature of the magnitude of the lumen of the cod-end mesh and the shape of the fish. Whether a cod-end is attached to a seine, mid-water trawl, bottom otter trawl or beam trawl is immaterial.

The conservation effect of a specific mesh size may be reduced by the illegal use of small-mesh blinders or attachments to nets which prevent the mechanical opening of the mesh lumen. It has also been shown that the escapement of small fish can be reduced by the masking of cod-end meshes when large catches are made, whether of fish, scruff or other debris.

4. MESH SELECTIVITY AND SELECTION FACTORS

The term selectivity is often used in two different ways. A trawl may be adapted in a way that allows it to catch flatfish more efficiently than cod or haddock. This feature of trawl design has sometimes been referred to as providing a selectivity for the target species. This preferential rate of capture is dependent on differences in behaviour or availability of the fish to the gear.

In its more usual sense the term selectivity refers to the mechanical selection of different sizes of fish as a consequence of the mesh size in use. In this sense the mechanism of selectivity of capture of fish is not confined simply to towed gears.

Each type of gear has its own selectivity or selection pattern. For example, a small-meshed purse-seine catches virtually everything that it encloses and is therefore unselective. At the other extreme, drift-nets catch only the fish which are just the right size to get stuck in the meshes, so individual drift-nets are highly selective. However, when drift-net fleets operate, individual vessels may have a wide range of sizes of mesh, often because of shrinkage in use. The fleet as a whole may then catch in a non-selective manner despite the high selectivity of individual nets. Long-lines and handlines have selectivities determined by the size of hook used, and perhaps bait. In addition, the distance between hooks also has an effect on the catch of these gears. With fixed gears, such as weirs or bagnets or even trammels, the size of individuals and the proportion of the stock taken may depend on differences of behaviour, for example, due to state of tide.

For many gears selectivity is difficult to quantify. But for trawls and seines, as has been shown in the previous section, methods exist which allow one to quantitatively relate the selectivities of different fish species to different mesh sizes. When a small-mesh cover is used on a trawl the sum of the catch in the cover plus the catch in the cod-end, i.e. the total entering the cod-end, is taken to indicate the total fish population in an area. The proportions of fish retained by cod-ends of different mesh sizes is then a simple calculation. Observations can be repeated for a range of mesh sizes and for different net materials. An alternative method is to fish different sized cod-ends alternately on the same fishing grounds or to fish them from two similar vessels working close together. Because of local variations in the abundances of fish and because each fishing vessel has its own characteristic fishing efficiency, the comparative fishing experiments need many hauls, say 50, to make valid statistical conclusions. Whatever method is used, it is essential that the fishing area is chosen to provide the appropriate range of fish sizes.

Figure 3 shows the results of experiments examining the selectivity of (a) haddock and (b) whiting, using a 70 mm cod-end mesh. Each dot represents the percentage of the length group retained in the cod-end. A smooth curve is drawn through these points and is shown as the "selection curve". The areas above the curve describe the numbers of fish which escape through the cod-end. Thus, of the total number of haddock caught between 240 and 250 mm, 40% were in the cod-end and 60% had gone through the cod-end mesh into the small-meshed cover. Of the fish between 300 and 310 mm, 99% were in the cod-end and only 1% in the cover. The size of fish at which half are retained and half are released is called the "50% selection length" - in this case 250 mm for haddock and 290 mm for whiting respectively. Because of such factors as some fish being more plump than others of the same length, all meshes in a cod-end not being of exactly the same size, and some blockage of meshes being caused by both fish and scruff, selection is not absolutely sharp at a particular fish size but is described by an S-shaped curve covering a band of fish lengths, in this example about 10 cm.

Dividing the selection length by the size of the mesh gives what is called the "selection factor" - in the case of this experiment 3.6 for haddock and 4.1 for whiting. The selection factor describes the relationship between the girth of the fish, its length and its ability to wriggle

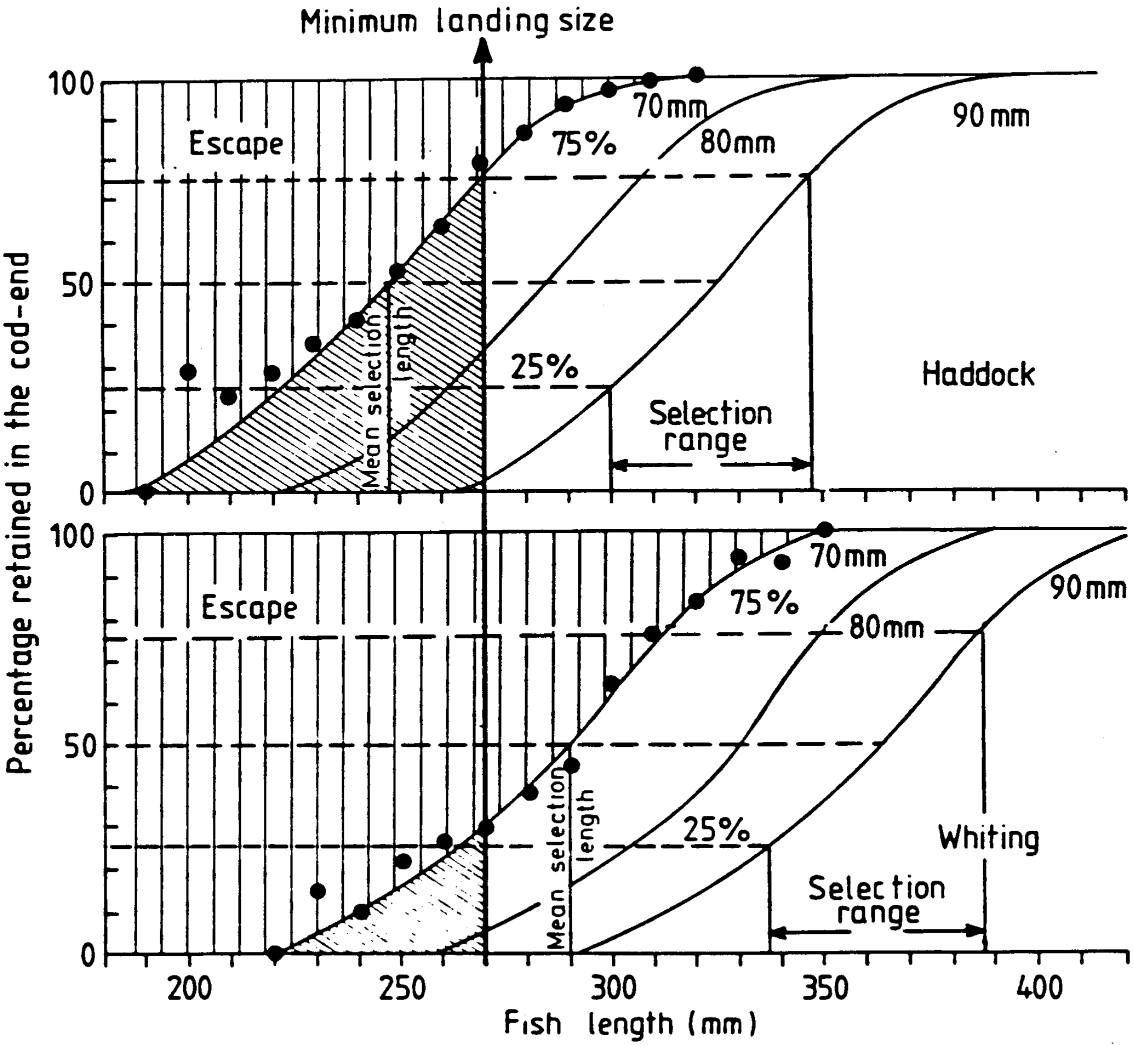

Figure 3. Length selection curves from experiments on haddock and whiting. With the present minimum size limit of 27 cm for haddock and whiting it can be seen that, for an increase to 90 mm cod-end mesh, almost all fish below this length would be expected to escape from the cod ends.

through a cod-end mesh. There is a selection factor for each fish species and these have been determined from a large series of experiments. The length interval between the 25 and 75% selection points is called the "selection range".

If the selection factor for a particular species of fish is known the 50% selection lengths for any given mesh sizes can be calculated. For example:

Haddock selection factor	3.6
Mesh size	75 mm
50% selection length	75 x 3.6 = 270 mm
Mesh size	90 mm
50% selection length	90 x 3.6 = 324 mm

In the experiment shown in Figure 3, the haddock caught ranged from 190 to 320 mm in length. The minimum legal landing size for haddock is currently 27 cm. The cross-hatched part of the curve indicates that, in this instance, the major part of the catch taken with a 70 mm cod-end consisted of fish below this minimum size and which should be discarded. If a 90 mm mesh were to be used, then only about 2% of the catch would be below the minimum size.

For whiting, the legal minimum landing size prior to the recent EEC Council Regulation No.171/83 was set at 23 cm. This allowed the legal retention on board of almost all whiting caught by a 70 mm cod-end in the experiment shown in Figure 3. Except in a few countries, many of these small fish are not marketable and are discarded at sea. A working group of the International Council for the Exploration of the Sea has shown that in 1979 the human consumption catch of whiting was 360 million fish (99 000 t), but that 640 million fish (77 000 t) were discarded. EEC Council Regulation No.171/83 (see Appendix 1) has increased the legal landing size to 27 cm, and the current mesh size is 80 mm.

It can easily be appreciated from this discussion and the selection curves in Figure 3 that, if one wished to maximize the retention of haddock, then the mesh size needed would be different from that if whiting were to be chosen. It has recently been shown (Macer, 1982) that to obtain the long-term maximum yield in weight per recruit in the North Sea cod stock, it would be necessary to fish with a cod-end of 250 mm. For North Sea haddock, whiting and saithe the equivalent mesh sizes are 140 mm, 90 mm and 160 mm respectively. In other areas where growth rates are different, one might expect different mesh sizes to be derived.

Only in certain areas or circumstances can trawl fisheries be directed at single species. The choice of mesh size in the North Sea, for example, has to be a compromise between those which might separately be considered optimal for cod, haddock and whiting and that which takes the mixture of species commercially desirable.

Over the years, much research effort has been expended on examination of selectivity differences between cod-ends constructed in different materials and with different braided twines. The method of measuring mesh size was defined in the Convention of 1946 (Gt Britain - Parliament, 1956) "so that a flat gauge 70 millimetres broad and 2 millimetres thick shall pass through it easily when the net is wet". To ensure that the same force each time was used, the method was later amended to include the proviso that a pressure of 4 kg should be applied when measuring.

The differentials incorporated in the mesh regulations in 1954 (Gt Britain - Parliament, 1954) arose as much from the construction of the nets in single or double twine as from the types of material used which had different stretching and shrinking characteristics. With the coming into general use of synthetics, net manufacturers developed methods of net construction which virtually removed the need for differentials. The International Council for the Exploration of the Sea (formerly through its Liaison Committee and now through the Advisory Committee on Fisheries Management (ACFM)) repeatedly commented that "there are no significant differences in selectivity between cod-ends made of single or double twine. On this basis, all the recommendations given above for changes in current mesh size refer to all nets irrespective of the material or construction" (ICES, 1979). These recommendations have now been taken into the EEC legislation under Council Regulation (EEC) No.171/83 (given in Appendix 1).

5. EFFECTS OF AN INCREASE IN MESH SIZE

These can be grouped under two headings: short-term and long-term effects. The short-term effect may be a reduction in marketable catches, brought about because some of the smaller marketable fish which had previously been retained by the cod-end can now escape through the meshes. By how much the catch is reduced depends upon the extent of the mesh increase and on the abundance of fish in the selection range. In the experiments illustrated in Figure 3, the implementation of the minimum legal size has contrasting effects on the landed catch. For the haddock the major part of the catch is below the legal limit and has to be discarded. In the case of whiting almost all the catch is of legal size but, being unmarketable, also has to be discarded.

It is difficult to quantify what the real short-term loss would be. Davis' (1934) experiment showed that the gross value of the commercial voyages with 85 mm nets exceeded the value of those with the 70 mm mesh, though catching less fish. Many fishermen commonly use mesh sizes well in excess of the minimum stipulated, for example, when fishing for cod. For national fleets the actual mesh size in use is often not known, except that it may well be greater than the minimum by some margin which safeguards the fisherman from chance prosecution.

When recommending changes in mesh size ICES scientists, in most cases, assume that the minimum mesh size is in use. Their calculation of short-term loss is therefore likely to be an overestimate, but it would be an underestimate if substantial catches were being taken with undersize meshes, whether taken either with blinded trawls or illegally in small-meshed fisheries. Tables 1, 2 and 3 show the calculated losses and long-term gains for a mesh change from current levels to 80 and 90 mm for the major species in, respectively, the North Sea, west of Scotland and the eastern English Channel.

The long-term effect arises because fish released due to the increase in mesh size are allowed to grow bigger before being caught. Some of those escaping will die from natural causes (such as predation), and they will be less numerous when they have reached a size at which they may be retained by a larger mesh, but will then weigh more. In recommending an increase in mesh size the fishery manager has to weigh these two opposing factors - is it better, i.e. more economic, to catch more small fish at perhaps a low price or to catch fewer larger ones with higher value?

With a larger mesh more of the young fish join the mature part of the stock and contribute to the annual spawning. At present, for most of the roundfish species, the success or failure of the fishery is dependent on the strength of the new year broods. The Total Allowable Catch (TAC) recommended must change from year to year, mirroring the strengths of the incoming recruit broods. The accuracy of the TAC depends upon how reliably the estimates of incoming recruitment can be made. Allowing more fish to reach the mature stock should make the fishery less dependent on the vagaries in level of recruitment of the incoming year brood. It should lead in the long term to more stable management strategies. In years of exceptionally high recruitment, the option would arise for management to allow more fishing in order to crop the surplus production.

There is, then, much to be said for increasing mesh sizes, but within limits. For example, in the case of plaice, the maximum gain from the growth of the plaice could only be achieved using a mesh size in excess of 150 mm. The use of such a mesh would release all soles and whiting, and a major part of the present catches of haddock. It is not the aim of fisheries scientists to allow fish to die of old age, but to obtain the maximum harvest while maintaining stocks in a healthy state.

Both short-term and long-term effects can be predicted, given a knowledge of the following factors: the length composition of the catch, the selection factors, the growth rate of the fish, the proportion of the stock dying each year from causes other than fishing (natural mortality), and the proportion caught at each age in the international fishery (fishing mortality).

In the calculation of immediate loss and long-term gain, it is essential to know the length distribution of the fish in an individual country's catch and, most important, the actual average mesh sizes used by that country's fleet. Unfortunately these latter data are not available for many of the major catching countries. The expected changes can only be calculated for those countries supplying length data of their catches and knowing mesh sizes already used.

Table 1 shows the predictions for the North Sea based on the mesh sizes used in 1975. The losses shown for the Netherlands for whiting and sole include those fish discarded at sea as unmarketable. For other countries the losses refer to landed catches.

Other than for whiting, it is seen that all countries gain in the long term by increasing the mesh size to 90 mm. The extent of the gains in whiting catches is dependent on whether the Danish industrial fishery continues to catch this species as by-catch with small mesh nets: the higher value assumes no by-catch in small-mesh industrial fishing. Major catches of whiting are made by countries using 75 mm mesh size; changing to 80 mm causes an expected increase even for English vessels.

Table 2 shows the long-term gains and short-term losses for the area to the west of Scotland (ICES Division VIa). There are long-term gains to be made for all countries for most species. The greatest short-term losses occur in those fleets now using the minimum legal mesh size.

In the eastern English Channel the national fisheries tend to operate in restricted areas with only a little overlap. The species preference tends to differ and, as a result, data are scanty for some species. Recent ICES assessments of the effects of mesh changes are given in Table 3. High immediate French losses on whiting are a reflection of the French national dispensation to certain vessels to use a mesh size below that agreed internationally. Nevertheless, the long-term gain from increasing the mesh size to 90 mm is apparent from the English and French data. There are modest long-term gains for sole by increasing mesh size to 90 mm, calculated on the assumption that the effective mesh size was 75 mm. Immediate losses are nevertheless high. As a major part of this fishery is by beam trawls, which are often used on dirty ground, it is likely that the effective mesh size is much below that used in the assessments. Increasing the mesh size might well result in much higher long-term gains than indicated here.

Table 1 Effects of mesh size changes from current levels to 80 and 90 mm in the North Sea (ICES Division IV) (ICES, 1974; ICES, 1975)

	Species	Gear	Current mesh in use (mm) (1975)	Short-term loss %		Long-term gain (%)	
				80	90	80	90
England	Cod	Trawl/seine	80	0	2	0	13
	Haddock	Trawl	80	0	6	0	14
		Seine	80	0	10	0	9
	Whiting	Trawl/seine	80	0	43	44 to 170	18 to 135
	Plaice	Trawl/seine	80	0	0	-	4
	Sole	Trawl	80	0	17	-	99
	Nephrops	Trawl	70	20	-	7	-
Scotland	Cod	Trawl/seine	75	<1	2	-	13
	Haddock	Trawl	75	<1	9	-	11
		Seine	75	<1	14	-	5
	Whiting	Trawl/seine	75	16	45	-8 to 140	-10 to 106
	Plaice	Trawl/seine	75	0	0	2	4
	Nephrops	Trawl	70	17	-	-	-
Netherlands	Cod	Trawl	75	0	9	0	4
	Haddock	Trawl	75	<1	13	5	6
	Whiting	Trawl	75	54	74	-38 to 36	-47 to 24
	Plaice	Beam trawl	75	1	2	2	2
	Sole	Beam trawl	75	12	15	21	38
Denmark	Haddock[1]	Industrial	16	-	-	6	18
	Whiting[1]	Industrial	16	0 to 88	0 to 95	8 to 18	10 to 7
	Plaice	Trawl	80	0	0	2	4
Federal Republic of Germany	Plaice	Trawl	80	0	0	2	4

- = No asessment made; [1] = The second figure in each loss/gain column corresponds with the changes expected from an increase in mesh from 16 mm.

Table 2 Effects of mesh size changes from current levels to 80 and 90 mm in the west of Scotland (ICES Division VIa) (ICES, 1978; ICES, 1981)

	Species	Gear	Current mesh in use (mm) (1975)	Short-term loss (%)		Long-term gain (%)	
				80	90	80	90
England	Cod	Trawl	80	0	<1	0	3
	Haddock	Trawl	80	0	3	3	10
Scotland	Cod	Trawl/seine	70	<1	2	<1	2
		Trawl	75	<1	<1	<1	3
	Haddock	Trawl/seine	70	3	11	0	-1
		Trawl	75	1	5	2	6
	Whiting	Trawl/seine	70	32	61	1	2
		Trawl	75	14	42	29	59
France	Cod	Trawl	75	<1	<1	<1	3
	Haddock	Trawl	75	1	7	2	5
Republic of Ireland	Cod	Trawl	70	0	0	<1	3
	Haddock	Trawl	70	<1	1	3	11
	Whiting	Trawl	70	33	63	0	-2

Table 3 Effects of mesh size changes from current levels to 80 and 90 mm in the eastern English Channel (ICES Division VIId) (ICES, 1978)

	Species	Gear	Current mesh (mm) (effective)	Short-term loss (%)		Long-term gain (%)	
				80	90	80	90
France	Cod	Trawl	54	2	4	2	5
	Whiting	Trawl	54	45	60	11	16
	Sole	Trawl	54	31	-	9	-
England	Whiting	Trawl	70	29	53	44	38
	Sole	Trawl	70	13	-	4	-
Belgium	Sole	Trawl	75	31	-	9	-

- = No assessment made.

For the Irish Sea and Bristol Channel a comprehensive review of management policies has already been published (Brander, 1977). The Irish Sea stocks have traditionally been subjected to a number of fisheries using small-mesh nets. Many of the vessels are relatively small and seasonally change from one fishery to another, often employing the same nets. At the present time there are three small-mesh fisheries in the Irish Sea: (i) the herring fishery; (ii) the Nephrops fishery; (iii) the English and Welsh shrimp fishery. In all these fisheries, by-catches of whitefish are taken to a greater or lesser extent dependent upon area of fishing and nationality involved. Despite the fact that the mesh size for directed fisheries for whitefish is 70 or 75 mm dependent on twine type, a considerable part of the catch of whiting, for instance, is taken in these small-mesh fisheries. The ICES Irish Sea and Bristol Channel Working Group has calculated that the quantities of small whiting discarded in the Irish Sea Nephrops fishery are comparable to the number of recruits to the human consumption fishery.

There are gains to be made in the catches of Nephrops by increasing the mesh size as indicated below:

		Current mesh (mm)	New mesh (mm)	Immediate loss (%)	Long-term gain (%)
Irish Sea	ca	55	70	20	4
Celtic Sea	ca	65	70	10	Small

Though sole stocks in both the Irish Sea and Bristol Channel cannot be described as overfished, the yields from both would benefit from an increase in mesh size. In the Irish Sea, if an 80 mm mesh size had been introduced on 1 January 1979, then the catch in that year would have been expected to drop by 19%, but by 1980 would have recovered to the 1977 level of catch. In the Bristol Channel the short-term losses of soles would be less severe than in the Irish Sea and the long-term gains would exceed the short-term losses considerably. A mesh increase to 90 mm in the Bristol Channel would be beneficial in the long term as this stock of soles has a growth rate similar to that of the North Sea stock.

6. CONCLUSIONS

It is over 70 years since the benefits were first demonstrated of using mesh sizes which minimize the catches of those fish which have the growth potential to increase considerably their weight. While 'growth overfishing', as it is often referred to, may not put stocks in danger, it reduces the potential yield.

In the history of international mesh regulations in the north-east Atlantic, the short-term loss which would result from an increase in mesh size has always commanded more emotional reaction than has any possible future gain. In the years before 1953, when the Permanent Commission discussed the introduction of an 80 mm mesh size for all North Sea trawls, the total international catch of North Sea soles averaged 19 000 tonnes per annum. Long-term gains were then expected to accrue from the use of the larger mesh. In 1977 the sole catch was 13 000 tonnes; the short-term effect of then changing to 80 mm would have resulted in losses of about 12%, far more than in 1953, but there would have followed long-term gains of the order of 30% to give catches approaching those of pre-1953. Those fishermen whose voices blocked the increase in mesh size in 1953 and whose annual catches have shrunk over the years may well regret their decisions.

How real are the short-term losses? Our estimates are based on the information from those countries which collect biological data on their catches. More importantly, they require some assessment of the mesh sizes used by the fleets. More often than not no actual observations of mesh size are available, and a 'guesstimate' of the mesh size in use has to be made. Nevertheless, the estimated mesh size probably tends to be an underestimate since most fishermen prefer to have nets which are already somewhat larger than the legal minimum mesh size. Thus the actual magnitude of the change from current average mesh size to any increased mesh is probably less than that assumed in the calculations, and it is known that some vessels in the North Sea are already using mesh sizes in excess of 90 mm. In addition, it has frequently been observed, both in experimental fishing and under commercial fishing conditions, that the catch rates of larger fish above the selective length increase in the bigger mesh trawls. This again would reduce the calculated short-term loss. On the other hand, for any country which does not enforce the regulations on minimum mesh size and on blinding of legal cod-end mesh, the loss would be greater than as calculated.

What is the cost of an increase in mesh size to the industry? There will be some reduction in catch particularly of lower value fish close to the minimum legal size. However, crew's time is saved by reduced sorting, gutting and discarding, some fuel saving has been detected, and increased price might be expected under the presently reducing TACs and supplies. Many fishermen in European countries have already recognised these advantages and increased their mesh sizes above the legal minima. Evidently, the consequent economic return to them has been sufficiently attractive and leads one to question the significance of the financial extent of the short-term loss in catch predicted in the assessment. What is certain is that the continued use of small meshes and lack of enforcement of the current mesh regulation causes a loss in yield to all fishermen.

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Appendix 1. COUNCIL REGULATION (EEC) No.171/83 of 25 January 1983, laying down certain technical measures for the conservation of fishery resources [with 1984 amendment]. (From: Official Journal of the European Communities, No. L24, 27 January, 1983.)

THE COUNCIL OF THE EUROPEAN COMMUNITIES ....
HAS ADOPTED THIS REGULATION:

Article 1 - Definition of areas

1. This Regulation applies to the taking and landing of biological resources occurring in all maritime waters under the sovereignty or jurisdiction of the Member States and situated in one of the following regions:

Region 1

(a) All waters off the coasts of the French department of St Pierre et Miquelon.

(b) All other waters which lie to the north and the west of a line running from a point at latitude 48°N, longitude 18°W; thence due north to latitude 60°N; thence due east to longitude 5°W; thence due north to latitude 60°30'N; thence due east to longitude 4°W; thence due north to latitude 64°N; thence due east to the coast of Norway.

Region 2

All waters situated north of latitude 48°N, but excluding the waters in region 1, the Baltic Sea and belts lying to the south and east of lines drawn from Hasenore Head to Gniben Point, from Korshage to Spodsbjerg and from Gilbjerg Head to the Kullen.

Region 3

All waters situated within those parts of the north-east Atlantic south of latitude 48°N, except the Mediterranean Sea and its dependent seas.

Region 4

All waters off the coasts of the French department of Guyana.

Region 5

All waters off the coasts of the French departments of Martinique and Guadeloupe.

Region 6

All waters off the coasts of the French department of Réunion.

2. These regions may be divided according to sub-areas or divisions of the International Council for the Exploration of the Sea (ICES) or sub-areas, divisions or subdivisions of the Northwest Atlantic Fisheries Organization (NAFO) or parts thereof or according to other geographical criteria.

3. For the purposes of this Regulation, the Kattegat is limited in the north by a line drawn from Skagen lighthouse to the lighthouse in Tistlarna, and from here to the nearest point on the Swedish coast, and in the south by a line drawn from Hasenore Head to Gniben Point, from Korshage to Spodsbjerg, and from Gilbjerg Head to the Kullen.

The Skagerrak is limited in the west by a line drawn from the lighthouse of Hanstholm to the lighthouse of Lindesnes and in the south by a line drawn from Skagen lighthouse to the lighthouse of Tistlarna and from here to the nearest point on the Swedish coast.

4. For the purposes of this Regulation, the North Sea shall comprise ICES sub-area IV, the adjacent part of ICES division IIa lying south of latitude 64°N and that part of ICES division IIIa which is not covered by the definition of the Skagerrak given in paragraph 3.

5. The sub-areas, divisions or subdivisions of the NAFO referred to in this Regulation are described in Annex III to Council Regulation (EEC) No.3179/78 of 28 December 1978 concerning the conclusion by the European Economic Community of the Convention on Future Multilateral Cooperation in the Northwest Atlantic Fisheries[1], as last amended by Regulation (EEC) No.654/81[2].

6. The definition of the ICES areas referred to in this Regulation is described in a Commission communication[3].

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(1) Official Journal of the European Communities No.L378, 30.12.1978, p.1

(2) Official Journal of the European Communities No.L 69, 14. 3.1981, p.1

(3) Official Journal of the European Communities No.C140, 3. 6.1982, p.3.

ANNEX I

Minimum mesh size provided for in Article 2. (From: Official Journal of the European Communities No. L288, Vol. 26, 21 October 1983.

Region	Part of region	Type of net	Minimum mesh size (mm)
1	NAFO, ICES sub-areas XIV, V	All	130([1])
	Other parts of the region	All	120
2	Skagerrak and Kattegat	All	80([2])
	North Sea:([3])		
	- until 31 December 1986([4])	All	80
	- from 1 January 1987([4])	All	90
	West of Scotland and Rockall (ICES sub-area VI) West of Ireland (ICES divisions VIIb and c) Bristol Channel (ICES division VIIf) South Coast of Ireland (ICES divisions VIIg, h, j and k)	All	80
	Irish Sea (ICES division VIIa)	Single twine Double twine	70 75
	English Channel (ICES divisions VIId and e)	All	75([5])
3		All	65
4		All	45
5		Token entry	Token entry
6		Token entry	Token entry

([1]) When fishing for blue ling in part of ICES division Vb under the sovereignty or jurisdiction of a Member State, the minimum mesh size is 80 mm.

([2]) When fishing for whiting, the minimum mesh size is 70 mm.

([3]) Except for fishing for sole by vessels not exceeding 300 bhp, in which case the minimum mesh sizes are 70 mm single twine and 75 mm double twine. To be reviewed before 31 December 1985. Council Regulation (EEC) No. 1637/84, Official Journal of the European Communities, No. L156, 13.6.84.

([4]) Council Regulation (EEC) No. 1637/84. Official Journal of the European Communities, No. L156, 13.6.84.

([5]) Increase to 80 mm on 1 January 1989, to be decided by 1 July 1987.
Council Regulation (EEC) No. 3625/84. Official Journal of the European Communities No. L.335, 22.12.84.

ANNEX II

Minimum mesh size provided for in Article 3* (From: Official Journal of the European Communities, No. L.24, 27 January 1983.)

Species	Minimum mesh size (mm)
Region 1	
Polar cod (Boreogadus saida)	
Capelin (Mallotus villosus)	
Blue whiting (Micromesistius poutassou)	16
Argentine (Argentina spp)	16
Herring (Clupea harengus)	16
Molluscs	16
Silver pout (Gadiculus thorii)	16
Nephrops (Nephrops norvegicus)	16
Norway pout (Trisopterus esmarkii)	16
Prawns (Pandalus spp)	16
except as specified below:	16
Prawns in NAFO sub-area 1 and ICES divisions V and XIV (offshore)	40
Redfish in NAFO division 3P	16
Clupeoid fish other than herring	16
Eels (Anguilla anguilla)	16
Great weevers (Trachinus draco)	16
Horse mackerel (Trachurus trachurus)	16
Mackerel (Scomber scombrus)	16
Sand-eels (Ammodytidae)	16
Saury (Scomberesox saurus)	16
Shrimps (Crangon spp)	16
Smelts (Osmerus spp)	16
Region 2 (1)	
Herring (Clupea harengus)	32(2)
Mackerel (Scomber scombrus)	16
except as specified below:	
Mackerel in the North Sea	32
Horse mackerel (Trachurus trachurus)	16
Sprat (Clupea sprattus)	16
Norway pout (Trisopterus esmarkii)	16
Blue whiting (Micromesistius poutassou)	16
Argentine (Argentina spp)	16
Prawns (Pandalus spp except Pandalus montagui)	30
Prawns (Pandalus montagui)	20
Shrimps (Crangon spp)	20
Eels (except elvers) (Anguilla anguilla)	16
Great weevers (Trachinus draco)	16
Molluscs (except cuttlefish - Sepia officinalis)	16
Sand-eels (Ammodytidae)	None
except as specified below:	
Sand-eels in the North Sea in the period between 1 November and the last day of February inclusive	16
Capelin (Mallotus villosus)	16
Saury (Scomberesox saurus)	16
Smelts (Osmerus spp)	16
Sardines (Sardina pilchardus)	16

(1) Except in Skagerrak and Kattegat for the species listed below.

*[small-meshed nets]

(2) Amended by Council Regulation (EEC) No. 2931/83. Official Journal of the European Communities, No. L288, 21.10.83.

ANNEX II (continued)

Species	Minimum mesh size (mm)
Skagerrak and Kattegat	
Herring (Clupea harengus)	32
Mackerel (Scomber scombrus)	32
Horse mackerel (Trachurus trachurus)	32
Deep-water prawn (Pandalus borealis)	30
Argentine (Argentinidae)	30
Sand-eel (Ammodytes spp)	None
except as follows:	
- in the Skagerrak between 1 November and the last day of February inclusive	16
- in the Kattegat between 1 August and the last day of February inclusive	16
Shrimp (Crangon spp and Leander adspersus):	
- inside four miles from the baselines	16
- outside four miles from the baselines	30
Garfish (Belone belone)	16
Grey gurnard (Eutrigla gurnardus)	16
Region 3	
Bastard sole (Dicologlossa cuneata)	40
Sardine (Sardina pilchardus)	20
Shrimps (Crangon spp)	20
Eels (except elvers) (Anguilla anguilla)	20
Sprat (Clupea sprattus)	16
Anchovy (Engraulis encrassicholus)	16
Sand-eel (Ammodytidae)	16
Herring (Clupea harengus)	40
Horse mackerel (Trachurus trachurus)	40
Mackerel (Scomber scombrus)	40

ANNEX IV

Nephrops. Minimum mesh size provided for in Article 4 (From: Official Journal of the European Communities, No. L.288, Vol. 26, 21 October 1983.)

Region	Part of region	Minimum mesh size (mm)
2	Skagerrak and Kattegat	60
2	Irish Sea (ICES division VIIa, ICES divisions VIIg and h) off the south coast of Ireland,	
	- until 30 June 1986	60
	- from 1 July 1986	70
	All other parts of the region	70
3		50

ANNEX V

Minimum size referred to in Article II (3)* (From: Official Journal of the European Communities, No. L.288, Vol. 26, 21 October 1983.)

Species	Region 1	Region 2	Region 3
Cod (Gadus morhua)	34 ([1])	30 ([2])	30
Haddock (Merlanogrammus aeglefinus)	31	27	27
Hake (Merluccius merluccius)	30	30	30
Plaice (Pleuronectes platessa)	25	27 ([3])	25
Witch (Glyptocephalus cynoglossus)	28	28	28
Lemon sole (Microstomus kitt)	25	25	25
Sole (Solea solea)	24	24	24
Turbot (Psetta maxima)	30	30	30
Brill (Scophthalmus rhombus)	30	30	30
Megrim (Lepidorhombus spp)	25	25	25
Whiting (Merlangius merlangus)	27	27 ([4])	23
Dab (Limanda limanda)	15	23 ([3])	15
Saithe (Pollachius virens)	35	30	30
Common sea bream (Pagellus bogaraveo)	-	-	12
Red mullet (Mullus surmuletus)	-	-	15
Bass (Dicentrarchus labrax)	-	Token entry	-
Conger eel (Conger conger)	-	-	58
Pollack (Pollachius pollachius)	-	-	22
Ling (Molva molva)	-	Token entry	63
Shad (Alosa spp)	-	-	30
Sturgeon (Acipenser sturio)	-	-	145
Grey mullet (Mugil spp)	-	-	20
Salmon (Salmo salar)	-	-	48
Trout (Salmo trutta)	-	-	23
Flounder (Platichthys flesus)	-	20 ([5])	-

([1]) Except in NAFO sub-area 1, plus ICES sub-areas XIV and V, where the minimum size shall be 40 cm.
([2]) Except in ICES division VIIa, where the minimum size shall be 45 cm between 1 October and 31 December.
([3]) In Skaggerak and Kattegat and, as from the entry into force of the 90 mm mesh size in the North Sea. In the other parts of region 2 and until the entry into force of the 90 mm mesh size in the North Sea, the minimum size will remain at 25 cm for plaice and 15 cm for dab.
([4]) Except in Skagerrak and Kattegat, where the minimum size shall be 23 cm.
([5]) In Skagerrak and Kattegat only.

*Minimum landing sizes for fish.

ANNEX VI

Minimum size referred to in Article 11(3). (From Official Journal of the European Communities, No. L.288, Vol. 26, 21 October 1983.)

Species	Region	Part of region	Minimum size
Herring (*Clupea harengus*)	1 2 3	Except Skaggerak and Kattegat	20 cm
	2	Skagerrak and Kattegat only	18 cm
Mackerel (*Scomber scombrus*)	2	North Sea only	30 cm
Mackerel (for industrial purposes)	2	Skaggerak and Kattegat only	30 cm
Whole Nephrops (*Nephrops norvegicus*)	2	Skaggerak and Kattegat only	40 mm cephalothorax length 130 mm overall length
	2	Except Skaggerak and Kattegat	25 mm cephalothorax length 85 mm overall length
	3		20 mm cephalothorax length 70 mm overall length
Nephrops tails	2	Skaggerak and Kattegat only	72 mm
	2	Except Skaggerak and Kattegat	46 mm
	3		37 mm
Lobster (*Homarus gammarus*)	2	Except Skaggerak and Kattegat	85 mm cephalothorax length 24 cm overall length([1])*
	2	Skaggerak and Kattegat only	78 mm cephalothorax length 22 cm overall length

([1]) From 1 May 1984

* Amended by Council Regulation (EEC) No. 2178/84, Official Journal of the European Communities, No. L199, 28.7.84.

ANNEX VI (contd)

Species	Region	Part of region	Minimum size
Spinous spider crab (*Maia squinado*)	2		120 mm
	3		Token entry
Edible crab (*Cancer pagurus*)	2		Token entry
	3		Token entry
Scallop (*Pecten maximus*)	2		100 mm
	3		Token entry
Clam (*Venus verrucosa*)	2	ICES Divisions VII d) and e) only	40 mm

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