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International Council for the
Exploration of the Sea

C.M.1978/G:7
Demersal Fish Committee

REPORT OF THE NORTH SEA ROUNDFISH WORKING GROUP

Charlottenlund, 3 - 7 April 1978

This Report has not yet been approved by the International Council for the Exploration of the Sea; it has therefore at present the status of an internal document and does not represent advice given on behalf of the Council. The proviso that it shall not be cited without the consent of the Council should be strictly observed.

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CONTENTS

.../...

Contents (ctd) Page

REPORT OF THE NORTH SEA ROUNDFISH WORKING GROUP

1. PARTICIPATION

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W Panhorst, ICES Systems Analyst, also attended the meeting.

2. TERMS OF REFERENCE

At the 1977 Statutory Meeting of ICES in Reykjavik, it was decided (C.Res.1977/2:22) that:

"the North Sea Roundfish Working Group should meet at Charlottenlund 3-7 April 1978 to:

(a) determine year class strengths for cod, haddock and whiting from data collected from the International North Sea Young Herring Surveys,

(b) assess TACs for 1979 for cod, haddock and whiting in Sub-areas IV, VI and VII (excluding Divisions VIIa and VIIf),

(c) report on the effect of increases in mesh size for these species in Sub-area VI,

(d) identify and specify in detail shortcomings and gaps in data required for stock assessment work,

(e) review and update the "Review of Fish Resources" given in the Appendix to the 1977 Working Group Report".

At the request of the Chairman of the Advisory Committee on Fishery Management (ACFM), the Working Group also considered:

(f) the applicability of a mesh assessment largely based on Division IVa data, to other parts of Region 2, with particular reference to whiting in the eastern English Channel,

(g) appropriate minimum landing sizes in relation to proposed mesh changes, and

(h) the calculation of TACs for Division IIIa.

3. TOTAL ALLOWABLE CATCHES (TACs)

3.1 Recommended TACs

Recommended TACs for 1979 are summarised below for various options.

TACs for 1979 (in '000 metric tons)

Sub-area	Option	Cod	Haddock	Whiting
IV	I	190	85	96
	II	175	80	75
	III	165	78	-
	IV	155	75	-
VI	I	14	11	12
	II	14	11	5.5
VII*		6.1	5.9	14
Div.IIIa		22	3.1	20

* excluding Divisions VIIa and VIIf.

In Options I and II, it is assumed that F values in 1978 remain at the same level as in 1977.

Option I gives the recommended TACs for 1979 if there is no change in mesh size in 1979.

Option II gives the recommended TACs for 1979 if there is an increase in mesh size to 90 mm in 1979.

Options III and IV have been included to allow for the possibility that F values in 1978 may be influenced by TACs set for 1978**.

For example, for cod the F values in 1978 would have to increase by about 20% to just take up the 1978 TAC of 236 000 tons. For whiting F values have to increase by about 100%. For haddock F values would have to decrease by about 20%. Option III gives the recommended TACs for 1979 if the F 1978 values are adjusted in this way, and if there is no change in mesh size in 1979.

Option IV gives the recommended TACs for 1979 in the comparable situation, but assuming that there is an increase of mesh size to 90 mm in 1979.

Options III and IV have been calculated for cod and haddock but not for whiting.

Catch predictions for these and further options are given in Tables 5.1.A and 5.1.B. Recommended values were selected from the options in these tables with the object of reducing F values in 1979 below their levels in 1977.

For haddock (Options III and IV) the recommended TACs for 1979 were chosen so as to keep F values in 1979 the same as those in 1978 (i.e., 20% below the 1977 levels).

For haddock in Options I and II, and for all options for other species, the recommended values were chosen so as to make F values in 1979 10% below the 1977 values.

**) TACs for 1978 have been agreed between Norway and the EEC for Sub-area IV. The values are: for cod.... 236 000 tons
for haddock.... 109 000 tons
for whiting.... 168 000 tons.

For haddock and whiting, the predictions in the tables for both landings and (in brackets) catches are given. The recommended TACs for these two species are based on predictions of landings, rather than catches.

Because of uncertainties in selection factors, the assessments, in which an increase in mesh size was allowed for, were made for a range of selection factors for each species. Values for high and low selection factors are given separately in Tables 5.1.A and 5.1.B. The recommended TACs are based on averages of the values obtained for high and low selection factors in each instance.

For stocks in Divisions IIIa, VIb and Sub-area VII (excluding Divisions VIIa,f) TACs were determined on the basis of average landings. The values obtained for Division VIb in this way have been included in the TACs for Sub-area VI given above.

3.2 Stocks in Division IIIa

There is a certain amount of interchange between the stocks of cod, haddock and whiting in the North Sea, and those in Division IIIa. It would be appropriate therefore to include a component of the Division IIIa landings along with the TAC for Sub-area IV.

Unfortunately, the reported landings from Division IIIa include landings from various zones, and the necessary data for separating the different components of the landings are not available.

The Group is therefore unable to recommend a TAC for that component of the Division IIIa stock, that, on biological grounds, should be included with Sub-area IV. A TAC for the whole of Division IIIa has been given, based on the reported landings statistics.

3.3 Management of Roundfish Stocks by Catch Quotas

The Working Group wishes to draw attention to the difficulty of controlling fishing mortality by means of catch quotas.

1. Due to the high rates of exploitation in the stocks considered in this report, the recruitig year classes make up a large proportion of an exploitable stock. Consequently, estimates of year class strength are an essential part of a catch prediction.

   Accurate catch predictions are impossible if average year class strengths have to be assumed. The high exploitation rate also increases the errors in extrapolation.

   The combination of these effects means that estimated TACs will vary considerably about their true values. Moreover, due to the small number of year classes in the fishery, the true value of a TAC will vary considerably from year to year. Pope and Garrod (1973) discuss this problem and point out that both problems may be reduced by the adoption of lower exploitation rates. The precision of estimation can also be increased by the provision of better data and, more importantly, by reducing the time period for which extrapolations have to be made. At present the 1979 TAC has to be estimated from 1977 data.

   Due to these problems the TACs estimated by the Working Group will inevitably have a considerable variability about their true value and consequently they can only provide approximate management advice.

2. Management of fish stocks by catch quotas is aimed at control of the rate of fishing mortality. To achieve this, it is necessary to control the catch, wheras, in practice, it is only possible to

control the landings. With the present mesh size large amounts of roundfish are discarded at sea. The proportion of fish discarded can in fact be so large, that there is little hope that controls placed on landings are likely to be effective at restricting catches. It is possible that in some instances, TACs are more effective at influencing rates of discarding than catches.

It seems unlikely therefore that TACs can present a satisfactory solution to the problem of managing fishing effort on roundfish stock, unless some means, such as higher mesh sizes, are found for greatly reducing the rates of discarding.

4. STATE OF EXPLOITATION

It is difficult to quantify the state of exploitation of cod, haddock and whiting stocks in Sub-areas IV, VI and VII. This is because criteria based on different asumptions lead to views that cannot easily be reconciled:

1) For some species, F values are greatly in excess of F_{max} values on yield per recruit curves. According to this criterion, a number of the stocks under consideration are all seriously overexploited (Figures 1-3).

2) Yield per recruit curves are not necessarily the same as total yield curves however. It is therefore not certain to what extent changes in total yield would necessarily be the same as changes in yield per recruit, for changes in fishing mortality.

3) During the 1960s, the stocks of cod, haddock and whiting in some areas and particularly in the North Sea and Division VIa increased significantly above their pre-1960 levels. This was a consequence of good recruitment, and it is not known to what extent this, and other changes that took place in North Sea fish stocks at the time, were the result of natural processes or to what extent they were an indirect outcome of fishing.

Although there are these difficulties in evaluating the state of exploitation of these stocks, it is recommended, on the basis of yield per recruit considerations, that fishing mortality should be reduced, and that reductions in effort should be made in small steps. This should lead to gains in both yield per recruit and also spawning stock biomass (Figures 1-3 and Figure 7).

5. MESH ASSESSMENTS

Assessments, using the method of Gulland (1961), have been made on the effects on yield per recruit of changes in mesh size in Divisions VIa and VIId.

5.1 Division VIa

Assessments were made of the long-term effects on yields/recruit of the adoption of 80 and 90 mm mesh sizes for cod,haddock and whiting in Div.VIa. Input data are shown in Tables 7.1 - 7.3 and 7.6 - 7.8. Overall results were as follows:

Species	Average catch 1970-76 (tons)	Long-term gains[1]	
		80 mm	90 mm
Cod	13 504	0% to 2%	0% to 4%
Haddock	28 680	0.4% to 2%	2% to 6%
Whiting	17 206	2% to 2%	3% to 5%

1) Range of values allows for range of selection factors.

More detailed results giving the gains and losses for national fleets shown in Tables 7.11 to 7.13. From the available data, long-term benefits using a 90 mm mesh size should be negligible, but the inclusion of data on discard, which were not available for these assessments, could alter this conclusion. Because of lack of data, the gains shown above can be regarded as underestimates of the likely long-term gains.

5.2 Division VIId

Assessments of the effect on yield/recruit of the adoption of 80 mm and 90 mm mesh sizes were made for cod and whiting in Division VIId. Input data are shown in Tables 7.4 - 7.5 and 7.9 - 7.10. As for the Division VIa assessments, calculations were done for a range of selection factors. Overall results were as follows:

Species	Average catch 1970-76 (VIId,e)(tons)	Long-term gains[1]	
		80 mm	90 mm
Cod	3 641	0% to 4%	0% to 10%
Whiting	6 819	8% to 12%	15% to 19%

1) Range of values allows for range of selection factors.

More detailed results giving the gains and losses for national fleets are shown in Tables 7.14 - 7.15 (90 mm only).

For both species, the introduction of 80 mm or 90 mm mesh sizes should lead to long-term gains even though some are not large.

5.3 General Comments on Mesh Size Increases

An increase in mesh size would appear to be particularly appropriate in fisheries in which extensive discarding is common practice.

Attention is drawn to the relatively large immediate losses for some species in some areas. Large short-term losses may be undesirable, and for this reason it may be appropriate to allow the rate of increase in mesh size to be more gradual in areas where the immediate losses would otherwise be unacceptably large.

6. SHORTCOMINGS AND GAPS IN DATA REQUIRED FOR STOCK ASSESSMENT PURPOSES

6.1 Age Composition Data

Age composition data are still not collected, or not adequately collected, by some countries.

The following text table indicates the percentages of the total international landings for which there are national sampling programmes providing age composition data.

Area	COD		HADDOCK		WHITING	
	L	D*	L	D*	L	D*
Sub-area IV 1976	84	10	69	60	85	59
1977	88	17	80	78	91	60
Div.VIa 1976	66	0	80	0	80	0
1977	70	0	82	0	74	0
Div.IIIa	+	0	+	0	+	0
Div.VIIa-e,g-k	0	0	0	0	0	0
Div. VIb	0	0	0	0	Included with Div. VIa	

L = Landings.

D = Discards.

*) % of consumption fishery covered.

In some areas (e.g., Divisions IIIa, VIIb,c, g-k) few, if any, age composition data are collected.

6.2 Year Class Strength

Recruitment surveys are needed in Sub-areas VI and VII.

6.3 Selectivity Data

Selectivity data available for the assessment group are based on experiments carried out some time ago. Information is now needed to take account of modern fishing practice, in which towing speeds may be higher than they used to be.

6.4 Effort Data

Reliable indices of fishing effort are required for all countries and fleets.

7. MINIMUM LANDING SIZES

The Working Group has considered the basis for relating minimum landing size to mesh size. This request has arisen from a suggestion that by making the minimum landing size correspond to something less than the 50% retention size of the mesh size in use, wastage of fish due to discarding could be reduced.

7.1 Need for a Minimum Landing Size

In the Recommendation 4 fishery a minimum landing size is intended to help the enforcement of a mesh size. The intention is that fishermen should be discouraged from using too small meshes, because of the wastage caused by having to discard the undersized part of the catch.

If a minimum landing size is to be effective, it is, therefore, unavoidable that some wastage of fish should have to occur. This waste should be regarded as a cost to be offset against the benefit expected from a more effective enforcement of the mesh size.

It follows that:

1) If a mesh size could be effectively enforced by direct measures, there should be no need for a minimum landing size.

2) So long as mesh size sizes cannot be effectively enforced by direct measures, minimum landing sizes may be helpful for enforcement purposes. However, because discarding is also influenced by market prices, there are likely to be situations in which discarding will occur, even if there was no minimum landing size.

7.2 Relationship between Minimum Landing Size and Mesh Size

One procedure that has been widely used is to make the minimum landing size correspond to the 50% retention length of the mesh size in use. This is one compromise between the need to reduce wastage on the one hand, and the need to accept some wastage for enforcement purposes on the other.

The Working Group considers that there is no optimal relationship between minimum landing size and mesh size. To facilitate the selection of a possible enforcement policy, however, a plot is presented of possible mesh selection ogives for 90 mm meshes for the three species in Figure 4. Some examples of possible minimum landing sizes for a 90 mm mesh, related according to various criteria, are also given.

8. FISHING EFFORT (Tables 1.9 - 1.11)

Fishing effort data were available for trawlers and seiners of the English and Scottish fleets respectively in various areas. Estimates of total international fishing effort were obtained by raising the respective English and Scottish effort data to the total international catches of cod, haddock and whiting in the North Sea. Statistically significant relationships between these fishing effort effort series and the VPA estimates of fishing mortalities were only found, however, for North Sea cod, based on an index of English seiner effort.

9. REVIEW OF FISH RESOURCES

Details of the cod and whiting resources in the English Channel, and cod, haddock and whiting resources in Sub-areas VIII and IX are given in the Appendix.

NOTES ON STOCK ASSESSMENT AND TAC CALCULATIONS

10. COD

10.1 North Sea (Sub-area IV)

10.1.1 VPA (Tables 2.1, 3.1 and 4.1)

The total international effort for cod, as calculated from English c.p.u.e. data suggested that in 1977 the effort level had increased after the drop in 1976. For the period 1970-77 there has been no steady trend in estimated fishing effort and, therefore the average F values estimated from VPA for the younger age groups during the years 1970-73 have been used as terminal

F values for 1977. For 5 year and older cod, a smoothed value was used as calculated from the F values for age groups 5-8 during the same period. The terminal F values used are consistent with the International effort based on English seiners.

10.1.2 Year class strength (Tables 5.2 and 5.3)

Year classes 1976 and 1977 were estimated from the predictive regression of VPA estimates on IYHS abundance indices (cf. Tables 5.2 and 5.3) as 330 x 10^6 and 175 x 10^6 1 year old fish respectively. For catch predictions, the fishing mortality on the 1976 year class in 1977 was adjusted to be consistent with the predicted strength of the 1976 year class. Year class 1978, entering the fishery in 1979, was assumed to be of average size (206 x 10^6 1 year old fish).

10.1.3 Catch predictions

The values of the different parameters used in the catch predictions are given in Table 6.1. Numbers landed are the provisional figures available for 1977. F values correspond to the VPA input terminal F values with the adjustment for age group 1 as explained under 10.1.2. Weight at age data were the same as last year. Input data were adjusted to ensure that the sum of products of the input numbers and the average weights coincided with the actual catch in 1977.

To take account of the proposed change in mesh size to 90 mm in 1979, two selection factors have been applied to take account of the probable range of values. The corresponding 50% retention lengths were calculated and the corresponding 50% retention ages were estimated from the von Bertalanffy growth curve (L_∞ = 115 cm, K = 0.3, t_0 = 0.8 years). The reduction in fishing effort on age group 1 was estimated from the proportion of the year that 1 group cod should be exploited with a 90 mm mesh size compared with the proportion of the year for which they should be exploited with a 75 mm mesh size. In addition, account was taken of the increase expected in the average weight of 1 group landed, as a result of the introduction of the 90 mm mesh. The results of the catch predictions are given in Tables 5.1.A and 5.1.B.

10.2 West of Scotland (Division VIa)

10.2.1 VPA

There was no new information available for adjusting the terminal F values compared with those in last year's VPA. Therefore the same value of 0.7 was used for all older age groups. For the younger age groups, input Fs were adjusted to be equal to be the averages for the period 1970-73.

10.2.2 Year class strength

No direct estimates of the strengths of year classes 1976 and 1977 were available, and therefore average values, based on the numbers of 1 year old cod in 1966-75, had to be used in the catch predictions. The F on the 1 year old fish in 1977 was adjusted so as to be consistent with the value used for the size of the 1976 year class.

10.2.3 Catch predictions

Catch predictions were carried out for the alternative assumptions that effort remained at the level assumed for 1977, and that the effort in 1979 was 10% below the 1977 level.

Because 1 group cod are exploited to only a very limited extent (F = 0.075) a change of mesh size to 90 mm in 1979 should not change the TAC significantly.

11. HADDOCK

11.1. Sub-Area IV

11.1.1. VPA

11.1.1.1. Input data (age composition) (Table 2.2)

Data for years 1959-74 were the same as those used in last year's analysis. Data for 1975 and 1976 were revised to take account of new information. For 1977, provisional age composition data were available from Denmark, England, Netherlands, Norway and Scotland; length composition data were provided by Belgium and France. Numbers at age were tabulated separately for the industrial (Rec.2) landings, consumption landings (Rec.4), and for discards, and were then summed after adjusting by sums of products (Σ number x mean weight).

11.1.1.2. Input F values (Table 3.2)

In the absence of significant correlations between various measures of international effort and F values, smoothed average values for the period 1971-73 were used (1970 values were omitted since some are rather erratic). F values for age 0 and 1 were adjusted to correspond with year class strengths estimated by the IYHS. A value of M = 0.2 was assumed, throughout.

11.1.2. Year class strengths (Table 4.2)

Values for 1976 and 1977 year classes at age 1 (obtained from the IYHS - see Section 10.1.2) were 460 and 694 million, respectively (Tables 5.2 - 5.3). The 1978 year class at age 0 was assumed to be 611 million, calculated from VPA as the average of the period 1959-73, but excluding the exceptional 1962 and 1967 year classes.

11.1.3. Catch predictions (Tables 6.2, 6.7, 6.8)

The starting point was the number of fish at each age landed from the industrial and consumption fisheries, and for the discards. Separate mean weights per age group were used for each of these categories and a weighted mean was used for the combined categories.

The Group was requested to investigate the effect on the 1979 TAC of possible changes in mesh size and predictions were made assuming an increase to 90mm in the Rec.4 fisheries in 1979. In view of the range in selection factors reported in the literature, it was decided to use a high and a low selection factor in the predictions involving a mesh increase.

Two main options were considered for 1978: that fishing effort remains the same as in 1977 (Option A) or that fishing effort is such that the TAC agreed between EEC and Norway (109 000 tons) is taken (Option B).

For Option A, the predicted landings will exceed the TAC and the following possibilities (referred to as run number in Tables 6.7 and 6.8) were considered for 1979.

1. No mesh change. No change in fishing effort.
2. No mesh change. Effort reduced by 10%.
3. Mesh in Rec.4 fisheries increased to 90mm.
   Low selection factor. No change in fishing effort.
4. As for (3) but with high selection factor.
5. As for (3) but fishing effort reduced by 10%.
6. As for (4) but fishing effort reduced by 10%.

For Option B, a reduction in effort of 20% will occur in 1978 and predictions for 1979 were made on the assumption that fishing effort remains at this reduced level. Three further possibilities for 1979 were considered:

1. No mesh change.
2. Mesh in Rec.4 fisheries increased to 90mm. Low selection factor.
3. As for (2) but with higher selection factor.

The simulation of the various eventualities for 1979 referred to above was carried out as follows.

Values of F-at-age for the Rec.2 fishery and for the Rec.4 fishery (landings and discards) in 1977 were estimated using the following relationships.

$$\text{Recommendation 4 } F_t = \frac{\text{Recommendation 4 } C_t \cdot \text{ Total } F_t}{\text{Total } C_t}$$

$$\text{Recommendation 2 } F_t = \frac{\text{Recommendation 2 } C_t \cdot \text{ Total } F_t}{\text{Total } C_t}$$

(F_t = F-at-age, C_t = catch in numbers at age)

Mean weight at age was calculated for the Rec.4 catch (landings and discards) and these mean weights were converted to mean length using an approprite length-weight function ($L = (w/.009)^{1/3}$ for haddock).

For each eventuality considered, the ratio percent retained by new mesh; percent retained by old mesh was calculated for each mean length at age. In the case of a proposed decrease in fishing effort, each of these ratios was multiplied by an appropriate value (e.g., for a proposed 10% reduction in effort the ratios were multiplied by 0.9). The values thus obtained estimate the proportional change in F-at-age in the Rec.4 fishery and were used to estimate new F-at-age arrays for that fishery.

For each simulation referred to in these tables, values of F-at-age for the Rec.2 fishery were changed appropriately in cases where a decrease in fishing effort was proposed.

Table 6.7 shows the estimated changes (expressed as percentages) in the Rec.4 F-at-age for each eventuality considered under Option A, while Table 6.8 shows corresponding values under Option B. Also included in these tables are the results of each simulation run. The results for catches and landings are summarised in Table 5.1A.

11.2. Division VIa

11.2.1. VPA

11.2.1.1. Input data (age composition) (Table 2.5)

Revised data for 1976 and provisional data for 1977 were available. For 1977, age composition data were provided by England, Ireland and Scotland. The data base for years prior to 1976 was the same as that used for last year's assessment.

11.2.1.2. Input F values (Table 3.5)

There were no significant correlations between measures of international effort and VPA F values, and average values for the period 1971-73 were therefore used. The F value at age 1 was adjusted to correspond to an estimated recruitment value (see following section).

11.2.2. Year class strengths (Table 4.5)

A significant correlation between VPA estimates of number at age 1 in the North Sea and in Division VIa was found (Figure 5). Using this correlation, the number of fish of the 1977 year class at age 1 was estimated (from IYHS) to be 45 million. An average recruitment of 32 million at age 1 in 1979 was assumed, calculated as the VPA average for the years 1965-73, but excluding the exceptional 1967 year class.

11.2.3. Catch predictions (Tables 6.5, 6.10)

These were basically similar to those previously described (see 11.1.3) except that there was no Option B, since there is no agreed TAC for 1978. It was assumed, therefore, that fishing effort in 1978 will be the same as in 1977.

12. WHITING

12.1 Sub-area IV

12.1.1 VPA

12.1.1.1 Input data (age compositions) (Table 2.3)

Data for the years 1960-75 were the same as those in last year's analysis. Data for the consumption and industrial fisheries and for discards in 1976 were updated. For 1977, age composition data were available from belgium, Denmark, England, Netherlands, Norway and Scotland. France provided a 1977 length frequency which was converted to an age frequency using Scottish age-length data. Numbers at age for the consumption and industrial fisheries and for discards were determined.

12.1.1.2 Input F values (Table 3.3)

No significant correlations were found between various measures of international effort and values of F taken from trial VPA runs. For this reasons average values of F-at-age for the period 1970-73 were used as input values in 1977. Values of F for ages 0 and 1 were adjusted to produce numbers of fish in the sea in agreement with recruitment estimates obtained from the IYHS data (see below). A value of M = 0.2 was assumed for all ages and years.

12.1.2 Year Class Strength

From the results of the IYHS (see Section 10.1.2 and Tables 5.2 and 5.3) it was estimated that there were 1 201 and 1 207 x 10^6 whiting of age 1 in 1977 and 1978, respectively.

The 1978 and 1979 year classes at age 0 were assessed to be 1 643 million fish, this value being the mean number of 0-group fish for the period 1959-73.

12.1.3 Catch Predictions (Tables 6.3 and 6.9)

These were basically the same as those described previously (see Section 11.1.3), except that Option B predictions were not made. This was because the present assessment shows that fishing effort would need to be doubled in 1978, in order to take the EEC/Norway agreed TAC. Such an increase in fishing effort was considered to be unrealistic, and consequently only Option A was run.

Mean weights were converted to mean lengths using the relationship:

$$(L = 5^{w^{1/3}})$$

12.2 Divisions VIa and VIb

12.2.1 VPA

12.2.1.1 Input data (age compositions)(Table 2.6)

Revised data for 1976 and provisional data for 1977 were available. Age composition data were provided by Scotland and Ireland. Data for years prior to 1976 were unchanged.

12.2.1.2 Input F values (Table 3.6)

No correlation was found between measures of total fishing effort and VPA F values, and therefore average values for the period 1970-73 were used. F values for age groups 0 and 1 were adjusted to correspond with recruitments estimated from IYHS (see following Section).

M was assumed to be 0.2 at all ages.

12.2.2 Year Class Strength (Section 10.1.2, and Tables 5.2 and 5.3)

A significant correlation was found between the VPA abundance at age 1 in the North Sea and in Division VIa (Figure 6). Estimates of the strength of the 1976 and 1977 year classes in Division VIa could therefore be made on the basis of estimates for Sub-area IV from IYHS. These gave values of 71 million at age 1 for both year classes. The 1978 year class was estimated at 102 million at age 0, this being the VPA average for the period 1960-73.

12.2.3 Catch Predictions (Tables 6.6 and 6.11)

These were basically the same as those previously described (see Section 11.1.3), except that, because there is no agreed TAC for 1978, Option B was not applicable.

13. NOTES ON MESH ASSESSMENTS

The mesh assessments were made using the method of Gulland (1961)[1]. The assessments were made for cod, haddock and whiting in Division VIa, and for cod and whiting in Division VIId. Tables 7.1 to 7.5 show the input length distributions used for analysis, the current mesh sizes and the calculated weights at length. Tables 7.6 to 7.10 show the values of t',*, fishing mortality, the 50% and 75% selection points for the current mesh sizes and also for the proposed 90 mm mesh. These are given for two options of selection factor for each fleet in each stock and area. The selection factors were chosen to represent low and high values taken from the literature. Tables 7.11 to 7.15 show the gains and losses for each fleet for each stock/area. Table 7.16 gives their values and sources.

The fishing mortalities used in the analyses were as follows: for Division VIa cod (0.4), haddock (0.3) and whiting (1.0). These were based on VPA results for recent years. For Division VIId cod and whiting, a value of 0.7 was used, based on French catch curve information.

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1) Gulland, J.A. 1961. The estimation of the effect on catches of changes in gear selectivity. J.Cons.int.Explor.Mer, 26(2):204-214.

*) t' is half the estimated time required to grow from the 50% release length of the current mesh size to the 50% release length of the new mesh.

The values of t' were estimated from available length at age and weight at age data.

14. TIMING OF WORKING GROUP MEETINGS

The Group discussed the timing of Working Group meetings and concluded that there would be advantages if these meetings took place during the second half of the year. The advantages are:

1) It would allow extra time for processing data for the previous year. Data from the first part of the current year should also be available.

2) For cod, haddock and whiting, it should enable additional recruitment estimates from pelagic 0-group surveys, to become available for the assessments.

3) It should enable TACs to be estimated with greater precision.

15. REFERENCE:

Pope, J.G. and Garrod, D.G., 1973. A contribution to the discussion of the effects of error on the action of catch and effort quotas. ICNAF Res.Doc. 73/110.

Table 1.1 Nominal catch of Cod, Haddock and Whiting (metric tons) by Division IIIa and Sub-areas IV, VI and VII, 1967-77 (Bulletin Statistique)

	Area[a] \ Year	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977*
COD	IIIa	17 010	16 649	13 243	14 238	19 052	21 667	22 942	27 452	32 284	37 980	1 576
	IV	249 803	285 314	199 258	224 745	320 564	347 055	234 466	211 291	186 453	214 161	179 846
	VI	25 214	25 022	24 272	13 557	10 760	17 266	12 746	14 827	13 406	19 000	12 668
	VII	23 162	20 270	21 509	15 102	22 134	18 767	19 239	17 350	20 206	19 600	11 032
HADDOCK	IIIa	469	582	1 056	942	2 249	8 989	3 091	4 618	6 115	9 094	334
	IV	167 408	139 469	639 195	671 833	258 220	213 556	196 079	193 429	174 163	207 538	152 695
	VI	21 176	21 429	27 398	35 018	46 920	50 518	32 848	67 258	63 611	62 118	22 253
	VII	7 343	3 726	5 392	5 931	6 518	11 248	12 480	10 585	8 638	5 479	2 621
WHITING	IIIa	30 157	29 497	16 544	13 130	13 989	14 652	22 547	28 842	19 690	18 595	91
	IV	91 245	144 920	215 829	181 506	113 044	109 532	141 191	188 585	140 166	197 404	123 451
	VI	19 709	14 474	12 550	12 499	16 032	15 394	16 709	17 058	20 053	24 955	16 510
	VII	33 123	29 691	26 821	15 710	17 836	20 845	26 655	28 203	32 433	33 793	20 290

* Provisional figures.

a) See footnotes on page 15.

Footnotes to Table 1.1

Cod in Division IIIa

Landings of German Democratic Republic in 1969-72 included in Sub-area IV.
Landings of Sweden in 1967-74 included in Sub-area IV.
Landings of Federal Republic of Germany for 1968-70 include miscellaneous products.

Haddock in Division IIIa

Landings of German Democratic Republic in 1969-72 included in Sub-area IV.
Landings of Sweden in 1968-74 included in Sub-area IV.

Whiting in Division IIIa

Landings of Sweden in 1967-74 included in Sub-area IV.

Cod in Sub-area IV

German Democratic Republic landings in 1969-72 included in Division IIIa.
Sweden: landings 1967-74 include Division IIIa.
Germany, Fed.Rep. of landings in 1968-70 include miscellaneous products.
For Netherlands: not included for 1967: 3 369 tons and 1968: 1 132 tons.
For 1977 Faroe Islands human consumption only.

Haddock in Sub-area IV

Landings for German Democratic Republic for 1969-72 include Division IIIa.
Landings for Sweden for 1968-74 include Division IIIa.
Netherlands: not included for 1967: 720 tons and for 1968: 306 tons caught mostly in Division IVb, rest in Division IVc.

Whiting in Sub-area IV

Landings for Sweden for 1967-74 include Division IIIa.
Netherlands: not included for 1967: 913 tons and for 1968: 267 tons.
For 1977 Faroe Islands human consumption only.

Cod in Sub-area VI

Landings for Germany, Fed.Rep. for 1968-70 include miscellaneous products.

Table 1.2 COD. Division IIIa and the Divisions of Sub-areas IV, VI and VII. Nominal catch by Divisions in metric tons 1967-77.

Area[a] \ Year	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977*
IIIa	17 010	16 649	13 243	14 238	19 052	21 667	22 942	27 452	32 284	37 980	1 576
IVa	89 923	74 051	56 015	79 606	67 370	80 650	69 557	72 406	58 343	69 071	44 295
IVb	134 258	175 949	122 027	110 271	184 957	215 160	134 953	114 087	107 227	126 218	94 464
IVc	25 622	35 314	21 216	34 868	68 237	51 245	29 956	24 798	20 883	18 872	41 310
VIa	23 025	24 357	21 739	12 682	10 666	14 699	12 263	13 652	13 163	17 405	12 539
VIb	2 189	665	2 533	875	94	2 567	483	1 175	243	1 595	129
VIIa	12 652	8 541	7 967	6 257	9 540	9 173	11 787	10 190	9 790	10 178	2 599
VIIb,c	1 479	2 259	4 418	2 049	1 302	735	1 009	405	692	756	187
VIId,e	3 300	4 113	3 856	2 553	5 432	3 544	2 077	3 436	5 082	3 365	5 818
VIIf	1 321	1 514	856	925	797	969	976	594	998	823	132
VIIg-k	4 410	3 843	4 412	3 318	5 063	4 346	3 390	2 725	3 644	4 478	2 302
Total	315 189	347 255	258 282	267 642	372 510	404 755	289 393	270 920	252 349	290 741	205 251

* Provisional figures.

a) See footnotes on pages 17 and 18.

Footnotes to Table 1.2

Division IIIa

German Democratic Republic figures for 1969-72
Swedish figures for 1967-74
} included in Div. IVa

Germany, Fed.Rep. figures for 1968-70 include miscellaneous products.

Division IVa

Norwegian figure for 1976 revised by the Working Group (April, 1978).
Danish figures for 1967-73 included in Division IVb.
German Democratic Republic figures for 1969-72 include Divs. IIIa and IVb,c.
Swedish figures for 1967-74 include Divisions IIIa and IVb.
Germany, Fed.Rep. figures for 1968-70 include miscellaneous products.
Danish figure for 1977 included in Division IVb.

Norwegian figures for 1967-68
USSR figures for 1967-73
} include Division IVb,c

Norwegian figures for 1969-72 and 1977 include Division IVb.
Norwegian figure for 1976 revised by the Working Group (April, 1978).
Norwegian figures for 1971 and 1972 not including catches from Rec.2 fisheries (1971 = 1 314 tons; 1972 = 1 656 tons).
Netherlands figure for 1977 included in Division IVc.
Swedish figure for 1977 includes Division IVb,c data from NEAFC Form Jan-Dec.

Division IVb

Danish figures for 1967-73 include Division IVa.

Faroe Islands figures for 1976 and 1977
German. Dem.Rep. figures for 1969-72
Norwegian figures for 1967-72 and 1977
Swedish figures for 1967-74 and 1976-77
USSR figures for 1967-73
} included in Division IVa

Danish figure for 1977 include Division IVa,c.
Netherlands: not included for 1967: 3 369 tons and 1968: 1 132 tons caught mostly in Division IVb, rest in Division IVc.
Germany, Fed.Rep. figures for 1968-70 include miscellaneous products.
Swedish figure for 1975 include Division IVa,c.
Netherlands figure for 1977 included in Division IVc.

Division IVc

Swedish figure for 1977
German Dem.Rep. figures for 1969-72
Norwegian figures for 1967-69
USSR figures for 1967-73
} included in Division IVa

Germany, Fed. Rep. figures for 1968-70 include miscellaneous products.
Netherlands figure for 1977 include Divisions IVa,b.
Swedish figure for 1975 included in Division IVb.

Division VIa

Swedish figure for 1968 includes Division VIb.
Germany, Fed.Rep. figures for 1968-70 include miscellaneous products.

Footnotes to Table 1.2 (ctd)

Division VIb

Swedish figure for 1968 included in Division VIa.

Division VIIa

French figure for 1971 includes Division VIIf.

Division VIIf

French figure for 1971 included in Division VIIa.

Table 1.3 HADDOCK. Division IIIa and the Divisions of Sub-areas IV, VI and VII. Nominal catch by Divisions in metric tons 1967-77.

Area[a] \ Year	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977*
IIIa	469	582	1 056	942	2 249	2 989	3 091	4 618	6 115	9 094	334
IVa	122 531	75 347	271 953	455 649	197 306	135 095	131 819	128 607	110 848	142 686	124 666
IVb	44 823	62 696	361 836	212 646	58 270	75 325	62 288	63 695	62 761	65 589	28 466
IVc	54	1 426	5 406	3 538	2 644	3 136	1 972	1 127	554	418	48
VIa	20 302	20 526	26 273	34 178	46 299	41 044	28 830	17 970	13 683	18 758	19 257
VIb	874	903	1 125	840	621	9 474	4 018	49 288	49 928	43 360	2 996
VIIa	2 614	611	807	624	1 343	1 318	2 364	697	276	345	66
VIIb,c	787	433	758	1 922	1 141	1 419	931	2 090	2 565	957	645
VIId,e	111	88	811	421	170	411	359	633	971	450	476
VIIf	66	47	50	77	152	766	1 804	594	928	428	17
VIIg-k	3 765	2 547	2 966	2 887	3 712	7 334	7 022	6 571	3 898	3 299	1 417
Total	196 396	165 206	673 041	713 724	313 907	278 311	244 498	275 890	252 527	285 384	178 388

* Provisional figures.

a) See footnotes on pages 20 and 21.

Footnotes to Table 1.3

Division IIIa

German Dem. Rep. figures for 1969-72 } included in Division IVa
Swedish figures for 1968-74 }

Division IVa

Swedish figure for 1975 } included in Division IVb
Danish figures for 1967-73 }

Danish figure for 1977 }
German.Dem.Rep. figure for 1976 }
Norwegian figures for 1967-69 } include Division IVb,c
USSR figures for 1967-73 and 1977 }
Swedish figure for 1977 }

German Dem.Rep. figures for 1969-72 include Divisions IIIa and IVb,c.

Norwegian figures for 1969-72 and 1977 } include Division IVb
Swedish figures for 1967 and 1976 }

Swedish figures for 1968-74 include Divisions IIIa and IVb.
Swedish figure for 1977 includes Division IVb,c.
Faroe Islands figure for 1977 include Division IVb - human consumption only.
Norwegian figures for 1971 and 1972 not including catches from the Rec.2 fisheries (1971: 4 512 tons; 1972: 5 685 tons).
Norwegian landings revised for 1976 by the Working Group (April, 1978).

Division IVb

Danish figures for 1967-73 include Division IVa.

Danish figure for 1977 }
Faroe Islands figure for 1977 }
German Dem.Rep. figures for 1969-72 and 1977 }
Norwegian figures for 1967-72 and 1977 } included in Division IVa
Swedish figures for 1967-74 and 1976-77 }
USSR figures for 1967-73 and 1977 }
Netherlands figure for 1977 }

Netherlands: not included for 1967: 720 tons, and for 1968: 306 tons caught mostly in Division IVb, rest in Division IVc.
Swedish figure for 1975 includes Division IVa,c.

Division IVc

Danish figure for 1977 }
German Dem.Rep. figures for 1969-72 and 1976 }
Norwegian figures for 1967-68 and 1976 }
Spanish figure for 1976 } included in Division IVa.
Swedish figure for 1977 }
USSR figures for 1967-73 and 1977 }
Netherlands figure for 1977 }

Div.IVc ctd....

Footnotes to Table 1.3 (ctd)

Division IVc (ctd)

Netherlands: not included for 1967: 720 tons, and for 1968: 306 tons caught mostly in Division IVb, rest in Division IVc.
Swedish figure for 1975 included in Division IVb.

Division VIIa

French figure for 1971 includes Division VIIf.

Division VIIf

French figure for 1971 included in Division VIIa.

Table 1.4 WHITING. Division IIIa and the Divisions of Sub-areas IV, VI and VII. Nominal catch by Divisions in metric tons 1967-77.

Year / Area[a)]	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977*
IIIa	30 157	29 497	16 544	13 130	13 989	14 562	22 547	28 842	19 690	18 595	91
IVa	43 218	51 701	49 839	32 185	23 451	32 932	31 104	81 693	75 444	107 246	87 424
IVb	41 449	76 928	157 568	126 024	70 728	66 789	96 678	87 842	41 930	69 904	21 096
IVc	6 578	16 291	8 422	23 297	18 865	9 811	13 409	19 050	22 792	20 763	14 931
VIa	17 586	13 989	12 181	11 222	15 225	15 313	16 646	17 057	20 041	24 937	16 504
VIb	2 123	485	369	1 277	807	81	63	1	12	18	7
VIIa	18 902	12 875	9 724	4 804	8 383	7 680	10 337	9 819	9 832	12 193	5 076
VIIb,c	2 246	3 249	3 595	1 507	287	1 056	1 091	1 243	1 829	1 530	101
VIId,e	5 554	6 640	5 066	4 825	3 592	3 676	5 647	8 572	11 400	10 020	10 593
VIIf	1 573	1 740	2 856	2 036	315	728	1 366	1 468	1 752	1 865	311
VIIg-k	4 848	5 187	5 580	2 538	5 259	7 705	8 214	7 101	7 620	8 185	4 209
Total	174 234	218 582	271 744	223 845	160 901	160 333	207 102	262 688	212 342	275 256	160 343

* Provisional figures.

a) See footnotes on pages 23 and 24.

Footnotes to Table 1.4

Division IIIa

Swedish figures for 1967-74 included in Division IVa.

Division IVa

Danish figures for 1967-73, Swedish figure for 1975 } included in Division IVb

French figure for 1969, Norwegian figures for 1967-68, USSR figures for 1967-73 and 1977 } include Divisions IVb,c

Swedish figures for 1967-74 include Divisions IIIa and IVb.
Norwegian figures for 1969-72 and 1976-77 include Division IVb.
Faroe Islands figure for 1977 includes Division IVb. Human consumption only.
Swedish figure for 1976 includes Division IVb.
Swedish figure for 1977 includes Divisions IVb,c. Data from NEAFC Form -Jan-Dec.
Norwegian figures for 1971 and 1972 not including catches from the Rec.2 fisheries (1971: 1 605 tons; 1972: 2 023 tons).
Norwegian landings for 1976 revised by the Working Group (April 1978)

Division IVb

Faroe Islands figure for 1977, French figure for 1969, Norwegian figures for 1967-72 and 1977, Swedish figures for 1967-74 and 1976-77, USSR figures for 1967-73 and 1977 } included in Division IVa

Danish figures for 1967-73 include Division IVa
Netherlands: not included for 1967: 913 tons and for 1968: 257 tons caught mostly in Division IVb, rest in Division IVc.
Swedish figure for 1975 includes Divisions IVa,c.
Danish figure for 1977 included in Division IVa.

Division IVc

French figure for 1969, Norwegian figures for 1967-69, Swedish figure for 1977, USSR figures for 1967-73 and 1977 } included in Division IVa.

Footnotes to Table 1.4 (ctd)

Division IVc (ctd)

Netherlands: not included for 1967: 913 tons and for 1968: 257 tons caught mostly in Division IVb, rest in Division IVc.
Swedish figure for 1975 included in Division IVb.
Danish figure for 1977 included in Division IVa.

Division VIIa

French figure for 1971 includes Division VIIf.

Division VIIf

French figure for 1971 included in Division VIIa.

Table 1.5 Nominal catches of COD (metric tons) from Recommendation 2 fisheries in Sub-area IV (data taken from NEAFC reports).

Country	1971		1972		1973		1974		1975		1976*	
	legal-sized	under-sized	legal-sized	under-sized	legal-sized	under-sized	legal-sized	under-sized	legal-sized	under-sized	legal-sized	under-sized
Belgium	...	...	...	...	...	...	...	...	13	-	7	-
Denmark	8 332	3 601	8 213	1 076	5 189	1 313	4 215	2 498	e)	e)	e)	e)
Faroe Isl.[a]	-	-	-	-	-	-	415	1	e)	e)	...	...
German Dem.R.	...	...	...	...	...	...	...	...	37	-	5	-
Germany,F.R.	4 125	970	555	54	?	?	-	1	249	60	45	420
Netherlands	8 199	-	?	-	5 931	67	7 679	-	e)	e)	e)	e)
Norway(IVa)	730	584	920	736	480	659	733	368	965	223	757	27
Poland	181	6	189	23	?	?	210	11	150	7[d]	148	7[d]
Sweden[a]	-	-	-	-	-	-	8 260	...	6 247	-	...	...
UK(England)	-	-	-	-	-	-	6	-	-	-	...	...
UK(Scotland)	-	-	-	-	-	-	741	-	1 983	-	1 357	...
Total[b]	21 567	5 161	9 877	1 889	11 600	2 039	22 259	2 879	9 644	290	2 319	454

Nominal catches of HADDOCK (metric tons) from Recommendation 2 fisheries in Sub-area IV (data taken from NEAFC reports).

Belgium	...	...	...	...	...	...	...	...	-	-	-	-
Denmark	13 657	7 651	9 088	11 568	771	3 155	9 364	27 785	e)	e)	e)	e)
Faroe Isl.[a]	-	-	-	-	-	-	20	186	e)	e)	e)	e)
German Dem.R.	...	...	...	...	...	...	...	...	27	-	3	-
Germany, F.R.	927	32	263	-	?	?	+		-	-	-	-
Netherlands	6 341	-	?	-	2 088	1	2 237	-	e)	e)	e)	e)
Norway (IVa)	2 176	2 336	2 742	2 943	1 055	4 102	3 379	2 356	2 613	7 227	1 737	1 396
Poland	12	1	38	7	?	?	115	7	77	3[d]	58	3[d]
Sweden[a]	-	-	-	-	-	-	2 954	...	2 978	...	e)	...
UK(Scotland)	-	-	-	-	-	-	553	1 842	652	1 582	992	546
Total	23 113	10 020	12 131	14 518	3 914	7 258	18 622	32 176	6 347	8 812	2 790	1 945

(ctd)

For footnotes, see page 26.

Table 1.5 (continued)

Nominal catches of WHITING (metric tons) from Recommendation 2 fisheries in Sub-area IV (data taken from NEAFC reports).

Country	1971		1972		1973		1974		1975		1976*	
	legal-sized	under-sized	legal-sized	under-sized	legal-sized	under-sized	legal-sized	under-sized	legal-sized	under-sized	legal-sized	under-sized
Belgium	...	...	...	...	...	...	...	...	94	-	42	-
Denmark	20 462	34 493	29 446	20 035	57 194	16 081	84 448	24 578	e)	e)	e)	e)
Faroe Isl.[a]	-	-	-	-	-	-	31	494	e)	e)	e)	e)
German D.R.	...	...	...	...	...	...	...	...	3	-	18	-
Germany,F.R.	2 923	119	926	184	?	?	1 081[c]		367	27	254	594
Netherlands	1 193	-	?	-	2 153	14	4 281	-	e)	e)	e)	e)
Norway(IVa)	995	610	1 254	769	1 322	166	4 710	312	12 550	693	6 744	-
Poland	2	-	-	-	?	-	74	4	45	2[d]	25	-
Sweden[a]	-	-	-	-	-	-	860	...	845	-	e)	e)
UK(Scotland)	-	-	-	-	-	-	1 442	559	3 441	948	3 127	67
Total	25 575	35 222	31 626	20 988	60 669	16 261	95 847	25 947	17 345	1 670	10 210	661

a) Division IIIa inclusive.

b) Total of available data only.

c) Excluded from totals.

d) Preliminary estimates.

e) No data.

*) Provisional data.

Table 1.6 Nominal catch of COD for Divisions IVa-IVc by country in metric tons, 1972-77.
(Bulletin Statistique)

Country	1972	1973	1974	1975	1976	1977*
Belgium	21 133	11 741	10 253	7 566	7 483	9 855
Denmark	72 520	47 950	54 207	46 344	53 277	38 814
Faroe Islands	284	803	416	732	448	286
France	24 038	13 247	7 275	8 667	8 079	7 510
German Dem.Rep.[a]	122	343	132	223	69	21
Germany,Fed.Rep.	49 431	21 410	17 089	16 457	24 445	20 433
Iceland	-	+	+	-	-	-
Ireland	-	-	-	-	98	123
Netherlands	47 634	25 758	24 029	23 263	21 835	30 049
Norway	4 377[b]	4 831	2 481	1 528	2 661[c]	2 192
Poland	189	1 551	4 750	2 991	2 961	481
Spain	91	90	80	63	14	-
Sweden[a]	8 769	8 074	8 168	900	532	470
UK (Engl.&Wales)	62 503	47 327	39 857	33 615	46 475	35 424
UK (Scotland)	55 190	48 844	39 887	37 308	39 597	34 411
USSR	774	2 497	2 667	6 796	6 187	-
Total	347 055	234 466	211 291	186 453	214 161	180 069

* Provisional figures.

a) GDR figure for 1972 and Swedish figures for 1972-74 include Div. IIIa.

b) Norwegian figure for 1972 do not include cod caught in Recommendation 2 fisheries (1972 = 1 656 tons).

c) Norwegian figure for 1976 revised for Div. IVa by the Working Group (April, 1978).

Table 1.7 Nominal catch of HADDOCK for Divisions IVa-IVc by country in metric tons, 1972-77.

(Bulletin Statistique)

Country	1972	1973	1974	1975	1976	1977*
Belgium	1 601	2 385	1 137	2 209	2 166	2 015
Denmark	34 858	13 118	44 342	32 930	46 899	19 966
Faroe Islands	5	1 198	435	267	183	18
France	7 814	4 695	4 020	4 646	5 500	6 914
German Dem.Rep.[a]	90	22	8	44	20	8
Germany,Fed.Rep	4 020	4 587	3 478	2 396	3 433	3 790
Iceland	-	-	-	-	-	-
Ireland	-	-	-	-	31	45
Netherlands	5 188	3 185	3 035	1 901	1 728	1 594
Norway	1 146[b]	5 611	5 954	331	3 473 [d]	1 356
Poland	38	2 553	3 001	1 485	1 155	485
Spain[c]	-	101	210	-	-	-
Sweden[a]	5 305	4 550	3 098	2 083	2 284	1 861
UK (Engl.& Wales)	20 827	16 586	10 798	11 499	17 238	17 167
UK(Scotland)	96 197	88 132	71 679	64 686	80 576	89 474
USSR	36 467	49 356	42 234	49 686	42 852	8 002
Total	213 556	196 079	193 429	174 163	207 538	152 695

* Provisional figures.

a) German Dem.Rep. figure for 1972 and Swedish figures for 1972-74 include Division IIIa.

b) Norwegian figure for 1972 does not include haddock caught in Recommendation 2 fisheries (1972 = 5 685 tons).

c) Spain reported 90 tons caught in 1975.

d) Norwegian figure for 1976 revised by the Working Group (April, 1978).

Table 1.8 Nominal catch of WHITING for Divisions IVa- IVc by country in metric tons, 1972-77.

(Bulletin Statistique)

Country	1972	1973	1974	1975	1976	1977*
Belgium	2 745	3 387	3 156	3 279	2 640	3 229
Denmark	50 109	73 928	109 654	61 941	116 973	46 347
Faroe Islands	-	1 453	1 126	764	1 262	5
France	19 822	20 353	19 825	20 079	19 557	17 610
German Dem.Rep.	-	5	-	3	18	-
Germany,Fed.Rep.	264	403	454	446	302	413
Ireland	-	-	-	-	4	7
Netherlands	7 613	8 811	12 057	14 078	12 274	9 111
Norway	28[a]	1 527	4 990	55	6 814[c]	2 737
Poland	-	7	1 002	888	509	445
Spain	107	119	110	65	18	-
Sweden[b]	596	2 328	2 440	255	145	1 485
UK (England and Wales)	3 789	4 592	5 519	5 246	5 112	6 621
UK(Scotland)	23 846	20 756	25 274	27 969	26 167	33 019
USSR	613	3 522	2 978	5 098	5 612	2 422
Total	109 532	141 191	188 585	140 166	197 407	123 451

* Provisional figures.

a) Norwegian figure for 1972 does not include whiting caught in Recommendation 2 fisheries (1972 = 2 023 tons).

b) Swedish figures for 1972-74 include Division IIIa.

c) Norwegian figure for 1976 revised by the Working Group (April, 1978).

Table 1.9 United Kingdom (England and Wales) fishing effort data for different areas.

Area		1970	1971	1972	1973	1974	1975	1976	1977
North Sea (Sub-area IV)	Hours	819.5	855.1	884.9	852.9	781.3	694.5	725.8	732.2
	Av. tons	56	54	60	56	58	52	59	61
	Ton-Hours	4 589	4 618	5 309	4 776	4 532	3 611	4 282	4 466
West of Scotland (Div. VIa)	Hours	49.2	33.3	33.6	32.4	31.1	35.8	40.6	54.3
	Av. tons	254	242	445	392	351	307	310	358
	Ton-Hours	1 250	806	1 495	1 270	1 092	1 099	1 259	1 944
Bristol Channel (Div. VIIf)	Hours	44.1	47.4	38.4	37.0	32.2	34.3	27.4	25.2
	Av. tons	56	49	52	57	62	41	45	52
	Ton-Hours	247	232	200	211	200	141	123	131

Note: HOURS are in thousands; TON-HOURS are in 10 thousands.

Table 1.10 United Kingdom (Scotland) fishing effort ('000 hours fishing) for different areas.

Area	Gear	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
IV	Trawl	206	203	112	110	149	177	176	179	150	122	144
	Light trawl	24	41	54	67	98	109	146	117	160	153	225
	Seine	499	537	479	411	399	379	405	350	342	308	314
	Total	729	781	645	588	646	665	727	646	652	583	683
VI(a+b)	Trawl	54	50	43	41	42	56	55	44	37	38	35
	Light trawl	83	66	105	115	129	142	91	86	129	139	144
	Seine	159	150	140	96	99	71	60	56	56	57	42
	Total	296	266	288	252	270	269	206	186	222	234	221

Table 1.11 International effort data from the North Sea.

Year	COD		HADDOCK		WHITING	
	International Effort		International Effort		International Effort	
	English[1] > 40' motor seine units	Scottish[2] units	English[1] > 40' Total trawl & seine units	Scottish[2] units	English[1] >40' Total trawl & seine units	Scottish[2] units
1959			164.16		571.73	
1960			153.92		300.67	
1961			121.56		309.78	
1962			98.26		200.50	
1963	9.61		82.52		231.69	
1964	10.69		87.56		166.30	
1965	9.81		118.73		166.10	
1966	10.00		163.03		271.22	
1967	11.08	42.914	133.60	15.793	167.49	20.169
1968	10.52	48.291	101.44	16.680	290.61	37.371
1969	9.21	38.822	272.56	58.867	564.48	67.876
1970	12.69	44.934	200.74	34.974	302.70	50.629
1971	15.83	55.624	90.44	13.725	153.07	27.294
1972	15.30	41.818	68.40	14.763	187.97	30.545
1973	14.33	34.898	69.99	16.175	180.66	49.454
1974	15.64	34.220	100.64	17.433	186.68	48.202
1975	18.61	32.585	68.57	17.555	124.14	32.675
1976	13.25	31.418	59.96	15.041	189.44	44.393
1977	16.98	35.687	48.06	11.656	107.67	26.656

1) Ton-hours x 10^{-7}.

2) Hours x 10^{-2}.

Table 2.1 COD. Sub-area IV. Catch in numbers ('000 fish) by year and by age.

AGE	1968	1969	1970	1971	1972	1973
0	0	0	0	0	0	0
1	9941	5109	47304	61347	6317	33809
2	79589	23009	27373	149128	195922	30551
3	36676	31590	16392	14385	43709	52648
4	11078	14959	12179	5952	5035	13163
5	5623	5190	6867	6028	2406	1905
6	1275	2842	1963	2394	2802	1038
7	623	688	1051	760	1449	988
8	314	379	207	394	545	486
9	154	170	221	182	339	38
10	103	54	136	82	102	41
11	21	110	46	53	5	64
12 +	9	17	24	26	11	73
TOTAL	145406	84117	113763	240731	258702	134804
Catches of mature fish (AGE >= 4)	19200	24409	22694	15871	12754	17796

AGE	1974	1975	1976	1977
0	0	274	174	112
1	15715	35086	6574	73425
2	53537	54771	97191	51234
3	11799	17597	19330	22374
4	5180	4078	6463	4173
5	4397	6401	1414	1739
6	974	1662	2254	586
7	472	378	729	802
8	373	144	96	267
9	310	175	54	185
10	65	73	54	24
11	35	29	14	8
12 +	27	20	14	58
TOTAL	92884	120688	134362	154986
Catches of mature fish (AGE >= 4)	11833	12960	11093	7841

Table 2.2 HADDOCK. Sub-area IV. Catch in numbers ('000 fish) by year and by age.

AGE	1960	1961	1962	1963	1964	1965
0	0	0	0	0	0	0
1	26394	20452	64398	25016	11	24631
2	117367	64283	23710	118135	426452	3723
3	9899	65993	32655	13487	146416	460835
4	5976	3884	18585	12228	17136	33171
5	23228	2326	1186	6490	9540	6839
6	2968	7350	679	533	4319	3817
7	1017	813	3436	362	323	672
8	449	398	260	919	532	259
9	0	59	26	9	60	18
10 +	0	0	4	9	11	0
TOTAL						
Catches of	187298	165558	144939	177188	604800	533965
mature fish	(AGE >= 2)					
	160904	145106	80541	152172	604789	509334

AGE	1966	1967	1968	1969	1970	1971
0	0	0	0	0	0	0
1	11741	101980	375954	96450	6270	48309
2	6651	25414	190064	1728521	119108	22735
3	17676	3332	26678	181820	1501064	37464
4	410528	6684	2336	26798	34647	372336
5	24649	194803	2244	5169	594	11383
6	4302	4836	66077	2252	512	675
7	408	498	566	42481	235	206
8	79	259	72	5051	2584	1827
9	5	42	11	13	19	864
10 +	0	3	6	0	3	211
TOTAL						
Catches of	476039	337851	664008	2088555	1665036	496010
mature fish	(AGE >= 2)					
	464298	235871	288054	1992105	1658766	447701

AGE	1972	1973	1974	1975	1976	1977
0	161936	41834	386956	70051	147446	44089
1	194924	21985	241173	776653	103177	98430
2	222225	265206	78126	416471	601124	105836
3	27356	240903	252116	53422	211482	338411
4	20070	8952	48950	116929	12607	44968
5	147479	6147	2636	16760	33469	3859
6	3277	1572	1136	708	5543	7674
7	123	39	9621	489	228	1070
8	433	1	236	3098	85	112
9	8	4	15	111	815	36
10 +	142	23	40	64	83	221
TOTAL						
Catches of	777973	586666	1021005	1454756	1116059	644706
mature fish	(AGE >= 2)					
	421113	522847	392876	608052	865436	502187

Table 2.3 WHITING. Sub-area IV. Catch in numbers ('000 fish) by year and by age.

AGE	1960	1961	1962	1963	1964	1965
0	16109	145581	57828	64257	198791	35800
1	94548	96464	73114	271742	61465	80050
2	58585	143598	78828	220766	157203	53023
3	86148	95377	96298	59022	113598	222525
4	14296	29198	28817	36292	22679	61271
5	21768	1629	6658	8838	11698	8466
6	3458	4319	284	1893	2904	3873
7	1025	306	1174	11	501	928
8+	2415	340	141	151	63	141
TOTAL	298352	516812	343142	662972	568902	466077
Catches of mature fish (AGE >= 2)	187695	274767	212200	326973	308646	350227

AGE	1966	1967	1968	1969	1970	1971
0	26864	225344	149071	114392	105852	969531
1	267347	187736	425514	513060	486258	208832
2	187031	163927	317412	790117	172353	90844
3	72901	123885	101396	133868	401920	22821
4	188881	28061	48832	30646	34378	115699
5	33896	59486	10730	11183	10568	13065
6	3226	7714	23612	3807	4051	2241
7	1540	923	2190	7248	504	801
8+	451	150	138	3499	1673	662
TOTAL	782137	797226	1078895	1607820	1217557	1424496
Catches of mature fish (AGE >= 2)	487926	384146	504310	980368	625447	246133

AGE	1972	1973	1974	1975	1976	1977
0	478565	201785	492277	181773	311435	263341
1	642039	638510	873497	602340	306092	460208
2	235436	446112	745235	273809	756273	279569
3	41610	108925	190795	255145	128010	246315
4	6816	18653	32495	60267	72995	28056
5	51901	5905	5000	11565	14483	21842
6	5971	18094	1779	2487	3478	4847
7	843	2638	5409	781	795	3989
8+	575	635	578	1651	591	410
TOTAL	1463756	1441257	2347065	1389818	1594152	1308577
Catches of mature fish (AGE >= 2)	343152	600962	981291	605705	976625	585028

Table 2.4 COD. Division VIa.
Catch in numbers ('000 fish) by year and by age.

AGE	1968	1969	1970	1971	1972	1973
1	222	84	92	335	220	153
2	859	986	272	884	2264	504
3	1862	970	944	523	1068	1271
4	1296	1519	457	709	483	518
5	112	624	356	220	405	145
6	121	104	133	185	91	161
7	72	84	24	68	72	42
8+	18	53	39	36	47	47
TOTAL	4562	4424	2317	2960	4650	2841
Catches of mature fish (AGE >= 4)	1619	2384	1009	1218	1098	913

AGE	1974	1975	1976	1977
1	727	1260	1988	482
2	1841	2043	4753	1171
3	752	1217	1362	1508
4	874	506	585	586
5	235	269	255	248
6	53	60	185	90
7	52	11	58	53
8+	22	19	18	11
TOTAL	4556	5385	9204	4149
Catches of mature fish (AGE >= 4)	1236	865	1101	988

Table 2.5 HADDOCK. Division VIa.
Catch in numbers ('000 fish) by year and by age.

AGE	1965	1966	1967	1968	1969	1970
1	5	278	516	9311	0	230
2	1654	359	11419	7387	48921	164
3	84419	1164	1239	3234	5928	71520
4	4697	47424	238	418	1386	3795
5	206	1606	18775	586	350	211
6	169	76	252	11729	576	92
7	139	30	20	655	3386	98
8	23	102	28	36	150	453
TOTAL	91312	51039	32487	33356	60697	76563
Catches of mature fish (AGE >= 2)	91307	50761	31971	24045	60697	76333

AGE	1971	1972	1973	1974	1975	1976
1	2448	590	1208	1970	4861	919
2	2844	22221	6520	3425	9519	25407
3	6627	2225	15648	9411	2773	14265
4	91387	2897	263	6131	3427	1825
5	590	56846	1147	97	1980	1698
6	86	612	31836	447	106	1044
7	6	37	139	11488	122	32
8	97	57	114	189	3770	31
TOTAL	104085	85485	56875	33158	26558	45221
Catches of mature fish (AGE >= 2)	101637	84895	55667	31188	21697	44302

AGE	1977
1	215
2	2014
3	29338
4	6794
5	817
6	504
7	409
8	40
TOTAL	40131
Catches of mature fish (AGE >= 2)	39916

Table 2.6 WHITING. Sub-area VI.
Catch in numbers ('000 fish) by year and by age.

AGE	1965	1966	1967	1968	1969	1970
0	0	0	0	0	0	0
1	2239	1126	4261	7037	684	697
2	4857	12935	25182	18154	25631	2676
3	41177	2454	10755	9729	9753	30312
4	5299	28248	857	3583	2794	4514
5	784	1767	16762	2[illegible]	1276	818
6	68	213	803	477[illegible]	109	210
7	185	36	84	269	1708	14
8 +	12	17	23	31	155	392
TOTAL	54621	46796	58727	43842	42110	39633
Catches of mature fish (AGE >= 2)	52382	45670	54466	36805	41426	38936

AGE	1971	1972	1973	1974	1975	1976
0	0	0	0	4	54	6
1	2640	11064	13009	7577	17551	7961
2	7712	9657	27463	42873	18712	44583
3	3936	3447	6758	12215	39477	16757
4	30759	1168	1831	2035	3243	22197
5	1394	12800	469	505	307	2509
6	249	712	5293	68	60	222
7	47	58	273	1387	6	38
8+	78	64	33	64	194	127
TOTAL	46815	38970	55129	66728	79604	94400
Catches of mature fish (AGE >= 2)	44175	27906	42120	59147	61999	86433

AGE	1977
0	14
1	3078
2	17450
3	33246
4	3607
5	5701
6	384
7	7
8+	5
TOTAL	63492
Catches of mature fish (AGE >= 2)	60400

Table 3.1 COD. Sub-area IV.
Fishing mortality by year and by age.

AGE	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
0	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1	.13	.07	.15	.16	.09	.27	.13	.19	.06	.35
2	.70	.48	.59	.99	1.13	.78	.88	.93	1.13	.90
3	.66	.67	.75	.74	.92	1.16	.82	.84	1.06	.90
4	.64	.63	.60	.69	.64	.82	.31	.77	.90	.70
5	.60	.72	.67	.68	.68	.52	.73	.80	.67	.66
6	.50	.71	.66	.52	.81	.71	.56	.68	.75	.66
7	.42	.55	.63	.59	.71	.77	.86	.44	.73	.66
8	.46	.49	.31	.51	1.20	.55	.77	.71	.19	.66
9	.59	.49	.60	.50	1.20	.22	.83	1.08	.64	.66
10	.46	.42	.96	.47	.59	.42	.73	.47	1.28	.66
11	.59	1.41	.79	1.45	.05	.96	.79	.87	.15	.66
12+	.55	.55	.66	.66	.66	.66	.66	.66	.66	.66
MEAN F FOR AGES >= 2 AND <= 8 (WEIGHTED BY STOCK IN NUMBERS)	.67	.60	.64	.93	1.06	.95	.78	.88	1.09	.88

AGE-NATURAL MORTALITY

0	1	2	3	4	5	6	7	8	9	10	11	12
.20	.20	.20	.20	.20	.20	.20	.20	.20	.20	.20	.20	.20

Table 3.2 HADDOCK. Sub-area IV.
Fishing mortality by year and by age.

AGE	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969
0	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1	.14	.17	.12	.01	.00	.56	.09	.16	.07	.32
2	.64	.56	.31	.33	.21	.08	.29	.29	.49	.50
3	.75	.94	.63	.29	.89	.38	.61	.23	.57	1.31
4	.71	.76	.78	.51	.74	.51	.68	.49	.24	2.54
5	.90	.68	.55	.70	.98	.76	.92	.83	.30	1.33
6	1.13	.83	.43	.52	1.65	1.64	1.91	.45	.77	.56
7	1.07	1.20	1.33	.43	.70	1.59	.80	1.68	.09	2.29
8	1.91	2.25	2.28	2.22	2.82	3.17	.84	2.61	1.50	2.67
9	.00	2.47	1.15	.48	1.10	1.10	.81	1.82	1.10	1.44
10+	.00	.00	1.10	1.10	1.10	.00	.00	1.10	1.10	.00
MEAN F FOR AGES >= 2 AND <= 6 (WEIGHTED BY STOCK IN NUMBERS)	.69	.72	.51	.35	.29	.38	.68	.68	.54	.56

AGE	1970	1971	1972	1973	1974	1975	1976	1977
0	.00	.00	.45	.03	.13	.11	.25	.06
1	.07	.06	.18	.10	.23	.41	.23	.27
2	.84	.35	.43	.39	.61	.77	.64	.39
3	1.14	.70	.96	1.23	.78	1.17	1.25	.96
4	1.01	1.03	1.07	1.02	.94	1.10	1.02	1.04
5	.40	1.19	1.94	1.27	1.01	1.04	1.22	1.10
6	.42	1.10	1.61	.08	.87	.85	1.34	1.10
7	.10	.30	.60	.06	1.02	1.29	.75	1.10
8	1.11	3.65	1.96	.01	.63	1.19	.83	1.10
9	.07	1.71	.23	.07	.16	.70	1.32	1.10
10+	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10
MEAN F FOR AGES >= 2 AND <= 6 (WEIGHTED BY STOCK IN NUMBERS)	1.11	.93	.78	.63	.76	.86	.78	.77

AGE-NATURAL MORTALITY

0	1	2	3	4	5	6	7	8	9	10
.20	.20	.20	.20	.20	.20	.20	.20	.20	.20	.20

Table 3.3 WHITING. Sub-area IV.
Fishing mortality by year and by age.

AGE	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969
0	.04	.15	.03	.15	.23	.04	.02	.08	.15	.12
1	.20	.32	.10	.22	.21	.14	.47	.24	.20	1.04
2	.28	.53	.47	.52	.19	.28	.55	.60	.80	.68
3	1.00	.98	.84	.80	.55	.46	.79	.89	.98	.98
4	1.87	1.22	.96	.94	.84	.66	.92	.84	1.15	.95
5	1.38	1.45	1.09	.92	.96	.92	.99	.87	.95	.93
6	1.88	1.27	1.20	1.17	.93	1.04	1.22	.64	1.11	1.15
7	1.14	.93	1.87	.12	1.26	.90	2.10	1.74	.37	1.40
8+	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80
MEAN F FOR AGES >= 1 AND <= 5 (WEIGHTED BY STOCK IN NUMBERS)	.40	.56	.32	.35	.29	.33	.62	.46	.37	.82

AGE	1970	1971	1972	1973	1974	1975	1976	1977
0	.11	.40	.17	.11	.17	.16	.21	.18
1	1.13	.31	.50	.36	.87	.32	.43	.54
2	1.38	.66	.71	.80	.93	.77	.87	.89
3	.91	.67	.74	.86	1.01	1.02	1.06	.80
4	.74	.75	.43	.92	.69	1.11	.96	.71
5	1.09	.72	.93	.83	.69	.57	.92	.89
6	1.12	.72	.89	1.07	.65	.91	.34	.95
7	.44	.69	.67	1.44	1.20	.67	.87	.81
8+	.80	.80	.80	.80	.80	.80	.80	.80
MEAN F FOR AGES >= 1 AND <= 5 (WEIGHTED BY STOCK IN NUMBERS)	1.06	.46	.57	.51	.90	.50	.73	.69

AGE-NATURAL MORTALITY

0	1	2	3	4	5	6	7	8
.20	.20	.20	.20	.20	.20	.20	.20	.20

Table 3.4 COD. Division VIa.
Fishing mortality by year and by age.

AGE	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
1	.04	.03	.02	.04	.06	.02	.10	.10	.28	.03
2	.28	.25	.14	.27	.45	.18	.45	.47	.68	.26
3	.48	.59	.40	.43	.62	.49	.45	.61	.67	.48
4	.73	.94	.62	.59	.91	.70	.74	.63	.68	.70
5	.38	.99	.60	.69	.83	.79	.83	.53	.77	.70
6	.54	.75	.59	.73	.70	.98	.78	.52	.89	.70
7	.66	.91	.38	.70	.72	.84	1.06	.36	1.53	.70
8+	.70	.70	.70	.70	.70	.70	.70	.70	.70	.70
MEAN F FOR AGES >= 2 AND <= 6 (WEIGHTED BY STOCK IN NUMBERS)										
	.47	.57	.38	.42	.55	.42	.52	.53	.69	.41

AGE-NATURAL MORTALITY

1	2	3	4	5	6	7	8
.20	.20	.20	.20	.20	.20	.20	.20

Table 3.5 HADDOCK. Division VIa.
Fishing mortality by year and by age.

AGE	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974
1	.00	.01	.02	.01	.00	.03	.03	.02	.07	.03
2	.22	.08	.79	.31	.09	.01	.49	.44	.24	.29
3	.52	.24	.43	.54	.44	.18	.67	.90	.64	.63
4	.58	.63	.07	.25	.47	.57	.38	.71	.24	.56
5	.30	.40	.56	.24	.34	.12	.16	.43	.70	.13
6	.41	.17	.10	.83	.40	.14	.07	.25	.46	.65
7	.14	.12	.06	.40	.61	.11	.01	.04	.08	.30
8	.15	.15	.15	.15	.15	.15	.15	.15	.15	.15
MEAN F FOR AGES >= 2 AND <= 6 (WEIGHTED BY STOCK IN NUMBERS)	.51	.58	.58	.51	.10	.19	.39	.44	.45	.51

AGE	1975	1976	1977
1	.04	.11	.01
2	.19	.31	.38
3	.40	.48	.72
4	.49	.49	.44
5	.35	.49	.43
6	.20	.32	.26
7	.37	.09	.20
8	.15	.15	.15
MEAN F FOR AGES >= 2 AND <= 6 (WEIGHTED BY STOCK IN NUMBERS)	.26	.37	.61

AGE-NATURAL MORTALITY

1	2	3	4	5	6	7	8
.20	.20	.20	.20	.20	.20	.20	.20

Table 3.6 WHITING. Sub-area VI.
Fishing mortality by year and by age.

AGE	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974
0	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1	.05	.02	.08	.04	.05	.04	.09	.16	.07	.12
2	.65	.47	.86	.57	.19	.29	.67	.58	.73	.36
3	.45	.82	.93	1.04	.70	.36	.90	.74	1.10	.86
4	.81	.64	.78	.99	1.02	.84	.77	.76	1.20	1.33
5	1.00	.71	1.04	.60	1.31	1.02	.69	.89	.82	1.52
6	.59	.86	.85	1.00	.54	.80	1.07	.96	1.28	.26
7	2.13	.74	1.05	.79	1.38	.12	.41	.80	1.37	1.77
8+	.70	.70	.70	.70	.70	.70	.70	.70	.70	.70
MEAN F FOR AGES >= 2 AND <= 5 (WEIGHTED BY STOCK IN NUMBERS)										
	.49	.59	.93	.72	.28	.39	.76	.74	.80	.44

AGE	1975	1976	1977
0	.00	.00	.00
1	.11	.15	.05
2	.49	.47	.57
3	.67	1.17	.78
4	.59	1.04	.89
5	.73	1.38	.86
6	.74	2.62	.83
7	.03	1.82	.70
8+	.70	.70	.70
MEAN F FOR AGES >= 2 AND <= 5 (WEIGHTED BY STOCK IN NUMBERS)			
	.60	.69	.72

AGE-NATURAL MORTALITY

0	1	2	3	4	5	6	7	8
.20	.20	.20	.20	.20	.20	.20	.20	.20

Table 4.1 COD. Sub-area IV.
Stock in numbers ('000 fish) at beginning of year.

AGE	1968	1969	1970	1971	1972	1973
0	106372	448842	550039	100027	193419	168246
1	92065	87090	367481	450334	81896	158358
2	172978	66415	66693	258245	313435	61352
3	82871	70547	33755	30119	78871	82853
4	25598	35077	29537	13011	11821	25681
5	13597	11056	15345	13289	5337	5124
6	3570	6103	4418	6428	5496	2220
7	1984	1780	2459	1863	3119	2002
8	927	1065	842	1074	846	1260
9	377	478	533	503	526	210
10	304	171	239	238	249	130
11	51	157	91	75	122	112
12+	12	23	31	34	14	95
TOTAL	500706	728804	1071463	875241	695150	507643
SPAWNING STOCK (AGE >= 4)	46420	55910	53494	36515	27529	36834

AGE	1974	1975	1976	1977
0	278890	149180	333315	123854
1	137748	228335	121891	272738
2	99247	98614	155348	93863
3	22986	33589	32005	40991
4	21165	8303	11823	9042
5	9294	12673	3160	3927
6	2489	3684	4669	1324
7	891	1166	1532	1811
8	758	309	616	603
9	596	288	124	418
10	137	212	80	54
11	70	54	108	18
12+	35	26	19	76
TOTAL	574305	536434	664690	548718
SPAWNING STOCK (AGE >= 4)	35435	26715	22131	17272

Table 4.2 HADDOCK. Sub-area IV.
Stock in numbers ('000 fish) at beginning of year.

AGE	1960	1961	1962	1963	1964	1965
0	173083	772302	3670249	83268	76795	179312
1	229349	141708	632308	3004946	68174	62875
2	271615	163986	97599	459632	2437647	55806
3	20514	117468	76726	58599	270185	1611915
4	12781	7962	37472	33622	35853	90859
5	42564	5129	3054	14104	16574	14060
6	4750	14172	2122	1439	5752	5089
7	1682	1257	5054	1128	701	908
8	565	475	308	1099	599	285
9	0	68	41	26	97	29
10 +	0	0	5	11	13	0
TOTAL	756902	1224528	4524937	3657874	2912390	2021139
SPAWNING STOCK (AGE >= 2)	354470	310517	222381	569660	2767421	1778952

AGE	1966	1967	1968	1969	1970	1971
0	937054	7690618	470670	133652	1097657	1617869
1	146809	767195	6296545	385352	109425	898685
2	29432	109607	536247	4815949	228837	83932
3	42331	18117	66893	268740	2394373	81226
4	906026	18850	11835	30895	59215	629153
5	44676	375091	9444	7588	1989	17694
6	5410	14643	133515	5715	1642	1096
7	807	657	7652	50378	2664	885
8	152	297	100	5755	4184	1969
9	10	54	18	18	326	1133
10 +	0	4	7	0	4	249
TOTAL	2112707	8995133	7532926	5704043	3900315	3333892
SPAWNING STOCK (AGE >= 2)	1028844	537320	765710	5185038	2693233	817337

AGE	1972	1973	1974	1975	1976	1977
0	487097	1631407	3529926	751610	720068	834478
1	1324599	253612	1297911	2541257	552201	456912
2	692187	908925	187813	845606	1383758	359257
3	48300	367408	506123	83897	320837	595637
4	33047	15216	87490	189541	21337	75450
5	184347	9241	4504	28085	51435	6269
6	4400	21671	2126	1345	8109	12467
7	298	717	16324	729	471	1738
8	539	134	552	4818	164	182
9	42	62	109	241	1199	58
10+	168	27	47	76	98	261
TOTAL	2775025	3208421	5632927	4447205	3059677	2342710
SPAWNING STOCK (AGE >= 2)	963329	1323402	805089	1154338	1787407	1051320

Table 4.3 WHITING. Sub-area IV.
Stock in numbers ('000 fish) at beginning of year.

AGE	1960	1961	1962	1963	1964	1965
0	489321	1153409	1890290	504463	1049066	985704
1	569887	386079	813150	1495430	355120	680024
2	266671	381461	229418	599819	979789	235419
3	148283	165652	183730	117178	293358	660635
4	18120	44838	50836	64633	43312	138494
5	31415	2293	10849	15993	20634	15256
6	4374	6487	440	2974	5229	6490
7	1629	548	1489	108	757	1697
8 +	3019	425	176	189	79	176
TOTAL	1532718	2141191	3180377	2800788	2747345	2723896
SPAWNING STOCK (AGE >= 2)	473511	601703	476938	800894	1343159	1058168

AGE	1966	1967	1968	1969	1970	1971
0	1220927	3435016	1214352	1074810	1153134	3239455
1	774709	975353	2609047	859892	776860	848656
2	484612	394664	629632	1752989	248352	204788
3	145073	229340	176514	232495	729403	51055
4	341394	53773	77468	54373	71345	239503
5	58640	111434	19024	20128	17258	27735
6	4958	17880	38259	6032	6529	4751
7	1874	1202	7744	10374	1563	1752
8 +	564	187	172	4374	2091	827
TOTAL	3032749	5218850	4772213	4015464	3006535	4618524
SPAWNING STOCK (AGE >= 2)	1037114	808481	948813	2080763	1076541	530412

AGE	1972	1973	1974	1975	1976	1977
0	3380618	2214604	3463733	1379135	1805246	1715021
1	1782188	2336729	1631206	2392432	965366	1197664
2	507160	883948	1339765	557667	1417558	515821
3	86494	205007	325971	433844	212331	487081
4	21412	33684	70832	97341	128508	60185
5	92851	11417	10981	28972	26229	40300
6	11045	29847	4085	4524	13372	8586
7	1889	3727	8374	1755	1491	7823
8+	719	794	722	2064	739	512
TOTAL	5884376	5719757	6855669	4897733	4570839	4032994
SPAWNING STOCK (AGE >= 2)	721570	1168424	1760729	1126167	1800227	1120309

Table 4.4 COD. Division VIa.
Stock in numbers ('000 fish) at beginning of year.

AGE	1968	1969	1970	1971	1972	1973
1	6266	2912	5069	8792	4303	6973
2	3859	4930	2308	4067	6896	3325
3	5340	2387	3149	1645	2535	3616
4	2727	2704	1087	1731	878	1121
5	385	1076	862	481	783	289
6	319	215	326	388	197	280
7	162	153	83	148	152	80
8+	23	68	50	46	60	60
TOTAL	19080	14443	12935	17298	15805	15744
SPAWNING STOCK (AGE >= 4)	3615	4215	2408	2794	2071	1830

AGE	1974	1975	1976	1977
1	8063	14181	9046	15453
2	5571	5946	10474	5619
3	2268	2910	3037	4330
4	1821	1183	1295	1270
5	455	711	516	537
6	107	163	341	195
7	86	40	80	115
8+	28	24	23	14
TOTAL	18400	25159	24812	27533
SPAWNING STOCK (AGE >= 4)	2498	2122	2255	2131

Table 4.5 HADDOCK. Division VIa.
Stock in numbers ('000 fish) at beginning of year

AGE	1965	1966	1967	1968	1969	1970
1	6329	28100	37554	772052	22313	10144
2	9188	5177	22755	30280	623694	18269
3	227432	6034	3915	8448	18153	466512
4	11643	110601	3893	2094	4021	9547
5	879	5330	48157	2973	1338	2050
6	556	535	2922	22623	1906	781
7	1137	303	369	2165	8070	1044
8	182	806	221	284	1185	3579
TOTAL	257346	156886	119787	840920	680682	511926
SPAWNING STOCK (AGE >= 2)	251017	128786	82233	68867	658368	501782

AGE	1971	1972	1973	1974	1975	1976
1	86311	42277	19798	76348	132400	9543
2	8098	68455	34080	15119	60729	104012
3	14809	4081	36119	22036	9299	41149
4	317540	6204	1361	15585	9628	5125
5	4420	177944	2493	878	7273	4812
6	1488	3087	94703	1017	631	4176
7	557	1141	1977	48995	433	421
8	766	450	901	1493	29788	245
TOTAL	433989	303640	191432	181471	250181	169484
SPAWNING STOCK (AGE >= 2)	347678	261363	171634	105123	117781	159941

AGE	1977
1	29767
2	6985
3	62325
4	20905
5	2561
6	2418
7	2481
8	316
TOTAL	121828
SPAWNING STOCK (AGE >= 2)	97992

Table 4.6 WHITING. Sub-area VI.
Stock in numbers ('000 fish) at beginning of year.

AGE	1965	1966	1967	1968	1969	1970
0	72137	73956	250778	18405	26642	39285
1	48480	59061	60550	205320	15069	21812
2	11129	37671	47338	45730	161749	11720
3	124802	4771	19249	16329	21195	109349
4	10404	65258	1719	6192	4728	8644
5	1343	3794	28179	643	1884	1389
6	166	402	1529	8183	288	414
7	224	75	140	536	2459	138
8 +	15	22	30	40	199	504
TOTAL						
	268700	245010	409511	301377	234212	193255
SPAWNING STOCK (AGE >= 2)						
	148083	111994	98183	77653	192502	132157

AGE	1971	1972	1973	1974	1975	1976
0	101457	248969	88605	218265	76249	86679
1	32164	83066	203838	72543	178697	62379
2	17229	23953	58040	155152	52563	130480
3	7190	7216	10971	23006	88530	26269
4	62310	2383	2832	2986	7956	37211
5	3055	23579	909	696	645	3613
6	410	1256	7910	326	125	254
7	152	115	395	1793	206	49
8 +	100	82	42	82	249	163
TOTAL						
	224067	390619	373543	474849	405221	347037
SPAWNING STOCK (AGE >= 2)						
	90446	58585	81100	184041	150274	198039

AGE	1977
0	77241
1	70961
2	43898
3	66866
4	6655
5	10752
6	741
7	15
8 +	6
TOTAL	
	277136
SPAWNING STOCK (AGE >= 2)	
	128934

Table 5.1.A Catch predictions for 1979 (in '000 metric tons).

Sub-area IV

(for haddock and whiting landings are shown with catches in brackets)

Alternatives	Cod	Haddock[1)]	Whiting
A1	203	92 (114)	103 (150)
A2	188	86 (103)	96 (140)
A3	201	88 (102)	84 (102)
A4	183	83 (92)	76 (86)
A5	186	83 (95)	78 (94)
A6	170	77 (85)	69 (79)
B1	179	-	-
B2	-	78 (92)	-
B3	177	-	-
B4	159	-	-
B5	-	75 (85)	-
B6	-	70 (77)	-

Option A Assuming 1978 effort = 1977 effort.

Option B Assuming 1978 effort is adjusted to just take up 1978 TAC.

1 No mesh change $F_{79} = F_{77}$

2 No mesh change $F_{79} = 0.9\ F_{77}$

3 Mesh change to 90 mm in 1979, $F_{79} = F_{77}$, low selection factor.

4 Mesh change to 90 mm in 1979, $F_{79} = F_{77}$, high selection factor.

5 Mesh change to 90 mm in 1979, $F_{79} = 0.9\ F_{77}$, low selection factor.

6 Mesh change to 90 mm in 1979, $F_{79} = 0.9\ F_{77}$, high selection factor.

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1) For haddock, Option B, $F_{79} = F_{78} = 0.8\ F_{77}$ for options given.

Table 5.1.B Catch predictions for 1979 (in '000 metric tons).

Division VIa

Alternatives[1]	Cod	Haddock	Whiting
A1	12.4	10.1	12.7
A2	11.5	9.3	11.8
A3	12.4	9.6	7.5
A4		8.9	4.6
A5	11.5	9.1	6.9
A6		8.9	4.2

1) As in Table 5.1.A.

	Cod	Haddock	Whiting
Div. VIb	2.6	1.2	- [2]
Div. IIIa	3.1	22	20
Sub-area VII (excluding Div.VIIa,f)	6.1	9.1	14

2) Not estimated separately but included with Division VIa.

Table 5.2 Revised estimates of year class strength.

Sub-area IV

Year	COD		HADDOCK		WHITING	
	IYHS[a]	VPA[c] M = 0.2	IYHS[b]	VPA[c] M = 0.2	IYHS[b]	VPA[c] M = 0.2
1964	17.1	222		63	418	680
1965	12.8	315	25	147	600	775
1966	30.5	283	91	767	519	975
1967	5.5	92	7 628	6 297	2 066	2 609
1968	6.3	87	119	385	18	860
1969	59.9	367	35	109	71	777
1970	89.4	450	1 545	899	225	849
1971	2.8	82	957	1 325	356	1 782
1972	31.5	158	230	254	1 161	2 337
1973	11.2	138	1 314	1 298	325	1 631
1974	54.5	228	1 370	2 541	943	2 392
1975	6.1	121	212	552	832	965
1976	44.2	330*	189	460*	436	1 201*
1977	(14.7)	175*	(477)	694*	441	1 207*

a) Geometric mean number per hours fishing during the International Young Herring Surveys (cf. ICES, Doc. C.M.1977/F:19).

b) Arithmetric mean number per hours fishing during the International Young Herring Surveys (cf. ICES, Doc. C.M.1977/F:19).

c) Millions of fish at age 1. (*estimated from regressions according to Table 5.3; Note that VPA estimates of recruitment in this table are different from the one used in calculating the regression (cf. ICES, Doc. C.M.1977/F:19).

Table 5.3 Predictive regressions of VPA estimates of year class size (y) on year class strength indices (x) from research surveys ($y = B_o + B_1 x$). (From ICES C.M.1977/F:19).

Data	n	B_o	B_1	r	p	Estimated size year class (1-year old) '000 000	
						1976	1977
Cod - IV - IYHS 1965-75	11	98	5.25	0.92	$p<0.01$	330	175
Haddock - IV - IYHS 1966-75	10	307	0.81	0.98	$p<0.01$	460	694
Whiting - IV - IYHS 1965-75	11	656	1.25	0.79	$p<0.01$	1 201	1 207

Table 5.4 NORTH SEA COD, HADDOCK AND WHITING.

Total numbers ('000) at each length group landed quarterly by Norway in 1977.[a)]

COD Length-group (cm)	Quarter 1	2	3	4	Total
15-19		41	8	1	50
20-24	5	70	16	2	93
25-29	56	36	100	3	195
30-34	209	172	63	65	509
35-39	112	160	54	4	330
40-44	10	61	89	10	170
45-49	3	6	32	3	44
50-54	1	7	16	2	26
55-59			16	2	18
60-64				7	7
65-69			8	1	9
.....					
85-89				7	7
Total	396	553	402	107	1 458
HADDOCK					
5- 9	33	9	490	93	625
10-14	173	127	1 477	3 084	4 861
15-19	770	674	152	1 140	2 736
20-24	264	544	464	118	1 390
25-29	274	341	228	158	1 001
30-34	202	220	95	72	589
35-39	63	67	53	56	239
40-44	22	47	6	25	100
45-49	6	+		7	13
Total	1 807	2 029	2 965	7 718	11 554
WHITING					
5- 9			501		501
10-14	6		143		149
15-19	31	22			53
20-24	394	480		33	907
25-29	1 435	731	429	76	2 671
30-34	1 952	262	518	382	3 114
35-39	717	109	152	729	1 707
40-44	93	11		431	535
45-49	7	11	76	45	139
Total	4 635	1 626	1 819	1 696	9 776

a) Measurements from Recommendation 2 fisheries only.

Table 6.1 COD. Sub-area IV.
Input data for catch predictions.[1)]

Age	1977 catch ('000)	F values 1977-78	Mean weight (kg)
1	73 425	.28	0.54
2	51 234	.9	0.92
3	22 374	.9	2.02
4	4 173	.7	3.82
5	1 739	.66	5.75
6	586	.66	7.64
7	802	.66	9.11
8	267	.66	10.37
9	185	.66	11.24
10+	90	.66	12

Year	Recruitment at age 1 ('000)
1978	175 000
1979	206 000

1) Each of the catch predictions was adjusted by +2.4% to allow for the fact that the sum of products of the 1977 catches and the mean weights at age need to be raised by 2.4% to equal the total landings in 1977.

Table 6.2 HADDOCK. Sub-area IV.
Input data for catch predictions.

AGE	INDUSTRIAL LAND. NOS	W	Consumpt.Land. NOS	W	DISCARDS NOS	W	TOTAL NOS
0	42548	0.013	0	0.000	0	0.034	42548
1	56306	0.046	3472	0.230	36194	0.121	95972
2	11137	0.183	26453	0.280	64648	0.148	102238
3	26112	0.304	201461	0.410	85566	0.193	313139
4	993	0.489	38615	0.580	661	0.194	40269
5	107	0.362	3341	0.710	4	0.233	3452
6	151	0.443	6708	0.940	0	0.000	6859
7	0	0.000	955	1.210	0	0.000	955
8	0	0.000	100	1.440	0	0.000	100
9	0	0.000	32	1.500	0	0.000	32
10	0	0.000	191	1.600	0	0.000	191
11	0	0.000	5	1.600	0	0.000	5
TOTAL :	137354		281333		187073		605760

REVISED INPUT DATA :

				Mean weight (kg)
0	44089	0	0	44089	0.0130
1	58345	3891	36194	98430	0.0809
2	11540	29648	64648	105836	0.1888
3	27058	225790	85567	338414	0.3467
4	1029	43278	661	44968	0.5722
5	111	3744	4	3859	0.6995
6	156	7518	0	7675	0.9299
7	0	1070	0	1070	1.2100
8	0	112	0	112	1.4400
9	0	36	0	36	1.5000
10	0	214	0	214	1.6000
11	0	6	0	6	1.6000
TOTAL :	142328	315308	187074	644710	

TOTAL WEIGTH OF LANDINGS : 183257
INDUSTR. L. 14207 Consump. L. 38459 DISCARDS 30591

AGE	FISH. MORT FOR YEAR 1977
0	.06
1	.27
2	.39
3	.96
4	1.04
5	1.1
6	1.1
7	1.1
8	1.1
9	1.1
10	1.1
11	1.1

NATURAL MORTALITY = .2

Table 6.3 WHITING. Sub-area IV.
Input data for catch prediction.

AGE	INDUSTRIAL LAND. NOS	W	Consump. LAND. NOS	W	DISCARDS NOS	W	TOTAL NOS
0	245175	0.020	0	0.000	18166	0.034	263341
1	279694	0.063	13588	0 187	166926	0.121	460208
2	82660	0.195	56095	0.228	140814	0.148	279569
3	29958	0.269	164176	0.269	52181	0.193	246315
4	3334	0.322	23134	0.322	1588	0.194	28056
5	2106	0.380	19118	0.380	618	0.233	21842
6	308	0.468	4499	0.468	40	0.233	4847
7	12	0.620	3977	0.620	0	0.000	3989
8	0	0.000	410	0.765	0	0.000	410
TOTAL :	643247		284997		380333		1308580

REVISED INPUT DATA :

0	243162	0	18166	261328	0.0210
1	277398	13588	166924	457910	0.0878
2	81981	56095	140813	278889	0.1779
3	29712	164176	52181	246069	0.2529
4	3307	23134	1588	28029	0.3147
5	2089	19118	618	21825	0.3758
6	305	4499	40	4844	0.4661
7	12	3977	0	3989	0.6200
8	0	410	0	410	0.7650
TOTAL :	637966	284997	380329	1303290	

TOTAL WEIGTH OF LANDINGS = 179608
INDUSTR. L. 48327 Consump. L. 79093 DISCARDS 52188

Age	FISH. MORT FOR YEAR 1977
0	.18
1	.54
2	.89
3	.80
4	.71
5	.89
6	.95
7	.81
8	.80

NATURAL MORTALITY = .2

Table 6.4 COD. Division VIa.
Input data for catch prediction.[1)]

Age	1977 catch ('000)	F values 1977-78	Mean weight (kg)
1	482	.075	.58
2	1 171	.26	1.22
3	1 508	.48	2.66
4	586	.7	4.25
5	248	.7	5.13
6	90	.7	6.41
7	53	.7	8.38
8	11	.7	9.00

Year	Recruitment at age 1 ('000)
1978	7 258
1979	7 258

1) Each of the catch predictions was adjusted by +19.6% to allow for the fact that the sum of products of the 1977 catches and the mean weights at age need to be raised by 19.6% to equal the total landings in 1977.

Table 6.5 HADDOCK. Division VIa.
Input data for catch prediction.

AGE	INDUSTRIAL LAND. NOS	W	Consumpt.LAND. NOS	W	DISCARDS NOS	W	TOTAL NOS
1	0	0.000	215	0.230	0	0.000	215
2	0	0.000	2014	0.280	0	0.000	2014
3	0	0.000	29338	0.410	0	0.000	29338
4	0	0.000	6794	0.580	0	0.000	6794
5	0	0.000	817	0.710	0	0.000	817
6	0	0.000	504	0.940	0	0.000	504
7	0	0.000	409	1.210	0	0.000	409
8	0	0.000	40	1.440	0	0.000	40
9	0	0.000	32	1.500	0	0.000	32
10	0	0.000	632	1.600	0	0.000	632
11	0	0.000	6	1.600	0	0.000	6
TOTAL :	0		40801		0		40801

REVISED INPUT DATA :

1	0	215	0	215	0.2300	
2	0	2014	0	2014	0.2800	
3	0	29337	0	29337	0.4100	
4	0	6794	0	6794	0.5800	
5	0	817	0	817	0.7100	
6	0	504	0	504	0.9400	
7	0	409	0	409	1.2100	
8	0	40	0	40	1.4400	
9	0	32	0	32	1.5000	
10	0	632	0	632	1.6000	
11	0	6	0	6	1.6000	
TOTAL :	0	40800	0	40800		

TOTAL WEIGTH OF LANDINGS : 19257
INDUSTR. L. 0 Consump.L. 19257 DISCARDS 0

AGE	FISH. MORT FOR YEAR 1977
0	.01
1	.38
2	.72
3	.44
4	.43
5	.26
6	.2
7	.15
8	.15
9	.15
10	.15

NATURAL MORTALITY = .2

Table 6.6 WHITING. Division VIa.
Input data for catch prediction.

AGE	INDUSTRIAL LAND. NOS	W	Consump. LAND. NOS	W	DISCARDS NOS	W	TOTAL NOS	
0	0	0.000	14	0.150	0	0.000	14	
1	0	0.000	3078	0.213	0	0.000	3078	
2	0	0.000	17450	0.241	0	0.000	17450	
3	0	0.000	33246	0.267	0	0.000	33246	
4	0	0.000	3607	0.310	0	0.000	3607	
5	0	0.000	5701	0.377	0	0.000	5701	
6	0	0.000	384	0.471	0	0.000	384	
7	0	0.000	7	0.563	0	0.000	7	
8	0	0.000	5	0.690	0	0.000	5	
TOTAL :								
	0		63492		0		63492	

REVISED INPUT DATA :

0	0	14	0	14	0.1500
1	0	3078	0	3078	0.2130
2	0	17452	0	17452	0.2410
3	0	33251	0	33251	0.2670
4	0	3608	0	3608	0.3100
5	0	5702	0	5702	0.3770
6	0	384	0	384	0.4710
7	0	7	0	7	0.5630
8	0	5	0	5	0.6900
TOTAL :					
	0	63501	0	63501	

TOTAL WEIGTH OF LANDINGS : 17198
INDUSTR. L. 0 Consump.L. 17198 DISCARDS 0

AGE	FISH. MORT FOR YEAR 1977
0	.0002
1	.045
2	.57
3	.78
4	.89
5	.86
6	.83
7	.7
8	.7

NATURAL MORTALITY = .2

Table 6.7 HADDOCK. Sub-area IV.
Further input for simulation runs - Option A[1)]

Age	Recommendation 4 fishery			Percent change of F_{77} in 1979					
				Runs					
	F_{77}	$\bar{w}_t$	$\bar{I}_t$	1	2	3	4	5	6
0	0	.034	15.6	0	-10	-100	-100	-100	-100
1	0.11	.132	24.5	0	-10	- 72	- 84	- 75	- 86
2	0.35	.190	27.6	0	-10	- 31	- 68	- 38	- 71
3	0.88	.350	33.9	0	-10	- 2	- 16	- 12	- 24
4	1.02	.574	40.0	0	-10	0	- 1	- 10	- 11
5	1.07	.709	42.9	0	-10	0	0	- 10	- 10
6	1.08	.940	47.1	0	-10	0	0	- 10	- 10
7	1.10	1.210	51.2	0	-10	0	0	- 10	- 10
8	1.10	1.440	54.3	0	-10	0	0	- 10	- 10
9	1.10	1.500	56.0	0	-10	0	0	- 10	- 10
10+	1.10	1.600	56.0	0	-10	0	0	- 10	- 10

Year		Results of Simulations					
1978	Rec.2 landings	10 023	Values identical to Run 1				
	Rec.4 landings	114 176					
	Discards	19 614					
	Total landings	124 199					
	Total catch	143 813					
	Sp. Stock biomass	251 567					
1979	Rec. 2 landings	8 532	7 860	8 771	9 058	8 059	8 293
	Rec.4 landings	83 176	77 819	79 644	73 605	74 492	68 939
	Discards	19 728	18 141	13 519	8 596	12 402	7 912
	Total landings	91 708	85 679	88 415	82 664	82 551	77 233
	Total catch	11 437	103 819	101 934	91 260	94 953	85 145
	Sp. Stock biomass	211 971	211 971	211 971	211 971	211 971	211 971
1980	Sp. Stock biomass	190 177	200 911	204 052	220 593	213 910	229 117

1) See footnote to Table 5.1.A for explanation.

Table 6.8 HADDOCK. Sub-area IV.
Further input for simulation runs - Option B[1)]

Age	Recommendation 4 fishery			Percent change of F_{77} in 1979		
				Runs		
	F_{77}	$\bar{w}_t$	$\bar{l}_t$	1	2	3
0	0	.034	15.6	-20	-100	-100
1	0.11	.132	24.5	-20	-78	-87
2	0.35	.190	27.6	-20	-45	-74
3	0.88	.350	33.9	-20	-22	-33
4	1.02	.574	40.0	-20	-20	-21
5	1.07	.709	42.9	-20	-20	-20
6	1.08	.940	47.1	-20	-20	-20
7	1.10	1.210	51.2	-20	-20	-20
8	1.10	1.440	54.3	-20	-20	-20
9	1.10	1.500	55.0	-20	-20	-20
10+	1.10	1.600	56.0	-20	-20	-20

Year	Results of Simulations			
1978	Rec.2 landings	8 426		
	Rec.4 landings	98 977	Values identical to Run 1	
	Discards	16 423		
	Total landings	107 402		
	Total catch	123 825		
	Sp. Stock biomass	251 567		
1979	Rec.2 landings	6 326	6 439	6 332
	Rec.4 landings	71 424	68 660	63 850
	Discards	14 387	9 886	6 364
	Total landings	77 750	75 099	70 182
	Total catch	92 138	84 985	76 546
	Sp. Stock biomass	238 818	238 818	238 818
1980	Sp. Stock biomass	251 336	261 954	274 657

1) See footnote to Table 5.1.A for explanation.

Table 6.9 WHITING. Sub-area IV.
Further input for simulation runs - Option A[1)]

Age	Recommendation 4 fishery			Percent change of F_{77} in 1979					
				Runs					
	F_{77}	$\bar{w}_t$	$\bar{I}_t$	1	2	3	4	5	6
0	0.01	.034	16.2	0	-10	-100	-100	-100	-100
1	0.21	.187	28.6	0	-10	-77	-84	-79	-86
2	0.63	.228	30.5	0	-10	-62	-80	-66	-82
3	0.70	.269	32.3	0	-10	-60	-76	-64	-78
4	0.63	.322	34.3	0	-10	-42	-63	-48	-67
5	0.80	.380	36.2	0	-10	-26	-48	-33	-53
6	0.89	.468	38.8	0	-10	-10	-20	-19	-28
7	0.81	.620	42.6	0	-10	-2	-7	-12	-16
8+	0.80	.765	45.7	0	-10	-1	-3	-11	-13

Year		Results of Simulations					
1978	Rec.2 landings	46 463	Values identical to Run 1				
	Rec.4 landings	64 285					
	Discards	48 456					
	Total landings	110 748					
	Total catch	159 204					
	Sp. Stock biomass	221 229					
1979	Rec.2 landings	44 479	41 210	49 852	51 461	45 728	47 064
	Rec.4 landings	58 619	54 610	34 543	24 055	31 849	22 153
	Discards	47 129	43 752	17 364	10 524	15 964	9 566
	Total landings	103 098	95 811	84 395	75 516	77 577	69 217
	Total catch	150 227	139 563	101 764	86 039	93 541	78 783
	Sp. Stock biomass	204 302	204 302	204 302	204 302	204 302	204 302
1980	Sp. Stock biomass	189 785	203 459	247 232	266 196	258 316	276 130

1) See footnote to Table 5.1.A for explanation.

Table 6.10 HADDOCK. Division VIa.
Further input for simulation runs - Option A[1)]

Age	Recommendation 4 fishery			Percent change of F_{77} in 1979 — Runs					
	F_{77}	$\bar{w}_t$	$\bar{l}_t$	1	2	3	4	5	6
1	.01	.23	29.4	0	-10	-30	-64	-37	-68
2	.38	.28	31.5	0	-10	-19	-40	-16	-46
3	.72	.41	35.7	0	-10	-1	-11	-11	-20
4	.44	.58	41.7	0	-10	0	-1	-10	-11
5	.43	.71	42.9	0	-10	0	0	-10	-10
6	.26	.94	47.1	0	-10	0	0	-10	-10
7	.20	1.21	51.2	0	-10	0	0	-10	-10
8+	.15	1.44	54.3	0	-10	0	0	-10	-10
Year	Results of Simulations								
1978	Rec.4 landings			11 252	Values identical to Run 1				
	Sp. Stock biomass			35 609					
1979	Rec.4 landings			10 147	9 312	9 633	8 886	9 073	8 137
	Sp. Stock biomass			24 882	24 882	24 882	24 882	24 882	24 882
1980	Sp. Stock biomass			25 909	26 909	26 554	27 493	27 196	28 386

1) See footnote to Table 5.1.A for explanation.

Table 6.11 WHITING. Divisions VIa+b.
Further input for simulation runs - Option A[1)]

Age	Recommendation 4 fishery			Percent change of F_{77} in 1979					
				Runs					
	F_{77}	$\bar{w}_t$	$\bar{l}_t$	1	2	3	4	5	6
0	.0002	.150	26.5	0	-10	-83	-87	-85	-88
1	.045	.213	29.8	0	-10	-64	-83	-68	-85
2	.57	.241	31.1	0	-10	-59	-80	-63	-82
3	.78	.267	32.2	0	-10	-50	-76	-55	-78
4	.89	.310	33.8	0	-10	-42	-63	-48	-67
5	.86	.377	36.1	0	-10	-27	-48	-34	-53
6	.83	.471	38.9	0	-10	-8	-20	-18	-28
7	.70	.563	41.3	0	-10	-4	-11	-14	-20
8+	.70	.590	44.2	0	-10	-2	-6	-12	-15

Year		Results of Simulations					
1978	Rec.4 landings	14 667	Values identical to Run 1				
	Sp. Stock biomass	30 510					
1979	Rec.4 landings	12 702	11 769	7 499	4 641	6 875	4 222
	Sp. Stock biomass	26 126	26 126	26 126	26 126	26 126	26 126
1980	Sp. Stock biomass	27 994	28 942	33 271	36 248	33 916	36 658

1) See footnote to Table 5.1.A for explanation.

Table 7.1 COD - Division VIa (West of Scotland).
Input length-frequency data for mesh selection analysis.

Length category (cm)	Number of fish x 10^{-3}							$\bar{x}$ weight[1] at length (kg)
	Engl.[3] & Wales	France[4]	Scotland[2]				Ireland	
			Nephrops trawl	Light trawl	Seine	Trawl		
25-29	1	0	1	6	9	1	0	.208
30-34	43	0	51	209	99	15	10	.343
35-39	75	2	80	155	92	23	82	.527
40-44	100	22	63	120	78	28	87	.768
45-49	110	25	70	80	65	40	43	1.072
50-54	89	32	69	72	56	52	28	1.447
55-59	80	64	61	84	66	55	42	1.901
60-64	71	132	66	84	27	52	25	2.441
65-69	74	165	35	89	16	51	24	3.076
70-74	64	167	32	53	20	54	23	3.811
75-79	52	140	32	71	31	75	25	4.655
80-84	45	82	61	31	22	66	20	5.615
85-89	36	67	2	4	1	12	14	6.699
90-94	22	9	0	0	0	0	7	7.915
95-99	13	6	0	0	0	0	2	9.269
100-104	6	0	0	0	0	0	1	10.769
105-109	2	0	0	0	0	0	0	12.423
110-114	1	0	0	0	0	0	0	14.238
115-119	<1	0	0	0	0	0	0	16.222
Total No.	884	913	623	1 059	582	523	433	
Weight landed	2 371	3 650	70	2 169	1 004	2 352	984	
Sum of products	2 309	3 367	1 295	1 810	886	1 551	899	
Mesh size (mm)	80	75	70	70	70	75	70	

1) Derived using L-W equation: $W_{(g)} = 0.01\ L^{3}_{(cm)}$

2) Based on mean 1973-76 frequency distribution (4 year average)

3) Based on mean 1975-77 frequency distribution (3 year average)

4) Based on 1977 data given in 3-cm groupings.

Table 7.2 HADDOCK - Division VIa (West of Scotland).
Input length-frequency data for mesh selection analysis.

Length category (cm)	Number of fish x 10^{-3}							$\bar{x}$ weight at length[1] (kg)
	Engl. and Wales[3]	France[4]	Ireland[4]	Scotland[2]				
				Nephrops trawl	Light trawl	Seine	Trawl	
21-22	0	0	0	0	0	<1	1	.096
23-24	0	0	0	0	2	1	4	.124
25-26	0	0	0	5	17	60	44	.158
27-28	4	139	1	33	226	687	315	.198
29-30	60	786	1	66	594	1 280	956	.243
31-32	299	1 248	7	77	650	1 473	1 796	.295
33-34	496	1 121	20	60	447	1 119	2 572	.354
35-36	656	783	47	40	329	754	2 809	.420
37-38	626	674	75	36	234	508	2 201	.494
39-40	621	669	70	27	208	305	1 474	.576
41-42	507	449	66	26	180	224	956	.667
43-44	421	342	53	16	133	172	669	.767
45-46	262	258	63	13	102	127	465	.876
47-48	211	204	70	10	74	110	318	.995
49-50	132	169	67	9	57	74	223	1.125
51-52	94	120	59	6	38	58	158	1.265
53-54	65	80	38	6	23	54	107	1.417
55-56	36	45	21	3	20	40	66	1.581
57-58	28	29	14	3	15	18	41	1.756
59-60	15	19	5	1	13	13	23	1.944
61-62	9	10	3	1	7	8	16	2.145
63-64	4	7	3	1	5	5	7	2.359
65-66	3	7	2	<1	5	2	5	2.587
67-68	2	5	1	<1	2	2	2	2.830
69-70	1	0	0	<1	1	1	1	3.087
71-72	1	0	<1	0	2	<1	1	3.359
73-74	<1	0	<1	<1	<1	0	<1	3.647
75-76	<1	0	0	0	0	0	<1	3.951
77-78	0	0	0	0	0	0	1	4.271
Total No.	4 553	7 164	686	439	3 384	7 095	15 231	
Weight landed	2 337	3 417	616	170	1 799	2 416	5 268	
Sum of products	2 866	3 706	609	211	1 584	2 929	7 637	
Mesh size (mm)	80	75	70	70	70	70	75	

1) Derived using L-W equation: $W_{(g)} = 0.009\ L^3_{(cm)}$

2) Based on mean 1973-76 frequency distribution (4 year average)

3) Based on mean 1975-77 frequency distribution (3 year average)

4) Based on 1977 data.

Table 7.3 WHITING - Division VIa (West of Scotland).
Input length-frequency data for mesh selection analysis.

Length category (cm)	Number of fish x 10^{-3}					$\bar{x}$ weight [1] at length (kg)
	Ireland[2]	Scotland[3]				
		Nephrops trawl	Light trawl	Seine	Trawl	
21-22	37	5	75	8	6	.085
23-24	169	109	537	131	34	.111
25-26	741	603	2 253	1 879	167	.141
27-28	1 823	1 111	3 270	5 309	405	.176
29-30	2 268	1 224	3 176	6 348	635	.216
31-32	1 784	1 050	2 666	4 838	666	.262
33-34	1 087	665	1 782	2 865	594	.314
35-36	610	393	1 081	1 488	460	.373
37-38	320	245	690	748	311	.439
39-40	160	165	404	393	207	.512
41-42	102	100	281	180	143	.593
43-44	41	62	100	84	83	.681
45-46	31	30	66	37	52	.779
47-48	15	22	47	21	29	.885
49-50	2	10	22	5	15	1.000
51-52	0	6	9	2	8	1.125
53-54	0	4	4	1	4	1.260
55-56	0	2	1	+	1	1.405
57-58	0	+	1	0	+	1.561
59-60	0	0	1	0	1	1.728
Total number	9 190	5 806	16 466	24 337	3 821	
Weight landed	2 580	2 313	3 726	5 873	992	
Sum of products	2 324	1 549	4 186	6 057	1 251	
Mesh size(mm)	70	70	70	70	75	

1) Derived from L-W equation: $W_{(g)} = 0.008\ L^{3}_{(cm)}$

2) 1977 frequency distribution

3) Based on mean 1973-76 frequency distribution (4 year average).

Table 7.4 COD - Division VIId.
Input length-frequency data for mesh selection analysis.

Length category (cm)	Number of fish x 10^{-3} France[2]	$\bar{x}$ weight at length[1] (kg)
31-33	286	.306
34-36	349	.404
37-39	209	.521
40-42	367	.659
43-45	279	.819
46-48	220	1.004
49-51	52	1.214
52-54	74	1.451
55-57	10	1.718
58-60	101	2.016
61-63	18	2.346
64-66	6	2.710
67-69	39	3.110
70-72	7	3.549
73-75	29	4.026
76-78	25	4.545
79-81	30	5.106
82-84	2	5.711
85-87	22	6.363
88-90	7	7.063
91-93	1	7.813
94-96	1	8.613
97-99	+	9.467
100-102	+	10.375
103-105	+	11.340
106-108	+	12.363
Total number	2 135	
Weight landed	2 349	
Sum of products	2 226	
Mesh size (mm)	54	

1) Derived from L-W equation: $W_{(g)} = 0.01\ L^{3.008}_{(cm)}$

2) Based on mean 1975-76 frequency distribution (2 year average).

Table 7.5 WHITING - Division VIId (English Channel).
Input length-frequency data for mesh selection analysis.

Length category (cm)	Number of fish x 10^{-3}		$\bar{x}$ weight[1] at length (kg)
	United Kingdom[2]	France[2]	
23-24	0	2 555	.118
25-26	3	3 725	.152
27-28	50	3 759	.191
29-30	123	7 420	.237
31-32	152	3 009	.291
33-34	130	380	.351
35-36	71	1 277	.420
37-38	39	3 759	.498
39-40	22	1 188	.584
41-42	11	50	.681
43-44	4	3	.788
45-46	2	2	.905
47-48	0	2	1.035
49-50	0	1	1.176
Total number	607	27 130	
Weight landed	186	7 242	
Sum of products	204	7 497	
Mesh size (mm)	70	54	

1) Derived from L-W equation: $W_{(g)} = 0.00561\ L^{3.1321}_{(cm)}$

2) Based on mean 1976-77 frequency distribution (2 year average).

Table 7.6 COD - Division VIa (West of Scotland).
Input parameters for mesh selection analysis.

Parameters	England and Wales	France	Scotland				Ireland
			Nephrops trawl	Light trawl	Seine	Trawl	
Mesh size(current)	80	75	70	70	70	75	70
Selection factor (low)	2.8	2.8	2.8	2.8	2.8	2.8	2.8
L_c (50)	22.6	21.2	19.7	19.7	19.7	21.2	19.7
L_c (75)	24.6	23.1	21.5	21.5	21.5	23.1	21.5
Mesh size(new)	90	90	90	90	90	90	90
Selection factor (low)	2.8	2.8	2.8	2.8	2.8	2.8	2.8
L_c (50)	25.4	25.4	25.4	25.4	25.4	25.4	25.4
L_c (75)	27.7	27.7	27.7	27.7	27.7	27.7	27.7
t'	.10	.12	.15	.15	.15	.12	.15
Mesh size(current)	80	75	70	70	70	75	70
Selection factor (high)	3.8	3.8	3.8	3.8	3.8	3.8	3.8
L_c (50)	30.2	28.3	26.4	26.4	26.4	28.3	26.4
L_c (75)	32.9	30.8	28.8	28.8	28.8	30.8	28.8
Mesh size(new)	90	90	90	90	90	90	90
Selection factor (high)	3.8	3.8	3.8	3.8	3.8	3.8	3.8
L_c (50)	33.9	33.9	33.9	33.9	33.9	33.9	33.9
L_c (75)	37.0	37.0	37.0	37.0	37.0	37.0	37.0
t'	.10	.15	.30	.20	.20	.15	.20

Table 7.7 HADDOCK - Division VIa (West of Scotland).
Input parameters for mesh selection analysis.

Parameters	England and Wales	France	Ireland	Scotland			
				Nephrops trawl	Light trawl	Seine	Trawl
Mesh size (current)	80	75	70	70	70	70	75
Selection factor (low)	3.1	3.1	3.1	3.1	3.1	3.1	3.1
L_c (50)	24.5	23.0	21.4	21.4	21.4	21.4	23.0
L_c (75)	26.4	24.8	23.1	23.1	23.1	23.1	24.8
Mesh size (new)	90	90	90	90	90	90	90
Selection factor (low)	3.1	3.1	3.1	3.1	3.1	3.1	3.1
L_c (50)	27.5	27.5	27.5	27.5	27.5	27.5	27.5
L_c (75)	29.7	29.7	29.7	29.7	29.7	29.7	29.7
t'	.25	.35	.45	.45	.45	.45	.35
Mesh size (current)	80	75	70	70	70	70	75
Selection factor (high)	3.5	3.5	3.5	3.5	3.5	3.5	3.5
L_c (50)	27.9	26.2	24.4	24.4	24.4	24.4	26.2
L_c (75)	30.2	28.5	26.4	26.4	26.4	26.4	28.5
Mesh size (new)	90	90	90	90	90	90	90
Selection factor (high)	3.5	3.5	3.5	3.5	3.5	3.5	3.5
L_c (50)	31.4	31.4	31.4	31.4	31.4	31.4	31.4
L_c (75)	33.9	33.9	33.9	33.9	33.9	33.9	33.9
t'	.30	.40	.55	.55	.55	.55	.40

Table 7.8 WHITING - Division VIa (West of Scotland).
Input parameters for mesh selection analysis.

Parameters	Ireland	Scotland			
		Nephrops trawl	Light trawl	Seine	Trawl
Mesh size (current)	70	70	70	70	75
Selection factor (low)	3.7	3.7	3.7	3.7	3.7
L_c (50)	25.9	25.9	25.9	25.9	27.8
L_c (75)	28.2	28.2	28.2	28.2	28.2
Mesh size (new)	90	90	90	90	90
Selection factor (low)	3.7	3.7	3.7	3.7	3.7
L_c (50)	33.3	33.3	33.3	33.3	33.3
L_c (75)	36.3	36.3	36.3	36.3	36.3
t'	1.15	1.15	1.15	1.15	0.65
Mesh size (current)	70	70	70	70	75
Selection factor (high)	4.0	4.0	4.0	4.0	4.0
L_c (50)	27.9	27.9	27.9	27.9	29.9
L_c (75)	30.4	30.4	30.4	30.4	32.6
Mesh size (new)	90	90	90	90	90
Selection factor (high)	4.0	4.0	4.0	4.0	4.0
L_c (50)	35.9	35.9	35.9	35.9	35.9
L_c (75)	39.1	39.1	39.1	39.1	39.1
t'	1.25	1.25	1.25	1.25	0.90

Table 7.9 COD - Division VIId. Input parameters for mesh selection analysis.

Parameters	France
Mesh size (current)	54
Selection factor (low)	2.9
L_c (50)	15.2
L_c (75)	16.7
Mesh size (new)	90
Selection factor (low)	2.9
L_c (50)	25.4
L_c (75)	27.7
t'	0.3
Mesh size (current)	54
Selection factor (high)	3.8
L_c (50)	20.4
L_c (75)	22.2
Mesh size (new)	90
Selection factor (high)	3.8
L_c (50)	33.9
L_c (75)	37.0
t'	.35

Table 7.10 WHITING - Division VIId (English Channel). Input parameters for mesh selection analysis.

Parameters	United Kingdom	France
Mesh size (current)	70	54
Selection factor (low)	3.7	3.7
L_c (50)	25.9	20.0
L_c (75)	28.2	21.8
Mesh size (new)	90	90
Selection factor (low)	3.7	3.7
L_c (50)	33.3	33.3
L_c (75)	36.3	36.3
t'	0.4	.675
Mesh size (current)	70	54
Selection factor (high)	4.0	4.0
L_c (50)	27.9	21.6
L_c (75)	30.4	23.5
Mesh size (new)	90	90
Selection factor (high)	4.0	4.0
L_c (50)	35.9	35.9
L_c (75)	39.1	39.1
t'	.4	.675

Table 7.11 Estimates (%) of immediate losses and long-term gains in COD yield resulting from the general use of a 90 mm mesh in Division VIa.

Country	Immediate losses		Long-term gains	
	Sel.fac.= 2.82	Sel.fac.= 3.77	Sel.fac.= 2.82	Sel.fac.= 3.77
England & Wales	0	0.8	+ 0.2	+ 5
France	0	0	+ 0.2	+ 5
Ireland	0	2	+ 0.2	+ 4
Scotland[1)]	0	2	+ 0.2	+ 4
Scotland[2)]	0	4	+ 0.2	+ 2
Scotland[3)]	0	4	+ 0.1	+ 1
Scotland[4)]	0	0.4	+ 0.2	+ 5
All countries	0	0	+ 0.2	+4

1) Nephrops trawl.

2) Light trawl.

3) Seine.

4) Trawl.

Table 7.12 Estimates (%) of immediate losses and long-term gains for HADDOCK in Division VIa.

90 mm mesh

Country and gear / Selection factor		Immediate losses		Long-term gains	
		3.06	3.49	3.06	3.49
England and Wales		1	4	+4	+15
France		3	11	+2	+7
Ireland		1	1	+5	+18
Scotland	Nephrops trawl	4	16	+1	+0.2
	Light trawl	4	16	+1	+0.2
	Seine	6	21	-2	-5
	Trawl	2	9	+3	+8
All Countries		-	-	+2	+6

80 mm mesh

England and Wales		0	0	+1	+4
France		0.3	2	+1	+2
Ireland		0.01	0.1	+1	+4
Scotland	Nephrops trawl	1	5	-0.03	-0.5
	Light trawl	1	5	-0.03	-0.5
	Seine	1	6	-0.4	-2
	Trawl	0.2	1	+1	+3
All Countries		-	-	+0.4	+2

Table 7.13 Estimates (%) of immediate losses and long-term gains for WHITING in Division VIa.

90 mm mesh size

Country and Sea / Sel Factors		Immediate losses 3.7	Immediate losses 4.0	Long-term gains 3.7	Long-term gains 4.0
Ireland		56	70	-2	-3
Scotland	Nephrops trawl	50	65	+10	+17
	Light trawl	53	67	+4	+9
	Seine	58	73	-6	-10
	Motor trawl	34	49	+47	+71
All Countries		-	-	+3	+5

80 mm mesh

Ireland		25	40	+1	-1
Scotland	Nephrops trawl	23	36	+4	+5
	Light trawl	25	38	+1	+2
	Seine	26	41	-0.2	-4
	Motor trawl	10	17	+22	+36
All Countries		-	-	+2	+2

Table 7.14 Estimates (%) of immediate losses and long-term gains in COD yield resulting from the general use of 80 mm and 90 mm mesh in Division VIId.

Country	Immediate losses		Long-term gains	
	Sel.fac.= 2.8	Sel.fac.= 3.8	Sel.fac.= 2.8	Sel.fac.= 3.8
France	0	8	0	10
All countries	0	8	0	10

80 mm mesh size

France	0	3	0	4
All countries	0	3	0	4

Table 7.15 Estimates (%) of immediate losses and long-term gains for WHITING in Division VIId.

90 mm mesh size

Country / Selection factor	Immediate losses		Long term gains	
	3.7	4.0	3.7	4.0
England and Wales	44	62	+39	+37
France	54	67	+14	+18
All Countries	-	-	+15	+19

80 mm mesh size

England and Wales	16	29	+32	+44
France	31	45	+8	+11
All Countries	-	-	8	+12

Table 7.16 Selection factors used in the assessment.

	COD	HADDOCK	WHITING
Lower limit	2.82[1)]	3.06[2)]	3.70[3)]
Upper limit	3.77[3)]	3.49[2)]	3.99[3)]

1) Bohl - Doc. C.M.1976/B:34 "Mesh selection of Baltic cod. German experiments in 1975".

2) Bohl - Doc. C.M.1975/B:24 "Preliminary results of comparative selection experiments with midwater trawls and bottom trawls in the North-East Atlantic".

3) Coop.Res.Rep., No.25, 1969.

Note: selection factors in 3) are calculated for polyamide, polyester, polyethylene and polypropylene.

Figure 1. North Sea COD.
Curves of yield per recruit and spawning stock biomass per recruit for:

A: present exploitation pattern

B: expected exploitation pattern with a 90 mm mesh size (selection factor = 3.77)

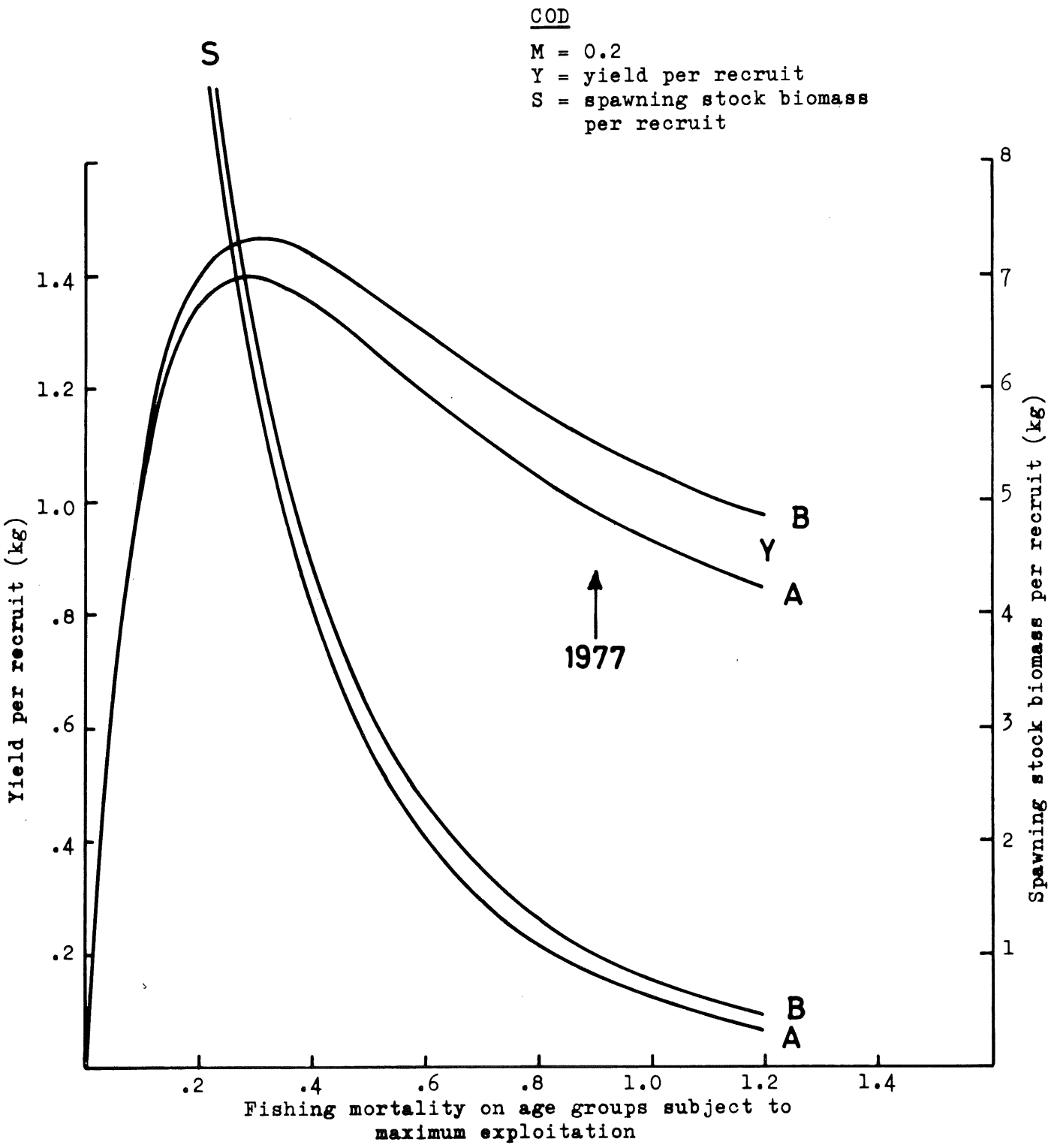


Figure 2. North Sea HADDOCK.
Curves of yield per recruit and spawning stock biomass per recruit for:

A: present exploitation pattern

B: expected exploitation pattern with a 90 mm mesh size (selection factor = 3.49).

HADDOCK

M = 0.2
Y = yield per recruit
S = spawning stock biomass per recruit

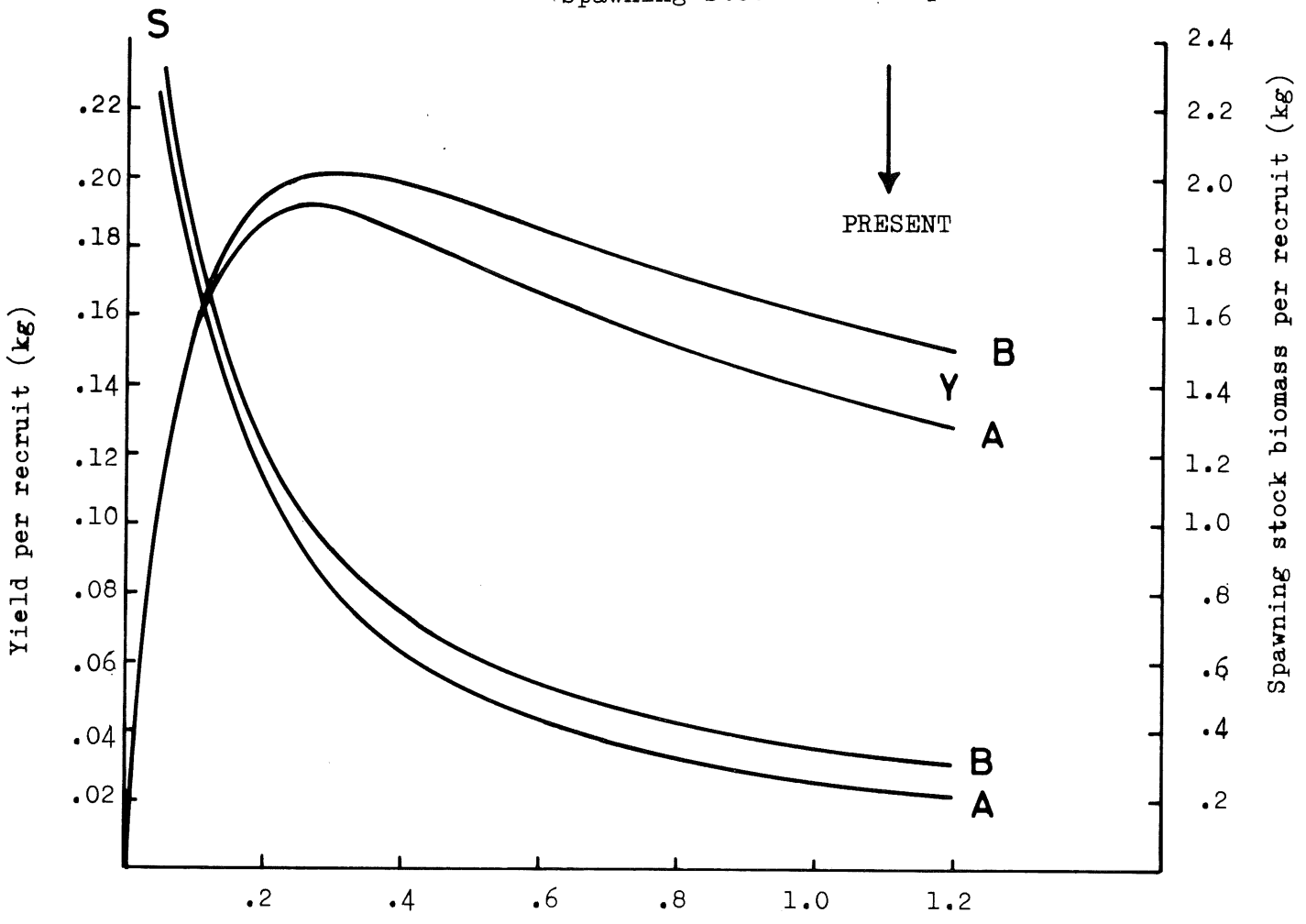


Figure 3. North Sea WHITING.
Curves of yield per recruit and spawning stock biomass per recruit.

WHITING

M = 0.2
Y = yield per recruit
S = spawning stock biomass per recruit.

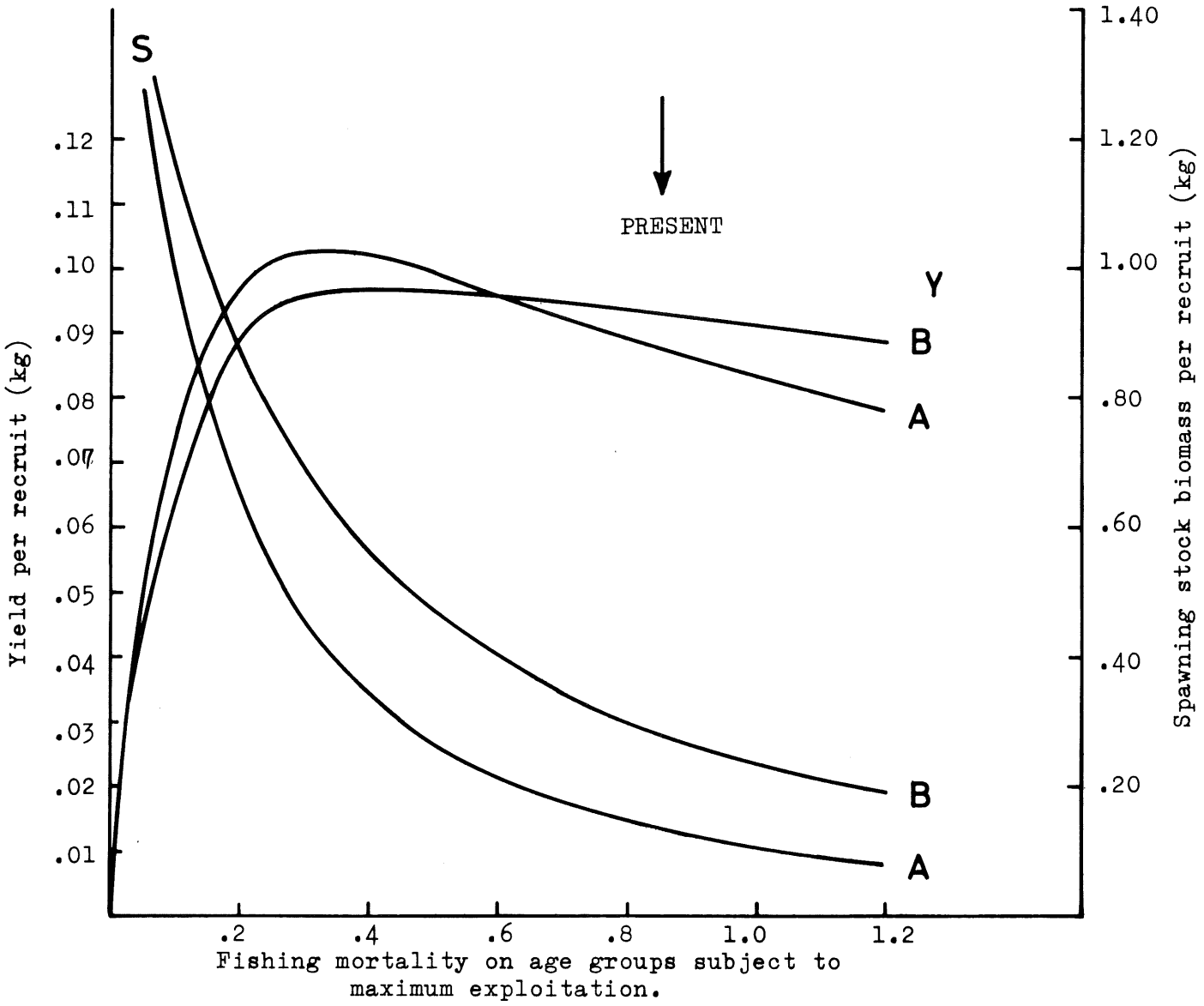
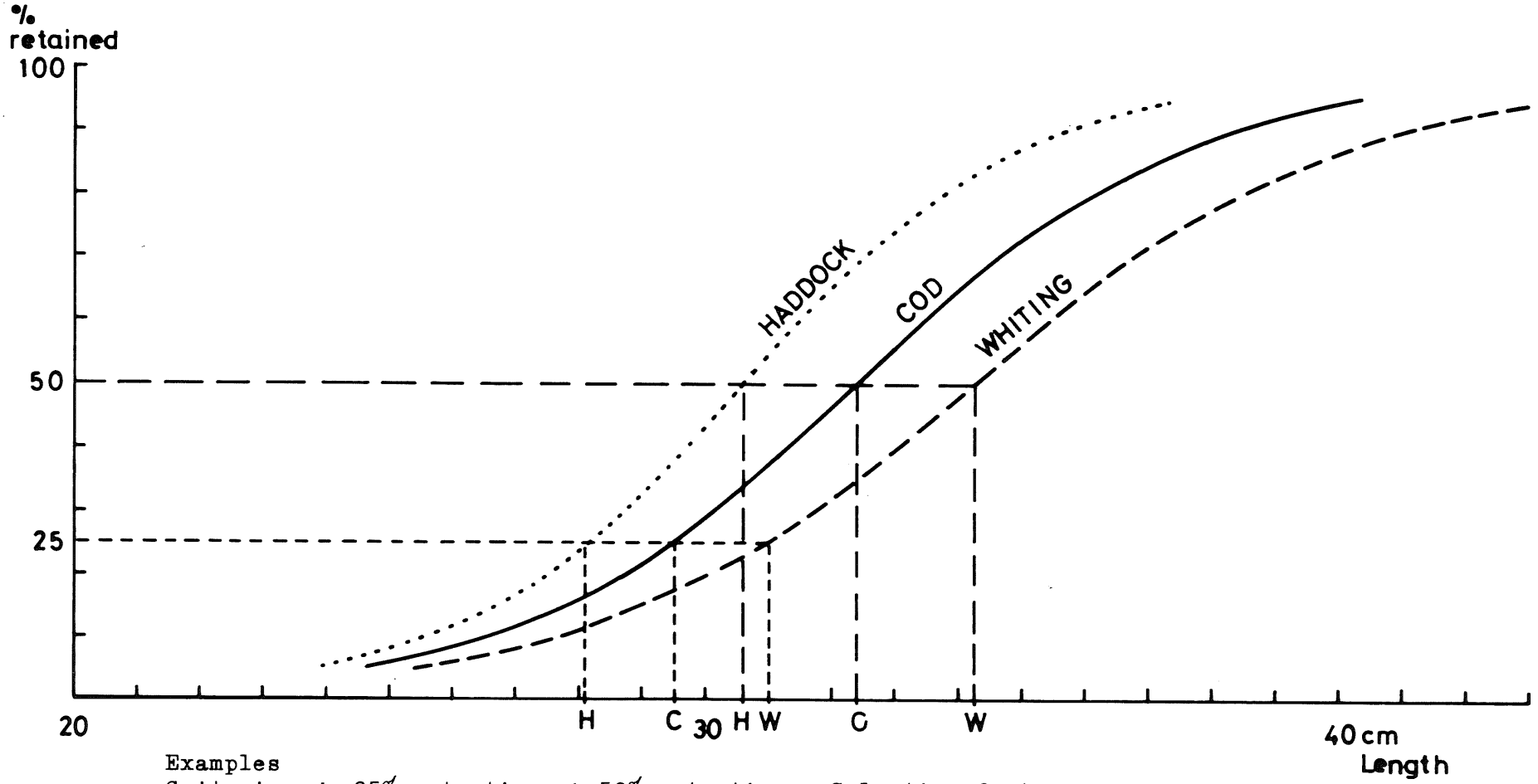


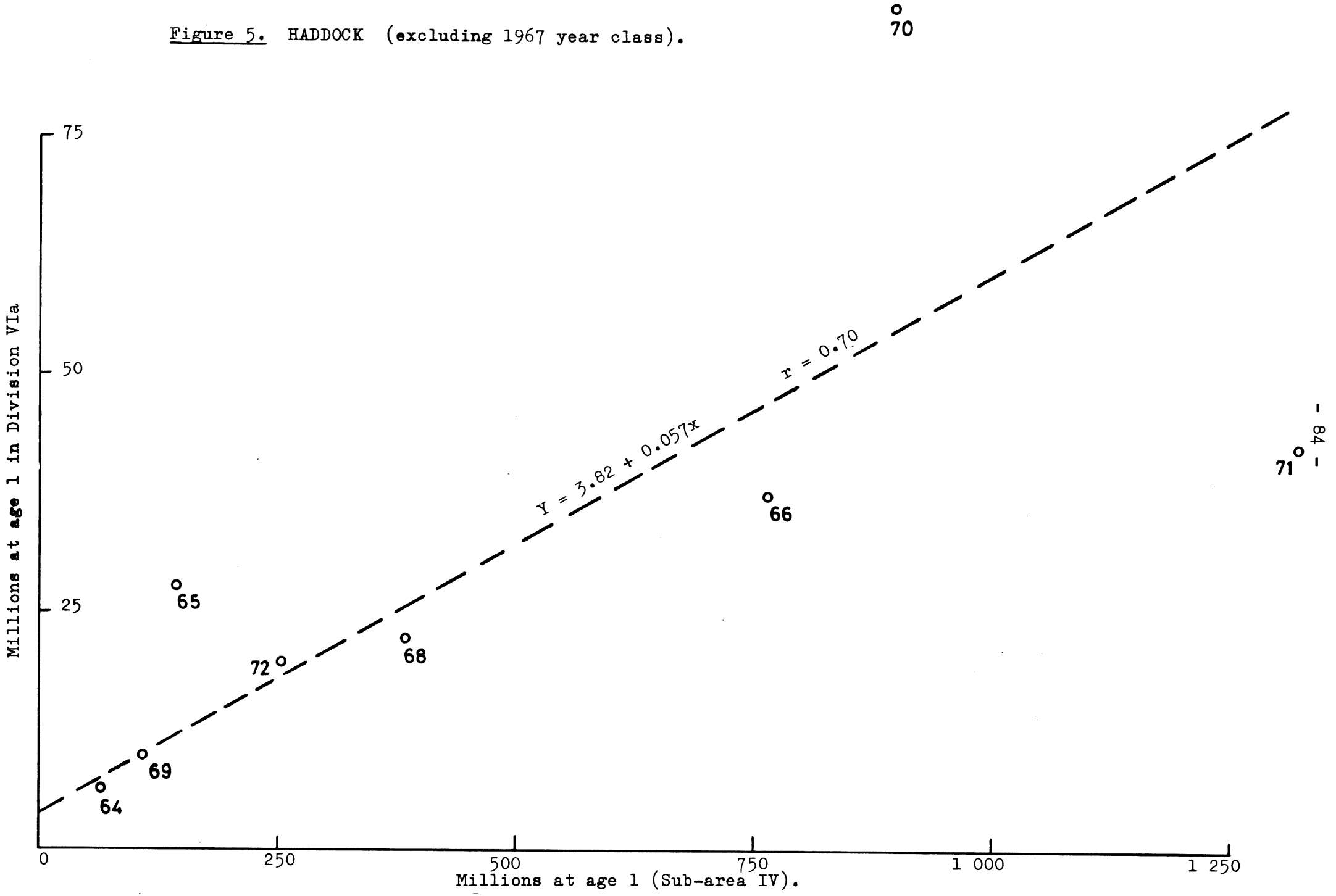
Figure 4. Selection ogives for COD, HADDOCK and WHITING at 90 mm mesh size with examples of possible minimum landing sizes according to different criteria.



Examples

Criterium	25% retention	50% retention	Selection factor
Cod	29.5	32.5	3.6
Haddock	28.0	30.5	3.4
Whiting	31.0	34.0	3.8

Figure 5. HADDOCK (excluding 1967 year class).



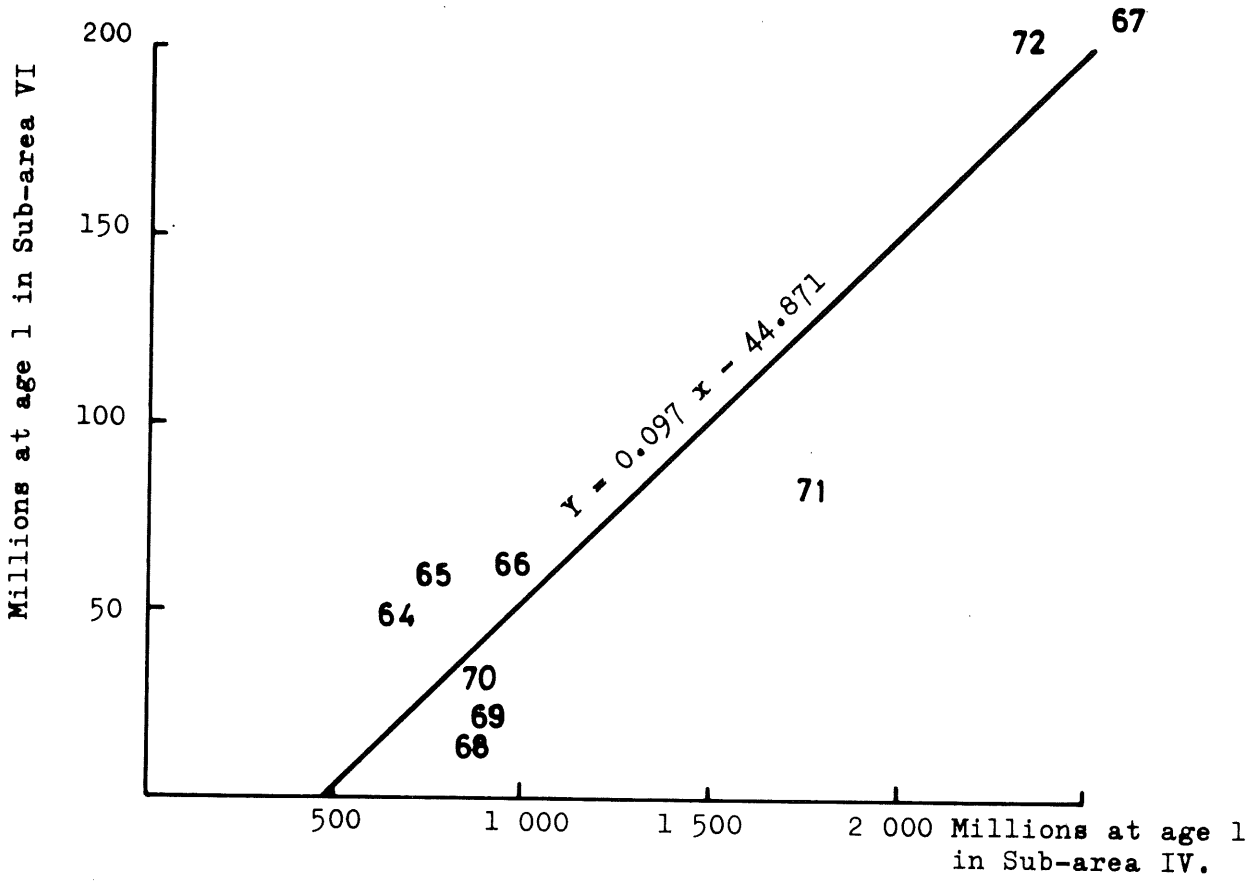


Figure 6. WHITING.

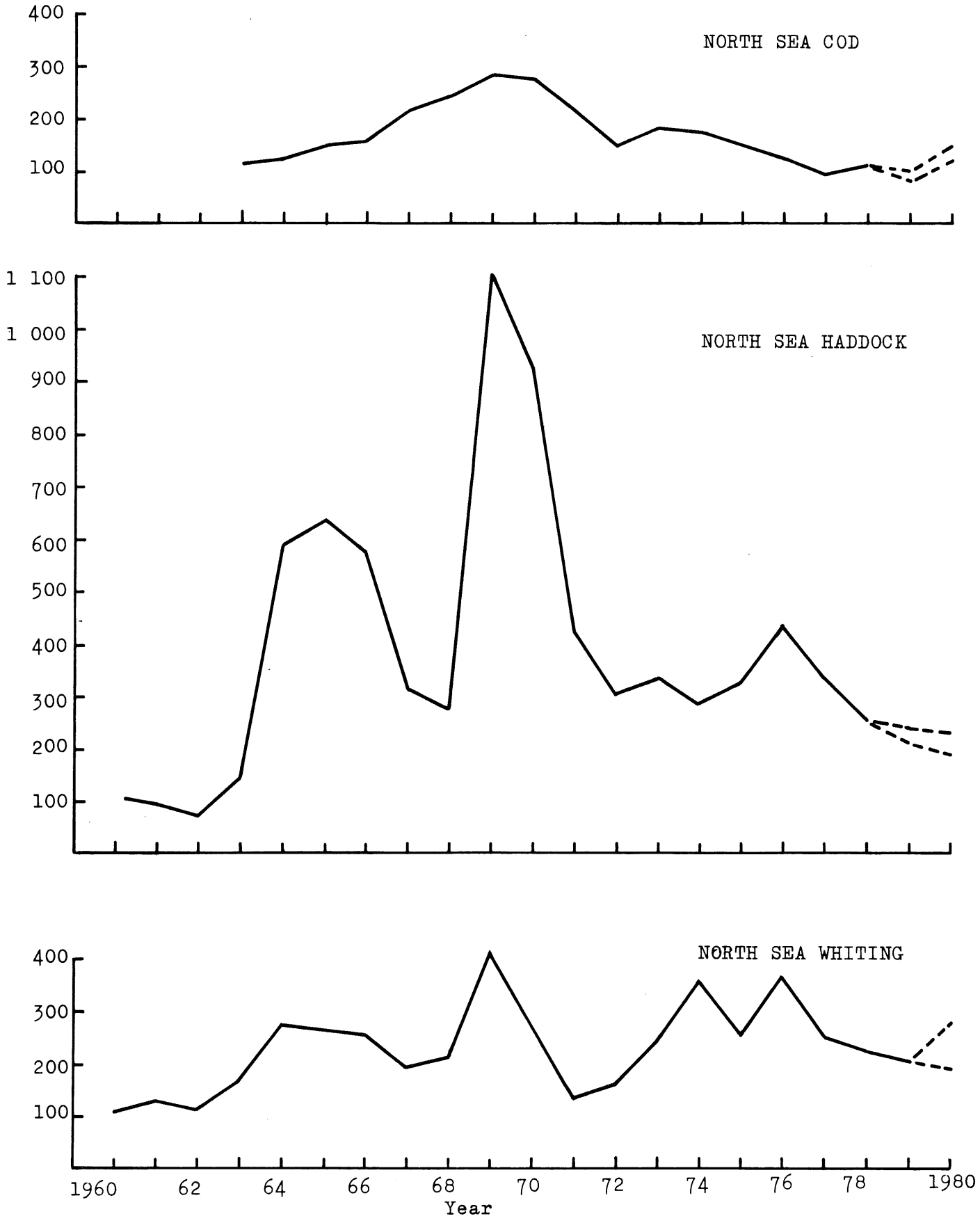


Figure 7. Estimates of spawning stock biomass at the beginning of the year. Estimates from VPA for M = 0.20.
For North Sea cod 4 years and older.
For North Sea haddock and whiting 2 years and older.

APPENDIX

REVIEW OF FISH RESOURCES

The Appendix deals with cod and whiting in the English Channel and cod, haddock and whiting in Sub-areas VIII and IX.

1. ENGLISH CHANNEL COD AND WHITING

1.1 Cod

1.1.1 General biology, distribution and migrations

Although cod spawn at a low intensity in the eastern English Channel it seems likely that the cod caught in the Channel mainly originate from the Southern Bight spawning. They first appear as 0-group during December at an average length of 22 cm (range 14 to 31 cm) in localised areas such as the Varne Bank, Bassin de Baas and in certain parts of Rye Bay, for example. It is possible that they migrate actively into the area from the Southern Bight when the spawning there has been particularly successful or it may be that recruitment to the Channel is dependent upon the direction and amount of residual drift through the Straits of Dover.

Most 1-group cod remain in the eastern English Channel during their first summer although some move west into ICES Division VIIe and are caught off Plymouth in July, while others move north into the deeper parts of the Straits of Dover off Ramsgate. The accepted idea is of a northwards migration of southerly fish into the central North Sea in the summer (Bedford, 1966; Lefranc, 1969). This is not so, however, for 1 year old Channel cod.

1.1.2 Exploitation and management

Exploitation proper begins to take place as early as April on the larger 1-group fish and recruitment is effectively complete by July when all of them exceed 30 cm. Exploitation in the eastern Channel continues during the autumn and there is evidence that "Channel" 1-groups are joined in December by much smaller 1-group cod which have spent the summer north of 53°N (i.e., "central North Sea" fish).

The classic view of southerly cod migrating northwards into the central North Sea in April is possibly fulfilled by those 2 year old Channel fish which lived as 1-group fish in the central North Sea, but may not be fulfilled by those which have grown up in the Channel. Tagging experiments in progress at the moment should provide confirmation of this (De Clerk, 1973).

There is no evidence of migration of cod between the Irish Sea or Bristol Channel and the English Channel.

The growth rate of "Channel" cod is certainly higher than that of "central North Sea" cod during their first two years of life. The mean weight at age of cod caught in the Channel is probably between that of the "Channel" cod and that of the "central North Sea" cod as previously defined.

Even though Channel cod grow more quickly than North Sea cod and do not mix randomly with them, it would be inappropriate to treat them as a completely separate stock for assessment purposes.

1.2 Whiting

There is a considerable United Kingdom fishery for whiting in both ICES Divisions VIId and VIIe. The fishing caught in Division VIIe are probably spawned in Division VIIe, but it is not certain where the Division VIId whiting originate. Small 0-group whiting are found in inshore areas such as Rye Bay in the autumn.

In Division VIId the main fishery takes place east of a line between Beachy Head and the Somme. Some of these fish are immigrants from the southern North Sea (Rout, 1962). Trawl surveys in 1976 have shown that whiting in depths shallower than 20 m rarely exceed 30 cm. Larger fish are found principally in water deeper than 20 m.

In Division VIIe the United Kingdom fishery takes place from Brixham and Plymouth in inshore areas where peak catch rates are obtained in July. The growth rate in Division VIIe is very much higher than that in the North Sea. Fish of a particular age in Division VIIe are approximately twice the weight of North Sea fish of the same age (Appendix Figure 1).

As some very large whiting have been captured in the eastern Channel in recent years by research vessels, it seems likely that the growth rate of Division VIId whiting is also high. This should be resolved finally this year when recently collected data are analysed.

As with Channel cod, it is likely that the Division VIId whiting are closely associated with whiting in the North Sea and should be assessed with them. For management purposes, the Division VIIe population can possibly be treated as a separate stock.

2. SUB-AREA VIII

Relatively small landings of cod, haddock and whiting are recorded from Sub-area VIII. The fish caught here all come from the northern part of the area and can be regarded as belonging to the southern part of stocks primarily located within EEC waters.

3. SUB-AREA IX

No landings of cod, haddock or whiting are recorded from Sub-area IX.

4. REFERENCES

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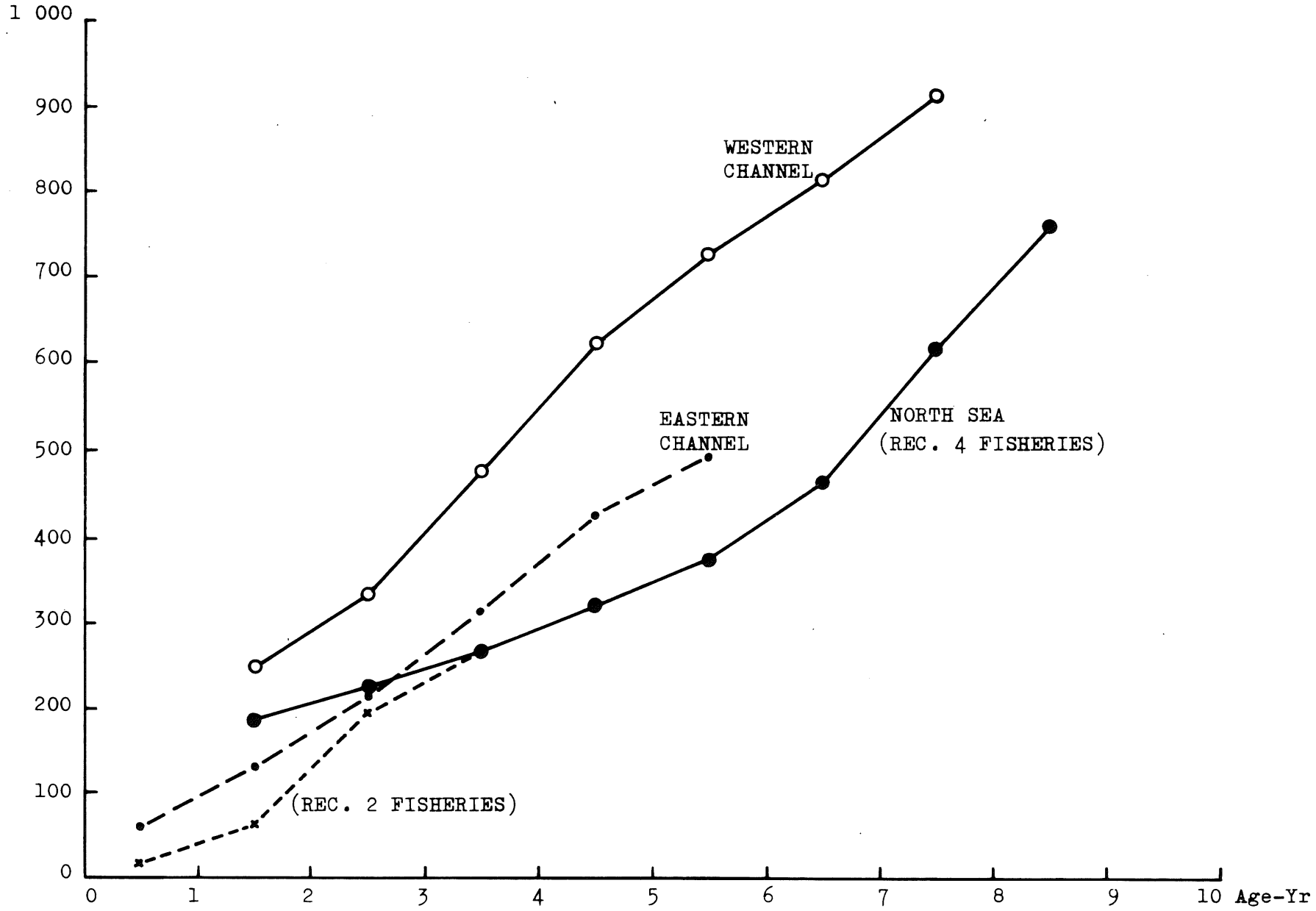

APPENDIX Figure 1. Weight at age of whiting in North Sea and English Channel.