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REPORT OF THE NORTH SEA ROUNDFISH WORKING GROUP

Charlottenlund, 15-19 March 1976

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Report of the North Sea Roundfish Working Group

Terms of Reference

At the 1975 Statutory Meeting of ICES in Montreal it was decided (C.Res.1975/2:28(i)) that:

> "the North Sea Roundfish Working Group should meet at Charlottenlund from 15-19 March 1976 to assess TACs for 1977 for cod, haddock and whiting in Sub-areas IV, VI and VII".

The Working Group was also asked, at the request of the Liaison Committee,"to consider the necessity of including gurnards in Recommendation 2"

Participation

The meeting was held in Charlottenlund from 15-19 March 1976 and was attended by:

O V Bakurin	U.S.S.R.
R De Clerck	Belgium
N Daan	Netherlands
J P Hillis	Ireland
J Janusz	Poland
J Lahn-Johannessen	Norway
R Jones (Chairman)	U.K. (Scotland)
H Knudsen	Denmark
C T Macer	U.K. (England)
A S Malkov	U.S.S.R.
J G Pope	U.K. (England)
C J Rørvik	Norway
P Sparre	Denmark
G Wagner	Germany (Federal Republic of)

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

Total Allowable Catches

Recommended TACs for 1977 are summarised below:

Sub-areas	Cod	Haddock	Whiting
IV	174 000	190 000	130 000
VI	9 300	12 000	21 000
VII	14 000	6 500	20 000

The estimates from which these values were chosen are given in Tables 33 and 34.

In each case the estimates given are the best that could be arrived at on the basis of the data available. None of the estimates can be regarded as accurate, however, and an assessment of the effect of adopting incorrect TACs is given in a later section.

In recommending these TACs, the objective has been to stabilise fishing mortalities at levels experienced during the past 4-5 years.

The Inclusion of Gurnards in Recommendation 2

Gurnards are not protected species, and the Group was asked by the Liaison Committee to consider the necessity of including this species in "Recommendation 2".

Table 31 shows length composition data for this species for Scottish commercial vessels. Measurements on Aberdeen fish market showed that landed fish mainly ranged from 28 to 45 cm in length. Measurements by observers on board commercial vessels showed that fish caught ranged from about 14-45 cm in length.

There would appear to be no basis, using these data, for the inclusion of this species in "Recommendation 2".

Details of the Calculations of TACs

TACs have been calculated by one of two methods:

1) By arriving at up-to-date estimates of the state of the stocks and then projecting forward to determine catch levels in 1977.

2) For some stocks the data have been inadequate to enable this method to be employed. In these cases, precautionary TACs have been determined on the basis of previous catch levels.

3) For one of these stocks (Division VIb haddock) special problems were encountered and these are described below.

In the first category are included stocks of cod, haddock and whiting in Sub-area IV and Division VIa and also cod in Division VIIa. The remaining stocks under consideration are included in the second category.

Cod, Haddock and Whiting in Sub-area IV and Division VIa and Cod in Division VIIa

Details of the input data used for calculating TACs for these stocks are given in Tables 38-44. A worksheet showing an example of the method of computation used is given in Table 45.

The following input data were employed for the most recent year for which sufficient data were available (i.e. for 1975 in most cases):

1) Estimates of the total numbers landed at each age (Tables 9-15).

2) Mean weights at age (Tables 38-44).

3) Assumed values of the natural mortality rate.

4) The strengths of the recruiting year classes (Tables 35-44).

5) Values of F (the instantaneous fishing mortality rate) at each age, based on the use of VPA.

Numbers Landed

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

Cod	Sub-area IV (1975) :	Belgium, Denmark, England, France, Netherlands, Norway, Scotland
	Division VIa (1975):	England, Ireland, Scotland
	Division VIIa (1975):	England, Ireland
Haddock	Sub-area IV (1975) :	Belgium, Denmark, England, Netherlands, Norway, Poland, Scotland
	Division VIa (1975):	England, Ireland, Scotland
Whiting	Sub-area IV (1975) :	Belgium, England, Netherlands, Norway, Poland, Scotland, U.S.S.R.
	Division VIa (1974):	England, Scotland.

Netherlands data on the discarding of whiting in Sub-area IV were reviewed and estimates were made for 1975.

Mean Weights

The Working Group produced appropriate estimates of mean weight at age data from several national sources.

Natural Mortality Rate

For cod, in all areas, a constant value of M = 0.2 was used.

In the haddock and whiting assessments a proposal was made to investigate the effect of different values of M on the catch predictions. For these species, therefore, separate assessments were made using values of M = 0.2 and 0.4, the value of 0.4 being based on estimates made by Malkov and Yefremov using the method of Tjurin (1972). The estimates obtained using these two values of M were not found to affect the catch predictions significantly. The TACs finally adopted were therefore based on the average of the results from the two methods.

Year Class Strength

Estimates of year class strengths were provided from several sources. For cod, haddock and whiting in Sub-area IV, the estimates obtained by the two days' "Meeting Gadoid Data from the North Sea Young Herring Surveys" were made available and are given in Table 35 in addition to Scottish research vessel catches and VPA estimates. For haddock in Division VIa estimates of year class strength obtained from Scottish research vessel catches were updated (Table 37). From these data the best possible estimates of year class strength were used in the catch predictions.

Estimates of Fishing Mortality Rate in Recent Years

Values of F at each age were first obtained from the results of VPA. Input data consisted of:

a)   Estimates of the numbers landed at each age and annually which were revised and updated and which are shown in Tables 9-15.

b)   Terminal values of F for all age groups in 1975 and for the oldest age groups in each year.

Trial runs were made to investigate the effect on the VPA values of F, of adopting different input values of F for 1975. In each instance it was found that variations the 1975 input values of F had relatively little effect on the estimates of F and stock size for years up to about 1971. For subsequent years, however, the values of F and stock size were sensitive to the 1975 input values and cannot be regarded as reliable.

In order to arrive at estimates of F values for 1975, it was also necessary to take account of probable trends in fishing effort. The difficulties encountered underlined the urgent need for meaningful fishing effort data for each species (see Appendix I for further details). It was recommended therefore that members of the Working Group should collect data on recent trends in fishing effort for consideration at future meetings.

Cod, Haddock and Whiting in the Remainder of Sub-Areas VI and VII

For these stocks there were insufficient data for making catch predictions in the way described above. During a period of stability, average landings might be used as a means of predicting catches. However, post-war trends in landings have been far from stable (Figures 2 and 3) so that estimates by this method are not easily carried out. Furthermore, in the case of one stock (Division VIb haddock) a sudden increase in recorded landings from around 1 000 tons annually prior to 1972 to about 50 000 tons annually in 1974 and 1975 made it extremely difficult to arrive at catch predictions on the basis of average catch levels.

The Group considered these problems and suggested TACs on the following grounds:

1) Cod, haddock and whiting stocks (excluding VIb haddock)

   TACs were arrived at from an examination of the landings shown in
   Figures 2 and 3. It was agreed that there was little scientific
   basis for the values actually recommended, but that precautionary
   values should be recommended to avoid the danger of these grounds
   becoming exploited due to the possible diversion of fishing effort
   from other parts of the North Atlantic.

2) Haddock (Division VIb)

   A difficulty was experienced with this stock since the recorded
   landings of haddock in Division VIb rose dramatically to 49 000 tons
   in 1974 and to 51 000 tons in 1975, largely as a result of catches
   reported by the U.S.S.R. Since the area of Rockall Bank within the
   100 fm line is about 2 700 square miles, this amounts to an annual
   catch per square mile in these two years of approximately 18.5 tons.
   This is extremely high when compared with the 1.0 to 6.0 tons of
   haddock per square mile normally sustained from the North Sea. If
   the VIb haddock catches of 1974 and 1975 were made from an accumu-
   lated biomass, it seems unlikely that such high catch rates could be
   sustained. Furthermore, the removal of such large quantities might
   even have reduced the stock to a below-average level, in which case
   further heavy fishing might seriously endanger the stock.

   Direct evidence is scanty, although Scottish research vessel sampling
   suggests that haddock catch rates on Rockall Bank were of the same
   order as those around Scottish north and west coasts in 1968 (Table 32).
   This suggests that at that time at least there was not a relatively
   large unexploited haddock stock on Rockall Bank.

   The Group considered that the data on this matter were insufficient
   for making a reliable estimation of the TAC. As a precautionary measure there-
   fore it was decided to estimate a TAC for Division VIb haddock on
   the basis of average landings, but excluding the landings in 1974 and
   1975. The recommended value is 2 000 tons and this value has been in-
   cluded in the total given for Sub-area VI.

For none of the Sub-areas VI and VII stocks considered in this section is there
sufficient evidence for estimating the TAC necessary for estimating the levels
of fishing mortality required for maximising conditional sustainable yields
per recruit.

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

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

As an example, the TAC for the North Sea haddock has been assessed at 190 000
tons. Figure 4 shows a possible relationship between predicted catches and
fishing mortality in 1977, the fishing mortalities being expressed as a percen-
tage of current values. The figure shows, for example, that if the TAC should
really have been set at 160 000 tons, the recommended level of 190 000 tons
would lead to a 25% increase in fishing mortality if the whole of this catch was
taken. The effect on fishing mortality in 1977 of other incorrect TACs can
also be determined from this figure.

More generally, such a graph must always pass through the origin and rise
as symptotically 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.

Mixed Fisheries

The overlapping distributions of cod, haddock and whiting in the North Sea results
in a substantially mixed fishery. Appendix II (p. 10) summarizes some of the
theoretical work done on this subject.

Trends in Landings (Figs. 1-3 and Table 1)

Sub-area IV

The general trend for all species and areas was for landings to increase during
the post-war period until the late 1960s or early 1970s. Since then these
landings have tended to decline.

Cod

Cod landings have tended to increase since the War and reached a maximum of
346 000 tons in 1972. Since then, the landings have declined to 211 000 tons
in 1974.

Haddock

Haddock landings have also tended to increase since the War, the peak value attained
being 672 000 tons in 1970. Since then landings have decreased to a value of
193 000 tons in 1974.

Whiting

Whiting landings have tended to increase during the post-war period, reaching a
maximum of 216 000 tons in 1969. The value for 1974 was 188 000 tons.

Sub-area VI

Cod

Cod landings increased during the post-war period to a maximum of about 25 000 tons
in 1967. Since then landings have decreased and the value for 1974 is 15 000 tons.

Haddock

Haddock landings have increased during the period reaching a maximum of 70 000 tons
in 1975. The increase in 1974/75 was largely due to very large recorded catches
by U.S.S.R. vessels from Division VIb.

Whiting

Whiting landings increased to a maximum in 1967 of 20 000 tons. The
value for 1974 is 17 000 tons.

Sub-area VII

Cod

Cod landings increased to a maximum of 23 000 tons in 1967. Since then they have
declined to 18 000 tons in 1974.

Haddock

Haddock landings increased to a maximum of about 15 000 tons in 1964. The value
for 1974 was 10 000 tons.

Whiting

Whiting landings have tended to fluctuate irregularly during the post-war period.
The 1974 value was 28 000 tons.

For all three species and areas the data for 1975 are provisional and cannot necessarily be taken as reliable.

APPENDIX I

NOTES ON STOCK ASSESSMENT AND TAC CALCULATIONS

Cod

North Sea - Sub-area IV

Since TACs should be based upon the North Sea as a whole and the separation of catches according to Divisions as reported by several countries in "Bulletin Statistique" is incomplete, no stock assessments have been carried out for Divisions IVa and IVb,c separately, as was done in former years. The age distributions of the catches were raised to reported catches for these two areas separately, before they were added and raised to the total international catch from the North Sea. Landings by Norway and Sweden were excluded as in previous reports, except for landings from Recommendation 2 fisheries in 1975.

A. VPA (Table 16)

Three VPAs were run using different input values of F after a trial run to estimate the general level of fishing mortality in 1971, for which year the Fs obtained from VPA are hardly affected by the absolute values of the input Fs. The different assumptions underlying these three runs reflected three different possibilities of trends in fishing effort:

1. Fishing mortality in 1975 equals the values in 1971

2. Fishing mortality in 1975 is 20% higher than in 1971

3. Fishing mortality in 1975 is 20% lower than in 1971.

The weighted average Fs for the population older than 2 years obtained were:

	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
1	.57	.63	.60	.64	.61	.67	.59	.62	.89	.93	.74	.72	.78
2	.57	.63	.60	.64	.62	.67	.59	.63	.90	.95	.78	.78	.93
3	.57	.63	.60	.64	.61	.66	.58	.62	.87	.88	.66	.59	.59

These results indicate that fishing mortality dropped in 1973 and 1974 as compared with the peak mortalities in 1971 and 1972 under all three assumptions upon the F level in 1975. Other indications (English c.p.u.e. data) that mortality in 1975 decreased since 1974 lead to the selection of Run 3 as the most likely real situation since in this case estimated F values in 1974 were at least not lower than the input value.

B. Year class strengths

Predictive regressions of the VPA estimates of year class size (Run 3) were highly correlated with the IYHS survey indices (r = 0.95, Table 36). Although the confidence limits are rather wide due to the limited number of observations, the year class 1975 appears to be a poor one. Using the predictive regression, the size of this year class is estimated at 124 millions of 1-year old fish in year class 1975.

The year class 1976, which enters the fishery in 1977, was assumed to be of average size (230 millions of 1-year old fish), but alternative predictions were made for a poor and a good year class entering the exploited stock.

C. TACs (Table 38)

The values of the different parameters used in the catch predictions are given in Table 38. Numbers landed are the provisional figures available for 1975. F values for each age group were taken from the VPA for the year 1974 as the most recent set available to reflect the present exploitation pattern. Smoothed values were used for the older age groups. Weight at age data were the same as those used during the 1975 Working Group meeting, but in the prediction programme these were adjusted so that the simulated catch corresponds to the actual catch.

The predicted catch for 1977 on the basis of constant F at age pattern and an average year class 1976 (230 millions of 1-year old cod) is 170 000 tons. The alternative assumptions of a poor year class 1976 (115 million) and a rich year class 1976 (345 million) resulted in TACs of 168 000 and 181 000 tons respectively, indicating a very limited effect of the uncertainty about this year class.

Although fishing mortality rate on 2 and 3 year old cod is too high, the exploitation rate on older fish is approximately at the level required for maximising yield per recruits. Therefore an increase in mesh size applied in the cod fisheries without reducing effort seems appropriate (ICES, Doc. C.M.1974/F:5).

A TAC of 174 000 tons was selected by the Working Group as the most appropriate one, if the mesh size remains unchanged.

West of Scotland - Division VIa

A. VPA (Table 19)

Taking the F values from the VPA for the year 1971 as a reference level the input values of F in 1975 had to be increased considerably above this level in order to stabilise the F value in the period 1973-75. However, since catches in 1975 might not have been completely reported for this Division not too much attention was given to the estimated level of fishing mortality in those years. Nevertheless, the output is consistent with a general increase in fishing effort.

B. Year class strengths

No data are available for the size of the year classes 1975 and 1976. Thus, average values of the numbers of 1-year old cod in 1966-73 were used to simulate the 1977 catch.

C. TACs (Table 39)

Catch predictions were carried out on the assumption that the level of fishing mortality in 1975 was 20% higher than that estimated from VPA for 1971. Input values are shown in Table 39. The average weights were calculated from English mean length at age data for 1974 and 1975, using a generalised length/weight relationship ($W = 0.01 L^3$), and adjusted to generate the 1975 catch.

Alternative TACs were calculated on the assumption that the fishing mortality remained constant throughout 1975 to 1977 at a level 20% above the 1971 level and for the case that the fishing mortality was reduced again in 1977 to the level in 1971, after having been 20% above this level in 1975 and 1976. The values obtained for the catches in 1977 were 9 428 and 7 972 tons, respectively.

The TAC proposed by the Working Group was based on the reduction of fishing mortality in 1977 to the level in 1971.

Irish Sea - Division VIIa

A. VPA (Table 22)

A summary of English catches of cod in the Irish Sea made available to the Working
Group by K Brander was updated and revised by inclusion of Irish data for 1974 and
1975. The VPA indicated an approximate. constant mortality throughout the period
1968-75.

The F values chosen for predicting the 1977 catch were the averages per age group
for the period 1969-73.

B. Year class strengths

No estimates of year class strengths were available for the 1975 and 1976 year
classes, which thus had to be assumed to be of average size as estimated from the
numbers of 1-year old cod during the period 1968-73.

C. TACs

Input values are given in Table 40. Two alternative catch predictions using the
average exploitation pattern in 1969-73 for the period 1975-77 and a reduction by
20% in 1977 yielded catches of 7 658 and 6 529 tons respectively. The estimated
values of fishing mortality appear to be rather high by comparison with other areas,
and must be expected to be above the level required to maximise; yield per recruit.
Therefore, the TAC advised by the Working Group is based upon a reduction of the
fishing mortality by 20%.

Haddock

North Sea - Sub-area IV

A. VPA (Table 17)

A trial run was made to estimate the exploitation pattern for the latest reliable
period. By inspection, the period 1970-72 was chosen to provide a reference level
(RL).

For each of the two values of the natural mortality coefficient, $M = 0.2$ and $M = 0$,
3 VPA runs were made, using terminal values for 1975 of $F = RL$, $F = RL + 20\%$ and
$F = RL - 20\%$.

B. TACs (Table 41)

Catch prediction runs were then made by computer using the 6 arrays of F. The array
finally adopted for the TAC values was $F = RL$, since (a) this gave the most stable
recent F values in the VPA and (b) it seemed unlikely that F in 1975 and 1974 was
lower than in the period 1970-72.

For $M = 0.2$, two prediction runs were made, one in which F values were held con-
stant to give a TAC at current effort and a second in which F in 1977 was reduced
by 50% to the level approximating to the conditional sustainable yield (see yield
curve in ICES Doc. C.M.1974/F:5). For $M = 0.4$ it is probable that at the current
level of F, the yield/recruit should be close to the conditional sustainable level.

The prediction runs were made using both 1974 and 1975 catches as the starting point.
It was considered that for this species, the 1974 age compositions and catch data
were more reliable than the 1975 data; 1974 was therefore chosen as the starting
point in the calculations. It should be noted that 0-group fish were not included
in the predictions.

The recommended TAC is the average of 1977 catch predictions for $M = 0.2$ and $M = 0.4$
with F in 1977 held at the RL values.

C. <u>Year class strengths</u>

Values for the 1974 and 1975 year classes were obtained from the results of
the Young Herring Survey, using a plot of catch per hour against VPA numbers.
For the 1976 year class, an average VPA value for the year classes 1965-73 was
used, but the exceptional 1967 year class was excluded.

D. <u>Mean weights</u>

These values were provided by U.K. (Scotland).

<u>West of Scotland - Division VIa</u>

The same methods were used as in the previous section dealing with haddock
in the North Sea,   with the exception of the following:

<u>VPA</u> (Table 20) <u>and TAC</u> (Table 42)

For M = 0.2 a reduction of F of 30% was used for calculating the TAC at condi-
tional sustainable yield/recruit, assuming the same yield/recruit curve as in
the North Sea (Sub-area IV).

The recommended TAC is the same as that for Sub-area IV.

<u>Recruitment</u>

The 1974 year class was obtained from the results of Scottish research vessel
data. The 1975 year class was assumed to bear the same relation to the average
as in the North Sea. The 1976 year class was assumed to be average, the latter
being calculated from VPA using year classes 1964-73 and excluding the exceptional
1967 year class.

<u>Mean weights</u>

In the absence of better data, the same values as in the North Sea were used.

<div align="center">Whiting</div>

<u>North Sea - Sub-area IV</u>

As values of fishing mortalities for age groups the output from the VPA for the
year 1971 was chosen, these being the most reliable up-to-date values from the
analysis (Table 18).

The 1975 catches per age group include an estimated amount of Dutch discards
(no actual data were available and the mean age composition for 1973-74 was used).
Predicted catches were reduced by 7% to take account of Dutch discards.

The strength of the 1975 year class was estimated from a plot of size of stock
of 1-year old whiting from VPA on catch per hour in IYHS for year classes 1964-73.
For the year class 1976 a mean of the VPA values for the same year was used.

With these assumptions simulated catches were calculated using a) the same F
values for age groups through the years 1975-77 and b) the same values for
1975 and 1976 but reducing the F values in 1977 with 50% (Table 43). The
resulting values are probably very near to the values giving conditional sustainable
yield per recruit.

For M = 0.4 the same comments apply as for hadock.

<u>West of Scotland - Division VIa</u>

Divisions VIa and VIb were treated together using the length and age compo-
sition data from Division VIa.

The procedure was in principle the same as for Sub-area IV. The main difference
is that data for 1975 were not available so that the prediction had to be based
on catch composition for 1974. For this reason the prediction is less reliable.
(Details are given in Tables 21 and 44).

The strength of the year class 1974 is estimated from a plot of values of stock size for 1-year old whiting from VPA on catches from Scottish research vessels for year classes 1964-72 excluding 1966 and 1968.

The strengths of the year classes 1975 and 1976 were taken to be average of the years 1964-72.

APPENDIX II

by

J G Pope

MULTISPECIES PROBLEMS

Multispecies problems may be sub-divided into two parts. These are:

1) The mixed fishery problem, where a fishery for one species also catches another species in sufficient numbers to prejudice management.

2) The problem of interspecific interactions where the population of one species may, through predation or competition for some common resource, effect the population size of another species.

The former of these two problems is of more immediate concern to this Working Group since the North Sea roundfish clearly constitute a mixed fishery. This problem has already arisen in the more southerly ICNAF regions and investigations of this problem have been reported to that Commission. In particular, Garrod described the by-catch matrix approach. The by-catch matrix shows in tabular form the average effect of fishing for one species on another species.

A simple example is shown below:

Species caught (catch rate)	Species sought	
	A	B
A	10	5
B	2	8

The consequence of this particular matrix is that if a unit of effort is directed at species A it results not only in a unit of effort directed at species A but also the equivalent of a $\frac{1}{4}$ of a unit of effort directed at species B. Similarly, a unit of effort directed at species B will result in one unit of fishing effort on species B and also $\frac{1}{2}$ a unit of effort directed at species A. For ICNAF region 5 and statistical Area 6 the by-catch matrixes were estimated from the tables of the effort of each nation, vessel category and gear in each month. Using these data the species sought in each case was taken to be the species which contributed the largest proportion of the catch of the effort group. A similar analysis for the North Sea roundfish would require catch and effort data on this from at least and preferably in greater detail from all countries and fleets fishing these resources.

The consequences of a by-catch matrix such as that shown in the example are best shown graphically plotting resulting fishing mortalities for both species. If the catchability of both species was the same then Figure 5 shows the consequences of the example. The lines OA and OB represent the loci of fishing mortality generated by fisheries directed at species A and B respectively. It is clear that only those values of F_A and F_B which lay between the lines OA and OB can be realised in practise. If the F_{max} for species A was 0.2 and F_{max} for species B was 0.6 then it would not be possible to achieve the MSY of B without overfishing species A even if all fishing effort were directed at species B. Clearly, the more the distribution of species overlap the more mixed the fishery is likely to be and the more is it likely that problems in the simultaneous achievement of quotas arise.

The roundfish fisheries of the northern and central North Sea are very mixed and problems of this nature can be anticipated.

Brown et al. (1973, 1975) as Fukuda (1973) and Gundermann et al. (1974) investigate these problems and use linear programming techniques to maximise the total catch subject to the constraint that no species should be overfished. The drawback with this approach is that on occasions it may be necessary to restrict the catch of an important and numerous species in order to avoid overfishing some rather less numerous species.

In some cases it may be possible to circumvent these problems by reducing the mixture rate by closing areas or seasons where by-catch rates are highest. Where this is not possible it may be necessary to violate the TAC for one species in order to maximise the total yield of all species. Pope (1975) has shown that taking the maximum yield for two species may in circumstances similar to the example require that one species be overfished and the other species underfished. If such an adjustment in TAC was made the appropriate method would be to increase the one TAC by a percentage and to reduce the other TAC by the same percentage. It would, however, be prudent to restrict such manipulations to fairly small percentages.

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Table 1 Nominal catch of cod, haddock and whiting (metric tons) by Sub-area, 1966-1975 (Bulletin Statistique)

Sub-area		1966	1967	1968	1969	1970	1971	1972	1973	1974	1975a)
Cod	IVb)	219 702	249 803	285 314	199 035	224 742	320 031	346 311	235 502	210 849	177 056
	VI	18 651	25 210	25 022	24 272	13 557	10 839	17 154	11 670	14 566	13 147
	VII	22 580	23 129	20 270	21 509	15 102	20 924	15 541	17 753	18 124	14 621
Haddock	IVb)	268 958	167 408	139 469	639 175	671 831	257 915	213 247	195 779	193 406	198 315
	VI	31 816	21 176	21 372	27 398	35 018	46 370	50 024	31 953	66 930	65 512
	VII	9 655	7 343	3 726	5 392	5 931	7 252	7 849	11 608	10 695	8 129
Whiting	IVb)	155 153	91 245	144 920	215 829c)	181 506	112 239	108 774	142 938	188 388	147 739
	VI	18 787	19 709	14 474	12 550	12 499	14 775	13 218	15 329	16 925	17 287
	VII	25 873	33 123	29 691	26 821	15 710	17 022	16 707	20 765	27 981	24 719

a) Provisional figures

b) Sweden: IV includes IIIa 1966-1974

c) Correction received from France 9 April 1975. Original figure reported to Bulletin Statistique 8 802 tons, final figure 25 602 tons.

The catch from the German Democratic Republic was not included in Bulletin Statistique until 1973.

Table 2 COD   Sub-areas IV, VI and VII.   Nominal catch by Divisions in metric tons, 1966-1975
(Bulletin Statistique)

Year / Area	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975[a]
IVa	69 100	89 900	74 100	55 800	80 600	68 100	81 800	70 300	72 000	40 109
IVb	125 200	134 300	175 900	122 200	113 500	190 000	205 700	135 200	114 000	26 543
IVc	25 400	25 600	35 300	21 200	34 900	68 200	51 200	30 000	24 800	16 126
VIa	17 129	23 021	24 357	21 739	12 682	10 032	14 936	10 515	13 415	11 829
VIb	1 522	2 189	665	2 533	875	807	2 218	1 155	1 151	1 318
VIIa	6 437	13 973	10 055	8 823	7 182	9 698	8 244	10 057	10 212	8 495
VIIb,c	206	1 479	2 259	4 418	2 049	2 153	622	838	415	409
VIId,e	1 064	3 267	4 113	3 856	2 553	5 425	3 537	2 071	3 432	2 491
VIIf	-	-	-	-	-	-	657	387	1 003	943
VIIg-k	14 873	4 410	3 843	4 412	3 318	3 648	2 481	4 400	3 062	2 283
Total	260 931	298 139	330 592	244 981	257 659	358 063	381 395	264 923	243 490	110 546

a) Preliminary figures, based on the available breakdown by divisions

Table 3   HADDOCK   Sub-areas IV, VI and VII.   Nominal catch by Divisions in metric tons, 1966-1975
(Bulletin Statistique)

Year Area	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975[a]
IVa	197 300	122 500	75 300	271 900	459 300	201 600	140 500	131 500	128 400	95 093
IVb	71 300	44 800	62 700	361 800	212 600	58 200	75 300	62 300	63 600	46 204
IVc	400	100	1 400	5 400	3 500	2 600	3 100	2 000	1 100	577
VIa	29 881	20 302	20 469	26 273	34 178	45 323	40 152	28 535	17 744	14 185
VIb	1 935	874	903	1 125	840	1 047	9 872	3 418	49 186	51 327
VIIa	407	2 680	658	857	701	1 819	2 204	2 169	683	333
VIIb,c	245	787	433	758	1 922	2 315	1 125	1 036	2 199	2 892
VIId,e	37	111	88	811	421	164	390	345	618	372
VIIf	-	-	-	-	-	-	365	1 848	512	510
VIIg-k	8 966	3 765	2 547	2 966	2 887	2 954	3 765	6 210	6 683	4 022
Total	310 471	195 919	164 598	671 990	716 349	316 022	276 773	239 361	270 725	215 515

a) Preliminary figures, based on the available breakdown by divisions.

Table 4   WHITING   Sub-areas IV, VI and VII. Nominal catch by Divisions in metric tons   1966-1975
(Bulletin Statistique)

Year / Area	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975[a]
IVa	76 000	43 200	51 700	29 600	33 500	24 300	34 300	34 400	81 400	45 802
IVb	72 700	41 400	76 900	158 200	126 000	70 700	66 700	96 600	87 800	18 262
IVc	6 400	6 600	16 300	11 200	23 300	18 800	9 800	13 400	19 100	20 151
VIa	15 542	17 586	13 989	12 181	11 222	13 968	13 137	15 266	16 924	17 252
VIb	3 245	2 123	485	369	1 277	807	81	63	1	35
VIIa	6 527	20 475	14 615	12 580	6 840	7 476	6 328	9 414	9 461	8 539
VIIb,c	276	2 246	3 249	3 595	1 507	1 381	2 065	952	1 243	1 474
VIId,e	1 307	5 554	6 640	5 066	4 825	4 193	4 882	5 644	8 574	7 680
VIIf	-	-	-	-	-	-	232	301	1 624	1 680
VIIg-k	17 763	4 848	5 187	5 580	2 538	3 972	3 200	4 454	7 079	5 346
Total	199 760	144 032	189 065	238 371	211 009	145 597	140 725	180 494	233 206	126 221

a) Preliminary figures, based on the available breakdown by divisions.

Table 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
Denmark	1 202	3 140	8 332	3 601	8 213	1 076	5 189	1 313	4 215	2 498
Germany,Fed.Rep.of	6 731	–	4 125	970	555	54	?	?	–	1
Netherlands	579	463	8 199	–	?	–	5 931	67	7 679	–
Norway (IVa)	211	8	730	584	920	736	480	659	733	368
Poland[a]	–	–	181	6	189	23	?	?	?	?
Sweden[a]	–	–	–	–	–	–	–	–	8 260	–
U.K.(England)	–	–	–	–	–	–	–	–	6	–
U.K.(Scotland)[a]	–	–	–	–	–	–	–	–	726	–
Faroe Islands[a]	–	–	–	–	–	–	–	–	415	1
Total[b]	8 723	3 611	21 567	5 161	9 877	1 889	11 600	2 039	22 034	2 868

(Denmark and Germany 1970 braced with value 20)

Nominal catches of Haddock (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
Denmark	145	201	13 657	7 651	9 088	11 568	771	3 155	9 364	27 785
Germany,Fed.Rep.of	5 913	67	927	32	263	–	?	?	+	–
Netherlands	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	?	?	?	?
Sweden[a]	–	–	–	–	–	–	–	–	2 954	–
U.K.(Scotland)[a]	–	–	–	–	–	–	–	–	563	1 842
Faroe Islands[a]	–	–	–	–	–	–	–	–	20	186
Total[b]	14 642	1 919	23 113	10 020	12 131	14 518	3 914	7 258	18 517	32 169

Nominal catches of Whiting (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
Denmark	102	141	20 462	34 493	29 446	20 035	57 194	16 081	84 448	24 578
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
Norway (IVa)	789	484	995	610	1 254	769	1 322	166	4 710	?
Poland[a]	–	–	2	–	–	–	?	–	?	?
Sweden[a]	–	–	–	–	–	–	–	–	860	–
U.K.(Scotland)[a]	–	–	–	–	–	–	–	–	1 448	559
Faroe Islands[a]	–	–	–	–	–	–	–	–	31	494
Total[b]	6 475	746	25 575	35 222	31 626	20 988	60 669	16 261	95 778	25 384

a) IIIa inclusive
b) Total available data only
c) excluded from totals

Table 6   Nominal catch of Cod for Divisions IVa-IVc by
           Country in metric tons, 1970-1975 (Bulletin
           Statistique)

Country	1970	1971	1972	1973	1974	1975[a]
Belgium	8 076	19 334	21 133	11 741	10 253	6 420
Denmark	40 017	68 179	72 520	47 950	54 207	46 989
England	38 464	55 525	62 503	47 327	39 857	32 554
Faroe Islands	78	123	284	803	416	c)
France	16 058	24 254	23 507	14 373	6 853	4 764
German Dem.Rep. [b]	3	18	122	343	132	223[d]
Germany, Fed.Rep.	20 093	46 647	49 431	21 410	17 089	13 806
Iceland	0	1	-	-	+	-
Netherlands	25 212	46 614	47 634	25 758	24 029	21 790
Norway	5 374[f]	7 732[f]	4 377[f]	4 831	2 461	2 767
Scotland	30 079	37 229	55 190	48 844	39 887	37 329
Sweden	8 925[d]	9 062[d]	8 769[d]	8 074[d]	8 168[d]	965(6 273[d])
Poland	219	178	189	1 551	4 750	2 991
USSR	32 147	5 153	774	2 497	2 667	6 413
Total	224 745	320 049	346 433	235 502	210 769	177 011[e]

a) Preliminary

b) The catch for the German Democratic Republic was not included in
   Bulletin Statistique until 1973

c) Data lacking for 1975

d) Including IIIa

e) Spain reported 45 tons caught in 1975 and 80 tons 1974

f) The figures do not include cod caught in Recommendation 2 fisheries.

Table 7   Nominal catch of Haddock for Divisions IVa-IVc by
country in metric tons, 1970-1975 (Bulletin Statistique)

Country	1970	1971	1972	1973	1974	1975[a]
Belgium	3 691	971	1 601	2 385	1 137	1 778
Denmark	158 276	31 043	34 858	13 118	44 342	33 262
England	19 500	16 648	20 827	16 586	10 798	10 823
Faroe Islands	--	--	5	1 198	435	b)
France	10 392	8 436	7 595	4 496	3 892	3 190
German Dem.Rep.	--	--	--	22	8	44[c]
Germany,Fed.Rep.of	5 075	3 045	4 020	4 587	2 478	1 869
Iceland	0	1	--	--	--	--
Netherlands	8 278	6 914	5 188	3 185	3 035	1 859
Norway	963[d]	1 063[d]	1 146[d]	5 611	6 059	17 572
Scotland	112 952	121 539	96 197	88 132	71 679	65 063
Sweden	8 704[c]	5 857[c]	5 305[c]	4 550[c]	3 098[c]	2 493(2 946[c])
Poland	--	--	38	2 553	3 001	1 485
USSR	344 000	62 398	36 467	49 356	42 234	58 787
Total	671 831	257 915	213 247	195 779	193 196	198 225[e]

[a] Preliminary

[b] Data Lacking for 1975

[c] Including IIIa

[d] Figures do not include Haddock caught in Recommendation 2 Fisheries

[e] Spain reported 90 tons caught in 1975 and 210 tons caught in 1974.

Table 8 Nominal catch of Whiting for Divisions IVa-IVc by
country in metric tons, 1970-1975 (Bulletin Statistique)

Country	1970	1971	1972	1973	1974	1975[a]
Belgium	2 799	2 108	2 745	3 387	3 156	2 729
Denmark	102 698	55 618	50 109	73 928	109 654	61 948
England	3 398	4 158	3 789	4 592	5 518	4 654
Faroe Islands	-	-	-	1 453	1 126	b)
France	25 842	15 863	19 171	22 219	19 537	13 268
German Dem.Rep.	-	-	-	5	-	3[c]
Germany, Fed.Rep.of	392	233	264	403	454	832
Netherlands	10 115	6 322	7 613	8 811	12 057	14 481
Norway	43[d]	25[d]	28[d]	1 527	5 080	13 856
Scotland	21 080	26 755	23 846	20 756	25 274	27 826
Sweden	820[c]	616[c]	596[c]	2 328[c]	2 440[c]	281(808[c])
Poland	-	-	-	7	1 002	888
USSR	14 319	541	613	3 522	2 978	6 923
Total	181 506	112 239	108 774	142 938	188 277	147 689[e]

[a] Preliminary

[b] Data lacking for 1975

[c] Including IIIa

[d] Figures do not include Whiting caught in Recommendation 2 fisheries

[e] Spain reported 50 tons caught in 1975 and 111 tons in 1974.

Table 9   North Sea Cod. Divisions IVa, b and c. Catch in numbers (1 000 fish) by year and by age

Age	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
1	18 622	47 311	40 500	75 633	65 388	9 941	5 109	47 304	61 248	6 306	33 958	15 679	20 087
2	37 798	23 681	68 149	65 705	81 282	79 589	23 009	27 373	148 888	195 570	30 686	53 414	46 464
3	6 192	15 967	1 441	26 341	26 741	36 676	31 590	16 392	14 362	43 630	52 881	11 772	17 232
4	3 069	3 439	6 715	5 896	9 265	11 078	14 959	12 179	5 943	5 086	13 221	15 145	4 281
5	2 360	1 513	1 783	2 513	2 698	5 623	5 190	6 867	6 018	2 402	1 913	4 387	7 787
6	1 404	1 652	873	1 065	1 750	1 275	2 842	1 963	2 390	2 797	1 043	972	2 139
7	67	433	510	409	655	623	688	1 051	759	1 446	992	471	458
8	485	99	275	362	304	314	379	207	393	544	488	372	224
9	4	390	14	77	148	154	170	221	182	338	38	309	252
10	5	1	81	64	36	103	54	136	82	102	41	65	93
11	1	1	1	25	2	21	110	46	53	5	64	35	50
12	2	2	4	8	6	9	17	24	26	11	73	27	16

Table 10 North Sea Haddock. Divisions IVa, b and c. Catch in numbers (1 000 fish) by year and by age.

Age	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970
1	32 500	30 800	29 700	69 200	199 600	2 000	73 000	11 700	102 000	376 000	96 500	6 300
2	17 200	117 400	64 300	23 700	118 100	430 500	3 700	6 700	25 400	190 100	1 728 500	119 100
3	8 400	9 900	66 000	32 700	13 500	146 400	460 800	17 700	3 300	26 700	181 800	1 501 100
4	79 700	6 000	3 900	18 600	12 200	17 100	33 200	410 500	6 700	2 300	26 800	34 600
5	14 500	23 200	2 300	1 200	6 500	9 500	6 800	24 600	194 800	2 200	5 200	5 600
6	3 400	3 000	7 400	700	500	4 300	3 800	4 300	4 800	66 100	2 300	2 500
7	2 200	1 000	800	3 400	400	300	700	400	500	600	42 500	1 200
8	300	400	400	300	900	500	300	80	300	70	5 100	2 600
9	30	50	60	30	10	60	20	5	40	10	10	20
10	10	10	10	4	10	10	10	1	3	6	1	3

Age	1971	1972	1973	1974	1975
0	–	161 900	41 800	387 000	32 600
1	48 300	194 900	22 000	241 200	407 000
2	22 700	222 200	265 200	78 100	198 500
3	37 500	27 400	240 900	252 100	51 000
4	372 300	20 100	9 000	49 000	122 500
5	11 400	147 500	6 100	2 600	20 300
6	700	3 300	1 600	1 100	1 100
7	200	100	40	9 600	800
8	1 800	400	1	200	4 600
9	900	8	4	20	200
10	200	100	20	40	70

Table 11   North Sea Whiting.   Divisions IVa, b and c.   Catch in numbers (1 000 fish) by year and by age

Age	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
0	35 800	26 864	191 789	134 199	1 115 820	1 046 260	954 802	465 242	196 142	476 625	14 393
1	80 050	267 347	153 438	442 578	502 496	485 073	229 151	662 951	708 680	876 658	1 015 220
2	53 023	187 031	94 117	250 033	502 217	146 747	38 077	152 941	362 632	654 566	375 394
3	222 525	72 901	77 020	71 144	107 715	290 755	17 660	33 888	85 616	164 728	180 766
4	61 271	188 881	22 638	37 496	26 911	31 392	102 669	6 153	17 866	28 654	44 952
5	8 466	33 896	58 305	9 976	8 419	9 828	11 250	50 548	5 768	4 572	7 441
6	3 873	3 226	7 386	23 534	3 758	3 830	2 162	5 633	17 680	1 766	1 556
7	928	1 540	913	2 173	7 042	457	795	843	2 608	5 378	650
8	141	451	150	138	3 499	1 673	662	575	635	578	2 009

Table 12 Cod. Division VIa. Catch in numbers (1 000 fish) by year and by age

Age	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
1	81	101	222	84	92	315	224	131	741	274
2	1 119	1 004	859	986	272	831	2 301	432	1 876	1 724
3	452	1 427	1 862	970	944	492	1 085	1 090	766	1 044
4	459	141	1 296	1 519	457	667	491	444	891	380
5	280	140	112	624	356	207	412	124	239	186
6	23	104	121	104	133	174	92	138	54	50
7	16	21	72	84	24	64	73	36	53	8
8	2	12	18	53	39	34	48	40	22	14

Table 13 Haddock. Division VIa. Catch in numbers (1 000 fish) by year and by age

Age	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
1	5	278	516	9 311	1	230	2 448	590	1 208	1 996	301
2	1 654	359	11 419	7 387	48 921	164	2 844	22 221	6 520	3 740	9 963
3	84 419	1 164	1 239	3 234	5 928	71 520	6 627	2 225	15 648	10 353	4 415
4	4 697	47 424	238	418	1 386	3 795	91 387	2 897	263	5 626	6 387
5	206	1 606	18 775	586	350	211	590	56 846	1 147	108	3 946
6	169	76	252	11 729	576	92	86	612	31 836	504	172
7	139	30	20	655	3 386	98	6	37	139	11 259	170
8	23	102	28	36	150	453.	97	57	114	208	8 909

Table 14 Whiting. Division VIa. Catch in numbers (1 000 fish) by year and by age

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

Table 15 Cod. Division VIIa. Catch in numbers (1 000 fish) by year and by age

Age	1968	1969	1970	1971	1972	1973	1974	1975
1	381	890	913	2 610	699	1 925	532	716
2	1 637	1 492	1 725	2 076	2 912	907	3 382	590
3	1 050	1 057	347	780	746	1 527	562	1 270
4	478	271	213	170	223	373	492	211
5	186	188	230	70	56	145	125	124
6	28	76	45	47	34	53	40	29
7	1	36	17	18	13	25	40	14

Table 16 North Sea Cod. Divisions IVa, b and c. Fishing mortalities by year and by age (M = 0.2)

Age	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
1	0.29	0.25	0.22	0.31	0.29	0.12	0.07	0.15	0.14	0.08	0.23	0.13	0.12
2	0.63	0.71	0.69	0.67	0.63	0.68	0.46	0.58	0.94	0.91	0.68	0.68	0.72
3	0.40	0.60	0.08	0.63	0.65	0.66	0.65	0.72	0.71	0.81	0.68	0.62	0.48
4	0.44	0.41	0.55	0.54	0.48	0.62	0.62	0.56	0.62	0.59	0.63	0.42	0.48
5	0.42	0.41	0.38	0.41	0.51	0.60	0.68	0.65	0.60	0.56	0.46	0.44	0.40
6	0.74	0.59	0.44	0.42	0.57	0.49	0.71	0.60	0.50	0.63	0.50	0.45	0.40
7	0.21	0.53	0.36	0.38	0.49	0.41	0.54	0.63	0.50	0.65	0.48	0.45	0.40
8	0.56	0.53	0.77	0.47	0.54	0.46	0.47	0.31	0.52	0.83	0.48	0.34	0.40
9	0.17	1.28	0.13	0.51	0.36	0.58	0.49	0.57	0.49	1.21	0.12	0.64	0.40
10	0.45	0.06	1.07	1.44	0.48	0.46	0.41	0.94	0.42	0.57	0.44	0.30	0.40
11	1.42	0.15	0.08	1.29	0.13	0.58	1.36	0.75	1.35	0.04	0.88	0.83	0.40
12	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.40	0.40	0.40	0.40
Mean F = >2 [x]	0.57	0.63	0.60	0.64	0.61	0.66	0.58	0.62	0.87	0.88	0.66	0.59	0.59

[x] Means weighted by stock numbers

Table 17   North Sea Haddock. Divisions IVa, b and c.   Fishing mortalities by year and by age (M = 0.2)

Age	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
0	-	-	-	-	-	-	-	-	-	-	-	-	-	0.42	0.04	0.12	0.01
1	0.10	0.16	0.24	0.13	0.07	0.03	1.17	0.09	0.16	0.07	0.32	0.06	0.06	0.17	0.09	0.33	0.18
2	0.56	0.64	0.56	0.31	0.33	0.22	0.08	0.29	0.29	0.49	0.50	0.83	0.35	0.43	0.37	0.53	0.50
3	0.46	0.74	0.94	0.63	0.29	0.89	0.38	0.61	0.23	0.57	1.31	1.13	0.68	0.93	1.20	0.73	0.80
4	0.98	0.72	0.76	0.78	0.51	0.74	0.51	0.68	0.50	0.24	2.53	1.00	1.01	1.02	0.95	0.87	1.00
5	1.30	0.90	0.68	0.56	0.70	0.98	0.75	0.91	0.83	0.30	1.37	0.39	1.17	1.78	1.06	0.83	1.20
6	1.03	1.12	0.85	0.45	0.48	1.62	1.61	1.92	0.44	0.77	0.59	0.43	1.13	1.51	0.07	0.54	1.10
7	1.56	1.04	1.11	1.35	0.50	0.60	1.63	0.73	1.74	0.09	2.29	0.09	0.30	0.46	0.05	0.73	1.00
8	1.57	1.80	2.12	2.40	2.38	3.00	3.31	0.87	3.11	1.62	2.71	1.12	3.73	1.88	0.01	0.42	1.00
9	1.14	1.51	2.44	1.14	0.54	1.65	2.74	0.81	1.77	2.11	1.24	0.07	2.02	0.26	0.07	0.19	1.00
10	0.80	0.80	0.80	0.80	0.80	0.80	0.80	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Mean F = >2[*]	0.89	0.69	0.73	0.53	0.35	0.30	0.38	0.68	0.68	0.54	0.57	1.10	0.92	0.74	0.60	0.69	0.68

[*] Means weighted by stock numbers

Table 18   North Sea Whiting. Divisions IVa, b and c. Fishing mortalities by year and by age (M = 0.2)

Age	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
0	0.05	0.03	0.08	0.14	0.90	0.86	0.42	0.17	0.07	0.13	0.42
1	0.17	0.63	0.24	0.27	1.13	1.44	0.45	0.58	0.41	0.47	0.46
2	0.30	0.71	0.47	0.76	0.56	1.37	0.38	0.63	0.73	0.83	0.38
3	0.46	0.86	0.74	0.82	0.90	0.76	0.57	0.68	0.90	0.91	0.58
4	0.63	0.92	0.73	1.06	0.87	0.73	0.68	0.40	0.98	0.92	0.68
5	0.91	0.88	0.84	0.85	0.74	0.97	0.64	0.87	0.83	0.75	0.65
6	1.00	1.15	0.48	1.03	0.95	0.92	0.58	0.78	0.90	0.66	0.62
7	0.66	1.72	1.38	0.25	1.06	0.27	0.49	0.47	1.11	0.79	0.54
8	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Mean F => 2[x]	0.46	0.82	0.63	0.80	0.62	0.91	0.57	0.67	0.77	0.85	0.45

[x])Means weighted by stock numbers

Table 19 Cod. Division VIa. Fishing mortalities by year and by age (M = 0.2)

Age	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
1	0.01	0.02	0.04	0.03	0.02	0.05	0.08	0.02	0.13	0.10
2	0.19	0.16	0.28	0.26	0.15	0.28	0.54	0.21	0.56	0.50
3	0.50	0.39	0.49	0.60	0.42	0.44	0.71	0.54	0.72	0.70
4	0.56	0.29	0.73	0.97	0.64	0.59	1.07	0.74	1.24	1.00
5	0.59	0.33	0.39	1.00	0.63	0.69	0.92	0.91	1.24	1.00
6	0.34	0.45	0.53	0.78	0.60	0.74	0.76	0.95	1.50	1.00
7	0.65	0.59	0.66	0.90	0.41	0.66	0.83	0.80	1.33	1.00
8	0.65	0.65	0.65	0.65	0.65	0.75	0.75	0.75	1.00	1.00
Mean F = >2[*]	0.30	0.26	0.48	0.59	0.40	0.43	0.66	0.48	0.75	0.62

Table 20 Haddock. Division VIa. Fishing mortalities by year and by age (M = 0.2)

Age	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
1	-	0.01	0.02	0.01	-	0.03	0.03	0.01	0.07	0.04	0.03
2	0.30	0.11	0.95	0.37	0.10	0.01	0.52	0.41	0.19	0.30	0.30
3	0.55	0.35	0.63	0.80	0.58	0.21	0.67	1.06	0.58	0.51	0.70
4	0.79	0.69	0.11	0.45	1.03	0.93	0.45	0.70	0.32	0.42	0.70
5	0.70	0.69	0.66	0.44	0.88	0.41	0.35	0.56	0.68	0.21	0.60
6	1.07	0.61	0.21	1.22	1.07	0.60	0.29	0.75	0.72	0.74	0.60
7	0.65	0.54	0.32	1.36	1.78	0.52	0.07	0.20	0.37	0.61	0.60
8	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60
Mean F = >2[*]	0.55	0.66	0.71	0.72	0.13	0.21	0.46	0.53	0.54	0.49	0.48

[*]Means weighted by stock numbers

Table 21   Whiting.   Division VIa.   Fishing mortalities by year and by age (M = 0.2)

Age	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974
1	0.05	0.02	0.08	0.04	0.05	0.03	0.09	0.16	0.11	0.09
2	0.62	0.47	0.86	0.56	0.17	0.30	0.63	0.51	0.77	0.63
3	0.44	0.76	0.92	1.03	0.69	0.32	0.99	0.65	0.83	0.99
4	0.76	0.63	0.67	0.95	0.99	0.82	0.62	0.94	0.88	0.65
5	0.93	0.63	0.99	0.45	1.15	0.94	0.65	0.58	1.45	0.65
6	0.45	0.71	0.67	0.88	0.33	0.58	0.87	0.84	0.51	0.87
7	1.60	0.46	0.69	0.50	0.96	0.06	0.24	0.50	0.94	0.24
8	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60
Mean F = >2$^{\maru}$)	0.47	0.64	0.94	0.95	0.78	0.36	0.66	0.62	0.70	0.77

Table 22   Irish Sea Cod.   Divisions VIIa.   Fishing mortalities by year and by age (M = 0.2)

Age	1968	1969	1970	1971	1972	1973	1974	1975
1	0.12	0.20	0.18	0.31	0.24	0.23	0.34	0.30
2	0.63	0.90	0.71	0.77	0.69	0.57	0.79	0.80
3	0.85	1.15	0.54	0.84	0.71	1.00	0.87	0.80
4	0.89	0.55	0.76	0.56	0.61	0.99	1.12	1.00
5	0.94	1.17	1.36	0.61	0.36	1.10	1.17	1.00
6	0.46	1.46	1.05	1.30	0.70	0.69	1.14	1.00
7	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Mean F = >2$^{\maru}$)	0.73	0.96	0.73	0.77	0.68	0.83	0.84	0.83

$^{\maru}$) Means weighted by stock numbers.

Table 23 North Sea Cod. Division IVa+bc. Stock in numbers at beginning of year (M = 0.2).

Age	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
1	82 428	234 402	223 132	315 660	285 899	93 885	88 267	376 846	500 977	89 415	182 323	137 822	195 600
2	88 303	50 744	149 352	146 235	190 464	175 290	67 905	67 657	265 910	354 971	67 518	118 715	98 707
3	20 563	38 505	20 403	61 413	61 029	83 271	72 426	34 970	30 903	85 258	116 581	27 870	49 479
4	9 408	11 279	17 245	15 405	26 732	26 068	35 402	31 064	13 997	12 478	30 914	48 214	12 292
5	7 545	4 950	6 149	8 108	7 334	13 583	11 438	15 609	14 532	6 146	5 666	13 491	25 888
6	2 938	4 061	2 695	3 434	4 384	3 588	6 092	4 729	6 643	6 516	2 882	2 924	7 111
7	394	1 153	1 847	1 424	1 856	2 023	1 795	2 450	2 116	3 297	2 834	1 425	1 523
8	1 244	262	556	1 054	799	932	1 098	854	1 066	1 053	1 407	1 431	745
9	28	584	126	210	538	382	482	559	513	521	377	715	838
10	15	19	133	90	103	308	175	242	260	257	127	274	309
11	1	8	15	37	18	52	160	95	77	139	119	67	166
12	0	0	6	11	8	13	24	34	36	16	109	40	24

Table 24 North Sea Haddock. Division IVa+bc. Stock in numbers at beginning of year (M = 0.2).

Age	1959	1960	1961	1962	1963	1964	1965	1966
1	367 702	234 201	151 660	637 623	3 202 690	70 170	114 798	146 878
2	43 910	271 741	163 998	97 448	459 664	2 442 050	55 645	29 279
3	24 814	20 556	117 542	76 720	58 485	270 242	1 611 890	42 220
4	138 395	12 786	7 996	37 526	33 578	35 747	90 920	906 035
5	21 571	42 457	5 112	3 067	14 134	16 563	14 006	44 700
6	5 738	4 833	14 110	2 131	1 437	5 768	5 114	5 400
7	2 996	1 678	1 296	4 960	1 117	728	936	841
8	407	514	486	351	1 055	556	328	150
9	48	69	70	48	26	80	23	10
10	13	13	13	5	13	13	13	1

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Age	1967	1968	1969	1970	1971	1972	1973	1974	1975
1	767 650	6 310 650	387 582	110 748	906 515	1 362 940	279 024	938 916	2 717 860
2	109 701	536 601	4 827 460	230 615	84 988	698 605	940 323	208 603	552 030
3	17 948	66 982	268 997	2 403 780	82 673	49 194	372 668	531 774	100 851
4	18 739	11 725	30 949	59 437	636 657	34 191	15 899	91 693	210 359
5	375 123	9 339	7 530	2 027	17 913	190 416	10 134	5 012	31 435
6	14 704	133 543	5 669	1 570	1 121	4 561	26 329	2 881	1 787
7	651	7 735	50 381	2 583	837	297	824	20 113	1 374
8	331	94	5 791	4 171	1 935	506	153	639	7 899
9	52	12	15	315	1 109	38	63	125	343
10	4	7	1	4	240	120	24	48	84

Table 25   Whiting. North Sea. Division IVa+bc.
Stock in numbers at beginning of year (M = 0.2).

Age	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
※ 0	802 819	1 002 470	2 707 300	1 129 420	2 050 590	1 979 030	3 068 430	3 341 140	3 330 570	4 207 060	45 983
1	575 737	624 980	796 494	2 043 540	803 749	685 596	688 342	1 655 650	2 316 390	2 549 860	3 014 850
2	226 480	399 261	272 682	514 056	1 275 110	212 386	133 111	358 117	762 338	1 260 640	1 301 900
3	661 591	137 765	159 913	138 899	197 797	594 506	44 208	74 800	156 469	300 488	448 859
4	143 742	342 174	47 857	62 198	50 309	66 058	227 358	20 392	30 971	51 901	99 404
5	15 437	62 907	112 064	18 975	17 631	17 224	26 065	94 432	11 174	9 475	16 994
6	6 667	5 104	21 324	39 798	6 648	6 922	5 363	11 293	32 301	4 008	3 678
7	2 102	2 016	1 319	10 839	11 677	2 101	2 259	2 457	4 222	10 709	1 704
8	279	892	297	273	6 919	3 308	1 309	1 137	1 256	1 143	3 973

※ 0-group estimates are national figures extrapolated to the beginning of the age group.

Table 26 Cod. Division VIa. Stock in numbers at beginning of year (M=0.2)

Age	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
1	9 335	4 766	6 101	2 736	4 672	7 665	3 262	6 024	6 672	3 172
2	7 198	7 570	3 811	4 795	2 164	3 742	5 991	2 469	4 814	4 794
3	1 249	4 886	5 293	2 348	3 039	1 527	2 316	2 845	1 632	2 262
4	1 167	618	2 719	2 665	1 054	1 641	809	928	1 354	653
5	689	544	379	1 070	831	455	747	226	363	319
6	88	313	320	210	321	362	188	245	75	86
7	37	52	163	154	79	144	141	71	78	14
8	3	16	24	69	51	43	61	51	26	17

Table 27 Haddock. Division VIa. Stock in numbers at beginning of year (M=0.2)

Age	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
1	4 791	24 974	32 526	697 407	22 413	9 575	90 446	51 521	20 616	53 746	11 231
2	7 047	3 918	20 196	26 164	562 580	18 349	7 632	71 841	41 649	15 789	42 202
3	218 906	4 282	2 884	6 379	14 789	416 484	14 875	3 702	38 883	28 228	9 565
4	9 402	103 654	2 461	1 254	2 339	6 804	276 606	6 258	1 055	17 834	13 838
5	446	3 510	42 510	1 800	652	684	2 195	144 525	2 536	627	9 554
6	279	181	1 439	18 027	948	222	371	1 267	67 451	1 052	416
7	318	78	81	951	4 371	265	99	226	451	26 806	412
8	31	136	37	48	200	604	129	76	152	277	11 879

Table 28 Whiting. Division VIa. Stock in numbers at beginning of year (M=0.2)

Age	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974
0*	72 339	74 341	273 133	17 711	27 925	43 060	97 955	166 915	118 458	443
1	48 796	59 226	60 865	223 622	14 501	22 863	35 255	80 199	136 659	96 986
2	11 433	37 930	47 473	45 988	176 733	11 255	18 090	26 483	55 694	100 157
3	126 092	5 018	19 460	16 439	21 405	121 611	6 809	7 916	13 032	21 103
4	10 809	66 310	1 919	6 362	4 816	8 814	72 329	2 076	3 400	4 648
5	1 409	4 123	29 035	806	2 022	1 460	3 193	31 718	661	1 153
6	206	456	1 796	8 872	420	524	468	1 368	14 516	127
7	249	107	183	753	3 015	246	241	161	486	7 144
8	29	41	56	75	375	949	189	155	80	155

*)0-group estimates are national figures extrapolated to the beginning of the age group

Table 29 Irish Sea Cod. Division VIIa. Stock in numbers at beginning of year (M=0.2)

Age	1968	1969	1970	1971	1972	1973	1974	1975
1	3 759	5 510	6 155	10 663	3 551	10 361	2 009	3 033
2	3 835	2 734	3 710	4 217	6 385	2 279	6 751	1 167
3	2 002	1 677	910	1 497	1 601	2 626	1 054	2 511
4	881	704	435	435	531	645	793	362
5	333	295	334	167	204	235	196	213
6	83	107	75	70	74	116	64	50
7	1	43	20	22	16	30	48	17

Table 30 North Sea Cod, Haddock and Whiting. Total numbers ('000) at each length group landed quarterly by Norway in 1975[a].

COD	Quarter				
Length group	1	2	3	4	Total
15-19	-	-	-	68	68
20-24	302	230	50	128	710
25-29	504	91	14	70	679
30-34	369	431	50	63	913
35-39	468	245	7	78	798
40-44	122	139	18	10	289
Total	1 765	1 136	139	418	3 457
HADDOCK					
Length group					
5-9	168	495	542	436	1 641
10-14	32 757	4 328	2 528	7 786	47 399
15-19	15 295	16 648	3 013	4 048	39 004
20-24	4 315	3 174	2 682	5 509	15 680
25-29	2 476	4 167	1 616	2 515	10 774
30-34	607	1 020	624	1 120	3 371
35-39	76	580	258	354	1 268
40-44	24	103	41	97	265
Total	55 718	30 515	11 304	21 865	119 402
WHITING					
Length group					
5-9	4		85		89
10-14	1 604	176	153	181	2 114
15-19	13 168	2 995	382	30	16 575
20-24	6 985	6 842	775	403	15 005
25-29	5 131	10 764	2 051	4 130	22 076
30-34	2 494	4 417	1 547	5 078	13 536
35-39	772	2 497	928	3 676	7 873
40-44	85	881	333	1 239	2 538
Total	30 243	28 572	6 254	14 737	79 806

a) Measurements from Recommendation 2 fisheries only.

Table 31 Length composition data for Gurnards (Scotland 1975).

Numbers measured on Aberdeen fish market (1975)

Length	Outer Hebrides	Butt of Lewis	North Coast	Total
20				
21			1	1
22				
23				
24				
25				
26			1	1
27				
28	1		1	2
29	4		6	10
30	6	2	8	16
31	6	2	14	22
32	8		9	17
33	7	13	11	31
34	15	9	14	38
35	14	5	14	33
36	12	5	9	26
37	9	10	7	26
38	9	3	6	18
39	9	9	6	24
40	2	12	1	15
41	5	8		13
42	3	5		8
43	1	3		4
44		3		3
45	1	2		3
46				
47				
48		1		1
57		1		1

Fish measured by observers on board commercial vessels (1975)

Cruise	Length Range
1	14-21
2	18-35
3	15-25
4	14-39
5	16-36
6	14-43
7	18-33
8	21-35
9	20-36
10	19-38
11	22-25
12	17-34
13	20-22
14	15-25

Table 32   Numbers of Haddock caught per 10 hours' fishing by F.R.S.
"Explorer" at Rockall and off the north and west coasts
of Scotland in 1968.

Year class	Mar.	Apr.	May	Oct.
1968	-	-	-	21 302
1967	18	40	77	139
1966	17	2	16	13
1965	65	83	89	42
1964	49	71	64	71
1963	108	137	11	22
1962	132	87	34	17
1961	63	57	51	24
1960	111	38	34	10
1959	39	2	20	1
1958 & older	14	5	4	2
Total	616	522	400	21 643

Year class	Area				
	North Coast	North Minch	Outer Hebrides	South Minch	South of Lat. 56°N
1968	67	3	0	0	0
1967	3 397	4 700	3 780	526	2 725
1966	331	500	60	46	10
1965	32	71	0	11	0
1964	24	8	3	2	0
1963	43	9	7	2	0
1962	231	361	80	88	0
1961 & older	4	34	10	10	0
Total	4 129	5 686	3 940	685	2 735

From Annales Biologiques

Table 33   TAC's for maintaining the level of fishing mortality
at the same level as in recent years.

Sub-areas	Cod	Haddock		Whiting	
	M = 0.2	M = 0.2	M = 0.4	M = 0.2	M = 0.4
IV	174 000	173 000	203 000	134 000	125 000
VI	10 700	-	-	20 200	21 400
VII	15 000	6 505[a]		20 000[a]	
Divisions & Sub-area					
VIa	9 450	10 200	8 900	-	-
VIb	1 300	2 000[a]		-	-
VIIa	7 500	-	-	-	-
VII (excluding VIIa)	7 500[a]	-	-	-	-

a) Estimates based on post landings and therefore dependant of M.

Table 34 TACs for adjusting fishing effort in 1977 to a
level required for improving yield per recruit.
(M = 0.2 for all species[a]))

Sub-area & Divisions	Cod	Haddock	Whiting
IV	146 000	103 000	· 76 000
VIa	8 000	7 800	12 000
VIIa	6 500	-	-

a) For haddock and whiting, with M = 0.4, current levels of
fishing mortality should approximately achieve the
conditional sustainable yield per recruit. For these
species, the TACs for maximising the conditional yields
per recruit are therefore the same as the TACs given in
Table 33 under the assumption of M = 0.4.

Table 35 Revised estimates of year class strength.

Year class	COD		HADDOCK				WHITING			
	IVb,c IYHS a)	IVa,b,c VPA b) M = 0.2	IV CPUE c)	IV IYHS a)	IV VPA b) M = 0.2	IV VPA b) M = 0.4	IV CPUE c)	IVb,c IYHS a)	IV VPA b) M = 0.2	IV VPA b) M = 0.4
1958			1 130		368	583	120		370[d]	
1959			350		234	387	220		575[d]	
1960			310		152	267	350		414[d]	
1961			1 560		638	1 117	390		916[d]	
1962		82	12 000		3 203	6 216	2 170		1 562[d]	
1963		234	20		70	153	80		387[d]	
1964	17	223	80		115	164	540	543	576	899
1965	13	316	90	31	147	248	290	602	625	898
1966	33	286	3 060	151	768	1 183	400	803	796	1 213
1967	5.6	94	20 000	8 891	6 311	10 091	1 380	1 726	2 044	3 218
1968	5.3	88	1 100	400	388	570	60	19	804	1 000
1969	61	377	970	38	111	189	160	89	686	866
1970	142	501	3 000	1 569	907	1 497	160	313	688	1 002
1971	3.0	89	2 600	5 223	1 363	2 253	240	936	1 656	2 319
1972	46	182	460	82	279	465	730	4 475	2 316	3 475
1973	9.6	138	1 600	1 840	939	1 663	480	934	2 550	3 899
1974	121	(196)	2 700	1 366	(2 718)	(5 172)	650	1 940	(3 015)	(4 335)
1975	(11)			(44)				(1 269)		

a) Average number per hour fishing during the International Young Herring Surveys (cf. ICES C.M. 1976/F:5).

b) Millions of fish at age 1.

c) Number of 1 year old fish per 100 hours fishing by Scottish research vessels (in "old Explorer" units).

d) Taken from 1975 Working Group report (ICES C.M. 1975/F:5).

Figures in brackets are provisional.

Table 36 Predictive regressions of VPA estimates of year class size on year class strength indices from research surveys.

	n	a	b	r	p	Estimate size year class 1975 (1 year old)
COD						
VPA IVa,b,c (M = 0.2) - IYHS (1967-1973)	7	90	3.08	0.95	p<0.01	124 millions
HADDOCK						
VPA IV (M = 0.2) - CPUE (1958-1973)	16	100	0.30	0.99	p<0.01	
VPA IV (M = 0.4) - CPUE (1958-1973)	16	187	0.50	0.99	p<0.01	
VPA IV (M = 0.2) - IYHS (1965-1973)	9	66	0.58	0.92	p<0.01	91 millions
VPA IV (M = 0.4) - IYHS (1965-1973)	9	124	0.94	0.92	p<0.01	165 millions
WHITING						
VPA IV (M = 0.2) - CPUE (1958-1973)	16	736	0.67	0.51	p<0.05	
VPA IV (M = 0.4) - CPUE (1964-1973)	10	1 003	1.97	0.62	p<0.10	
VPA IV (M = 0.2) - IYHS (1964-1973)	10	854	0.40	0.67	p<0.05	1 364 millions
VPA IV (M = 0.4) - IYHS (1964-1973)	10	1 214	0.64	0.68	p<0.05	2 022 millions

where $Y = a + b x$
Y = VPA estimate
x = CPUE from research vessel surveys
n = number of observations
r = correlation coefficient
p = level of significance

Table 37 Comparison of Haddock year class strengths, North Sea and Scottish west coast grounds. Numbers of 1+ Haddock caught per 10 hours' fishing by Scottish research vessels.

Year class	North Sea a)	North Coast of Scotland S	A	North Minch S	A	Outer Hebrides S	A	South Minch S	A	South of Lat. 56°N S	A	Clyde S	A	Rockall S	A
1958	1 132	53		3	50	0	30			0					
1959	347		0		23		0				0				
1960	311	10	120	68	26	12	230			0	28				
1961	1 560	2 550	5 490	1 080	970	27	130			0	22	1 380	0		
1962	12 000	7 307	7 130	108	2 663	10	1 123	6	110	26	80				
1963	20	13	0		8.1		10		1.7	0	0				
1964	82		12	3.5	5.0	2.2	1.2	2.9	12		0				
1965	95	675		8		0		15							
1966	3 060	420		17		0		0						0	16
1967	20 000		3 400		4 700		3 800		526		2 725			30	139
1968	1 100	No West Coast Survey in 1969												7 000	14 000
1969	970		23 b)		0 b)		38 b)		0 b)		0 b)			11 b)	
1970	3 000		654		65		20		0						
1971	2 600		1 599		153		16		4		80		0		
1972	460		2 227		81				0		20				
1973	1 600		2 412		132				34				0		
1974	2 700				6 695		4 741		666						

a) North Sea catches in "Old Explorer" units. Catches for all other regions in "New Explorer" units.

b) Numbers of small fish under-represented since the mesh used was larger than in previous west coast surveys.

S = Spring Cruises.

A = Autumn Cruises.

Table 38 North Sea Cod (Sub-area IV). Input data for catch prediction.

Age	1975 Catch '000	F Values 1975-1976	Mean Weight kg
1	20 087	0.13	0.54
2	46 464	0.68	0.92
3	17 232	0.62	2.02
4	4 281	0.42	3.82
5	7 787	0.44	5.75
6	2 139	0.45	7.64
7	458	0.45	9.11
8	224	0.40	10.37
9	252	0.40	11.24
10	93	0.40	12
11	50	0.40	12
12+	10	0.40	12

Recruitment at age 1 '000		Simulated catches '000 tons	
Year		$F_{77}=F_{75}$	$F_{77}=0.8 \times F_{75}$
1976	124 000	180	180
1977	230 000	174	146

Table 39 West of Scotland Cod (Division VIa). Input data for catch prediction.

Age	1975 Catch '000	F Values 1975-1976	Mean Weight kg
1	274	0.1	0.58
2	1 724	0.34	1.22
3	1 044	0.53	2.66
4	380	0.71	4.25
5	186	0.83	5.13
6	50	0.9	6.41
7	8	0.9	8.38
8+	14	0.9	9.0

Recruitment at age 1 '000		Simulated catches '000 tons	
Year		$F_{77}=F_{75}$	$F_{77}=0.8xF_{75}$
1976	5 570	9.7	9.7
1977	5 570	9.4	8.0

Table 40 Irish Sea Cod (Division VIIa). Input data for catch prediction.

Age	1975 Catch '000	F Values 1975-1976	Mean Weight kg
1	795	0.23	0.61
2	655	0.72	1.66
3	1 409	0.84	3.33
4	234	0.69	5.09
5	138	0.92	6.19
6	32	1.04	6.76
7+	15	1.00	8.30

Recruitment at age 1 '000		Simulated catches '000 tons	
Year		$F_{77}=F_{75}$	$F_{77}=0.8xF_{75}$
1976	6 760	6.7	6.7
1977	6 760	7.7	6.5

Table 41 North Sea Haddock. (Sub-area IV). Input data for catch prediction.

Age	1974 Catch '000	F Values M = 0.2	1974-1976 M = 0.4	Mean Weight kg
1	241 200	0.18	0.10	0.23
2	78 100	0.50	0.30	0.28
3	252 100	0.80	0.60	0.41
4	49 000	1.00	0.80	0.58
5	2 600	1.20	0.80	0.71
6	1 100	1.10	0.80	0.94
7	9 600	1.00	0.80	1.21
8	200	1.00	0.80	1.44
9	20	1.00	0.80	1.50
10+	40	1.00	0.80	1.60

	Recruitment at age 1 '000	Simulated catches '000 tons		Recruitment at age 1 '000	Simulated catches '000 tons
Year		$F_{77}=F_{74}$	$F_{77}=0.5xF_{75}$		$F_{77}=F_{74}$
1975	1 250 000	220	220	2 122 300	225
1976	130 000	214	214	218 000	236
1977	594 000	173	103	1 008 500	204

Table 42 West of Scotland Haddock (Division VIa). Input data for catch prediction.

Age	1974 Catch '000	F Values M = 0.2	1974-1976 M = 0.4	Mean Weight kg
1	1 996	0.03	0.02	0.23
2	3 740	0.30	0.30	0.28
3	10 353	0.70	0.50	0.41
4	5 626	0.70	0.50	0.58
5	108	0.60	0.50	0.71
6	504	0.60	0.50	0.94
7	11 259	0.60	0.50	1.21
8+	208	0.60	0.50	1.44

	Recruitment at age 1 '000	Simulated catches '000 tons		Recruitment at age 1 '000	Simulated catches '000 tons
Year		$F_{77}=F_{75}$	$F_{77}=0.7xF_{75}$		$F_{77}=F_{75}$
1975	80 000	13.4	13.4	141 700	13.2
1976	10 000	10.7	10.7	17 700	10.6
1977	32 900	10.2	7.8	58 200	8.9

Table 43 North Sea Whiting (Sub-area IV). Input data for catch prediction.

Age	1975 Catch '000	F Values M = 0.2	1975-1976 M = 0.4	Mean Weight kg
1	1 015 218	0.45	0.32	0.079
2	375 394	0.38	0.26	0.142
3	180 766	0.57	0.38	0.157
4	44 952	0.68	0.51	0.182
5	7 441	0.64	0.48	0.222
6	1 556	0.58	0.40	0.277
7	650	0.49	0.35	0.332
8+	2 009	0.80	0.60	0.406

Year	Recruitment at age 1 '000	Simulated catches '000 tons $F_{77}=F_{75}$	Simulated catches '000 tons $F_{77}=0.5 \times F_{75}$	Recruitment at age 1 '000	Simulated catches '000 tons $F_{77}=F_{75}$	Simulated catches '000 tons $F_{77}=0.5 \times F_{75}$
1976	1 363	144	144	2 013	138	138
1977	1 272	134	76	1 879	125	68

Table 44 West of Scotland Whiting (Division VIa). Input data for catch prediction.

Age	1975 Catch '000	F Values M = 0.2	1975-1976 M = 0.4	Mean Weight kg
1	7 577	0.09	0.06	0.213
2	42 873	0.63	0.48	0.241
3	12 215	0.99	0.81	0.267
4	2 035	0.62	0.46	0.310
5	505	0.65	0.47	0.377
6	68	0.87	0.59	0.471
7	1 387	0.24	0.15	0.563
8	64	0.60	0.40	0.690

Year	Recruitment at age 1 '000	Simulated catches '000 tons $F_{77}=F_{75}$	Simulated catches '000 tons $F_{77}=0.5 \times F_{75}$	Recruitment at age 1 '000	Simulated catches '000 tons $F_{77}=F_{75}$	Simulated catches '000 tons $F_{77}=0.5 \times F_{75}$
1975	207 000	20.4	20.4	350 000	20.8	20.8
1976	76 000	24.6	24.6	128 000	25.7	25.7
1977	76 000	20.2	12.0	128 000	21.4	12.2

Table 45.* Example of Worksheet used for catch prediction.

Species: Whiting
Start year: 1975
Sub-area IV
Natural mortality = 0.20

Age*	Catch in start year 1975*	F*	A e^{-Z}	B $F(1-e^{-Z})/Z$	C Stock 1975	D Stock 1976	E Catch 1976	F Stock 1977	G Catch 1977	$\overline{W}$ (kg)*
1	101 521.8	.45	.5220	.3309	3 068 051	(1 363 000)	(451 017)	(1 272 000)	(420 905)	.079
2	375 394	.38	.5599	.2883	1 302 095	1 601 522	461 719	711 486	(205 121)	.142
3	180 766	.57	.4630	.3975	454 757	729 043	289 795	896 692	356 435	.157
4	44 952	.68	.4148	.4522	99 407	210 553	95 212	337 547	152 639	.182
5	7 441	.64	.4317	.4330	17 185	41 234	17 854	87 337	37 817	.222
6	1 556	.58	.4584	.4027	3 864	7 419	2 988	17 801	7 168	.277
7	650	.49	.5016	.3540	1 836	1 771	627	3 401	1 204	.332
8+	2 009	.80	.3679	.5057	3 973	921	466	888	449	.406
Catch ('000 tons)	173.184						169.2			157.1
Corrected catch ('000 tons)	158.369						154.7			143.6

* See page 47 for detailed information.

Input data * : Catch in start year 1; exploitation pattern (F's); value of mean weights $\bar{W}$ (kg); year class strengths ('000 tons)

Stock = number at start of year.

Col. C = (1975 catch)/B

Col. D = A x C displaced by one age group, e.g. age 2 to age 3

Col. F = A x D displaced by one age group

Col. E = B x D
Col. G = B x F } catches in numbers

Weight of catch = sum of products of catches x $\bar{W}$

Corrected weight = catches adjusted in proportion to actual 1975 catch (correction factor = 158.369/173.184)

New year classes are inserted at the top of columns D and F.

Values dependent on year class strength inputs are shown in brackets

All fish caught in 1975 which were 9 years or older were treated as 8 years old. No fish were assumed to survive beyond 9 years of age in the catch prediction.

The 1975 catches per age group include an estimated amount of Dutch discards. The predicted catch in 1977 was reduced by an appropriate fraction to arrive at the TAC on page 1.

Figure 1. Total International Landings, Sub-area IV.
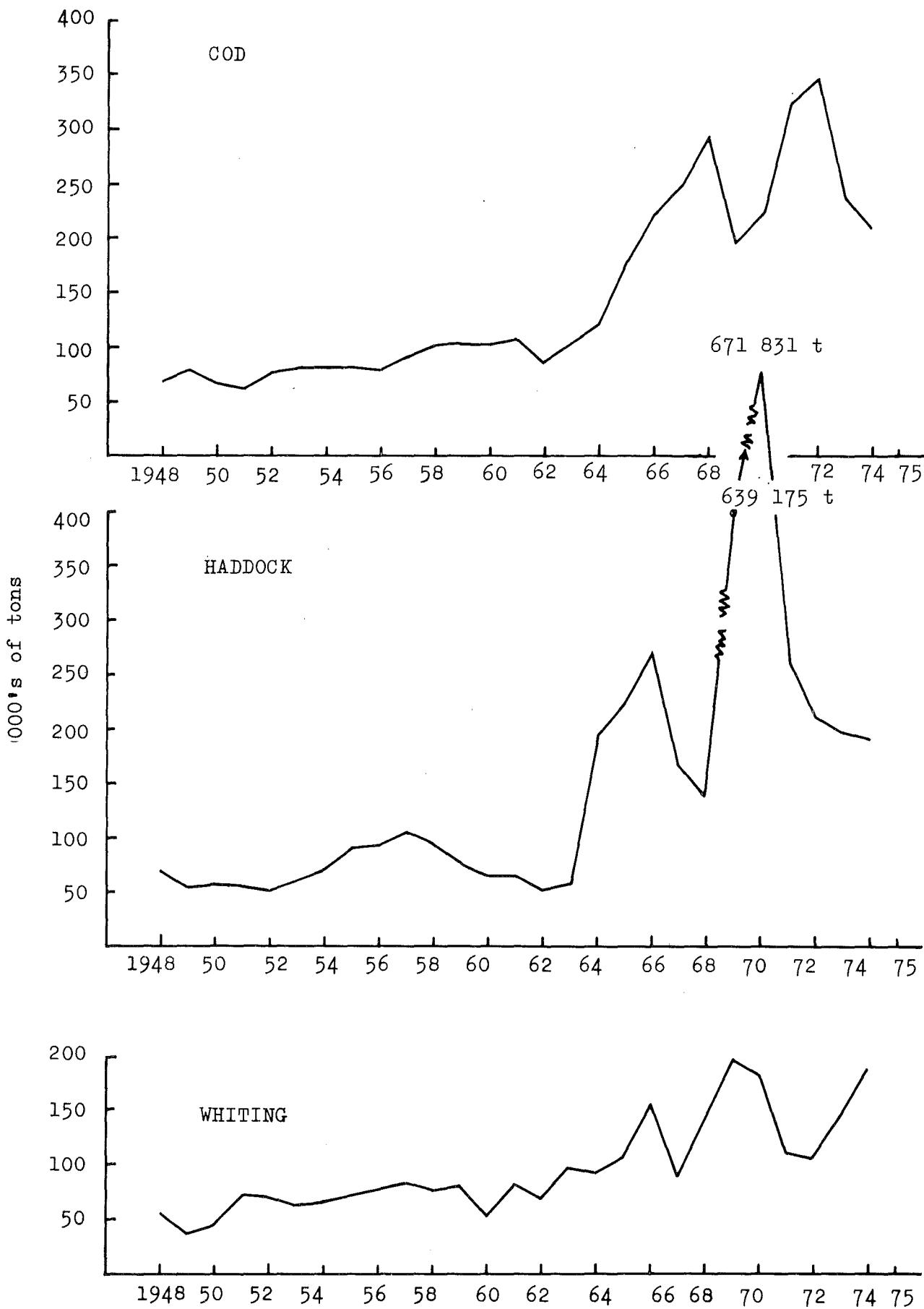
Figure 2. Total International Landings, Sub-area VI.
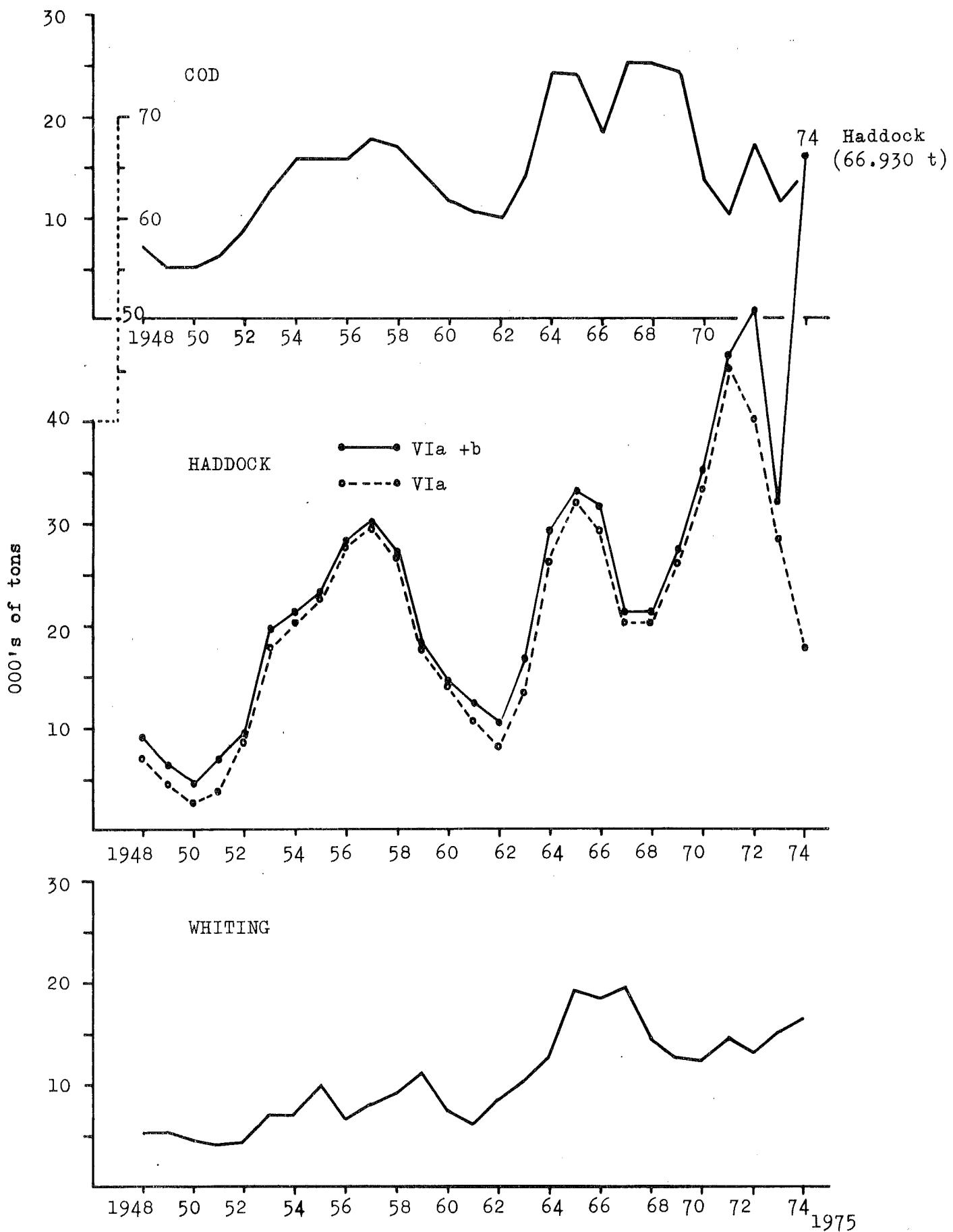
Figure 3. Total International Landings, Sub-area VII.
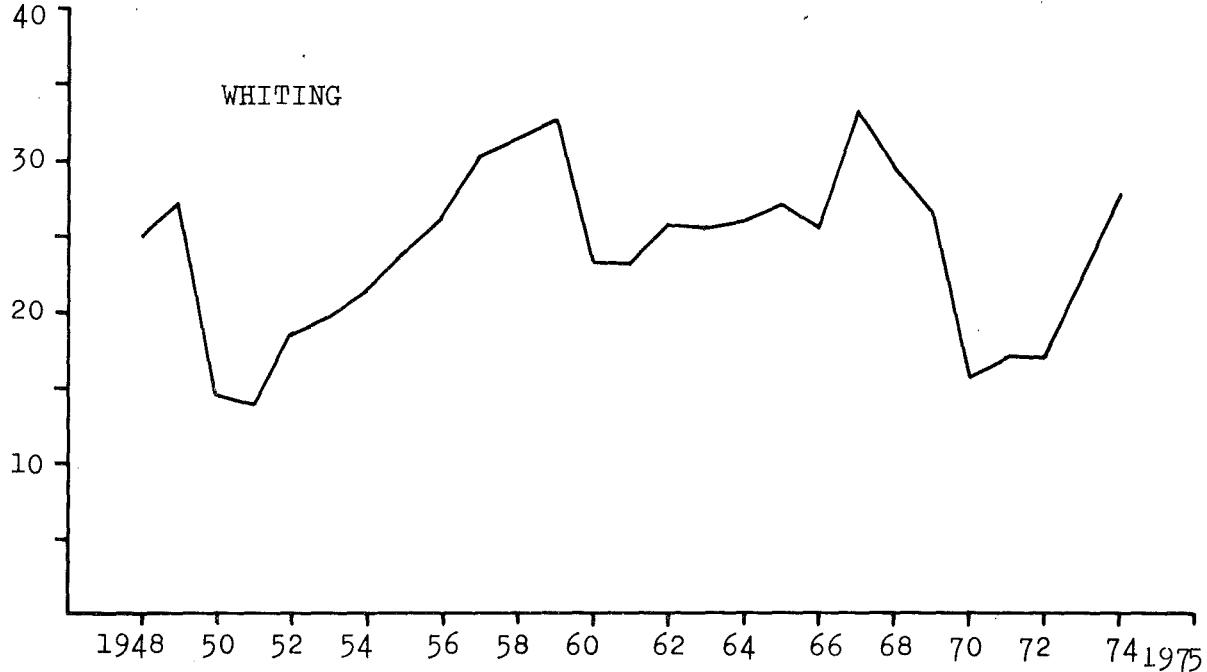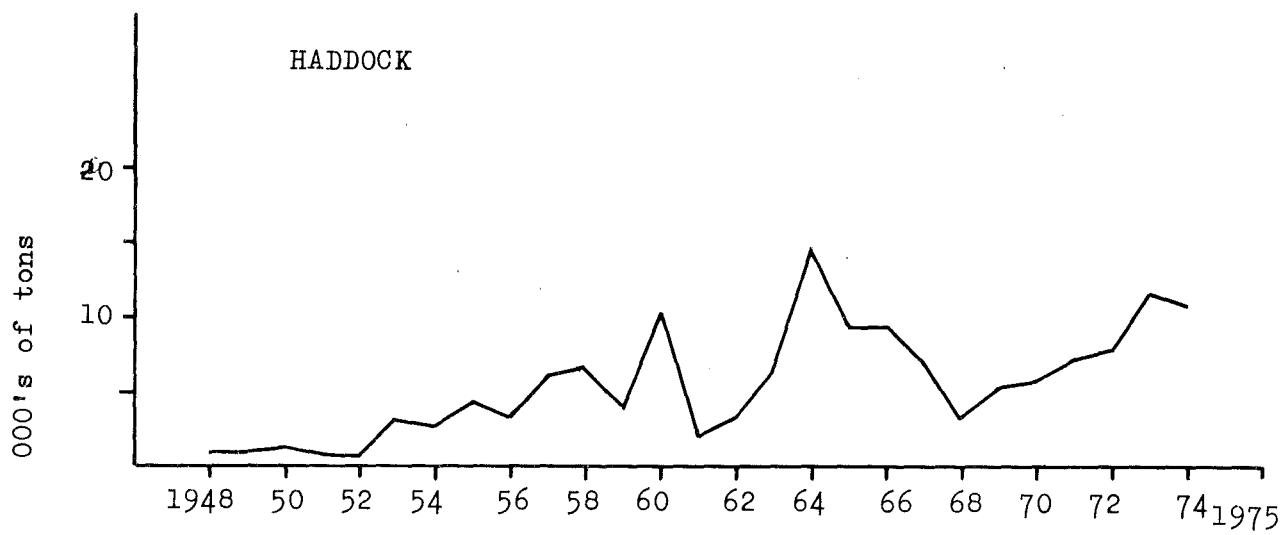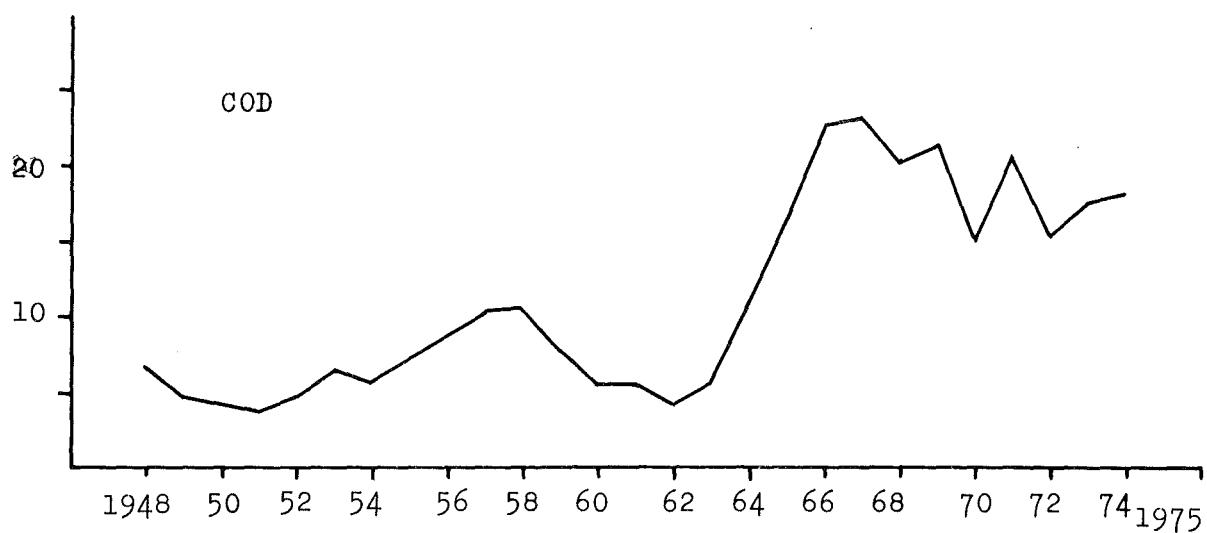
Figure 4. North Sea Haddock.
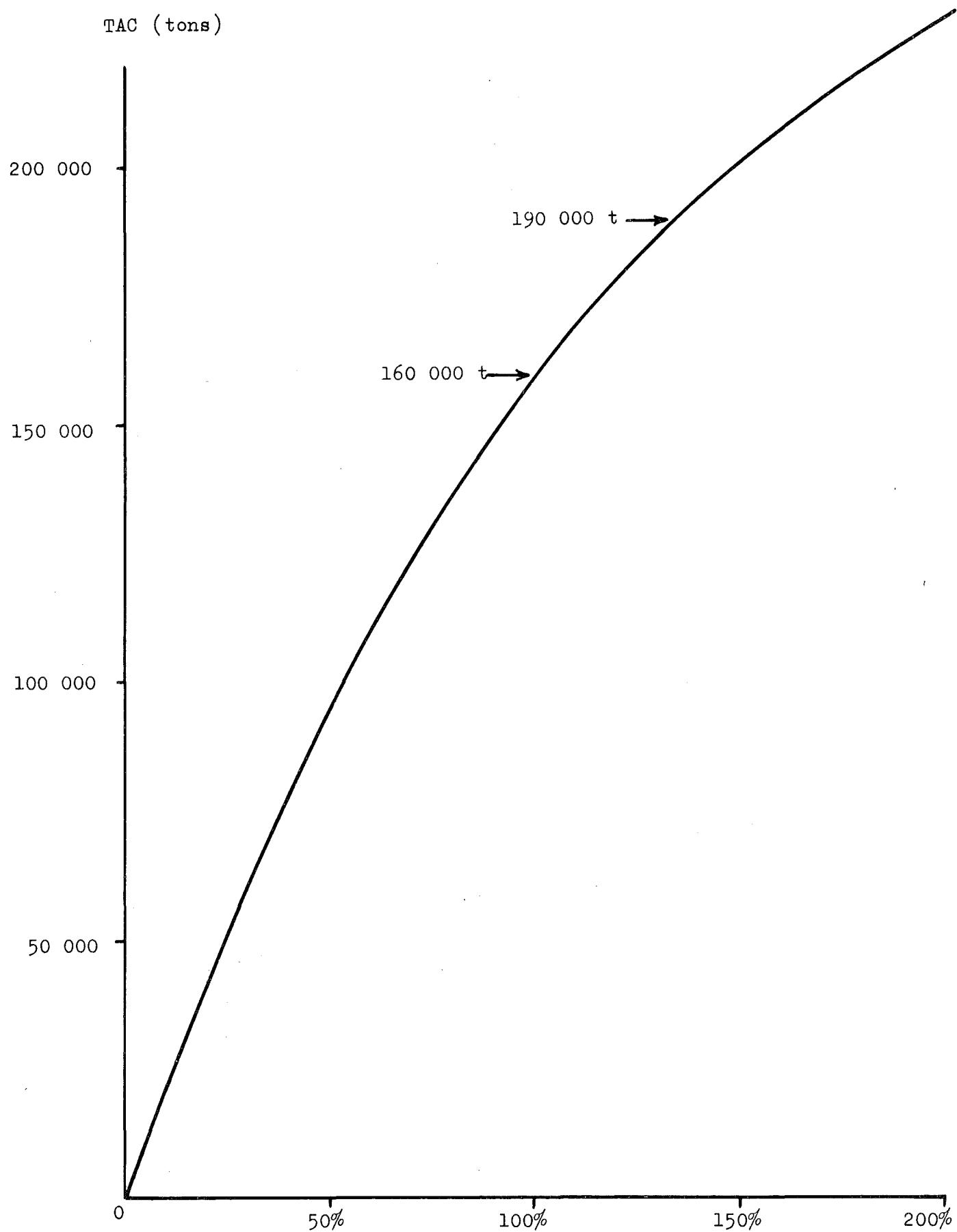
F values in 1977 expressed as percentage of the F values of recent years.

Figure 5. Fishing mortalities for Species A and B (see Appendix II, pp. 10 and 11).