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REPORT OF THE HAKE WORKING GROUP

La Rochelle, 20-24 January, 1969

Participants:

J. Dardignac, France (Convenor)
O. Cendrero, Spain
R. Monteiro, Portugal
B. W. Jones, U.K.
R. Jones, U.K.

1. Terms of Reference

At the 56th Statutory Meeting of ICES in 1968 it was resolved (C.Res.1968/2:10) that "a Working Group be established to assess the present state and the effects of fishing on the exploited hake stocks in NEAFC Regions 2 and 3". Accordingly, the Working Group, constituted as above, met in La Rochelle on 20-24 January 1969.

2. Introduction

After the initial review of the data available to the Working Group it became clear that much of the data was not in a form which could be sub-divided according to fishing areas. The general approach has, therefore, been to consider the hake fishery in ICES sub-areas VI, VII, VIII and IX as a single unit. The greater part of the fishing in this area is known to be distributed in ICES sub-areas VII and VIII with smaller amounts of fishing in Division VIa (mainly U.K.) and sub-area IX (mainly Portugal). No account has been taken in this report of the fishing in sub-area IV, or of the possible interaction of the sub-area IV hake stock with that in sub-areas VI-IX. This is because it was felt that any such interaction would have a negligible effect on the results obtained.

3. Description of the Fisheries

The principal countries fishing for hake in sub-areas VI-IX are France, Spain, Portugal and the United Kingdom, and descriptions of the fisheries of each of these countries are given below:

3.1 France

French vessels working in Divisions VIa, VIIa-c, VIIe-f, VIIIa-c and IXa can be divided into three categories:

Large trawlers, over 75 ton G.R.T., and known as "hauturiers", work on the continental slope between Portugal and the West of Scotland and in the Celtic Sea. They do not all fish primarily for hake, but they all catch this species to a greater or lesser degree. More than 90% of the vessels of this category are based at ports of Lorient, Concarneau and La Rochelle.

The second category comprises smaller vessels, mainly under 50 tons G.R.T. known as "artisans". These work mainly in the Bay of Biscay and, to a lesser extent, in the Irish Sea. For the most part their range of activity is more limited than that of the "hauturiers", and in the Bay of Biscay they rarely work in depths greater than 120 metres, or more than 60 miles from the coast. In this region their fishing grounds often coincide with areas known to be hake nursery grounds. These vessels tend to alternate trawling with other seasonal fishing and their catches are primarily composed of Nephrops, sole and young hake.

A third category of vessel consists of trawlers known as "semi-industriels". These vessels are better characterised by their type of fishing than by their tonnage (50-150 tons G.R.T.). They work essentially in the Irish Sea (VIIa, VIIg) and west of Ireland, and fish primarily for whiting and cod, catching hake less frequently.

In 1967 these three categories of vessel contributed to the total French catch of hake in the following proportions:-

	% By Weight	% By Numbers
"Hauturiers"	71	54
"Semi-industriels"	7	5
"Artisans"	22	41

3.2 Spain

The Spanish fleet may be conveniently divided into two groups of vessel. The large vessels, mainly over 200 H.P., are trawlers that operate either singly, or in groups as pair trawlers. These vessels, although not uncommon on inshore grounds, operate mainly offshore in sub-areas VIII and VII and, to a lesser extent, in VIa. Their main ports are San Sebastian, Vigo, and La Coruna.

In addition to the large trawlers there are a number of inshore boats proper, normally under 150 H.P. and averaging around 20 H.P. These vessels operate trawls, hand-lines or gill-nets and fish seasonally for hake, sardine, anchovy and tuna.

3.3 Portugal

All the Portuguese hake catches come from division IXa and, except for small quantities taken by lines and gill-nets, are entirely taken by trawlers. The average size of the trawlers is about 150 tons G.R.T..

3.4 United Kingdom

The United Kingdom catches of hake are taken by trawlers working mainly in VIa and VII. In England, hake has been particularly important for vessels based at the west coast ports of Milford Haven and Fleetwood, but as the abundance of hake has declined, these ports have become progressively less dependent on hake catches and other species of fish have made up an increasing proportion of the total demersal landings.

For Scotland, hake landings from VIa are taken by trawlers landing at east coast ports and by seiners landing at west coast ports. About half of the total is caught by seiners, mainly under 60 ft in length, landing at the Scottish west coast port of Ayr.

4. Landings, Effort and Landings per Unit Effort

4.1 Landings (Table 1)

No breakdown of total landings into ICES regions has been possible and so the landings from sub-areas VI-IX have been treated as a single entity. The best possible estimates for each country have been obtained and these are tabulated for the years 1953-1967 in Table 1.

Of the various countries, France and Spain have accounted for the greatest part of the landings, and together have taken 84% of the total (Spain 47%, France 36%). United Kingdom catches have accounted for 12% of the total and Portugal 5%. Other countries have contributed less than 0.5% to the total.

During the period 1953-1967 total landings have fluctuated around a level of about 90,000 tons. This reached a maximum of 101,000 tons in 1955. There was a second maximum of 100,000 tons in 1961 and since then landings have tended to decline.

4.2 Fishing Effort (Tables 2-4)

Estimates of fishing effort have been obtained for France, Portugal and the United Kingdom in various units. For France, detailed information was available on the mean horse power and days at sea for "hauturiers" working out of La Rochelle, Lorient and Concarneau from 1953-1967 (Table 2). This showed that during this period there had been a considerable increase in the fishing effort by "hauturiers". Comparable data were not available for "semi-industriels" or "artisans" but it is known that their number and mean horse power has also been increasing during the same period. In Table 2, estimates of the total French effort by all vessels have also been tabulated in "hauturier" units. These show that from 1953-1967 the French effort has increased nearly threefold.

Portuguese effort has been estimated in terms of hours fishing by Portuguese trawlers from 1960-1965 (Table 3). These data show an increase up to 1962 and a decline thereafter.

Fishing effort by English trawlers during the period 1955-1967 has been tabulated for various areas in Table 4. This is given in thousands of ton-hours in motor-trawler units. Since 1960 there has been a slight decline in effort in divisions VIa and VIIf-k. In division VIIa effort has remained fairly constant during recent years. In the case of Scotland, there are few vessels fishing specifically for hake and no attempt has been made to determine representative fishing effort statistics for these vessels.

For Spanish vessels no estimates were available of total fishing effort. It is known, however, that from 1964-1968 there has been a decline in the fishing effort of trawlers fishing in sub-areas VI-IX and operating out of Vigo and La Coruna. This has been due to the replacement of many of these vessels by stern trawlers which have since been working more distant fisheries. Trawl effort in other ports has not changed. In the case of the smaller inshore vessels, it is known that there has been a steady increase in their fishing power over the period 1964-1968.

4.3 Landings per unit effort (Table 5)

Estimates of the landings per unit effort have been made in the various national units for French, Portuguese and English vessels. For comparative purposes these have been expressed as percentages of their 1961 value and these values are shown in Table 5 and Figure 1.

French and English data agree quite well in showing a declining trend in the landings per unit effort from 1955 to 1967. English data are shown for divisions VIa and also VIIf-k. The results for divisions VIIf-k appear to agree better with the French data which is in accordance with expectation since more French fishing takes place in and near divisions VIIf-k than in division VIa. During recent years there has been a decline in the number of English vessels fishing specifically for hake and this factor could have operated so as to exaggerate the rate of decline in the English landings per unit effort.

In contrast to the French and English data, the Portuguese landings per unit effort have tended to increase. These were available for the period 1960-1965 and over this period show an accelerated rate of increase.

5. Length Compositions (Tables 6-8)

Detailed length compositions were available for French, Portuguese and English vessels. For Spanish vessels some indication was available of the nature of the length composition of the catches.

For France, measurements of hake landed by the three main classes of vessel have been made at La Rochelle in 1967. In the case of the "hauturiers", measurements were made from vessels operating in all of the major sub-areas. These showed that the landings from vessels operating in divisions VIa and VIIb-c contained a greater proportion of large hake than did those from vessels operating in sub-areas VIII and IX and the remainder of sub-area VII (Figure 2). A summary of these data, for all areas, is included in Table 6 and Figure 2. It appears that of the three classes of vessel, "hauturiers" contained the greatest proportion of large fish while the "artisans" contained the greatest proportion of small fish. Landings by "artisans" in fact contained some fish (0.4% by numbers) in the 20-24 cm length range.

For Portugal, measurements of the catch, before discarding, have been made at sea during the period 1960-1967 (Table 7). These measurements come exclusively from division IXa. The length compositions were found to differ significantly from ground to ground but the results tabulated are believed to be representative of the Portuguese catches as a whole. They show that a large proportion of the catches consists of very small hake and in some years fish as small as 5-9 cm were present.

For the United Kingdom, a long series of measurements have been made from trawlers landing at Fleetwood and Milford Haven, broken down by sub-divisions. Landings at Fleetwood come from division VIa. Landings at Milford Haven come from division VIa and also from sub-area VII. A comparison of vessels from VIa landing at each port shows that the Fleetwood vessel land relatively fewer small fish than the Milford Haven vessels (Figure 2). This may be due to the fact that in recent years the Fleetwood vessels have tended to use larger mesh-sizes than the Milford Haven vessels, but there are also differences in the grounds fished by the two fleets. For comparison with the French and Portuguese length compositions, the Milford Haven landings from divisions VIIf-k have been chosen as most appropriate and these are shown in Table 8 from 1951-1967.

Since French, Portuguese and English length compositions are only all available for 1967, the percentage length compositions for these vessels in that year are shown together for comparative purposes in Table 6 and Figure 2. These clearly show the differences in the length compositions of the different groups of vessels. The French "artisans" and the Portuguese trawlers contain the greatest proportion of small hake. The French "hauturiers" and the English trawlers on the other hand contain the greatest proportion of large hake.

For Spain, no detailed length measurements were available. A breakdown of the landings by size categories was available however for the two categories of Spanish vessels. Trawler landings were found to contain a higher proportion of small hake and sometimes as much as 85% by weight of the landings consisted of hake under 1 kg in weight (about 55 cm). The landings of inshore vessels on the other hand mainly consist of hake over 1½ kg in weight (about 60 cm).

6. Discards

No precise data were available of the rate of discarding of hake by French vessels. In the case of "hauturiers" and "semi-industriels" it was felt that discarding was very small and could be ignored for the purpose of the assessments. In the case of "artisans" it was recognised that a certain proportion of the very small hake caught were not fully represented in the market landings. No estimates were available of this proportion however. In the case of Spanish trawlers it is known that some fish are discarded but no estimates were available of the amount.

In the case of Portuguese trawlers no estimates were available of the quantity of fish discarded. The majority of discards were believed to be of fish under 15 cm in length however. It was thought that the percentage discarded would not be more than 15% by number and on the basis of the Portuguese length-composition data this should be equivalent to a much smaller percentage by weight.

No data were available on the rate of discarding by U.K. trawlers but it was believed that this was very small.

7. Cod-end Mesh-Sizes and Material (Table 9)

For French vessels, measurements of the cod-ends in use have been made at La Rochelle from 1965 to 1967. The material and average mesh-sizes obtained are shown in Table 9. For French "hauturiers" the mean was 63 mm with the majority lying in the range 60-65 mm. For the semi-industriels two different mesh-sizes were used. A mesh of 50 mm was used when fishing for Nephrops and a mesh of 70 mm was used when fishing for protected species. "Artisans" used much smaller meshes than either of the two other classes of vessel The mean was 43 mm with a majority of values lying in the range 35-50 mm. For most French vessels the material in use was double polyamide. For Spanish vessels the only cod-end measurements that were available were some, made in 1966 and 1967, in La Rochelle. The majority of these measurements covered the range 40-45 mm. For most Spanish vessels the material in use is simple polyethylene.

For Portuguese vessels, no cod-end mesh measurements were available. Most Portuguese vessels use double polyethylene in their cod-ends.

United Kingdom trawlers fishing for hake mainly used cod-ends made of polyethylene. The mesh-sizes of Milford Haven vessels were mainly in the range 75-80 mm while the Fleetwood vessels used mesh-sizes in the range 70-100 mm.

8. Assessments

Assessments of the effect of various increases in mesh-size have been made using the method of Gulland (1961).

Data required are:

8.1 Length compositions

8.2 Selectivity data

8.3 Growth data

8.4 Mortality data

8.5 Discards.

8.1 Length Compositions

The following length compositions were used in the assessment:

For French vessels, the French length-composition data are shown in Table 6.

For Spanish trawlers it was agreed that the most appropriate length composition to use was that of the French "artisans".

For Portuguese vessels a length composition based on the mean of the 1960-1967 Portuguese length compositions was used (Table 7).

For United Kingdom vessels the length composition of the landings by Milford Haven vessels from divisions VIIf-k was thought to be the most appropriate to use. Length compositions from this source were available for a considerable period (Table 8) and a length composition based on the mean of the 1958-1967 length compositions was used for the assessment.

8.2 Selectivity data

The selectivity data used in the assessment are summarised in Table 10. Where mesh-sizes were known the appropriate values were used, but where, as in the case of the Portuguese trawlers, no measurements were available, a suitable value was assumed.

To determine the 50% lengths corresponding to each mesh-size, selection factors for hake were required. Experiments using double nylon cod-ends have given selection factors ranging from 3.2-5.4 (Ancellin, 1956; Monteiro, 1966; Dardignac et al., 1967 and 1968). It was felt that this range was rather large and that the true value could reasonably be supposed to lie within the range 3.6-4.6. Assessments were done using each of these values.

8.3 Growth data

The 50% ages corresponding to the various mesh-sizes, were calculated by converting the 50% lengths in Table 10 to ages using the hake age/length relationship given by Meriel-Bussy, 1968.

A length/weight relationship was also required and the values used are tabulated in Table 11 (from French unpubl.data).

8.4 Mortality data

Estimates of hake total mortality were available from the age compositions of hake caught by the "Thalassa" from 1965 to 1967 and landed by French "hauturiers" of La Rochelle in 1967. The average of nine independent estimates gave a value of the total mortality rate (Z) = 0.74 (unpubl. French results).

No estimates were available of the natural mortality rate (M). For the assessment, values were required over the selection range of the mesh-sizes considered and values of 0.2 and 0.3 were assumed. It was felt that these values could be too high, but that to use values which were too high was not inappropriate as this would tend to under- rather than to over-estimate any gains that might accrue from an increase in mesh-size.

For the assessment, values of $E = F/Z$ over the exploited age range were also required. No estimates were available and assessments were made using values of E = 0.6 and 0.8.

8.5 Discards

In view of the lack of information on discards, no account was taken of this factor in the assessments. The effect of ignoring discards should be to under-estimate the long-term benefits to each gear.

9. Effects of Increases in Mesh-Size

The effects of increases in mesh-size have been calculated for increases in mesh-size to 60 mm, 70 mm and 80 mm. No reference has been made to the material in use because the uncertainty in the selection factor is greater than the differential selectivity effects of the different materials. Where the mesh-size of a vessel category was greater than the mesh-size adopted, it was assumed that the mesh-size of that category of vessel remained constant, i.e. in no case was the mesh-size of any vessel category reduced.

9.1 Immediate effects (Table 12)

French "hauturiers" and semi-industrials: an increase in mesh-size up to 80 mm would lead to immediate losses of the order of 3-10% by weight.

French "artisans" and Spanish trawlers: immediate losses would vary from 6-14% for an increase in mesh-size to 60 mm to 20-42% for an increase to 80 mm.

Portuguese trawlers: immediate losses would vary from 7-14% for an increase to 60 mm to 18-32% for an increase to 80 mm.

United Kingdom trawlers: immediate losses would only occur if the mesh-size were increased to 80 mm. They would then be of the order 2-20%.

All gears: immediate losses would vary from 4-10% for an increase to 60 mm to 14-30% for an increase to 80 mm.

9.2 Long-term gains (Table 13)

Long-term gains have been calculated for each gear category for various combinations of selection factor, E and M (Table 13).

French "hauturiers" and "semi-industriels": long-term gains vary from 9-31% for an increase to 60 mm to 26-83% for increases to 80 mm.

Spanish trawlers and French "artisans": long-term gains vary from 2-13% for an increase to 60 mm to 4-20% for an increase to 80 mm. In the case of the French "artisans" it must be stressed however that owing to the limited offshore range of these vessels these gains could easily be over-estimates of the true values. The assessments have all been made on the assumption that any fish released by an increase in mesh-size would ultimately become equally available to all vessels. Owing to the restricted range of the "artisans" it is quite possible that they would not be able to benefit by the amounts indicated above, due to the possibility that as the fish grow they might move offshore and away from the grounds worked by the "artisans".

Portuguese trawlers: long-term gains vary from 1-13% for an increase in mesh-size to 60 mm to 7-38% for an increase to 80 mm. To some extent these gains would be dependent on fish, released by other gears, migrating to division IXa and, in the event of this not occurring, these gains would be over-estimated.

United Kingdom trawlers: the calculated long-term gains vary from 9-31% for an increase (by other vessels) to 60 mm to 27-62% for an increase to 80 mm. However, United Kingdom trawlers tend to fish outside the area in which the majority of fish released by an increase in mesh-size would tend to be found. The calculated values probably over-estimate the true long-term gains to United Kingdom trawlers, and this should be particularly true for trawlers fishing in the north of the area (i.e. division VIa). To this extent, therefore, some of the long-term gains attributed to the United Kingdom trawlers would in reality accrue to other vessels (i.e. French "hauturiers" and "semi-industriels" and Spanish and Portuguese trawlers).

All gears: long-term gains vary from 5-18% for an increase to 60 mm to 12-42% for an increase to 80 mm.

9.3 Long-term gains when French "artisans" do not increase their mesh-size and other vessels do so (Table 14)

The long-term gains in this situation follow a similar pattern to those in Table 13 but are naturally not so great. No estimates have been given for the French "artisans" in this instance. To do this would involve an estimate of the proportion of fish released by "other" gears that would become available to the French "artisans". This is not known and so no realistic estimate can be given of the long-term gain to "artisans" in this instance.

10. Comments on Assessments

It must be stressed that although precise numerical values have been tabulated in Tables 12-14 the reliability of these estimates is dependent on the data supplied and on the assumptions made. The largest single component of the fishery consists of Spanish trawlers for which no length-composition data were available and for which a length composition had to be assumed. The second largest component consists of French vessels for which length-composition data were available, but for one year only. In view of the changes in length composition from one year to the next, due to the influence of good and bad year-classes, a length composition based on one year only can never be relied on to be truly representative. Spanish and French vessels together land 84%

of the hake from the region concerned and therefore no great reliability can be placed on the precise value given in the assessments. They can only be used as a first set of estimates of the probable direction of the effect of changes in mesh-size. A second factor, which could influence the results is the possibility that an increase in the efficiency of capture of hake may result from an increase in mesh-size (Dardignac et al., 1967). If this proves to be the case, the effect of this on the assessments would need to be taken into account. Some account should also be taken of the distribution of fishing. By far the greatest amount of fishing takes place in the central part (sub-areas VII and VIII) of the area covered by the assessments. The results would be expected to be more applicable to this area, and the effects to the north and south would be less certain.

11. Effects of Fishing

The Group considered that it had neither the necessary data, nor the time available, to assess the effects of fishing on the stocks of hake in any greater detail than has been done in the discussion in the section dealing with landings and effort.

12. Recommendations

1. The Group recommended that all countries should collect length and, if possible, age composition data of hake caught or landed by commercial vessels.

2. The Group recommended that all countries should continue to collect catch and effort data in as detailed a form as possible.

3. The Group recommended that as soon as sufficient data under (1) and (2) have been collected, it should meet again to make further assessments.

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Table 1. Total landings of hake from sub-areas VI, VII, VIII and IX - thousands of tons, round fresh.

Years	Portugal*	Spain	France	England	Scotland	Other Countries	Total
1953	2.9	41.1	27.5	18.4	2.2	0.3	92.4
1954	3.0	41.5	26.5	14.9	1.9	0.2	88.0
1955	2.7	51.9	31.0	12.4	2.3	0.5	100.8
1956	1.9	38.0	30.3	12.1	1.7	0.3	84.3
1957	2.8	42.8	28.8	10.2	1.5	0.3	86.4
1958	3.8	40.3	35.1	9.7	1.2	0.3	90.4
1959	3.6	42.8	38.7	7.0	1.1	0.3	93.5
1960	3.8	46.1	40.0	6.9	1.4	0.4	98.6
1961	4.7	47.5	40.1	5.5	1.7	0.5	100.0
1962	5.1	37.5	37.4	6.3	3.1	0.5	89.9
1963	5.8	46.0	32.2	5.5	2.3	0.3	92.1
1964	6.4	39.8	31.4	4.2	1.6	0.3	83.7
1965	7.9	32.9	27.7	3.5	1.7	0.4	74.1
1966	6.0	30.3	25.2	2.3	2.0	0.4	66.2
1967	Not available	33.9	26.4	2.1	1.5	Not available	-

* Derived partly from statistics given in "Bulletin Statistique" and partly from statistics supplied by Monteiro for 1960-1965.

Table 2. Estimates of total fishing effort by all French vessels - based on "hauturiers" landing at La Rochelle, Lorient and Concarneau.

Year	"Hauturiers" from Concarneau, Lorient and La Rochelle			Total French effort (1,000 units)
	Mean Power (H.P.)	Thousands of days absent	Total effort in 1,000 units*	
1953	358	37.0	134.2	209.7
1954	371	38.7	146.4	218.1
1955	364	41.3	153.9	235.5
1956	386	44.5	177.0	262.1
1957	405	54.0	223.1	291.1
1958	413	60.6	257.1	350.7
1959	420	64.8	276.3	399.2
1960	439	66.4	295.5	414.9
1961	459	66.7	308.5	452.6
1962	476	66.2	319.7	469.4
1963	513	65.0	334.2	485.8
1964	551	71.7	393.6	548.6
1965	600	73.6	440.9	611.0
1966	631	72.4	454.8	654.3
1967	655	66.6	434.7	617.3

* Days absence per 100 H.P.

Table 3. Estimate of fishing effort by Portuguese trawlers.

Year	Hours Fishing
1960	166,137
1961	190,362
1962	213,000
1963	207,348
1964	184,996
1965	184,173

Table 4. Estimates of fishing effort by English trawlers in various sub-regions.

Year	Thousands of ton-hours Motor trawler unit		
	VIa	VIIf-k	VIIa
1955	29	21.4	2.4
1956	30	8.6	4.1
1957	30	8.2	5.4
1958	37	17.4	6.3
1959	35	9.3	6.9
1960	37	4.8	5.1
1961	32	4.5	5.2
1962	30	3.7	5.9
1963	29	3.4	5.9
1964	30	4.2	5.7
1965	30	3.4	6.2
1966	25	3.7	5.1
1967	23	3.9	6.0

Table 5. Estimates of the landings of hake per unit effort, expressed as percentages of the 1961 value.

Year	England[1]		Portugal[2]	France[3]
	VIa	VIIf-k	IXa	VIa, VII, VIII, IXa
1955	208	197		148
1956	224	127		129
1957	212	132		111
1958	165	65		112
1959	119	118		109
1960	115	112	94	108
1961	100	100	100	100
1962	125	115	97	90
1963	112	109	115	74
1964	91	56	140	64
1965	78	62	176	51
1966	53	44		44
1967	46	41		48

1) Tons/million ton hours (motor trawl units).

2) Kg/hours fishing.

3) Kg/days absence/100 H.P.

Table 6. Percentage length compositions of hake in 1967.

Length	France			Portugal*	United Kingdom
	"Hauturiers"	Semi-industriels	"Artisans"		
10-14	-	-	-	0.9	-
15-20	-	-	-	23.5	-
20-24	0.1	0.2	0.4	37.5	-
25-29	4.3	8.0	14.9	20.4	2.4
30-34	13.3	24.7	45.6	8.5	36.6
35-39	11.6	13.0	19.5	5.5	29.3
40-44	15.7	10.3	9.8	2.1	9.7
45-49	18.7	9.2	5.3	0.8	7.2
50-54	14.8	8.0	2.8	0.6	6.6
55-59	9.3	5.9	0.9	0.2	4.2
60-64	5.1	6.1	0.3	-	2.2
65-69	4.1	8.6	0.2		0.9
70-74	1.6	3.3	0.1		0.4
75-79	0.7	1.4	0.06		0.3
80-84	0.4	0.9	0.04		0.3
85-89	0.1	0.3	0.01		0.1
90-94	0.07	0.1	-		0.1
95-99	0.04	0.08	-		0.1
100-104	0.01	0.03	-		
105+	0.01	0.03	-		

* From measurements made at sea.

Table 7. Length composition of Portuguese hake catches from division IXa (from measurements made at sea).

ngth	1960		1961		1962		1963		1964		1965		1966	1967
	Total Catch*	Catch per 100 hrs	Total Catch*	Catch per 100 hrs	Total Catch*	Catch per 100 hrs	Total Catch*	Catch per 100 hrs	Total Catch*	Catch per 100 hrs	Total Catch*	Catch per 100 hrs	%	%
-9	124	74	129	68	-	-	4	2	25	13	-	-		
-14	927	558	2,893	1,520	405	190	574	277	803	434	-	-	10.4	0.9
-19	4,183	2,518	6,239	3,277	11,096	5,210	5,583	2,692	6,808	3,680	7,439	4,039	27.3	23.5
-24	2,272	1,368	4,353	2,287	14,447	6,783	7,990	3,853	9,537	5,155	39,899	21,664	35.4	37.5
-29	946	570	2,548	1,339	6,326	2,970	6,714	3,238	6,989	3,778	6,763	3,672	11.9	20.4
-34	1,269	764	1,836	965	2,619	1,230	5,767	2,781	5,378	2,907	10,820	5,875	7.8	8.5
-39	1,173	706	2,030	1,066	1,880	883	4,059	1,958	3,567	1,928	12,849	6,976	2.8	5.5
-44	1,230	740	1,571	826	479	225	2,817	1,358	1,609	870	2,029	1,101	4.4	2.1
-49	795	478	467	246	447	210	1,351	651	445	241	-	-		0.8
-54	359	216	136	72	215	101	1,083	522	207	112	-	-		0.6
-59	133	80	64	33	204	96	759	366	228	123	-	-		0.2
-64	149	90	111	58	343	161	492	237	49	26	-	-		
-69	198	119	33	17	102	48	586	282	45	24	-	-		
-74	127	76	62	33	364	171	371	179	26	14	-	-		
-79	43	26	12	7	218	102	270	130	-	-	-	-		
0+	112	68	13	7	465	219	192	93	-	-	-	-		
tal	14,040	8,451	22,497	11,821	39,610	18,599	38,612	18,619	35,716	19,305	79,799	43,327		

* Estimated total landings in thousands of fish.

Table 8. Length composition of hake landed at Milford Haven (U.K.) from divisions VIIf-k (numbers/100 hours fishing).

Length	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1962	1963	1964	1965	1966	1967
20-24	-															
25-29	-		9	3												35
30-34	759	1,343	354	354	216	60	477	251	386	147	357	64	96	86	56	541
35-39	1,675	1,694	623	775	617	151	789	716	907	299	644	204	120	157	201	433
40-44	1,217	937	492	714	482	168	500	675	797	212	484	283	125	89	188	143
45-49	782	734	447	549	256	101	565	336	343	144	203	313	89	37	115	106
50-54	414	431	313	344	154	68	148	133	201	96	109	221	66	34	63	98
55-59	227	201	175	211	85	39	96	62	113	43	54	151	71	39	36	62
60-64	95	97	92	132	50	21	51	48	84	19	37	142	68	47	13	33
65-69	41	37	60	82	29	12	33	35	47	10	31	87	39	27	7	14
70-74	18	22	39	64	24	8	25	22	41	7	16	47	22	18	5	6
75-79	17	17	28	52	17	6	19	14	32	4	8	24	15	15	6	4
80-84	16	18	19	38	13	4	13	10	25	3	5	22	8	12	4	4
85-89	21	13	9	16	7	2	6	7	15	2	2	5	4	5	3	2
90-94	14	10	6	9	4	1	4	2	9	1	1	3	3	2	2	2
95-99	12	7	4	4	2	1	3	1	7	1	1	1	2	1	1	2
100-104	3	8	4	4	2	-	1	1	4	-	1	1	1	1	-	-
105+	1	3	2	2	1	-	-	-	1	-	-	-	-	-	-	-
	5,312	5,572	2,676	3,353	1,959	642	2,730	2,310	3,012	988	1,953	1,568	729	570	700	944

Table 9. Mesh-sizes and materials in use in the various fisheries.

			Mesh-size (mm)
ance	"Hauturiers" "Semi-industriels" "Artisans"		mainly 60-65 50mm and 70mm mainly 35-50 } Double polyamide
ain	Trawlers		40-45* (Double polyethylene)
ited ngdom	Trawlers	Fleetwood Milford Haven	70-100 (Double 75-80 polyethylene)

From measurements made on the cod-ends of Spanish trawlers in La Rochelle.

Table 10. Selectivity data used in the assessments.

	Mesh-size	Selection factor = 3.6		Selection factor = 4.6	
		50% length	50% age	50% length	50% age
France (Hauturiers	63	22.7	2.25	29.0	3.08
France (Semi-industriels	63				
France (Artisans	43				
Spain Trawlers	43	15.5	1.44	19.8	1.94
Portugal Trawlers	43				
United Kingdom Trawlers	75	27.0	2.80	34.5	3.67
For mesh-changes	70	25.2	2.60	32.2	3.42
	80	28.8	3.04	36.8	4.08

Table 11. Length/weight data used in the assessments (from French unpubl.data).

ngth cm	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85-89	90-94	95-99	100-104	105+
eight kg.	0.01	0.03	0.07	0.13	0.22	0.34	0.50	0.70	0.95	1.25	1.62	2.07	2.63	3.29	3.98	4.70	5.40	6.05	6.80	7.50

Table 12. Immediate losses % (by weight) for different increases in mesh-size.

Gear	Selection Factor	Mesh-size mm		
		60	70	80
France "Hauturiers" and "Semi-Industriels"	4.6	Negligible	3	10
	3.6	Negligible	1	3
Spanish trawlers and French Artisans	4.6	14	27	42
	3.6	6	12	20
Portugal	4.6	14	23	32
	3.6	7	9	18
United Kingdom trawlers	4.6	0	0	20
	3.6	0	0	2
All gears	4.6	10	18	30
	3.6	4	8	14

Table 13. Long-term gains % (by weight) for increases in mesh-size by all vessels.

Gear	Selection Factor	E(1)	M(2)	Mesh-size mm		
				60	70	80
French "Hauturiers" and "Semi-industriels"	4.6	0.6	0.3	+22	+35	+53
		0.8	0.2	+31	+51	+83
	3.6	0.6	0.3	+ 9	+15	+26
		0.8	0.2	+13	+21	+37
Spanish trawlers and French "Artisans"	4.6	0.6	0.3	+ 5	+ 1	0
		0.8	0.2	+13	+14	+20
	3.6	0.6	0.3	+ 2	+ 2	+ 4
		0.8	0.2	+ 6	+ 7	+13
Portuguese trawlers	4.6	0.6	0.3	+ 5	+ 7	+16
		0.8	0.2	+13	+20	+38
	3.6	0.6	0.3	+ 1	+ 6	+ 7
		0.8	0.2	+ 5	+11	+16
United Kingdom trawlers	4.6	0.6	0.3	+22	+39	+36
		0.8	0.2	+31	+56	+62
	3.6	0.6	0.3	+ 9	+16	+27
		0.8	0.2	+13	+22	+38
All gears	4.6	0.6	0.3	+10	+14	+19
		0.8	0.2	+18	+28	+42
	3.6	0.6	0.3	+ 5	+ 7	+12
		0.8	0.2	+ 8	+12	+21

(1) Over the exploited range of ages.

(2) Over the selection range of ages.

Table 14. Long-term gains % (by weight).
French "Artisans" constant. Increases in mesh-size by other vessels only.

Gear	Selection Factor	E(1)	M(2)	Mesh-size mm		
				60	70	80
French "Hauturiers" and "Semi-industriels"	4.6	0.6	0.3	+20	+26	+44
		0.8	0.2	+29	+43	+70
	3.6	0.6	0.3	+ 8	+13	+22
		0.8	0.2	+12	+19	+34
Spanish trawlers	4.6	0.6	0.3	+ 3	- 5	- 6
		0.8	0.2	+11	+ 8	+12
	3.6	0.6	0.3	+ 2	0	0
		0.8	0.2	+ 5	+ 6	+10
Portuguese trawlers	4.6	0.6	0.3	+ 3	0	+ 9
		0.8	0.2	+11	+14	+29
	3.6	0.6	0.3	0	+ 4	+ 3
		0.8	0.2	+ 4	+ 9	+13
United Kingdom trawlers	4.6	0.6	0.3	+20	+30	+28
		0.8	0.2	+29	+48	+51
	3.6	0.6	0.3	+ 8	+14	+23
		0.8	0.2	+12	+20	+35
All gears	4.6	0.6	0.3	+ 8	+ 7	+12
		0.8	0.2	+16	+21	+32
	3.6	0.6	0.3	+ 4	+ 5	+ 8
		0.8	0.2	+ 8	+10	+19

(1) Over the exploited range of ages.

(2) Over the selection range of ages.

FIG. 1
LANDINGS PER UNIT EFFORT RELATIVE TO THOSE IN 1961

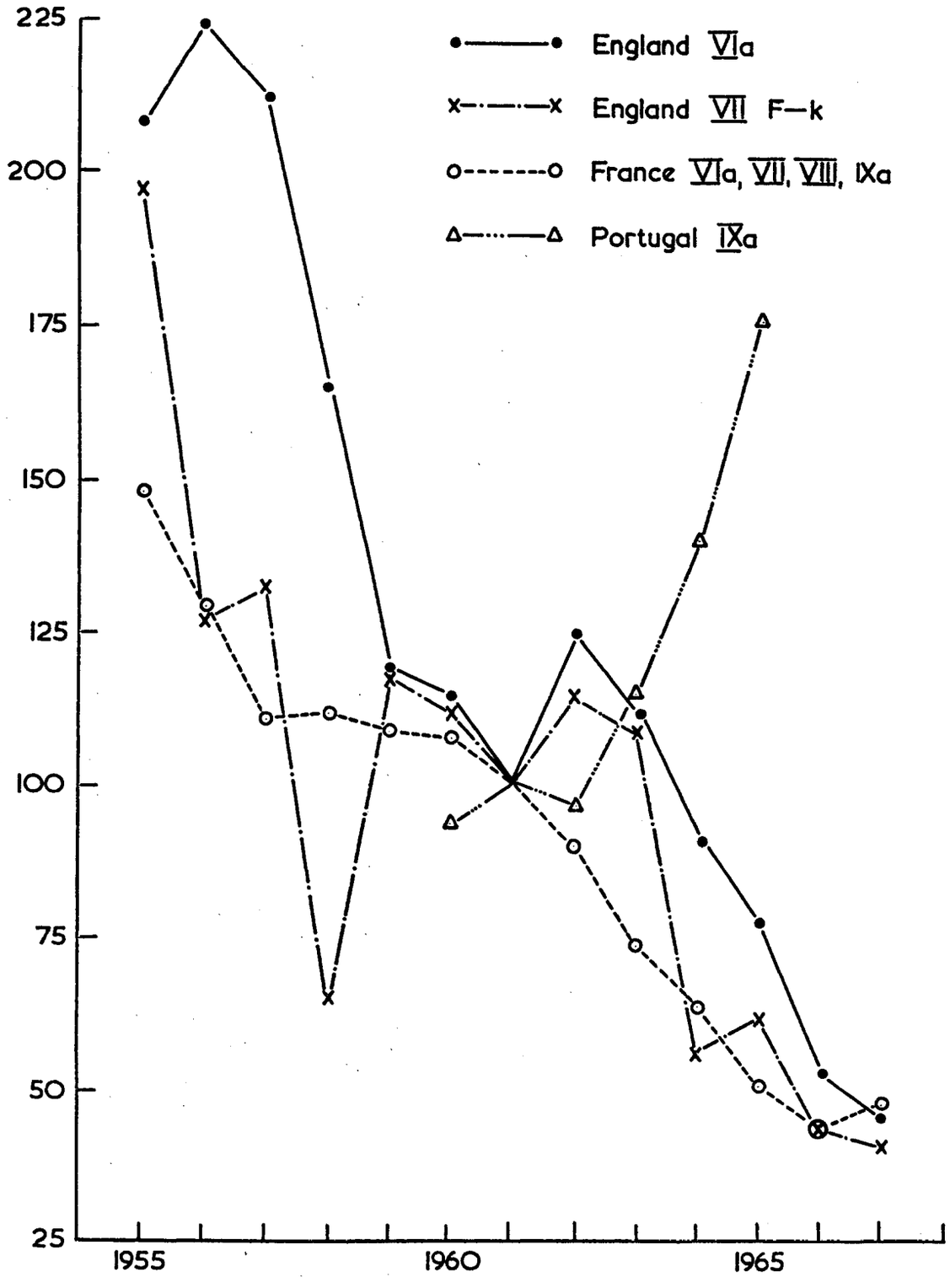

FIG. 2

PERCENTAGE/LENGTH COMPOSITIONS OF HAKE FROM VARIOUS COUNTRIES AND DIVISIONS IN 1967