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Demersal Fish (Northern) Committee

REPORT OF THE NORTH SEA ROUNDFISH WORKING GROUP

Charlottenlund, 21-25 March 1977

REPORT OF THE NORTH SEA ROUNDFISH WORKING GROUP

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Note: See also Doc. C.M.1977/F:8 - APPENDIX.

REPORT OF THE NORTH SEA ROUNDFISH WORKING GROUP

1.   Participation

D.W. Armstrong	UK (Scotland)
R. de Clerck	Belgium
N. Daan	Netherlands
J.P. Hillis	Ireland
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J. Janusz	Poland
J. Lahn-Johannessen	Norway
R. Jones (Chairman)	UK (Scotland)
H. Knudsen	Denmark
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G. Lefranc	France
C.T. Macer	UK (England)
V.P. Ponomarenko	USSR
J.G. Pope	UK (England)
P. Sparre	Denmark
I.G. Tsenker	USSR
G. Wagner	Germany, Fed. Rep. of

V.M. Nikolaev, ICES Statistician, also attended the meeting.

2.   Terms of Reference

At the 1976 Statutory Meeting of ICES in Copenhagen, it was decided (C.Res.1976/2:28) that:

"the North Sea Roundfish Working Group should meet at Charlottenlund from 21-25 March 1977 to:

(a)   summarise the gadoid data collected from the North Sea Young Herring Surveys;

(b)   assess TACs for 1978 for cod, haddock and whiting in Sub-Areas IV, VI and VII."

Also, as a result of a request from NEAFC, the Group was asked to provide information on the distribution, biology and state of exploitation of certain fish stocks with reference to 200 mile fishery zones.

3.   Total Allowable Catches (TACs)

Total allowable catches for 1978 for different assumptions about changes in fishing effort are summarised below

TACs for 1978 (in '000 metric tons)

Option A

Sub-Area	Cod	Haddock	Whiting
IV	240(174)	112(190)	173(130)
VI	21.9(9.3)	13.4(12)	17.8(21)
VII	20.2(14)	8.2(6.5)	25.7(20)

Table cont'd. ...

Option B

Sub-Area	Cod	Haddock	Whiting
IV	220	106	161
VI	20.4	12.4	16.6
VII	19.5	8.2	25.7

The values in brackets under Option A are the recommended TACs for 1977. Differences between the recommended TACs for 1977 and 1978 are largely due to differences in yearclass strengths.

3.1. Recommended TACs

The TACs given under Options A and B were chosen from the predictions as the most appropriate for consideration by management.

Option A gives the TACs that should be adopted if the object is to prevent fishing mortality in 1978 from increasing above its 1976 - 1977 level.

Option B gives the TACs that should be adopted, if the object is to reduce fishing mortality in 1978 by 10% compared to the level in 1976 and 1977.

Because of uncertainties about the state of exploitation of the stocks and because, in an event, it would be inadvisable to try to reduce fishing effort too rapidly, it is recommended that TACs be chosen so as to reduce the fishing mortality rate, but by no more than 10% in the first instance (Option B).

3.2. Relationship between stocks in Sub-Area IV and Division IIIa

The Sub-Area IV catch predictions and TACs are for Sub-Area IV only, and do not include Division IIIa.

It was noted however that there is a certain amount of interchange between the stocks of cod, haddock and whiting in the North Sea and those in Division IIIa (see Appendix).

3.3. Difficulties of controlling fishing mortality by means of a TAC

The Working Group wishes to draw attention to the difficulty of controlling fishing mortality by means of a TAC:

1) For years with relatively large variation in recruitment in which the recruiting yearclasses make up a large proportion of the exploitable stock estimates of yearclass strength are an essential part of a catch prediction. Reliable catch predictions are impossible if average yearclass strengths have to be assumed in the assessments.

The case of Division VIa cod for example, the appearance of a good yearclass in 1974, necessitated a revision of the 1977 catch prediction to 21 000 tons (Table 6.4). This compared with a value of only 9 400 tons calculated in last year's Working Group Report (ICES, C.M.1976/F:9, Table 33), a value that was determined before it was known that the 1974 yearclass was a good one.

2) For fisheries with relatively large variations in discarding, in which the discards make up a significant proportion of the catch, estimates of the rate of discarding are an essential part of a catch prediction. For example, in the case of North Sea haddock and whiting, discarding rates were estimated for the Netherlands and the UK (Scotland). These showed that the quantities discarded could be particularly high at times when good yearclasses are entering Recommendation 4 fisheries. This happened in the North Sea in 1976

and in that year it was estimated that the Netherlands and the UK (Scotland) alone discarded about 40 000 tons of haddock and 34 000 tons of whiting.

Attention is drawn to a previous report (C.M.1975/F:5) in which an increase in mesh size for vessels fishing for cod, haddock and whiting in the North Sea was recommended.

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

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 assumptions 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 (Table 5.4). According to this criterion, a number of the stocks under consideration are all seriously overexploited.

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 1960's, 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.

   Updated figures of cod, haddock and whiting nominal catches are given in Tables 1.1. - 1.8.

5. Biology and Distribution with reference to Fisheries Zones

An account of the distribution and biology of various species has been prepared by members of the Working Group. This is given in the Appendix to the report.

6. Method of Determining Catch Predictions

6.1. General

Catch predictions for each species were calculated using the methods described in the previous report of the Working Group (Anon 1976), i.e., for those stocks for which age composition data were available, an estimate was made of the age composition for 1976 and this was projected forward taking account of available recruitment estimates to determine values for the catches in 1977 and 1978. This method was used for the stocks of cod, haddock and whiting in Sub-Area IV and Division VIa, and also for cod in Division VIIa.

For haddock and whiting in the North Sea, account was taken of Recommendation 2 as well as Recommendation 4 fisheries when preparing the input data for the catch predictions. For the remaining stocks under consideration, precautionary TACs were calculated on the basis of previous catch predictions.

6.2. Estimates of discards

Estimates were available of the numbers of discarded haddock and whiting in Sub-Area IV by the following countries:

Haddock - Netherlands, UK(Scotland)
Whiting - Netherlands, UK(Scotland)

6.3. Natural mortality rate

For cod, haddock and whiting a constant value of M = 0.2 was used in the assessments.

6.4. Yearclass strength

For North Sea cod, haddock and whiting, estimates of yearclass strength were based on data obtained from the International Young Herring Surveys. These surveys showe that the 1975 yearclass appears to be poor for cod and haddock, and average for whiting. The 1976 yearclass appears to be average for cod and whiting, but poor for haddock. For cod, the 1976 yearclass, although average, is good when considered with the yearclasses prior to 1969. For cod, haddock and whiting in other areas, no direct estimates were available and average yearclass strengths were assumed in the catch predictions.

6.5. Numbers landed

Estimates of the numbers landed at each age or length were provided by the following countries:

Cod   Sub-Area IV -   Belgium, Denmark, France, Netherlands, Norway, Poland, UK(England and Scotland)

    Division VIa -   Ireland, UK(England and Scotland)

    Division VIIa -   Ireland, UK(England and Wales)

Haddock

    Sub-Area IV -   Belgium, Denmark, Netherlands, Norway, Poland, UK(England and Scotland)

    Division VIa -   Ireland, UK(England and Scotland)

Whiting

    Sub-Area IV -   Belgium, Denmark, Netherlands, Norway, Poland, UK(England and Scotland)

    Division VIa -   UK(Scotland) and Ireland

6.6. Estimates of fishing mortality rate in recent years

A difficulty with the estimation of fishing mortality rates is that VPA does not necessarily provide reliable estimates of these parameters for the 3 or 4 most recent years. To obtain these, additional information or assumptions are required.

One approach was to investigate the long-term relationship between fishing mortality and total international effort. For cod and whiting, the relationship obtained was good (Figs. 1 & 2). For haddock, the relationship between effort and mortality rate was

not very good and it was not possible to say from this investigation that fishing mortality had necessarily changed (Figure 3).

7.   Haddock (Division VIb)

The recorded landings of haddock from Division VIb in 1974, 1975 and 1976 were 49 000, 50 000 and 41 000 tons respectively. Prior to 1974, haddock landings from this area were about 1 000 - 2 000 tons annually.

The area of Rockall Bank where haddock are normally caught is about 2 700 square miles. The catch rates for the years 1974, 1975 and 1976 have therefore been 18.1, 18.5 and 15.2 tons per square mile annually. These catch rates are extremely high when compared with average haddock catch rates in other parts of the North Atlantic, and the Group felt that it would be unwise to continue fishing at so high an intensity.

As a precautionary measure, it is strongly recommended that a TAC of 2 000 tons should be adopted.

8.   Fishing Effort (Tables 1.9 - 1.11)

Fishing effort data were available for English and Scottish vessels fishing in the North Sea and to the west of Scotland. English data were also available for the Irish Sea. In addition, other countries had some effort data but only for periods that were too short to give useful indications of trends in catch rate.

Raising the English data to total international fishing effort for cod, haddock and whiting in the North Sea, gave the time series shown in Table 1.11. These are given for the years for which VPA estimates of fishing mortality were also available.

Table 1.11 also shows the time series of international fishing effort obtained by raising Scottish effort data to total international catch for cod, haddock and whiting in the North Sea. Obvious relationships between these fishing effort series and the VPA estimates of fishing mortality were observed for North Sea cod (Figure 1) (for the English series), and for North Sea whiting for both series (Figure 2 shows the result obtained using Scottish data). North Sea haddock (Figure 3) fishing mortalities did not relate well to either the Scottish or English fishing effort series nor with an alternative series based on Danish industrial fishing effort.

Fishing effort series for cod, haddock and whiting west of Scotland did not relate well to fishing mortalities calculated by VPA, neither did fishing effort for cod in the Irish Sea.

It is possible that the measurement of fishing effort in these various areas could be improved by basing international effort estimates on more homogeneous sectors of national fishing fleets.

The Group recommended that research be carried out to see if more reliable effort series can be constructed.

9.   The Effect on Fishing Mortalities of a TAC being set too high

If a TAC is overestimated, the percentage increase in fishing mortality will be greater than the percentage by which the TAC exceeds its correct level.

As an example, the 1978 TAC for the North Sea cod has been assessed at 240 000 tons (Option A). Figure 4 shows the relationship between the TAC set in 1978 and the fishing mortality in that year. The fishing mortality in 1978 is expressed as a percentage of the 1976 value. Two possible relationships are shown. The first (lower line) results from the Working Group's estimates of fishing mortality in 1976. The second (upper line) results from assuming that the 1976 fishing mortality was equal to the average in the period 1963-72. This latter assumption leads to more conservative results than does the Working Group's estimate. The figure shows that if the second relationship is correct, the TAC (for stabilising fishing mortality) should have been set at 211 000 tons. Clearly, if the Option A TAC of 240 000 tons were caught, this would lead to a 20% increase in fishing mortality in 1978. The effect on fishing mortality in 1978 of other incorrect TAC's, under either assumption, can also be determined from this figure. More generally, such graphs must always pass through the origin and rise asymptotically to a TAC level equal to the exploitable biomass of the stock. Consequently, the effect of successive unit percentage increases in TAC will produce increasingly large percentage increases in the fishing mortality.

10. Notes on Stock Assessment and TAC Calculations

10.1. Cod

10.1.1. North Sea (Sub-Area IV)

10.1.1.1. VPA (Tables 2.1, 3.1 and 4.1)

Since the fishing mortalities given in the 1975 Working Group report suggest that the change in F values with time might be small, a different approach was tried for determining terminal F values. This was done by calculating the ratios of the catches of each yearclass in consecutive years. If it is assumed that fishing mortalities on consecutive age groups in consecutive years are the same, it follows that

$$C_{a,t}/C_{a+1, t+1} = \exp(F+M), \text{ where } C_{a,t}$$

is the total catch of age group "a" in year "t". This permits F to be estimated directly. The average value obtained in this way for 7 year and older cod was 0.55, and this value has been applied as terminal F value for the oldest age group throughout the years 1963 to 1965. The total international effort for cod, as calculated from English cpue data, also indicated only minor variations over this period, but in 1976 the level of effort had apparently dropped below the average level observed before by some 25% (Figure 1). Since there is a reasonably good relationship between the F values for age groups 2-8, and the total international effort, the terminal F values in 1976 were reduced by 25% for all age groups after calculating the average fishing mortalities on each age group during the period 1963-73.

The resulting fishing mortalities from the VPA are relatively higher in the years 1971, 1972 and 1973, when fishing for cod was extremely profitable as a consequence of the presence of the two exceptionally strong 1969 and 1970 yearclasses. Apparently these yearclasses attracted much fishing effort and experienced a high mortality as a consequence. In recent years the fishing mortality appeared to have declined, as explained above.

10.1.1.2. Yearclass strengths

Predictive regressions of the VPA estimates of yearclass size were significantly correlated with IYHS abundance indices (Table 5.3.). Yearclasses 1975 and 1976 were estimated using this regression as 123 x 10^{6} and 256 x 10^{6} 1-year-old fish

respectively. The fishing mortality on the 1975 yearclass in 1976 was adjusted to simulate the predicted yearclass strength. Yearclass 1977 entering the fishery in 1978 was assumed to be of average size (230 x 10^6 1-year-old fish).

10.1.1.3. Catch predictions (Tables 5.1 and 6.1)

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 1976. The F values correspond to the VPA input terminal F values. Weight at age data were the same as last year, but an adjustment of -6.26% was made to simulate the actual catch in 1976.

There seems to be no urgent need to reduce exploitation rates drastically, since there is above average recruitment and fishing mortalities are not excessively high. TACs were calculated: a) assuming that the fishing mortalities in 1976 were 25% lower than the average for the period 1963-1975, b) based on the more pessimistic view that fishing mortalities in 1976 were similar to the average values over the period 1963-1975. A TAC of 220 000 tons was selected by the Working Group as the most appropriate one for 1978.

10.1.2. West of Scotland - Division VIa

10.1.2.1. VPA (Tables 2.4, 3.4 and 4.4)

The terminal F value calculated from the catch ratios of 5 years and older cod over the entire period was 0.7. For younger age groups in 1976 the average values for each of these age groups were used.

10.1.2.2. Yearclass strengths

Since no direct estimates were available of the strengths of the yearclasses of 1975 and 1976, average values of the number of 1-year-old cod in 1966-73 were used for the catch predictions. From the catch data, the 1974 year class appears to be a particularly strong one.

10.1.2.3. Catch predictions (Tables 5.1 and 6.4)

Weight at age data were adjusted by +2.85% to simulate the actual catch in 1976. Catch predictions were carried out on the assumption that the average level of fishing mortality applied to the exploitation rate in 1976 and 1977 was at an average level.

The predicted catch for 1977 is 20 600 tons, which compares with a prediction in last year's Working Group report of only 9 400 tons. This increase is caused by the apparent strength of the 1974 yearclass in the 1976 catches. The latter contributed 16 000 tons instead of a predicted value of 9 700 tons, which illustrates the difficulties that can arise when assessing TACs without proper estimates of yearclass strength.

A TAC of 19 100 tons was recommended for Division VIa cod for 1978 (Table 5.1). For Division VIb cod, a precautionary TAC of 1 300 tons was recommended (Table 5.1).

10.1.3. Irish Sea (Division VIIa)

10.1.3.1. VPA (Tables 2.7, 3.7 and 4.7)

Similar procedures as for Division VIa were followed to obtain terminal F values, which were smaller than those obtained in the former Working Group report.

The resulting F estimates indicate that the level of exploitation has been relatively constant over the time period for which data are available.

10.1.3.2. Yearclass strength

K. Brander (personal communication) estimated the size of the 1975 yearclass as 2 500 000 1-year-old fish. To account for the number of fish of this yearclass taken in 1976 by the Irish fishery using this value, it would be necessary to increase the terminal F value on this age group to 1.4, which appears to be unrealistic. Therefore, this yearclass, as well as those of 1976 and 1977, was assumed to be of average strength (6 866 000 1 year olds).

10.1.3.3. Catch predictions (Tables 5.1 and 6.7)

Weights at age were adjusted by -5.88% to simulate the actual catch in 1976. Subsequent to the 1976 meeting, Brander pointed out that the 1974 yearclass was rather better than its presence in the 1975 catch as 1 year olds had indicated. Consequently, the catch in 1976 was higher than predicted, and as a result, the predicted catches in 1977 and 1978 continue to be better than previously estimated. A TAC of 8 600 tons was recommended for Division VIIa for 1978 (Table 5.1.). For Divisions VIIb-k, a precautionary TAC of 10 900 tons was recommended (Table 5.1).

10.2.   Haddock

10.2.1. North Sea (Sub-Area IV)

10.2.1.1. Total international catch per age group

For the years 1959-71, the data presented in last year's report (ICES, CM1976/F:9, Table 10) were used. The age compositions for these years are based solely on samples from Recommendation 4 fisheries by England, the Netherlands and Scotland, and therefore they probably underestimate the catches of younger age groups. From 1972, the data included the catches from the Recommendation 2 fisheries by Denmark and Norway, and, in addition, Dutch discards. However, as a result of new information on discarding rates, it was decided to revise the data base back to 1972.

In addition to revised Dutch data, new information on discarding by Scottish vessels in 1975 and 1976 was available, and it is believed that similar discarding by these vessels also occurred prior to 1975. Accordingly, estimates were made of Scottish discards from 1972 to 1974, based on the ratio Scottish discards at age in 1975 and 1976 to total numbers at age in international landings. No attempt was made to revise the data prior to 1972.

In the revised data, catches of age groups 1-3 are increased considerably by the inclusion of the discards.

The data for 1976 are provisional.

10.2.1.2. Mean weight at age (Table 6.2)

Data were available for the Danish and Norwegian Recommendation 2 fisheries, for the Scottish discards, and for the Scottish and Polish Recommendation 4 fisheries.

10.2.1.3. VPA (Table 2.2)

The catch at age was derived as described in 10.2.1.1.   For natural mortality, a value of $M = 0.2$ was assumed for all age groups. A terminal F value of 1.1 was used for the oldest age group (age 10) in all years. This was derived by inspection of values of survival rates (e^{-z}) for age groups 6-10 in successive years, under

the assumption that fishing mortality is relatively constant in successive years in the older fish.

With reference to F values in 1976. an attempt was made to estimate these by relating past F values to various measures of fishing effort, but no satisfactory relationship could be found (Figure 2). Therefore, for age groups older than 2, mean F values for the period 1970-72 were used and adjusted to give a smoothed exploitation pattern. For age groups 0 and I, input F values were adjusted to produce population numbers which corresponded to those indicated by the International Young Herring Survey (Table 5.3). However, for age group 2, this procedure was not possible, since the catch had already exceeded the value indicated by the IYHS. For this age group, therefore, a value was obtained from the exploitation pattern by interpolation.

10.2.1.4. Yield per recruit (Table 5.4)

The effect of various F values on yield per recruit was investigated, using the 1976 assumed exploitation pattern and mean weights at age weighted by the numbers caught (Table 6.2). A reduction of about 70% of the present value (F = 1.1) is necessary to achieve the maximum yield per recruit at F = 0.3. The gain in yield per recruit is 20%.

10.2.1.5. Catch predictions

Input values for the catch predictions are given in Tables 6.2 and 5.5. The starting point was the catch at age in 1976 for the following categories: Rec.2 landings; Rec.4 landings; and discards. Age compositions for the first two categories were adjusted by sums of products (numbers x mean weight) to agree with preliminary catch data for 1976. Sums of products were used to estimate the weight of discards.

The following predictions were made:

Run 1. Fishing mortality constant 1976-78
$$(F_{76} = F_{77} = F_{78})$$

Run 2. Here it was assumed that the TAC of 190 000 tons for 1977 previously recommended by the Group would be taken.

This would result in an increase in F_{77} of 25%. It has been assumed that F_{78} then returns to the 1976 level.

$$(F_{77} = 1.25 \times F_{76} ; F_{78} = F_{76})$$

Run 3. Here it was assumed that the 1977 landings were 190 000 tons and that the increased F value was maintained in 1978.

$$(F_{78} = F_{77} = 1.25 \times F_{76})$$

Run 4. As for Run 2, except that the TAC in 1978 achieves a reduction of 10% in F compared to 1976.

$$(F_{77} = 1.25 \times F_{76} ; F_{78} = 0.9 \times F_{76})$$

Run 5. F constant in 1977 and reduced by 10% in 1978.

$$(F_{77} = F_{76} ; F_{78} = 0.9 \times F_{76})$$

<u>Run 6</u>. F constant in 1977 and reduced by 20% in 1978.

$$(F_{77} = F_{76} \; ; \; F_{78} = 0.8 \times F_{76})$$

Recruitment estimates were obtained from the IYHS data or were assumed to be average for future yearclasses. The average was calculated from yearclasses 1958-72, but excluding the exceptional yearclasses of 1962 and 1967.

The results of the prediction runs are given in Table 6.2.

TACs given in Section 3 of the report were based on Run 1 (Option A) and Run 5 (Option B).

10.2.2. <u>West of Scotland (Division VIa)</u>

10.2.2.1. <u>Total international catch per age group</u>

The same data base was used as in last year's report (ICES, CM1976/F:9, Table 13). The 1975 age compositions were updated and a provisional 1976 age composition was produced.

10.2.2.2. <u>Mean weight at age</u>

These are shown in Table 6.5 and are the same as those used last year.

10.2.2.3. <u>VPA</u> (Tables 2.5, 3.5 and 4.5)

Terminal F values in 1976 were obtained from average values in the period 1970-73. The exploitation pattern obtained indicated that F decreased on the older age groups and a terminal value of 0.15 was therefore selected for age 8 for all years.

For age groups 1 and 2, F values were adjusted so that population numbers corresponded to estimates of recruitment based on North Sea data.

The relation between effort data and F values was examined, but no satisfactory relations were obtained.

10.2.2.4. <u>Yield per recruit</u>

The same calculations were made as for the North Sea using the weight data and exploitation pattern given in Table 6.5. The present value of F (0.64) is close to that corresponding to F_{max} with reference to yield per recruit.

10.2.2.5. <u>Catch predictions</u>

The input data for these calculations are given in Table 6.5. The starting point was the catch at age in 1976. Recruitment of 1-group fish in 1977 was estimated from the correlation between recruitment in Division VIa and in Sub-Area IV. Recruitment in 1978 was assumed to be average, based on the yearclasses 1964-72 (excluding the 1967 yearclass).

The following prediction runs were made:

<u>Run 1</u>. No change in fishing mortality

$$(F_{76} = F_{77} = F_{78})$$

Run 2. Here it was assumed that the TAC of 10 000 tons recommended by the Group for 1977 would be taken. This implies a reduction in fishing mortality of 40%. It was then assumed that F returned to the 1976 level in 1978.

$$(F_{77} = 0.6 \times F_{76} \; ; \; F_{78} = F_{76})$$

Run 3. No change in fishing mortality in 1977, but the reduction by 10% in 1978.

$$(F_{77} = F_{76} \; ; \; F_{78} = 0.9 \times F_{76})$$

Run 4. F constant in 1977 and reduced by 20% in 1978.

$$F_{77} = F_{76} \; ; \; F_{78} = 0.8 \times F_{76})$$

The results are given in Table 6.5.

TACs given in Table 5.1 were based on Run 1 (Option A) and Run 3 (Option B), and a precautionary TAC of 2 000 tons was recommended for Division VIb (Table 5.1).

10.2.3. Sub-Area VII

For Sub-Area VII, a precautionary TAC of 8 200 tons was recommended (Table 5.1).

10.3. Whiting

10.3.1. North Sea (Sub-Area IV)

10.3.1.1. Total international catch per age group

Estimates of the number of whiting discarded by Dutch vessels in each age group have been included in the total age composition used for the VPA assessments in earlier reports of the North Sea Roundfish Working Group. However, Dutch discard age compositions have been reassessed by Daan (1976). These new data have been included in the age compositions used during the present meeting of the Working Group.

Scottish discard data were also available at the meeting for 1975 and 1976. Provisional estimates for these 2 years show an average discarding rate by weight of 55% of the landed quantities. This rate has been used each year from 1967 to 1974 to calculate the quantity discarded by Scottish vessels. These figures, together with the weight of the Dutch discarded fish, estimated from their length compositions by numbers and a length/weight relation (W = 0.008 l^3), have been used to raise the Dutch age composition to a total age composition for the Netherlands and Scotland. Separate age compositions for Scotland and the Netherlands were available for both 1975 and 1976.

10.3.1.2. Mean weight at age

The mean weights at age used for the Recommendation 4 fisheries are based on Scottish landings in the period 1964-73. For the industrial fisheries age groups 0, 1 and 2, values from Danish landings in 1975 were used. The same values were used for the discards. The values in Table 6.3 are based on the numbers in the 3 components.

10.3.1.3. VPA

Based on the relationship between total international effort and F in Figure 2, it was decided to use mean values of fishing mortality for age groups 0-4 in

1972-73 as F values for 1976 in the VPA. For older age groups, the mean for all ages in the two years (0.85) was used (Table 3.3).

It was noted that with these values, the VPA estimate of strength of the year-class 1974 was much higher than the IYHS estimate. However, even an F value of 1.2 for two year olds in 1976 was not sufficient to make the two estimates agree. No adjustments were made to the F value to try to take account of this factor therefore.

10.3.1.4. Catch predictions

The input data for the catch prediction (Table 6.3) was based on three components in the catches in 1976, i.e., the catch in Recommendation 4 fisheries, the catch in Recommendation 2 fisheries and discards from the Dutch and Scottish Recommendation 4 fisheries (Table 5.6).

The numbers of recruits as 0-group fish were all taken to be $2\ 300 \times 10^6$.

Predicted catches of each yearclass were reduced by a fraction based on ratios of discarded/total number landed in each age group to arrive at predictions of landings.

Six prediction runs were made as follows:

Run 1. $F_{76} = F_{77} = F_{78}$ (no change in fishing mortality)

Run 2. $F_{76} = F_{77}$; $F_{78} = 0.9 \times F_{76}$

Run 3. $F_{76} = F_{77}$; $F_{78} = 0.8 \times F_{76}$

Runs 4 - 6. As Runs 1 - 3, but with a 25% reduction of F_{76}.

The results are given in Table 6.3.

TACs given in Section 3 of the report were based on Run 4 (Option A) and Run 5 (Option B).

10.3.2. Sub-Area VI

In most years the catches from Division VIb were small compared to the catches from Division VIa, and the two Divisions were treated together.

For the years 1965 to 1976, age composition data for the Scottish landings were available. For 1976, Irish data were also available.

For the VPA, the exploitation pattern in 1976 was adjusted so that it corresponds to the average at 1971-73 (Table 3.6). The same F values were used for the catch prediction (Table 6.6). The strengths of the yearclasses 1976 and 1977 were taken to be average for the years 1964-73. Three prediction runs were made:

Run 1. No change in fishing mortality.

$$\left(F_{76} = F_{77} = F_{78}\right)$$

Run 2. A reduction of fishing mortality in 1978 by 10%.

$$\left(F_{77} = F_{76} \; ; \; F_{78} = 0.9 \times F_{76}\right)$$

Run 3. A reduction of fishing mortality in 1978 by 20%.

$$\left(F_{77} = F_{76} \; ; \; F_{78} = 0.8 \times F_{76}\right)$$

The results are given in Table 6.6.

TACs given in Section 3 of the report were based on Run 1 (Option A) and Run 2 (Option B).

10.3.3. Sub-Area VII

For Sub-Area VII, a precautionary TAC of 25 700 tons was recommended (Table 5.1).

Table 1.1 Nominal catch of Cod, Haddock and Whiting (metric tons) by Div. IIIa and Sub-areas IV, VI and VII, 1966-1976 (Bulletin Statistique)

	Sub-Area a)	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976*)
Cod	IIIa	15 706	17 010	16 649	13 243	14 238	19 052	21 667	22 942	27 452	32 284	33 481
	IV	220 033	249 803	285 314	199 258	224 745	320 564	347 055	234 466	211 247	187 692	208 884
	VI	18 655	25 214	25 022	24 272	13 557	10 760	17 266	12 746	14 827	13 406	13 352
	VII	22 580	23 162	20 270	21 509	15 102	22 134	18 767	19 239	17 350	20 206	...
Haddock	IIIa	695	469	582	1 056	942	2 249	8 989	3 091	4 618	6 115	3 019
	IV	269 205	167 408	139 469	639 195	671 833	258 220	213 556	196 079	193 640	184 003	205 654
	VI	31 816	21 176	21 429	27 398	35 018	46 920	50 518	32 848	67 258	63 611	59 017
	VII	9 655	7 343	3 726	5 392	5 931	6 518	11 248	12 480	10 585	8 638	...
Whiting	IIIa	20 306	30 157	29 497	16 544	13 130	13 989	14 652	22 547	28 842	14 690	17 127
	IV	157 573	91 245	144 920	215 829	181 506	113 044	109 532	141 191	188 663	153 409	190 686
	VI	18 787	19 709	14 474	12 550	12 499	16 032	15 394	16 709	17 058	20 053	20 520
	VII	25 873	33 123	29 691	26 821	15 710	17 836	20 845	26 655	28 203	32 433	...

*) provisional figures.

a) see footnotes on following page

Footnotes to Table 1.1.

Cod in Division IIa

Landings of German, Dem.Rep. in 1966, 1969-72 included in Sub-Area IV.
Landings of Sweden in 1966-74 included in Sub-Area IV.
Landings of GermanyFed.Rep. for 1968-70 include miscellaneous products.

Haddock in Division IIIa

Landings of German, Dem.Rep. in 1966, 1969-72 included in Sub-Area IV.
Landings of Sweden in 1966, 1968-74 included in Sub-Area IV.

Whiting in Division IIIa

Landings of German, Dem.Rep. in 1966 included in Sub-Area IV.
Landings of Sweden in 1966-74 included in Sub-Area IV.

Cod in Sub-Area IV

German, Dem.Rep. landings in 1966, 1969-72 include Division IIIa.
Sweden: landings 1966-74 include Division IIIa.
GermanyFed.Rep. landings in 1968-70 include miscellaneous products.
French figures for 1971-75 revised (March 1977).
Norway landings revised for 1974-75.
For Netherlands - not included for 1967 - 3 369 tons and 1968 - 1 132 tons.

Haddock in Sub-Area IV

French landings for 1971-75 figures revised.
Landings for Germany, Dem.Rep. for 1966, 1969-72 include Division IIIa.
Landings for Sweden for 1966, 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.
Norway landings revised for 1974-75.

Whiting in Sub-Area IV

Landings for Germany, Dem.Rep. in 1966 include Division IIIa.
Landings for Sweden for 1966-74 includes Sub-Area IV and Division IIIa.
France - figures for 1971-1975 revised (March 1977).
Netherlands: Not included for 1967 - 913 tons and for 1968 - 267 tons.
Norway landings revised for 1974-75.

Cod in Sub-Area VI

Landings for GermanyFed.Rep. include miscellaneous products.
Landings for France 1971-75 revised.

Haddock in Sub-Area VI

French landings for 1971-75 figures revised.

Whiting in Sub-Area VI

French data for 1971-75 revised.

Footnotes to Table 1.1 (Continued)

Cod in Sub-Area VII

Landings for France for 1971-75 revised.

Haddock in Sub-Area VII

French landings for 1971-1975 figures revised.

Whiting in Sub-Area VII

French figures for 1971-75 revised.

Table 1.2 <u>COD</u> Div. IIIa and the Div. of Sub-areas IV, VI and VII

Nominal catch by Divisions in metric tons 1966 - 1976

Year / Area[a]	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976[*]
IIIa	15 706	17 010	16 649	13 243	14 238	19 052	21 667	22 942	27 452	32 284	33 481
IVa	69 440	89 923	74 051	56 015	79 606	67 370	80 650	69 557	72 362	59 582	56 189
IVb	125 233	134 258	175 949	122 027	110 271	184 957	215 160	134 953	114 087	107 227	135 705
IVc	25 360	25 622	35 314	21 216	34 868	68 237	51 245	29 956	24 798	20 883	16 990
VIa	17 133	23 025	24 357	21 739	12 682	10 666	14 699	12 263	13 652	13 163	11 690
VIb	1 522	2 189	665	2 533	875	94	2 567	483	1 175	243	1 662
VIIa	5 249	12 652	8 541	7 967	6 257	9 540	9 173	11 787	10 190	9 790	8 142
VIIb, c	206	1 479	2 259	4 418	2 049	1 302	735	1 009	405	692	...
VIId, e	1 064	3 300	4 113	3 856	2 553	5 432	3 544	2 077	3 436	5 082	...
VIIf	1 188	1 321	1 514	856	925	797	969	976	594	998	...
VIIg-k	14 873	4 410	3 843	4 412	3 318	5 063	4 346	3 390	2 725	3 644	...
Total	273 974	315 189	347 255	258 282	267 642	372 510	404 755	289 393	270 876	253 588	

Footnotes to Table 1.2.

Division IIIa

German, Dem.Rep. figures for 1966 and 1969-72) included in Division IVa.
Swedish figures for 1966-74)

GermanyFed.Rep. figures for 1968-70 include miscellaneous products.
Danish figure for 1976 including industrial catch only and is lacking some landings
    in foreign ports.

Division IVa

Danish figures for 1966-73 included in Division IVb.
German, Dem.Rep. figures for 1966 and 1969-72 include Divisions IIIa and IVb,c.
Swedish figures for 1966-74 include Divisions IIIa and IVb.
GermanyFed.Rep. figures for 1968-70 include miscellaneous products.
French figures for 1971-75 revised (March 1977).
Danish figure for 1976 included in Division IVb.

French figures for 1966 and 1976)
Norwegian figures for 1966-68 and 1976) include Division IVb,c
USSR figures for 1966-73)

Norwegian figures for 1969-72 include Division IVb.

Norwegian figures 1974-75 revised (March 1977).
Norwegian figures for 1971 and 1972 not including catches from Recommendation 2
    fisheries (1971 = 1 314 tons; 1972 = 1 656 tons).

Division IVb

Danish figures for 1966-73 included in Division IVa.
French figures for 1971-75 revised (March 1977).

Faroe Islands figure for 1976)
French figures for 1966 and 1976)
German, Dem.Rep. figures for 1966, 1969-72 and 1976)
Norwegian figures for 1966-72 and 1976) included in Division IVa
Swedish figures for 1966-74)
USSR figures for 1966-73)

Swedish figure for 1976;)
UK (Eng. + Wales) figure for 1976) included Division IVa,c - from Data Form 5.

Netherlands: Not included for 1967 - 3 369 tons and 1968 - 1 132 tons caught mostly
    in Division IVb, rest in Division IVc.
GermanyFed.Rep. figures for 1968-70 include miscellaneous products.
Swedish figures for 1975 include Division IVa,c.
Danish figure for 1976 includes Division IVa,c. From Recommendation 12 form
    industrial catch only in Division IVa 988 tons; Division IVb 2 529 tons.

Division IVc

French figure for 1966)
German , Dem.Rep. figures for 1966, 1969-72 and 1976)
Norwegian figures for 1966-69) included in Division IVa.
USSR figures for 1966-73)

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

Footnotes to Table 1.2 (Continued)

Danish figure for 1976   )
French figure for 1976   )
Swedish figures for 1975 and 1976)   included in Division IVb.
UK (Eng. + Wales) figure for 1976)

French figures for 1971-75 revised.

Division VIa

Swedish figure for 1968 includes Division VIb.
Germany, Fed.Rep. figures for 1968-70 include miscellaneous products.
French figures for 1971-75 revised.

Division VIb

Swedish figure for 1968 included in VIa.
French figures for 1971-75 revised.

Division VIIa

French figures for 1971-75 revised.
French figure for 1966 included in Division VIIg-k.
French figure for 1971 includes Division VIIf.

Division VIIb,c

French figure for 1966 included in Division VIIg-k.
French figure for 1971-75 revised.

Division VIId,e

French figures for 1971-75 revised.

Division VIIf

French figures for 1971-75 revised.
French figure for 1966)
Polish figure for 1976) included in Division VIIg-k

French figure for 1971 included in Division VIIa.

Division VIIg-k

French figure for 1971-75 revised.
French figure for 1966 includes Divisions VIIa,b,c and f.
Polish figure for 1976 includes Division VIIf.

Table 1.3   HADDOCK   Div. IIIa and the Div. of Sub-areas IV, VI and VII
Nominal catch by Divisions in metric tons 1966 -1976

Year \ Area a)	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976 ≆)
IIIa	695	469	582	1 056	942	2 249	2 989	3 091	4 618	6 115	3 019
IVa	197 518	122 531	75 347	271 953	455 649	197 306	135 095	131 819	128 818	120 688	161 015
IVb	71 283	44 823	62 696	361 836	212 646	58 270	75 325	62 288	63 695	62 761	44 306
IVc	404	54	1 426	5 406	3 538	2 644	3 136	1 972	1 127	554	333
VIa	29 881	20 302	20 526	26 273	34 178	46 299	41 044	28 830	17 970	13 683	15 698
VIb	1 935	874	903	1 125	840	621	9 474	4 018	49 288	49 928	43 319
VIIa	270	2 614	611	807	624	1 343	1 318	2 364	697	276	220
VIIb,c	245	787	433	758	1 922	1 141	1 419	931	2 090	2 565	...
VIId,e	37	111	88	811	421	170	411	359	633	971	...
VIIf	137	66	47	50	77	152	766	1 804	594	928	...
VIIg-k	8 966	3 765	2 547	2 966	2 887	3 712	7 334	7 022	6 571	3 898	...
Total	311 371	196 396	165 206	673 041	713 724	313 907	278 311	244 498	276 101	262 367	

≆)provisional figures

a)see footnotes on following page

Footnotes to Table 1.3.

Division IIIa

German, Dem.Rep. figures for 1966 and 1969-72) included in Division IVa.
Swedish figures for 1966 and 1968-74   )

Danish figure includes industrial catch only and is lacking some landings in foreign
   ports.

Division IVa

Swedish figure   for 1975   ) included in Division IVb.
Danish   figures for 1966-73   )

French figures for 1971-75 revised.

French figure for 1966   )
German, Dem.Rep. figure for 1976   )
Norwegian figures for 1966-69 and 1976   ) include Division IVb,c
USSR figures for 1966-73   )

German, Dem.Rep. figures for 1966 and 1969-72 include Division IIIa and IVb,c.

Norwegian figures for 1969-72) include Division IVb.
Swedish figure for 1967   )

Swedish figures for 1966 and 1968-74 include Divisions IIIa and IVb.
Danish figure for 1976 includes Divisions IVb,c - data from Data Form 5. From
   Recommendation 12 industrial catch only Division IVa - 26 074; IVb - 12 785;
   IVc - 12.
French figure for 1976 includes Division IVb,c from Data Form 5, up to November 1976.

Spanish   )
Swedish   ) figure for 1976 includes Division IVb,c from Data Form 5.
UK (Eng. + Wales))

Faroe Islands figure for 1976 includes Division IVb - the split in areas calculated
   from logbook returns up to 12 November 1976.
Norwegian figures for 1971 and 1972 not including catches from the Recommendation 2
   fisheries (1971 = 4 512 tons; 1972 = 5 685 tons).
Norwegian landings revised for 1974-75.

Division IVb

Danish figures for 1966-73 include Division IVa.

Faroe Islands figure for 1976   )
French figures for 1966 and 1976   )
German, Dem.Rep. figures for 1966, 1969-72 and 1976   )
Norwegian figures for 1966-72 and 1976   ) included in Division IVa.
Spanish figure for 1976   )
Swedish figures for 1966-74 and 1976   )
UK (Eng. + Wales) figure for 1976   )
USSR figures for 1966-73   )

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.
Danish figure for 1976 includes Division IVb,c - data from Data Form 5. From
   Recommendation 12 industrial catch only Division IVa - 26 074 tons; IVb - 12 785;
   IVc - 12.
French figures for 1971-75 revised.

Footnotes to Table 1.3 (Continued)

Division IVc

French figures for 1966 and 1976   )
German, Dem.Rep. figures for 1966, 1969-72 and 1976)
Norwegian figures for 1966-68 and 1976   )
Spanish figure for 1976   )   included in Division IVa.
Swedish figure for 1976   )
UK (Eng. + Wales) figure for 1976   )
USSR figures for 1966-73   )

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.
Danish figure for 1976 includes Division IVb,c - data from Data Form 5. From
   Recommendation 12 industrial catch only Division IVa - 26 074; Division IVb -
   12 785; Division IVc - 12.
French figures for 1971-75 revised.

Division VIa

French figures for 1971-75 revised.

Division VIb

French figures for 1971-75 revised.

Division VIIa

French figures for 1971-75 revised.
French figure for 1966 included in Division VIIg-k.
French figure for 1971 includes Division VIIf.

Division VIIb,c

French figures for 1971-75 revised.
French figure for 1966 included in Division VIIg-k.

Divisions VIId,e

French figures for 1971-75 revised.

Division VIIf

French figures for 1971-75 revised.
French figure for 1966 included in Division VIIg-k.
French figure for 1971 included in Division VIIa.

Division VIIg-k

French figures for 1971-75 revised.
French figure for 1966 includes Divisions VIIa,b,c and f.

Table 1.4 <u>WHITING</u> Div. IIIa and the Div. of Sub-areas IV, VI and VII

Nominal catch by Divisions in metric tons 1966 - 1976

Year Area a)	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976*
IIIa	20 306	30 157	29 497	16 544	13 130	13 989	14 562	22 547	28 842	19 690	17 127
IVa	78 438	43 218	51 701	49 839	32 185	23 451	32 932	31 104	81 771	88 687	98 475
IVb	72 704	41 449	76 928	157 568	126 024	70 728	66 789	96 678	87 842	41 930	67 010
IVc	6 431	6 578	16 291	8 422	23 297	18 865	9 811	13 409	19 050	22 792	25 210
VIa	15 542	17 586	13 989	12 181	11 222	15 225	15 313	16 646	17 057	20 041	20 498
VIb	3 245	2 123	485	369	1 277	807	81	63	1	12	22
VIIa	5 803	18 902	12 875	9 724	4 804	8 383	7 680	10 337	9 819	9 832	9 421
VIIb,c	276	2 246	3 249	3 595	1 507	287	1 056	1 091	1 243	1 829	...
VIId,e	1 307	5 554	6 640	5 066	4 825	3 592	3 676	5 647	8 572	11 400	...
VIIf	724	1 573	1 740	2 856	2 036	315	728	1 366	1 468	1 752	...
VIIg-k	17 763	4 848	5 187	5 580	2 538	5 259	7 705	8 214	7 101	7 620	...
Total	222 539	174 234	218 582	271 744	223 845	160 901	160 333	207 102	262 766	225 585	241 786

*) provisional figures

a) see footnotes on following page

Footnotes to Table 1.4.

Division IIIa

German, Dem.Rep. figure for 1966 } included in Division IVa.
Swedish figures for 1966-74 }

Danish figure for 1976 includes industrial catch only and is lacking some landings in foreign ports.

Division IVa

French figures for 1971-75 revised.
German, Dem.Rep. figure for 1966 includes Divisions IIIa and IVb,c.
Danish figures for 1966-73 } included in Division IVb.
Swedish figure for 1975 }

French figures for 1966 and 1969 }
German, Dem.Rep. figure for 1976 }
Norwegian figures for 1966-69 and 1976} include Divisions IVb,c.
USSR figures for 1966-73 }

Swedish figures for 1966-73 include Divisions IIIa and IVb.
Norwegian figures for 1969-72 include Division IVb.
Danish figure for 1976 includes industrial catch only and is lacking some landings in foreign ports.
Faroe Islands figure for 1976 includes Division IVb. The split on areas calculated from logbook returns up to 12 November 1976.
French figure for 1976 included in Division IVc.

Spanish }
Swedish } figure for 1976 includes Divisions IVb,c - from Data Form 5.
UK (Eng. + Wales)}

Norwegian figures for 1971 and 1972 not including catches from the Recommendation 2 fisheries (1971 = 1 605 tons; 1972 = 2 023 tons).
Norwegian landings revised for 1974-75.

Division IVb

French figures for 1971-75 revised.

Faroe Islands figure for 1976 }
French figures for 1966 and 1969 }
German, Dem.Rep. figures for 1966 and 1976 }
Norwegian figures for 1966-72 and 1976 } included in Division IVa.
Spanish figure for 1976 }
Swedish figures for 1966-74 and 1976 }
UK (Eng. + Wales) figure for 1976 }
USSR figures for 1966-73 }

Danish figures for 1966-73 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 1976 includes industrial catch only and is lacking some landings in foreign ports.
French figure for 1976 included in Division IVa.

Footnotes to Table 1.4 (Continued)

Division IVc

French figures for 1971-75 revised.

French figures for 1966 and 1969)
German   Dem.Rep. figures for 1966 and 1976)
Norwegian figures for 1966-69 and 1976)
Spanish figure for 1976 } included in Division IVa.
Swedish figure for 1976)
UK (Eng. + Wales) figure for 1976)
USSR figures for 1966-73)

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 1976 includes industrial catch only and is lacking some landings
    in foreign ports.
French figure for 1976 includes Division IVa and Division IVb - from Data Form 5,
    up to November 1976.

Division VIa

French figures for 1971-75 revised.

Division VIb

French figures for 1971-75 revised.
Faroe Islands: The split on areas calculated from logbook returns up to 12 November
    1976.

Division VIIa

French figures for 1971-75 revised.
French figure for 1966 included in Division VIIg-k.
French figure for 1971 includes Division VIIf.

Division VIIb,c

French figures for 1971-75 revised.
French figure for 1966 included in Division VIIg-k.

Division VIId,e

French figures for 1971-75 revised.

Division VIIf

French figures for 1971-75 revised.
French figure for 1966 included in Division VIIg-k.
French figure for 1971 included in Division VIIa.

Division VIIg-k

French figure for 1971-75 revised.
French figure for 1966 includes Divisions VIIa,b,c and f.

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

Country	1970 legal-sized	1970 under-sized	1971 legal-sized	1971 under-sized	1972 legal-sized	1972 under-sized	1973 legal-sized	1973 under-sized	1974 legal-sized	1974 under-sized	1975※ legal-sized	1975※ under-sized
Denmark	1 202	} 20	8 332	3 601	8 213	1 076	5 189	1 313	4 215	2 498	} 248 d	
Germany, Fed.Rep.of	6 731	3 140	4 125	970	555	54	?	?	-	1		
Netherlands	579	-	8 199	-	?	-	5 931	67	7 679	368	} 1 347 d	
Norway (IVa)	211	463	730	584	920	736	480	659	733	11		7
Poland a)	-	8	181	6	189	23	?	?	220	...	150	
Sweden a)	-	-	-	-	-	-	-	-	8 260	...	6 247	...
U.K.(England)	-	-	-	-	-	-	-	-				
U.K.(Scotland) a)	-	-	-	-	-	-	-	-	736	-	1 983	-
Faroe Islands	-	-	-	-	-	-	-	-	415	1	-	
Total b)	8 723	3 611	21 567	5 161	9 877	1 889	11 600	2 039	22 254	2 879	} 10 032	

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

Country	1970 legal	1970 under	1971 legal	1971 under	1972 legal	1972 under	1973 legal	1973 under	1974 legal	1974 under	1975 legal	1975 under
Denmark	145	} 201	13 657	7 651	9 088	11 568	771	3 155	9 364	27 785	} 8 621 d	
Germany, Fed.Rep.of	5 913	67	927	32	263	-	?	?	-	-		
Netherland	7 003	-	6 341	-	?	-	2 088	1	2 237	-		
Norway (IVa)	1 726	1 852	2 176	2 336	2 742	2 943	1 055	4 102	3 379	2 356		
Poland a)	-	-	12	1	38	7	?	?	115	7	77	3
Sweden a)	-	-	-	-	-	-	-	-	2 954	...	2 978	...
U.K.(Scotland) a)	-	-	-	-	-	-	-	-	553	1 842	652	1 582
Faroe Islands	-	-	-	-	-	-	-	-	20	186		
Total b)	14 642	1 919	23 113	10 020	12 131	14 518	3 914	7 258	18 622	32 176	} 13 940	

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

Country	1970 legal	1970 under	1971 legal	1971 under	1972 legal	1972 under	1973 legal	1973 under	1974 legal	1974 under	1975 legal	1975 under
Denmark	102	} 141	20 462	34 493	29 446	20 035	57 194	16 081	84 448	} 24 578	} 366 d	
Germany, Fed.Rep.of	3 666	262	2 923	119	926	184	?	?	1 081 c)			
Netherlands	2 020	-	1 193	-	?	-	2 153	14	4 281	312	} 13 794 d	
Norway (IVa)	789	484	995	610	1 254	769	1 322	166	4 710	4		2
Poland a)	-	-	2	-	-	-	?	?	74	...	45	
Sweden a)	-	-	-	-	-	-	-	-	860	...	845	...
U.K.(Scotland) a)	-	-	-	-	-	-	-	-	1 442	559	3 441	948
Faroe Islands	-	-	-	-	-	-	-	-	31	494		
Total b)	6 475	746	25 575	35 222	31 626	20 988	60 669	16 261	95 847	25 947	} 19 538	

a) IIIa inclusive b) total of available data only c) excluded from totals d) preliminary estimates ※) for Belgium in IVc catches of legal-sized fish were 13 tons for cod and 94 tons for whiting; for the German Democratic Republic catches of legal sized fish were 37 tons for cod, 27 tons for haddock and 3 tons for whiting.

Table 1.6   Nominal catch of COD for Div. IVa-IVc
by country in metric tons, 1971 - 1976
(Bulletin Statistique)

Country	1971	1972	1973	1974	1975	1976[*]
Belgium	19 334	21 133	11 741	10 253	7 566	5 957
Denmark	68 179	72 520	47 950	54 207	46 344	53 971
Faroe Islands	123	284	803	416	732	400
France[a]	24 769	24 038	13 247	7 275	8 667	5 646
German Dem.Rep.[b]	18	122	343	132	223	69
Germany,Fed.Rep.	46 647	49 431	21 410	17 089	16 457	21 094
Iceland	1	-	+	+	-	
Netherlands	46 614	47 634	25 758	24 029	23 263	22 924
Norway	7 732[c]	4 377[c]	4 831	2 437[d]	2 767[d]	2 913
Poland	178	189	1 551	4 750	2 991	2 961
Spain	-	91	90	80	63	
Sweden[b]	9 062	8 769	8 074	8 168	900	721
U.K.(Engl.& Wales)	55 525	62 503	47 327	39 857	33 615	46 475
U.K.(Scotland)	37 229	55 190	48 844	39 887	37 308	39 566
U.S.S.R.	5 153	774	2 497	2 667	6 796	6 187
Total	320 564	347 055	234 466	211 247	187 692	208 884

[*] provisional figures

a) French figures for 1971-1975 revised

b) GDR figures for 1971-1972 and Swedish figures for 1971-1974 include IIIa

c) Norwegian figures for 1971-1972 do not include cod caught in Recommendation 2
fisheries (1971 = 1 314; 1972 = 1 656 tons)

d) Norwegian figures for 1974-1975 revised for Div. IVa (March 1977).

Table 1.7   Nominal catch of HADDOCK for Div. IVa-IVc
             by country in metric tons, 1971 - 1976
             (Bulletin Statistique)

Country	1971	1972	1973	1974	1975	1976[*]
Belgium	971	1 601	2 385	1 137	2 209	1 605
Denmark	31 043	34 858	13 118	44 342	32 930	46 821
Faroe Islands	-	5	1 198	435	267	14
France[e]	8 738	7 814	4 695	4 020	4 646	3 680
German Dem.Rep.[a]	3	90	22	8	44	20
Germany, Fed.Rep.	3 045	4 020	4 587	3 478	2 396	3 204
Iceland	1	-	-	-	-	
Netherlands	6 914	5 188	3 185	3 035	1 901	1 754
Norway	1 063[b]	1 146[b]	5 611	6 165[d]	10 171[d]	3 098
Poland	-	38	2 553	3 001	1 485	1 155
Spain[c]	-	-	101	210	-	222
Sweden[a]	5 857	5 305	4 550	3 098	2 083	3 091
U.K.(Engl.& Wales)	16 648	20 827	16 586	10 798	11 499	17 238
U.K.(Scotland)	121 539	96 197	88 132	71 679	64 686	80 062
U.S.S.R.	62 398	36 467	49 356	42 234	49 686	43 690
Total	258 220	213 556	196 079	193 640	184 003	205 654

[*] provisional figures

a) German Democratic figures for 1971-72 and Swedish figures for 1971-1974
   include IIIa

b) Norwegian figures for 1971 and 1972 do not include haddock caught in
   Recommendation 2 fisheries. (1971 = 4 512 tons; 1972 = 5 685 tons)

c) Spain reported 90 tons caught in 1975

d) Norwegian figures for 1974 and 1975 revised for Div. IVa (March 1977)

e) French figures for 1971-1975 revised.

Table 1.8   Nominal catch of WHITING for Div. IVa-IVc
by country in metric tons, 1971 - 1976

Country	1971	1972	1973	1974	1975	1976[*]
Belgium	2 108	2 745	3 387	3 156	3 279	2 186
Denmark	55 618	50 109	73 928	109 654	61 941	116 862
Faroe Islands	-	-	1 453	1 126	764	6
France[a]	16 668	19 822	20 353	19 825	20 079	12 958
German Dem. Rep.	-	-	5	-	3	18
Germany, Fed. Rep.	233	264	403	454	446	359
Iceland	-	-	-	-	-	
Netherlands	6 322	7 613	8 811	12 057	14 078	12 370
Norway	25[b]	28[b]	1 527	5 068[c]	13 298[c]	6 072
Poland	-	-	7	1 002	888	509
Spain	-	107	119	110	65	73
Sweden[d]	616	596	2 328	2 440	255	847
U.K. (Engl. & Wales)	4 158	3 789	4 592	5 519	5 246	5 680
U.K. (Scotland)	26 755	23 846	20 756	25 274	27 969	26 038
U.S.S.R.	541	613	3 522	2 978	5 098	6 708
Total	113 044	109 532	141 191	188 663	153 409	190 686

[*]   provisional figures

a)   French figures for 1971-1975 revised.

b)   Norwegian figures for 1971 and 1972 do not include whiting caught in
     Recommendation 2 fisheries. (1971 = 1 605 tons; 1972 = 2 023 tons).

c)   Norwegian figures for 1974 and 1975 revised for Div. IVa (March 1977).

d)   Swedish figures for 1971-1974 include IIIa.

Table 1.9   U.K. (England and Wales) Fishing Effort data for different areas

Area		1970	1971	1972	1973	1974	1975	1976
North Sea	Hours	819.5	855.1	884.9	852.9	781.3	694.5	725.8
	Av. Tons	56	54	60	56	58	52	59
	Ton-Hours	4 589	4 618	5 309	4 776	4 532	3 611	4 282
W. of Scotland	Hours	49.2	33.3	33.6	32.4	31.1	35.8	40.6
	Av. Tons	254	242	445	392	351	307	310
	Ton-Hours	1 250	806	1 495	1 270	1 092	1 099	259
Irish Sea	Hours	128.0	151.4	147.9	159.3	119.7	142.8	133.5
	Av. Tons	43	41	39	43	41	40	42
	Ton-Hours	550	621	577	585	491	571	561
Bristol Channel	Hours	44.1	47.4	38.4	37.0	32.2	34.3	27.4
	Av. Tons	56	49	52	57	62	41	45
	Ton-Hours	247	232	200	211	200	141	123

Note: HOURS are in thousands, TON-HOURS in 10 thousands

Table 1.10   U.K. (Scotland) Fishing Effort (000's hours fishing) for different Areas

Sub-area	Gear	1967	1968	1969	1970	1971	1972	1973	1974	1975
IV	Trawl	206	203	112	110	149	177	176	179	150
	Light trawl	24	41	54	67	98	109	146	117	160
	Seine	499	537	479	411	399	379	405	350	342
	Total	729	781	645	588	646	665	727	646	654
VI	Trawl	54	50	43	41	42	56	55	44	37
	Light trawl	83	66	105	115	129	142	91	86	129
	Seine	159	150	140	96	99	71	60	56	56
	Total	296	266	288	252	270	269	206	186	222

Provisional figures for 1976 show that 1976 effort in Sub-area IV was about 90% of that in 1975.
In Sub-area VI the 1976 effort was about the same as in 1975

Table 1.11   International Effort Data from the North Sea

Year	Cod International Effort		Haddock International Effort		Whiting International Effort	
	English Units 100 hrs	Scottish Units 100 hrs	English Units 100 hrs	Scottish Units 100 hrs	English Units 100 hrs	Scottish Units 100 hrs
1959			97 198			
1960			109 798			
1961			104 522			
1962			84 568			
1963	36 999		75 241			
1964	43 587		94 615			
1965	43 034		133 697		186 530	
1966	41 213		196 357		331 869	
1967	46 120		180 873		230 406	
1968	42 318	42 914	144 842	15 793	424 087	20 169
1969	38 282	48 291	385 785	16 680	809 264	37 371
1970	47 883	38 822	282 342	58 867	437 740	67 876
1971	49 367	44 934	132 631	34 974	232 477	50 629
1972	49 135	55 624	90 736	13 725	255 806	27 294
1973	42 254	41 818	100 829	14 763	262 243	30 545
1974	41 418	34 898	139 957	16 175	266 971	49 454
1975	38 522	34 220	105 188	17 433	185 561	48 202
1976	32 620	32 585	87 202	17 555	266 068	32 675

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

Age	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
0	0	0	0	0	0	0	0	0	0	0	0	0	274	317
1	18 622	47 311	40 500	75 633	65 388	9 941	5 109	47 304	61 347	6 317	33 809	15 715	35 086	12 182
2	37 798	23 681	68 149	65 705	81 282	79 589	23 009	27 373	149 128	195 922	30 551	53 537	54 771	105 109
3	6 192	15 976	14 441	26 341	26 741	36 676	31 590	16 392	14 385	43 709	52 648	11 799	17 597	22 510
4	3 069	3 439	6 715	5 896	9 265	11 078	14 959	12 179	5 952	5 095	13 163	5 180	4 078	9 805
5	2 360	1 513	1 783	2 513	2 698	5 623	5 190	6 867	6 028	2 406	1 905	4 397	6 401	1 550
6	1 404	1 652	873	1 065	1 750	1 275	2 842	1 963	2 394	2 802	1 038	974	1 662	2 374
7	67	433	510	409	655	623	688	1 051	760	1 449	988	472	378	737
8	485	99	275	362	304	314	379	207	394	545	486	373	144	114
9	4	390	14	77	148	154	170	221	182	339	38	310	175	63
10	5	1	81	64	36	103	54	136	82	102	41	65	73	44
11	1	1	1	25	2	21	110	46	53	5	64	35	29	22
12+	2	2	4	8	6	9	17	24	26	11	73	27	20	16

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

Age	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
0	0	0	0	0	0	0	0	0	0	161 900	41 800	387 000	62 303	144 891
1	199 600	2 000	73 000	11 700	102 000	376 000	96 500	6 300	48 300	292 350	33 000	361 800	653 682	91 166
2	118 100	430 500	3 700	6 700	25 400	190 100	17 285	119 100	22 700	288 860	344 760	101 530	262 828	552 299
3	13 500	146 400	460 800	17 700	3 300	26 700	181 800	15 011	37 500	27 400	240 900	252 100	38 852	220 267
4	12 200	17 100	33 200	410 500	6 700	2 300	26 800	34 600	372 300	20 100	9 000	49 000	96 419	12 792
5	6 500	9 500	6 800	24 600	194 800	2 200	5 200	600	11 400	147 500	6 100	2 600	10 489	35 363
6	500	4 300	3 800	4 300	4 800	66 100	2 300	500	700	3 300	1 600	1 100	652	5 578
7	400	300	700	400	500	600	42 500	200	200	100	40	9 600	434	242
8	900	500	300	80	300	70	5 100	2 600	1 800	400	1	1	2 888	83
9	10	60	20	5	40	10	10	20	900	8	4	200	108	800
10	10	10	10	1	3	6	1	3	200	100	20	20	42	87

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

Age	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
0	35 800	26 864	225 344	149 071	114 392	105 852	969 531	478 565	201 785	492 277	181 773	298 317
1	80 050	267 347	187 736	425 514	513 060	486 258	208 832	642 039	638 510	873 497	602 340	274 648
2	53 023	187 031	163 927	317 412	790 117	172 353	90 844	235 436	446 112	745 235	273 809	663 190
3	222 525	72 901	123 885	101 396	133 868	401 920	22 821	41 610	108 925	190 795	255 145	124 264
4	61 271	188 881	28 061	48 832	30 646	34 378	115 699	6 816	18 653	32 495	60 267	69 475
5	8 466	33 896	59 486	10 730	11 183	10 568	13 065	51 901	5 905	5 000	11 565	14 106
6	3 873	3 226	7 714	23 612	3 807	4 051	2 241	5 971	18 094	1 779	2 487	3 402
7	928	1 540	923	2 190	7 248	504	801	843	2 638	5 409	781	954
8	141	451	150	138	3 499	1 673	662	575	635	578	1 651	154

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

Year / Age	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
1	81	101	222	84	92	335	220	153	727	1 260	548
2	1 119	1 004	859	986	272	884	2 264	504	1 841	2 043	4 252
3	452	1 427	1 862	970	944	523	1 068	1 271	752	1 217	1 542
4	459	141	1 296	1 519	457	709	483	518	874	506	688
5	280	140	112	624	356	220	405	145	235	269	256
6	23	104	121	104	133	185	91	161	53	60	169
7	16	21	72	84	24	68	72	42	52	11	65
8+	2	12	18	53	39	36	47	47	22	19	15

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

Year / Age	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
1	5	278	516	9 311	0	230	2 448	590	1 208	1 970	4 861	915
2	1 654	359	11 419	7 387	48 921	164	2 844	22 221	6 520	3 425	9 519	16 056
3	84 419	1 164	1 239	3 234	5 928	71 520	6 627	2 225	15 648	9 411	2 773	12 325
4	4 697	47 424	238	418	1 386	3 795	91 387	2 897	263	6 131	3 427	1 403
5	206	1 606	18 775	586	350	211	590	56 846	1 147	97	1 980	1 488
6	169	76	252	11 729	576	92	86	612	31 836	447	106	911
7	139	30	20	655	3 386	98	6	37	139	11 488	122	29
8	23	102	28	36	150	453	97	57	114	189	3 770	15

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

Age	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
0	0	0	0	0	0	0	0	0	0	4	54	1
1	2 239	1 126	4 261	7 037	684	697	2 640	11 064	13 009	7 577	17 551	11 918
2	4 857	12 935	25 182	18 154	25 631	2 676	7 712	9 657	27 463	42 873	18 712	45 387
3	41 177	2 454	10 755	9 729	9 753	30 312	3 936	3 447	6 758	12 215	39 477	14 329
4	5 299	28 248	857	3 583	2 794	4 514	30 759	1 168	1 831	2 035	3 243	15 730
5	784	1 767	16 762	267	1 276	818	1 394	12 800	469	505	307	1 413
6	68	213	803	4 772	109	210	249	712	5 293	68	60	104
7	185	36	84	269	1 708	14	47	58	273	1 387	6	18
8	12	17	23	31	155	392	78	64	33	64	194	1

Table 2.7. Cod.
Division VIIa. Catch in numbers ('000 fish) by year and by age.

Age	1968	1969	1970	1971	1972	1973	1974	1975	1976
1	364	882	905	2 762	777	2 258	462	936	1 817
2	1 563	1 481	1 710	2 200	3 241	1 064	4 284	759	2 881
3	1 003	1 050	344	824	832	1 792	561	1 632	479
4	456	269	211	179	247	437	392	276	351
5	177	186	229	76	61	172	60	152	39
6	28	76	44	49	39	63	43	33	54
7+	2	37	18	19	13	30	9	16	15

Table 3.1. <u>Cod.</u>
<u>Sub-Area IV.</u>   Fishing mortality by year and by age.

Age	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
1	0.22	0.25	0.22	0.31	0.29	0.13	0.07	0.15	0.16	0.08	0.21	0.10	0.11	0.12
2	0.63	0.48	0.69	0.68	0.63	0.69	0.47	0.61	0.97	1.09	0.72	0.61	0.58	0.52
3	0.40	0.60	0.61	0.63	0.66	0.66	0.67	0.74	0.76	0.89	1.03	0.69	0.41	0.50
4	0.44	0.41	0.56	0.54	0.48	0.64	0.63	0.59	0.67	0.68	0.75	0.25	0.54	0.43
5	0.42	0.41	0.38	0.42	0.52	0.60	0.72	0.68	0.67	0.65	0.59	0.60	0.55	0.41
6	0.74	0.59	0.44	0.42	0.58	0.49	0.71	0.66	0.53	0.78	0.65	0.70	0.48	0.41
7	0.21	0.53	0.36	0.38	0.49	0.42	0.55	0.63	0.58	0.73	0.71	0.71	0.65	0.41
8	0.56	0.53	0.78	0.47	0.54	0.46	0.49	0.31	0.51	1.17	0.59	0.65	0.49	0.41
9	0.18	1.28	0.13	0.52	0.36	0.59	0.49	0.59	0.50	1.19	0.21	0.97	0.74	0.41
10	0.46	0.06	1.08	1.46	0.49	0.46	0.42	0.96	0.46	0.59	0.42	0.67	0.65	0.41
11	0.28	0.15	0.08	1.31	0.14	0.59	1.38	0.77	1.42	0.04	0.93	0.76	0.74	0.41
12+	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.41
Mean F $\geqslant$ 2	0.57	0.51	0.65	0.64	0.62	0.67	0.60	0.64	0.91	1.03	0.86	0.58	0.53	0.51

(Sum of F's weighted by stocks in numbers)

Table 3.2. <u>Haddock.</u>
<u>Sub-Area IV.</u>   Fishing mortalities by year and by age.

Age	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.43	0.03	0.16	0.12	0.26
1	0.10	0.16	0.24	0.13	0.07	0.03	1.16	0.09	0.16	0.07	0.32	0.07	0.06	0.24	0.14	0.35	0.43	0.27
2	0.56	0.64	0.56	0.31	0.33	0.22	0.08	0.29	0.29	0.49	0.50	0.84	0.35	0.54	0.49	0.84	0.47	0.80
3	0.46	0.74	0.94	0.63	0.29	0.89	0.38	0.61	0.22	0.57	1.31	1.14	0.70	0.97	1.29	0.83	0.96	0.93
4	0.98	0.72	0.76	0.78	0.51	0.74	0.51	0.68	0.50	0.24	2.55	1.00	1.03	1.09	1.05	1.08	0.91	1.04
5	1.29	0.90	0.67	0.56	0.70	0.97	0.75	0.90	0.83	0.30	1.35	0.40	1.18	1.95	1.32	1.08	0.71	1.10
6	1.03	1.11	0.84	0.45	0.48	1.61	1.60	1.91	0.43	0.77	0.58	0.42	1.20	1.59	0.09	0.93	0.91	1.10
7	1.56	1.03	1.09	1.34	0.50	0.59	1.61	0.73	1.72	0.09	2.28	0.09	0.29	0.52	0.06	1.03	1.35	1.10
8	1.52	1.77	2.04	2.25	2.33	2.98	3.17	0.83	3.06	1.54	2.45	1.09	3.50	1.65	0.01	0.48	1.09	1.10
9	0.97	1.31	2.20	0.97	0.44	1.45	2.46	0.65	1.53	1.86	1.04	0.05	1.77	0.20	0.05	0.23	0.52	1.10
10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10
Mean F $\geqslant$ 2	0.89	0.69	0.73	0.53	0.35	0.30	0.38	0.68	0.68	0.54	0.57	1.11	0.94	0.84	0.70	0.86	0.58	0.85

(Sum of F's weighted by stocks in numbers)

Table 3.3. Whiting.
Sub-Area IV. Fishing moratlities by year and by age *)

Age	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
0	0.04	0.02	0.07	0.15	0.84	0.76	0.40	0.17	0.10	0.18	0.18	0.14
1	0.14	0.47	0.24	0.20	1.05	1.13	0.32	0.50	0.36	0.84	0.34	0.45
2	0.28	0.55	0.60	0.79	0.67	1.40	0.66	0.74	0.80	0.92	0.71	0.77
3	0.46	0.78	0.88	0.97	0.97	0.91	0.69	0.73	0.96	1.00	1.00	0.85
4	0.62	0.91	0.81	1.12	0.92	0.73	0.73	0.46	0.90	0.88	1.10	0.85
5	0.91	0.87	0.84	0.88	0.87	1.00	0.69	0.90	0.93	0.65	0.95	0.85
6	1.00	1.15	0.49	1.02	0.95	0.95	0.60	0.81	0.97	0.83	0.80	0.85
7	0.66	1.72	1.38	0.25	1.08	0.30	0.49	0.47	1.11	0.91	1.19	0.85
8	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Mean F≥3	0.50	0.88	0.84	0.98	0.96	0.89	0.72	0.78	0.95	0.97	1.01	0.85

(Sum of F's weighted by stocks in numbers)

Table 3.4. Cod.
Division VIa. Fishing mortalities by year and by age.

Age	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
1	0.01	0.02	0.04	0.03	0.02	0.04	0.06	0.02	0.08	0.06	0.09
2	0.19	0.16	0.28	0.25	0.14	0.26	0.44	0.18	0.41	0.35	0.27
3	0.50	0.39	0.48	0.59	0.40	0.43	0.57	0.48	0.44	0.53	0.48
4	0.56	0.28	0.73	0.94	0.62	0.59	0.93	0.61	0.72	0.60	0.66
5	0.59	0.33	0.38	0.99	0.60	0.69	0.83	0.82	0.63	0.51	0.70
6	0.34	0.46	0.54	0.75	0.59	0.73	0.70	0.98	0.84	0.32	0.70
7	0.66	0.59	0.66	0.91	0.38	0.70	0.72	0.84	1.06	0.41	0.70
8+	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70
Mean F≥2	0.30	0.26	0.47	0.57	0.38	0.41	0.54	0.41	0.49	0.42	0.34

(Sum of F's weighted by stocks in numbers)

*) Scottish and Dutch discards included.

Table 3.5. **Haddock.**
Division VIa. Fishing mortalities by year and by age.

Age	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
1	0.00	0.01	0.02	0.01	0.00	0.03	0.03	0.02	0.08	0.04	0.05	0.042
2	0.22	0.08	0.79	0.31	0.09	0.01	0.53	0.43	0.23	0.34	0.26	0.21
3	0.52	0.24	0.43	0.54	0.44	0.18	0.69	1.08	0.61	0.61	0.50	0.64
4	0.58	0.63	0.07	0.25	0.47	0.57	0.38	0.76	0.34	0.52	0.47	0.51
5	0.30	0.40	0.56	0.24	0.34	0.12	0.16	0.43	0.81	0.20	0.31	0.38
6	0.41	0.17	0.10	0.83	0.40	0.14	0.07	0.25	0.46	0.89	0.35	0.23
7	0.14	0.12	0.06	0.40	0.61	0.11	0.01	0.04	0.08	0.30	0.65	0.15
8	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Mean F $\geqslant$ 2 (Sum of F's weighted by stocks in numbers)	0.51	0.58	0.57	0.51	0.11	0.19	0.39	0.44	0.44	0.41	0.27	0.32

Table 3.6. **Whiting.**
Sub-Area VI. Fishing mortalities by year and by age.

Age	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
1	0.05	0.02	0.08	0.04	0.05	0.04	0.10	0.17	0.08	0.13	0.14	0.10
2	0.63	0.47	0.86	0.57	0.19	0.31	0.67	0.59	0.77	0.41	0.51	0.67
3	0.44	0.77	0.93	1.03	0.69	0.36	1.01	0.74	1.13	1.00	0.83	0.96
4	0.77	0.63	0.69	0.97	1.01	0.83	0.77	1.00	1.22	1.46	0.82	1.00
5	0.94	0.65	1.00	0.48	1.23	0.98	0.67	0.88	1.78	1.60	0.94	1.11
6	0.47	0.74	0.70	0.90	0.37	0.67	0.96	0.89	1.23	2.06	0.87	1.04
7	1.69	0.50	0.75	0.54	1.02	0.07	0.31	0.62	1.12	1.49	1.36	0.71
8	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.90	0.90	0.90	0.90	0.90
Mean F $\geqslant$ 5 (Sum of F's weighted by stocks in numbers)	0.99	0.65	0.98	0.85	1.03	0.78	0.68	0.88	1.26	1.51	0.92	1.10

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Table 3.7. <u>Cod.</u>
<u>Division VIIa.</u> Fishing mortalities by year and by age.

Age	1968	1969	1970	1971	1972	1973	1974	1975	1976
1	0.12	0.19	0.17	0.30	0.25	0.23	0.19	0.13	0.35
2	0.60	0.93	0.66	0.77	0.69	0.63	0.90	0.56	0.71
3	0.82	1.10	0.57	0.80	0.77	1.10	0.82	1.12	0.86
4	0.86	0.54	0.68	0.67	0.59	1.34	0.77	1.39	0.78
5	0.89	1.14	1.33	0.57	0.51	1.14	0.65	0.80	0.75
6	0.43	1.37	0.97	1.29	0.65	1.77	1.06	0.93	0.75
7+	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
Mean F $\geq$ 2	0.70	0.95	0.69	0.77	0.69	0.95	0.87	0.91	0.73

(Sum of F's weighted by stocks in numbers)

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

Age	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
0	286 351	271 531	384 463	346 244	112 963	105 115	452 559	560 740	105 299	236 172	224 503	470 218	145 190	349 925
1	103 698	234 445	222 311	314 772	283 481	92 487	86 061	370 524	459 095	86 212	193 361	183 808	384 982	118 624
2	38 238	68 141	149 387	145 564	189 738	173 313	66 761	65 851	260 736	320 605	64 886	127 878	136 317	283 558
3	20 553	38 453	34 566	61 441	60 484	82 680	70 820	34 036	29 433	80 878	88 603	25 851	56 821	62 601
4	9 403	11 271	17 194	15 386	26 755	25 625	34 921	29 758	13 239	11 265	27 302	25 778	10 627	30 734
5	7 542	4 946	6 142	8 067	7 318	13 602	11 077	15 218	13 469	5 522	4 671	10 607	16 445	5 050
6	2 936	4 058	2 692	3 428	4 350	3 575	6 107	4 436	6 325	5 642	2 371	2 121	4 752	7 735
7	393	1 151	1 844	1 421	1 851	1 996	1 785	2 462	1 878	3 035	2 121	1 013	866	2 401
8	1 243	261	555	1 052	796	929	1 075	845	1 076	857	1 192	854	408	371
9	27	584	125	209	537	380	479	541	506	528	219	541	366	205
10	15	19	133	90	102	307	173	240	245	251	132	145	167	143
11	4	8	14	37	17	51	159	93	75	127	115	71	61	72
12	3	3	5	11	8	12	23	33	35	15	100	37	27	24

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

Age	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
0	988 160	1 223 190	3 441 470	1 211 980	2 195 170	2 165 990	3 241 110	3 388 710	2 258 920	3 356 000	1 213 750	2 513 570
1	681 856	776 720	977 208	2 614 330	857 951	778 008	829 049	1 783 540	2 343 350	1 667 480	2 304 270	830 025
2	237 112	486 111	396 304	631 149	1 757 310	246 792	205 708	491 134	885 049	1 345 170	587 005	1 345 510
3	664 198	146 457	230 561	177 849	233 724	732 915	49 820	87 242	192 000	326 863	438 209	236 135
4	144 319	344 301	54 895	78 456	55 448	72 335	242 338	20 408	34 291	60 328	98 060	132 021
5	15 454	63 377	113 781	19 932	20 918	18 126	28 539	95 150	10 598	11 471	20 459	26 805
6	6 667	5 117	21 703	40 157	6 765	7 168	5 449	11 697	31 703	3 423	4 922	6 465
7	2 102	2 016	1 329	10 857	11 899	2 152	2 265	2 457	4 254	9 868	1 217	1 813
8	279	892	297	273	6 919	3 308	1 309	1 137	1 256	1 143	3 265	305

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

Age	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
1	9 406	4 825	6 266	2 896	5 277	8 860	4 390	7 450	10 144	25 497	7 014
2	7 209	7 628	3 859	4 929	2 295	4 238	6 952	3 396	5 962	7 649	19 738
3	1 258	4 895	5 340	2 387	3 149	1 634	2 674	3 661	2 326	3 229	4 428
4	1 165	625	2 727	2 704	1 087	1 731	869	1 234	1 859	1 230	1 554
5	686	543	385	1 076	862	481	783	281	547	742	555
6	88	312	319	215	326	388	197	280	101	238	366
7	36	51	162	153	83	148	152	80	86	36	141
8	3	15	23	68	50	46	60	60	28	24	19

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

Age	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
1	6 329	28 100	37 554	772 051	21 780	9 491	88 237	43 061	17 449	57 409	119 193	24 528
2	9 188	5 177	22 755	30 281	623 693	17 832	7 563	70 032	34 722	13 196	45 224	93 199
3	227 432	6 034	3 915	8 448	18 153	466 511	14 451	3 645	37 406	22 561	7 727	28 465
4	11 643	110 601	3 893	2 094	4 021	9 547	317 539	5 913	1 010	16 632	10 055	3 842
5	879	5 330	48 157	2 973	1 338	2 050	4 420	177 944	2 257	591	8 126	5 161
6	556	535	2 922	22 623	1 906	781	1 488	3 087	94 703	826	396	4 873
7	1 137	303	369	2 165	8 070	1 044	557	1 141	1 977	48 995	278	229
8	182	806	221	284	1 185	3 579	766	450	901	1 493	29 788	119

Table 4.6. **Whiting.**
Sub-Area VI. Stock in numbers ('000 fish) at beginning of year.

Age	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
0	72 234	74 142	251 357	17 553	26 597	39 001	97 727	226 000	86 685	174 914	168 552	1
1	48 633	59 140	60 703	205 794	14 371	21 776	31 932	80 012	185 033	70 972	143 204	137 950
2	11 365	37 796	47 403	45 855	162 137	11 149	17 199	23 762	55 541	139 757	51 277	101 429
3	125 805	4 963	19 351	16 382	21 297	109 667	6 723	7 192	10 816	20 978	75 957	25 220
4	10 719	66 076	1 874	6 274	4 771	8 726	62 569	2 007	2 812	2 861	6 320	27 012
5	1 394	4 049	28 845	769	1 951	1 423	3 122	23 790	605	681	547	2 284
6	197	444	1 736	8 718	390	457	438	1 310	8 080	83	112	174
7	244	100	174	704	2 891	222	195	137	439	1 928	9	39
8	26	37	50	67	336	849	169	117	60	117	355	2

Table 4.7.   Cod.
Division VIIa.   Stock in numbers at beginning of year.

Age	1968	1969	1970	1971	1972	1973	1974	1975	1976
1	3 654	5 689	6 442	11 698	3 906	12 095	2 869	8 579	6 749
2	3 790	2 663	3 863	4 459	7 095	2 499	7 871	1 933	6 180
3	1 953	1 705	863	1 635	1 688	2 914	1 095	2 631	903
4	857	705	464	398	604	640	796	396	706
5	327	296	337	192	166	273	138	302	81
6	88	110	77	73	89	82	71	59	112
7	3	47	23	24	16	38	11	20	19

Table 5.1. Predictions of catches and landings in 1978 ('000 tons).

Species	Area	A ($F_{78}=F_{76}$) Catch	Landings	B ($F_{78}=0.9 \times F_{76}$) Catch	Landings	C ($F_{78}=0.8 \times F_{76}$) Catch	Landings	All Options
Cod	IV	240		220		200		
	VIa	20.6		19.1		17.4		
	VIb							$1.3^{1)}$
	VIIa	9.3		8.6		7.9		
	VIIb-k							$10.9^{1)}$
Haddock	IV	126	112	118	106	109	97	
	VIa	11.4		10.4		9.5		
	VIb							$2.0^{1)}$
	VII							$8.2^{1)}$
Whiting	IV	202	173	187	161	172	148	
	VI	17.8		16.6		15.2		
	VII	-		-		-		$25.7^{1)}$

1) Averages for period 1966-1975.

A. Effort in 1978 the same as in 1976 and 1977.

B. Effort in 1978 10% lower than in 1976 and 1977.

C. Effort in 1978 20% lower than in 1976 and 1977.

Table 5.2. Revised estimates of yearclass strength.

Yearclass	Cod Div.IVa,b,c		Haddock Div.IVa,b,c		Whiting Div.IVa,b,c	
	IYHS[a]	VPA[b] M=0.2	IYHS[a]	VPA[b] M=0.2	IYHS[a]	VPA[b] M=0.2
1958				368		
1959				234		
1960				152		
1961				638		
1962		104		3 203		
1963		234		70		
1964		222		115		682
1965		315		147		777
1966	33	283	151	767	803	977
1967	5.6	92	8 891	6 296	1 726	2 614
1968	5.9	86	425	385	18	858
1969	59	371	45	109	86	778
1970	125	549	2 114	974	296	829
1971	2.6	86	3 044	1 510	710	1 784
1972	38	193	461	273	4 272	2 343
1973	10	184	3 685	1 338	703	1 667
1974	77	385	1 663	2 050	1 292	2 304
1975	6.4		312		1 306	
1976	(45)		(375)		(1 030)	

a) Average number per hour fishing during the International Young Herring Surveys (cf. ICES, C.M.1976/F:20).

b) Millions of fish at age 1.

Figures in brackets are provisional.

Table 5.3. Predictive regressions of VPA estimates of yearclass size (y) on yearclass strength indices (x) from research surveys ($y = B_o + B_1 x$).

Data	n	B_o	B_1	r	p	Estimated size yearclass (1 year old) '000 000	
						1975	1976
Cod IVa,b,c(M=0.2) - IYHS (1966-1974)	9	100.36	3.47	0.93	$p < 0.01$	6.4	45
Haddock IVa,b,c(M=0.2) - IYHS (1966-1973*)	7	258.03	0.30	0.86	$p < 0.01$	352	371
Whiting IVa,b,c(M=0.2) - IYHS (1966-1974)	9	956.44	0.56	0.71	$p < 0.05$	1 306	1 030

*) Excluding 1967.

Table 5.4. Percentage change in F values needed to give MSY per recruit. Also percentage gains in yield per recruit for $F = F_{max}$.

Species	Area	% Change in F values	% Gain in yield per recruit
Cod	IV	-50	+15
	VIa	-45	+ 7
	VIIa	-65	+20
Haddock	IV	-70	+20
	VIa	0	0
Whiting	IV	-70	0*
	VIa	-65	0*

* Yield per recruit curve flat-topped.

Table 5.5. Haddock.
Sub-Area IV. Input data for catch prediction.
1976 catch in numbers ('000 fish).

Age	Industrial landings		Other landings		Discards		Total
	Numbers	Weight	Numbers	Weight	Numbers	Weight	Numbers
0	144 791	0.025	0	0.000	70	0.041	144 861
1	60 485	0.064	2 150	0.230	28 519	0.108	91 154
2	157 246	0.157	200 575	0.280	194 452	0.185	552 273
3	23 849	0.334	173 925	0.410	22 492	0.246	220 266
4	60	0.423	12 618	0.580	114	0.253	12 792
5	2 584	0.556	32 704	0.710	75	0.314	35 363
6	34	0.666	5 544	0.940	0	0.000	5 578
7	0	0.000	242	1.210	0	0.000	242
8	0	0.000	83	1.440	0	0.000	83
9	0	0.000	800	1.500	0	0.000	800
10	0	0.000	87	1.600	0	0.000	87
Total	389 050		428 728		245 722		1 063 500
Total weight	41 629		165 466		44 642		

Table 5.6. Whiting.
Sub-Area IV. Input data for catch prediction.
1976 catch in numbers ('000 fish).

Age	Recommendation 4 Fisheries		Recommendation 2 Fisheries		Discards
	Catch '000	Mean weight kg	Catch '000	Mean weight kg	'000
0			293 317	.020	5 000
1	7 950	.187	245 162	.063	21 536
2	113 425	.228	433 514	.195	116 251
3	57 773	.269	54 917	.269	11 574
4	56 787	.322	6 759	.322	5 929
5	13 423	.380	272	.380	411
6	3 341	.468	42	.468	19
7	939	.620	13	.620	2
8	154	.765	–	.765	

Table 5.7. North Sea Cod, Haddock and Whiting.
Total numbers ('000) at each length group landed
quarterly by Norway in 1976[a].

Cod Length group	Quarter				Total
	1	2	3	4	
10-14		24			24
15-19		166	95	47	308
20-24	24	47	47	47	165
25-29	95	71	24	308	498
30-34	95	214	95	379	783
35-39	118	261	236	261	876
40-44	94	118	118	188	518
45-49	47	24	212	94	377
50-54		24	71	70	165
55-59	47		71		118
Total	520	949	969	1 394	3 832
Haddock					
5- 9	5		422	18	445
10-14	211	79	2 014	750	3 054
15-19	396	2 083	528	3 513	6 520
20-24	519	569	2 970	1 253	5 311
25-29	844	545	1 541	1 330	4 260
30-34	127	147	602	675	1 551
35-39	22	47	121	242	432
40-44	9	4	47	45	105
45-49	9		19	5	33
50-54			6	1	7
Total	2 142	3 474	8 270	7 832	21 718
Whiting					
10-14	4		5	17	26
15-19	23		18	74	115
20-24	357	100	195	537	1 189
25-29	1 487	2 095	988	4 072	8 642
30-34	972	1 535	1 197	5 670	9 374
35-39	389	559	495	1 902	3 345
40-44	25	50	185	270	530
45-49		33	58	56	147
50-54				2	2
55-59			6		6
Total	3 257	4 372	3 147	12 600	23 376

a) Measurements from Recommendation 2 fisheries only.

Table 6.1.   Cod.
Sub-Area IV.   Input data for catch prediction.

Age	1976 Catch '000	F-values 1976-1977	Mean weight kg[*]
1	12 182	0.115	0.54
2	105 109	0.52	0.92
3	22 510	0.50	2.02
4	9 805	0.43	3.82
5	1 550	0.41	5.75
6	2 374	0.41	7.64
7	737	0.41	9.11
8	114	0.41	10.37
9	63	0.41	11.24
10+	82	0.41	12

a)   Assuming F_{76} is 25% below average for the period 1963-75.

Year	Recruitment at age 1 '000	Simulated catches '000 tons		
		$F_{78} = F_{76}$	$F_{78} = 0.9 \times F_{76}$	$F_{78} = 0.8 \times F_{76}$
1977	256 000	221	221	221
1978	230 000	240	220	200

b)   Assuming F_{76} is the same as the average for the period 1963-75.

Year	Recruitment at age 1 '000	Simulated catches '000 tons		
		$F_{78} = F_{76}$	$F_{78} = 0.9 \times F_{76}$	$F_{78} = 0.8 \times F_{76}$
1977	256 000	195	195	195
1978	230 000	211	195	177

[*]   These values had to be adjusted by -6.26% to yield the actual catch in weight in 1976.

Table 6.2. Haddock.
Sub-Area IV. Input data for catch prediction.

	Input data				Prediction runs					
Age	1976 Catch '000s	Mean weight (kg)	F_{76}	Run No.	Ratio of F's			Predicted 77		Predicted 78	
					F_{76}	$:F_{77}$	$:F_{78}$	Landings	Catches	Landings	Catches
0	144 861	.029	.26	1	1	:1	:1	165	(183)	112	(126)
1	91 154	.086	.27	2	1	:1.25	:1	189	(210)	93	(106)
2	552 273	.210	.80	3	1	:1.25	:1.25	189	(210)	106	(121)
3	220 266	.396	.93	4	1	:1.25	:0.9	189	(210)	87	(99)
4	12 792	.549	1.04	5	1	:1	:0.9	165	(183)	106	(118)
5	35 363	.704	1.1	6	1	:1	:0.8	165	(183)	97	(109)
6	5 578	.940	1.1								
7	242	1.210	1.1								
8	83	1.440	1.1								
9	800	1.500	1.1								
10	87	1.600	1.1								

Nos. 1 063 500

Weight 251 737

M = 0.2

Recruitment at age 0

1977   648 000 000
1978   648 000 000

Table 6.3.   Whiting.
            Sub-Area IV.   Input data for catch prediction.

Age	1976 Catch landings + discards '000	Mean weight kg	F values M = 0.2
0	298 317	0.020	0.14
1	274 648	0.066	0.45
2	663 190	0.200	0.77
3	124 264	0.269	0.85
4	69 475	0.322	0.85
5	14 106	0.380	0.85
6	3 402	0.468	0.85
7	954	0.620	0.85
8	154	0.765	0.80

Recruitment at age 0 in '000

1976	2 300 000
1977	2 300 000
1978	2 300 000

Simulated catches ('000 tons) with F values in column 4

Year	Change in F	Catch	Landings (= catch - discards)
1977	$F_{77} = F_{76}$	190	165
1978	$F_{78} = F_{76}$	202	173
	$F_{78} = 0.9 \times F_{76}$	187	161
	$F_{78} = 0.8 \times F_{76}$	172	148

Simulated catches ('000 tons) with F values in column 4 reduced by 25%.

Year	Change in F	Catch	Landings (= catch - discards)
1977	$F_{77} = F_{76}$	221	191
1978	$F_{78} = F_{76}$	248	214
	$F_{78} = 0.9 \times F_{76}$	229	198
	$F_{78} = 0.8 \times F_{76}$	208	179

Table 6.4. Cod.
Division VIa. Input data for catch prediction.

Age	1976 Catch '000	F values 1976-1977	Mean weight kg[*]
1	548	0.09	0.58
2	4 252	0.27	1.22
3	1 542	0.48	2.66
4	688	0.66	4.25
5	256	0.70	5.13
6	169	0.70	6.41
7	65	0.70	8.38
8+	15	0.70	9.00

Year	Recruitment at age 1 '000	Simulated catches '000 tons		
		$F_{78} = F_{76}$	$F_{78} = 0.9 \times F_{76}$	$F_{78} = 0.8 \times F_{76}$
1977	6 613	21.0	21.0	21.0
1978	6 613	20.6	19.1	17.4

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

Age	1976 Catch '000	F values 1976-1977	Mean weight kg
1	922	.042	.230
2	16 187	.21	.28
3	12 425	.64	.41
4	1 414	.51	.58
5	1 500	.38	.71
6	918	.23	.94
7	29	.15	1.21
8	15	.15	1.44
9	3 831	.15	1.50

Year	Recruitment at age 1 '000	Simulated catches '000 tons
1977	25 900	Run 1 1977 16.3 $(F_{77} = F_{76})$
1978	31 500	1978 11.4 $(F_{78} = F_{76})$
		Run 2 1977 10.8 $(F_{77} = 0.6 \times F_{76})$
		1978 13.6 $(F_{78} = F_{76})$
		Run 3 1977 16.3 $(F_{77} = F_{76})$
		1978 10.4 $(F_{78} = 0.9 \times F_{76})$
		Run 4 1977 16.3 $(F_{77} = F_{76})$
		1978 9.5 $(F_{78} = 0.8 \times F_{76})$

[*] These values had to be adjusted by +2.85% to yield the actual catch in weight in 1976.

Table 6.6. Whiting.
Sub-Area VI. Input data for catch prediction.

Age	1976 Catch '000	F values M = 0.2	Mean weight kg
1	11 918	0.10	0.213
2	45 387	0.67	0.241
3	14 329	0.96	0.267
4	15 730	1.00	0.310
5	1 413	1.11	0.377
6	104	1.04	0.471
7	18	0.71	0.563
8	-	0.90	0.690

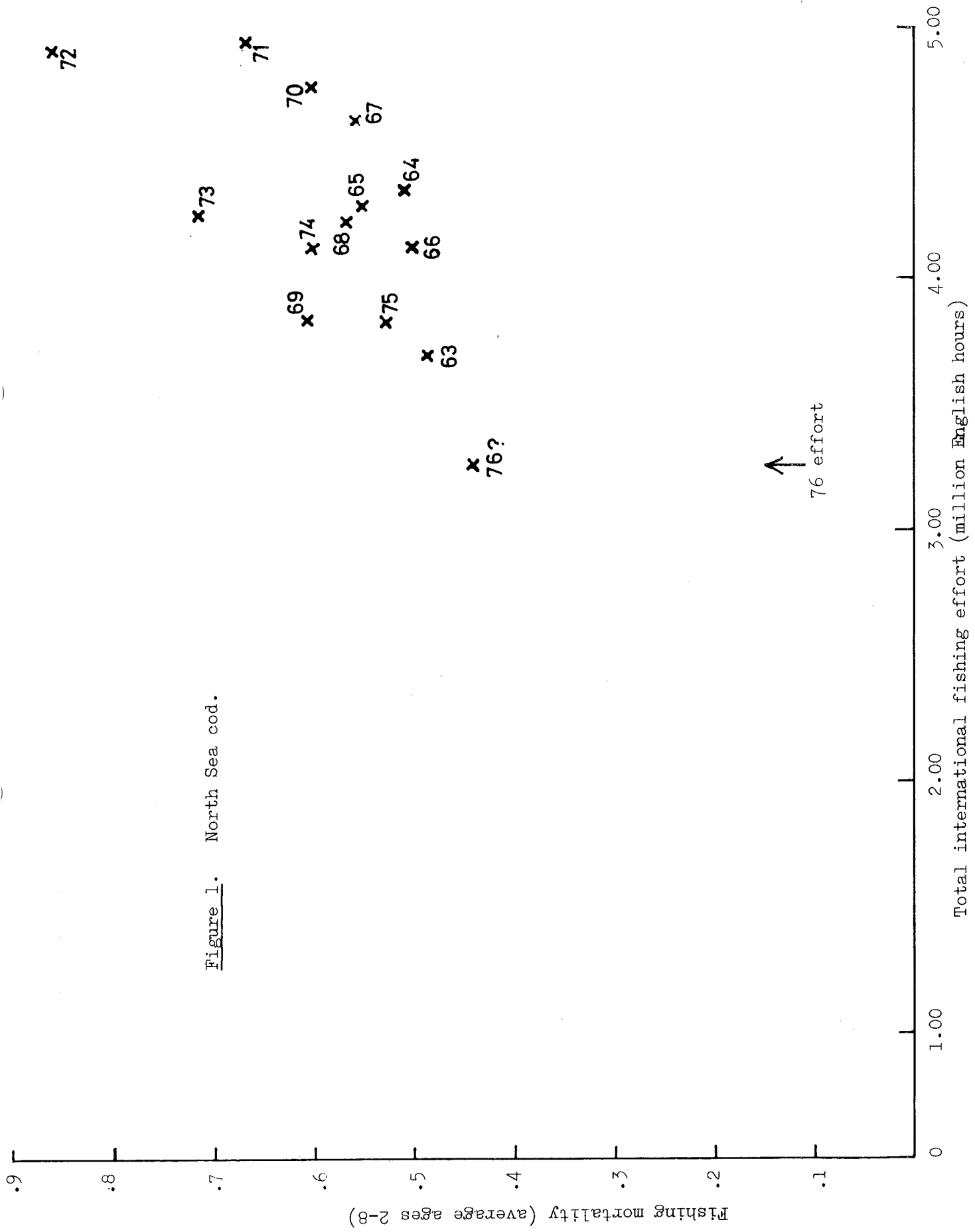| Year	Recruitment at age 1 '000	Simulated catches '000 tons		
		$F_{78} = F_{76}$	$F_{78} = 0.9 \times F_{76}$	$F_{78} = 0.8 \times F_{76}$
1977	77 800	22.4	22.4	22.4
1978	77 800	17.8	16.6	15.2

Table 6.7. Cod.
Division VIIa. Input data for catch prediction.

Age	1976 Catch '000	F values 1976-1977	Mean weight kg[*]
1	1 817	0.35	0.61
2	2 881	0.71	1.66
3	479	0.86	3.33
4	351	0.78	5.09
5	39	0.75	6.19
6	54	0.75	6.76
7+	15	0.75	8.30

Year	Recruitment at age 1 '000	Simulated catches ' 000 tons		
		$F_{78} = F_{76}$	$F_{78} = 0.9 \times F_{76}$	$F_{78} = 0.8 \times F_{76}$
1977	6 866	9.8	9.8	9.8
1978	6 866	9.3	8.6	7.9

[*] These values had to be adjusted by -5.88% to yield the actual catch in weight in 1976.

Figure 1.   North Sea cod.

Fishing mortality (average ages 2-8)

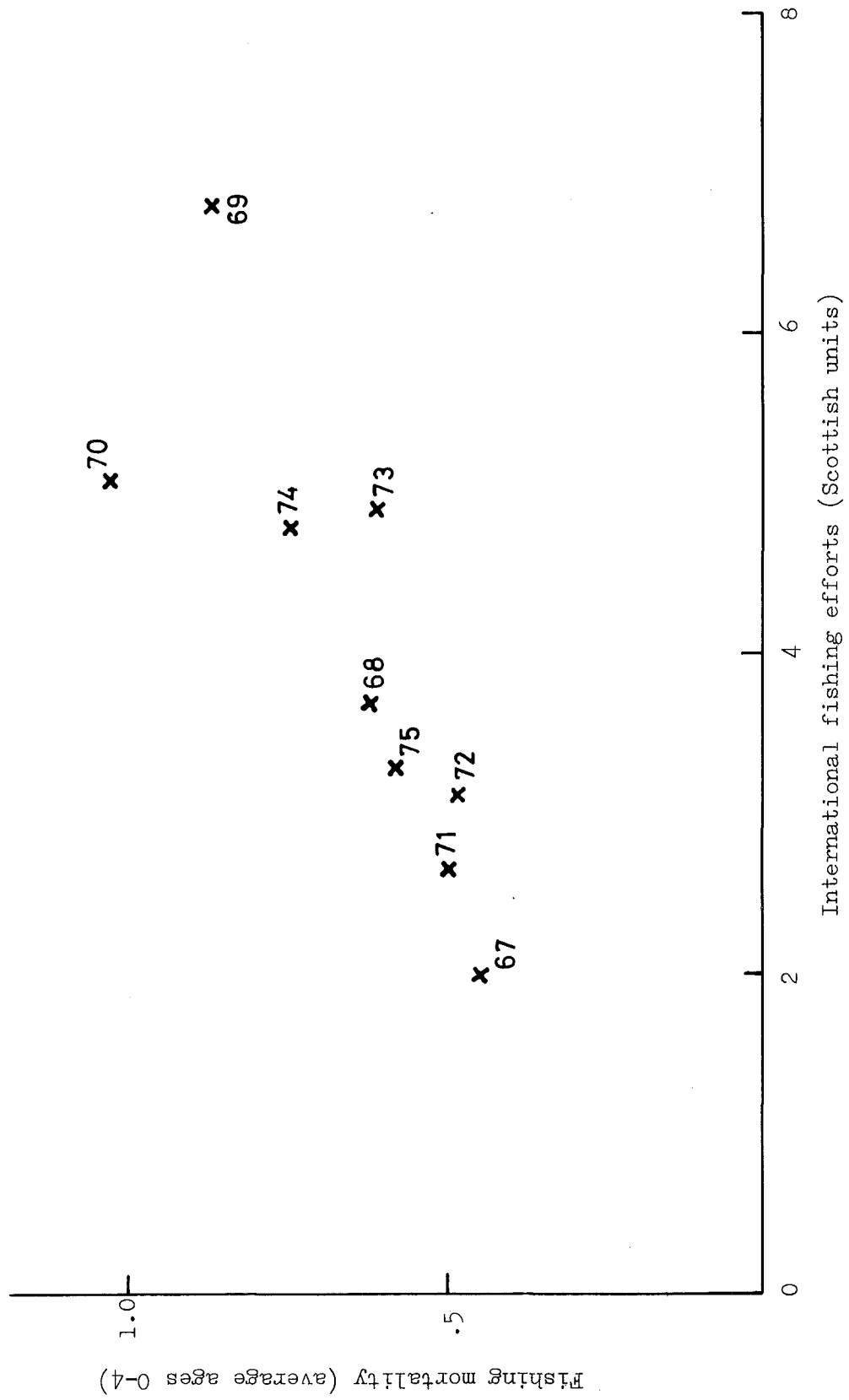Total international fishing effort (million English hours)
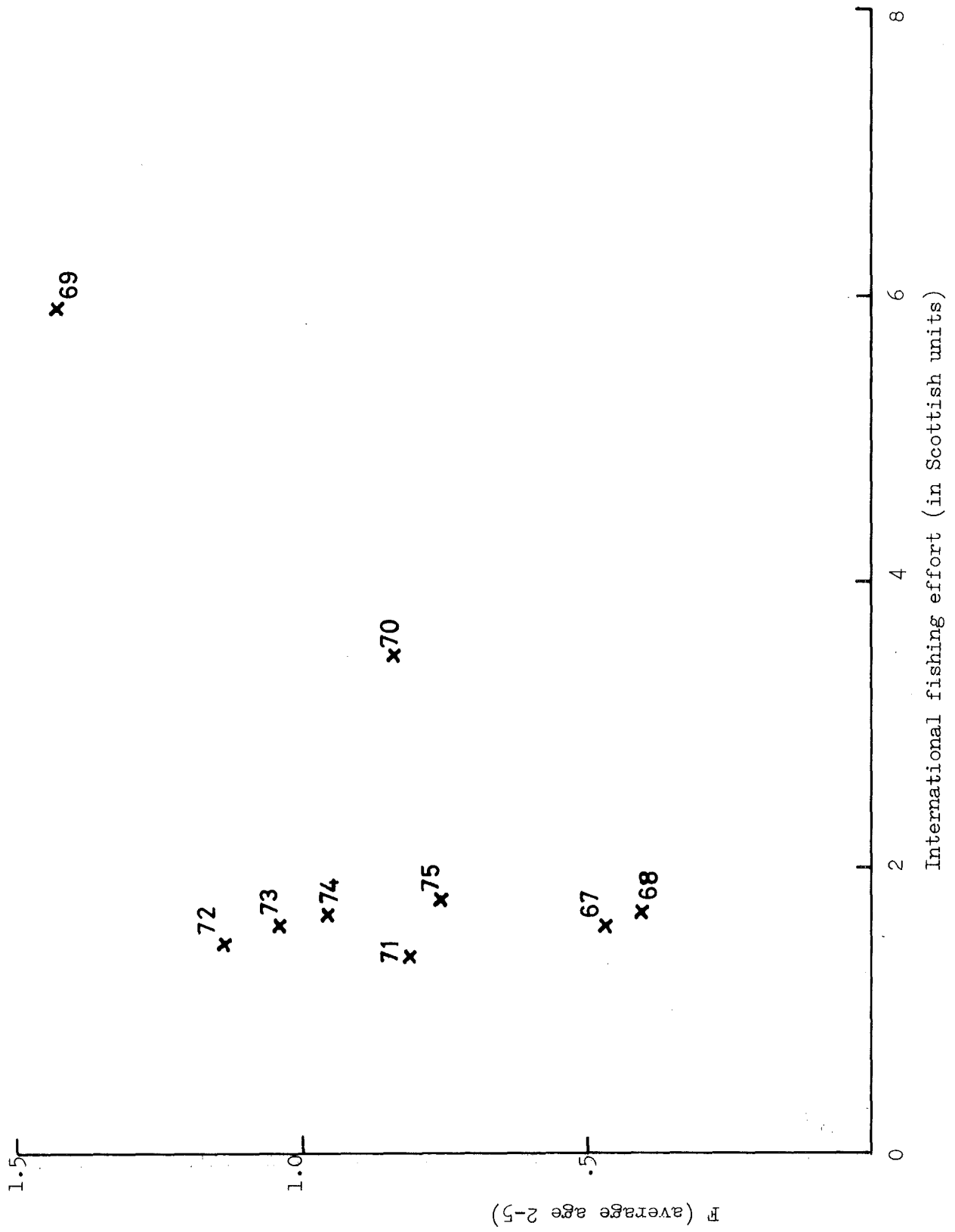
76 effort

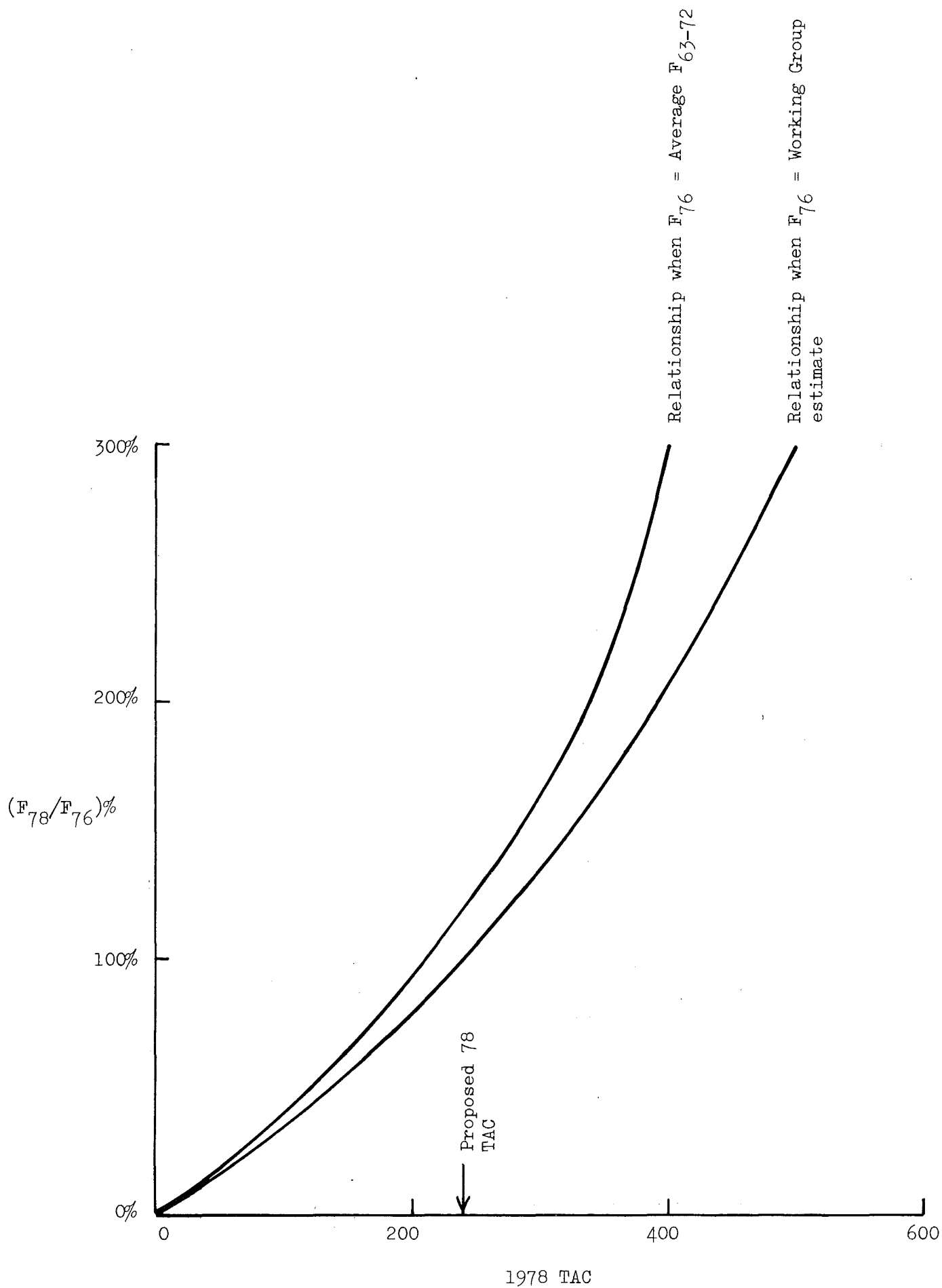Figure 2. North Sea whiting.

Figure 3. North Sea haddock.

Figure 4. North Sea cod.
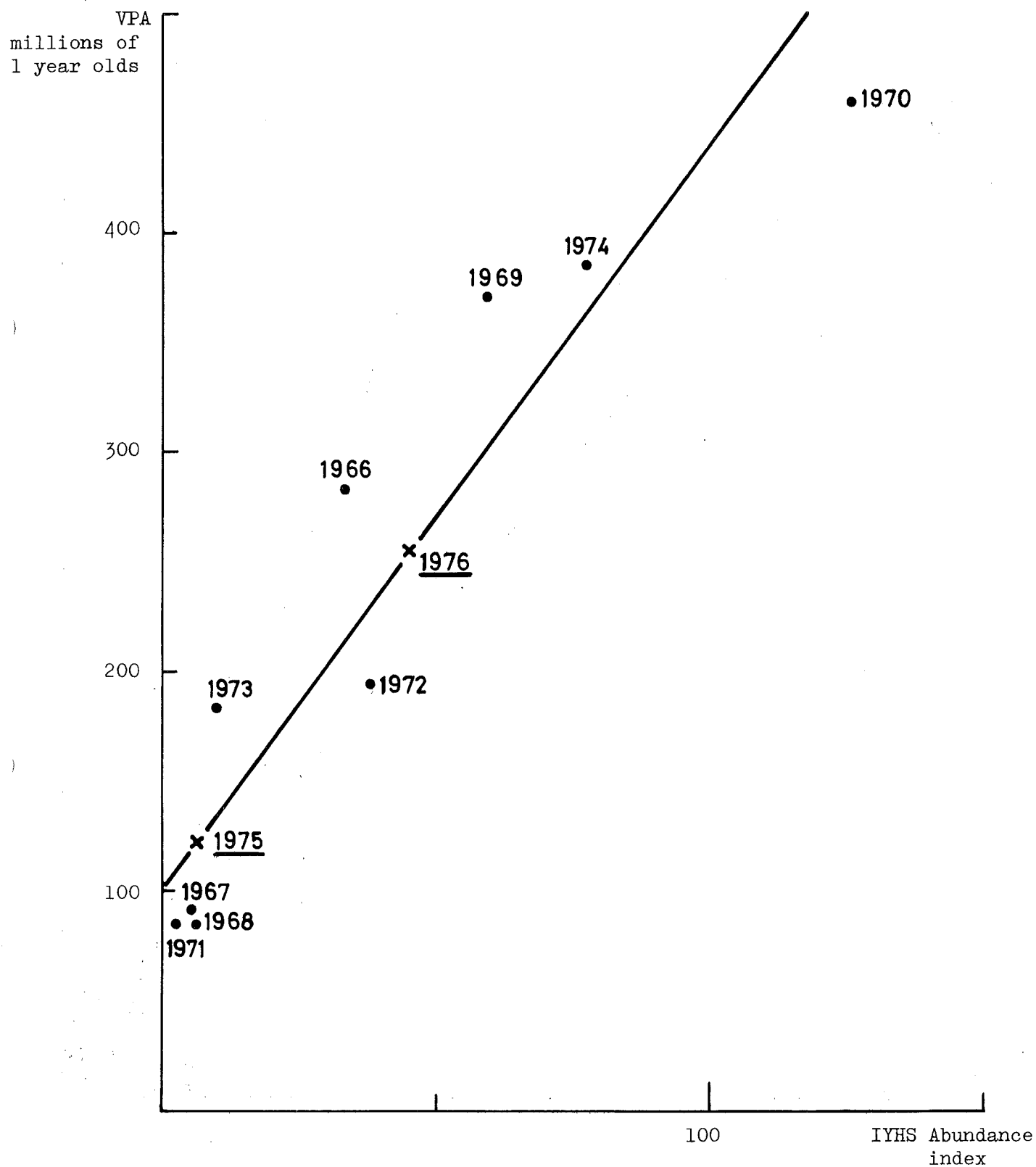Relationship between 1978 TAC and F_{78} as a percentage of F_{76}.

Figure 5. North Sea cod in Divisions IVa,b,c.
Predictive regression yearclass strength
on IYHS abundance estimates.

Figure 6. North Sea haddock.
Predictive regression yearclass strength
(1967, 1974 data points omitted) on IYHS
abundance estimates.

Figure 7. North Sea whiting.
Predictive regression yearclass strength on
IYHS abundance estimates.