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## REPORT OF THE NORTH SEA ROUND FISH WORKING GROUP

Copenhagen, 13 - 25 March 1986

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T A B L E O F C O N T E N T S

<u>Section</u>	<u>Page</u>
1 PARTICIPANTS . . . . .	1
2 TERMS OF REFERENCE . . . . .	1
2.1 Data Base Revisions . . . . .	1
2.2 Problems in Maintaining a Valid Data Base . . . . .	2
3 NATURAL MORTALITY RATES . . . . .	2
4 VPA TUNING METHODS . . . . .	3
4.1 An Alteration to the Catchability Tuning Program Used at Last Year's Meeting . . . . .	5
5 ESTIMATES OF RECRUITMENT . . . . .	6
5.1 Indices Available . . . . .	6
5.2 Use of Indices . . . . .	7
6 RELATIONSHIP BETWEEN NORTH SEA AND WEST OF SCOTLAND STOCKS . . . . .	8
7 CATCH OPTIONS FOR INDUSTRIAL FISHERIES . . . . .	9
8 SAFE BIOLOGICAL LIMITS . . . . .	10
9 YIELD PER RECRUIT AND LONG-TERM POTENTIAL . . . . .	10
9.1 Yield per Recruit . . . . .	10
9.2 Long-Term Potential . . . . .	11
10 FISHING EFFORT DATA . . . . .	11
11 NORTH SEA COD . . . . .	11
11.1 Catch Trends . . . . .	11

<u>Section</u>	<u>Page</u>
11.2 Age Composition . . . . .	12
11.3 Recruitment . . . . .	12
11.3.1 1983 year class in 1984 (age 1) . . . . .	12
11.3.2 1983 year class in 1985 (age 2) . . . . .	12
11.3.3 1984 year class in 1985 (age 1) . . . . .	13
11.3.4 1985 year class in 1986 (age 1) . . . . .	13
11.3.5 1986 and later year classes (age 1) . . . . .	13
11.4 Weight at Age . . . . .	13
11.5 Fishing Mortalities in 1985 . . . . .	13
11.6 Fishing Mortalities at the Oldest Age . . . . .	14
11.7 VPA Results . . . . .	14
11.8 Catch Predictions . . . . .	14
11.9 Safe Biological Limits . . . . .	14
11.10 Long-Term Potential . . . . .	15
12 COD IN DIVISION VIA . . . . .	15
12.1 Catch Trends . . . . .	15
12.2 Age Composition . . . . .	15
12.3 Recruitment . . . . .	16
12.3.1 1984 year class in 1985 . . . . .	16
12.3.2 1985 year classes and later . . . . .	16
12.4 Weight at Age . . . . .	16
12.5 Fishing Mortalities in 1985 . . . . .	16
12.6 Fishing Mortalities on the Oldest Age . . . . .	16
12.7 VPA Results . . . . .	16
12.8 Catch Predictions . . . . .	17
12.9 Safe Biological Limits . . . . .	17
12.10 Long-Term Potential . . . . .	17
13 COD IN DIVISION VIB . . . . .	17
14 COD IN SUB-AREA VII . . . . .	17
14.1 Cod in Divisions VIId,e . . . . .	17
14.2 Cod in Divisions VI Ib,c and VIIg-k . . . . .	17
15 NORTH SEA HADDOCK . . . . .	18
15.1 Catch Trends . . . . .	18
15.2 Age Compositions . . . . .	18
15.3 Weights at Age . . . . .	18
15.4 Recruitment . . . . .	18
15.4.1 1983 year class in 1984 . . . . .	19
15.4.2 1984 year class in 1985 . . . . .	19
15.4.3 1985 year class in 1986 . . . . .	19
15.4.4 1986 year classes and later . . . . .	19
15.5 Fishing Mortality Rates . . . . .	19
15.6 VPA Results . . . . .	19
15.7 Catch Predictions . . . . .	20

<u>Section</u>	<u>Page</u>
15.8 Safe Biological Limits . . . . .	20
16 HADDOCK IN DIVISION VIa . . . . .	21
16.1 Catch Trends . . . . .	21
16.2 Age Compositions . . . . .	21
16.3 Weights at Age . . . . .	21
16.4 Recruitment . . . . .	21
16.4.1 1985 year class in 1986 . . . . .	21
16.4.2 1984 year class in 1985 . . . . .	21
16.4.3 1986 year classes and later . . . . .	21
16.5 Fishing Mortality Rates . . . . .	21
16.6 VPA Results . . . . .	22
16.7 Catch Prediction . . . . .	22
16.8 Safe Biological Limits . . . . .	22
17 HADDOCK IN DIVISION VIb . . . . .	23
17.1 Catch Trends (Table 17.1) . . . . .	23
17.2 Age Compositions (Table 17.2) . . . . .	23
17.3 Research Vessel Survey Data . . . . .	23
17.4 Fishing Prospects . . . . .	23
18 HADDOCK IN SUB-AREA VII . . . . .	24
19 NORTH SEA WHITING . . . . .	24
19.1 Catch Trends . . . . .	24
19.2 Age Compositions (Table 19.6) . . . . .	24
19.3 Mean Weight at Age . . . . .	25
19.4 Recruitment . . . . .	25
19.5 Fishing Mortalities (Table 19.8) . . . . .	25
19.6 VPA Results . . . . .	26
19.7 Catch Prediction . . . . .	26
19.8 Safe Biological Limits . . . . .	26
20 WHITING IN DIVISION VIa . . . . .	27
20.1 Catch Trends . . . . .	27
20.2 Age Compositions (Table 20.6) . . . . .	27
20.3 Weight at Age . . . . .	27
20.4 Fishing Mortalities . . . . .	27
20.5 Recruitment . . . . .	27
20.6 VPA Results . . . . .	27
20.7 Catch Prediction . . . . .	28
20.8 Safe Biological Limits . . . . .	28
21 WHITING IN DIVISION VIb . . . . .	28

<u>Section</u>	<u>Page</u>
22 WHITING IN SUB-AREA VII . . . . .	28
22.1 Whiting in Divisions VII d,e . . . . .	28
22.2 Whiting in Divisions VII b,c,g-k (Table 22.4) . . . . .	29
23 SAITHE IN THE NORTH SEA (Sub-area IV and Division IIIa)	29
23.1 Catch Trends . . . . .	29
23.2 Age Compositions . . . . .	29
23.3 Proportion Mature at Each Age . . . . .	29
23.4 Weight-at-Age Data . . . . .	29
23.5 Virtual Population Analysis . . . . .	30
23.5.1 Fishing mortality in 1985 and on oldest age group . . . . .	30
23.5.2 Results . . . . .	30
23.6 Catch Predictions . . . . .	30
23.7 Safe Biological Limits . . . . .	31
24 SAITHE IN SUB-AREA VI . . . . .	31
24.1 Catch Trends . . . . .	31
24.2 Age Compositions . . . . .	31
24.3 Proportion Mature at Each Age . . . . .	32
24.4 Weight-at-Age Data . . . . .	32
24.5 Virtual Population Analysis . . . . .	32
24.5.1 Fishing mortality in 1985 and on the oldest age group . . . . .	32
24.5.2 Results . . . . .	32
24.6 Catch Predictions . . . . .	33
24.7 Safe Biological Limits . . . . .	33
25 QUARTERLY CATCH-AT-AGE DATA . . . . .	33
26 ACKNOWLEDGEMENTS . . . . .	34
27 METHODS OF CATCH PREDICTION . . . . .	34
28 REFERENCES . . . . .	35
Tables 11.1 - 24.12 . . . . .	36
Figures 10.1 - 24.2 . . . . .	137

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Dr. E.D. Anderson, the ICES Statistician, attended the meeting.

## 2 TERMS OF REFERENCE

At the 1985 Statutory Meeting of ICES it was decided (C.Res. 1985/2:3:5) that the North Sea Roundfish Working Group should meet from 13-25 March 1986 at ICES headquarters to:

- a) review the biological evidence for any links between North Sea and West of Scotland stocks, and, if appropriate, perform combined assessments,
- b) assess the status of and provide catch options for 1987 inside safe biological limits for cod, haddock, whiting and saithe in Sub-areas IV and VI and cod and whiting in Divisions VIIId,e,
- c) provide quarterly catch-at-age data for 1985 for North Sea cod, haddock, whiting and saithe as input for the Multispecies VPA.

### 2.1 Data Base Revisions

Preliminary data were prepared for 1985 and amendments were made to the 1984 data.

Quarterly Belgian data for North Sea cod and whiting from the early 1970's to recent years, supplied for use in the data base for Multispecies VPA and not previously made available to this Working Group, were aggregated to annual level and added to the appropriate data bases. French data were supplied in a more disaggregated form than previously presented and appropriate amendments were made to the data bases.

The best available data base now exists only on microcomputers brought to the meeting. No attempt was made to fully update the ICES data base since it is envisaged that further small amendments are required. To this end during the course of the meeting, each nation's source data as they now exist were printed and made available to the originators for final checking and amendment.

Differences between the current ICES data base and that on the microcomputers are negligible for all practical purposes and it is hoped that the ICES data base can be fully amended in advance of next year's meeting.

## 2.2 Problems in Maintaining a Valid Data Base

Problems with the Dutch landings statistics are still in evidence. The official Dutch landings data consist only of the total weight landed of each species and even these data are less precise than in previous years. No information is available on the weight landed by vessel type or by quarter and this leads to problems and possible errors in the derivation of catch-at-age data. Furthermore, no effort data are available so that it is no longer possible to maintain the series available up to 1983 of Dutch beam trawl catch per effort which used to be an important input to various VPA tuning methods.

No estimates based on biological sampling were available of the number at age of whiting and haddock in the Danish industrial by-catch in 1985, although an estimate was available of the total weight caught of each of these species. Especially when taken in conjunction with the poor Danish data on by-catch age composition for 1984 (also brought about by the refusal of Danish fishermen to allow sampling by the Danish Institute), this has caused a serious reduction in the validity of the international catch-at-age data base. The fact that the Danish Institute is currently being prevented from obtaining biological samples is, in effect, reducing the value of other nations' data.

It must be stressed, therefore, that the Group simply does not know what the age composition of the Danish by-catch of haddock and whiting was in 1984 and 1985 and any work on these species presented in this report must be interpreted with this fact in mind.

It should also be noted that no material improvement in this situation has occurred in the first quarter of 1986 so that it is likely that the Group will experience the same problems at its next meeting.

## 3 NATURAL MORTALITY RATES

The Group was informed that the current estimates of  $M$  at age produced by the multispecies VPA would probably not be changed to any significant extent as a result of future work. On this basis it was decided to use smoothed estimates of  $M$  at age from the "key run" of the multispecies VPA (p.12, Anon., 1986a).

The age-dependent  $M$  values were only used with respect to the North Sea stocks of cod, haddock and whiting. It was felt that, in the absence of a multispecies VPA for any other area, it would be unwise to extrapolate results from the North Sea to other stocks. It will be recalled that no estimate of  $M$  at age for saithe in the North Sea is produced from MSVPA and the traditional value of 0.2 has been retained for this species.



The revisions to natural mortality rate will, of course, result in higher estimates of stock numbers and lower estimates of fishing mortality than those provided by previous assessments and this should be borne in mind when interpreting the results presented in this report.

The Group is aware that amending the natural mortality values in the manner indicated is only a poor approximation to MSVPA. In particular, implementation of MSVPA would result in natural mortality values which vary slightly from year to year.

The values of M at age used by this Group are shown in the text table below.

Age	Cod	Haddock	Whiting	Saithe
<u>North Sea</u>				
0	2.70	2.05	2.25	0.2
1	0.80	1.45	0.95	0.2
2	0.35	0.35	0.45	0.2
3	0.25	0.25	0.35	0.2
4	0.2	0.25	0.30	0.2
5	0.2	0.2	0.25	0.2
6	0.2	0.2	0.25	0.2
7+	0.2	0.2	0.2	0.2
<u>Other areas</u>				
All	0.2	0.2	0.2	0.2

#### 4 VPA TUNING METHODS

The only method used by the Group this year was the catchability analysis described in Appendix 2 of the 1984 Report of the North Sea Roundfish Working Group (Anon., 1985a). The Group felt that the method could be successfully applied to all stocks with the exception of cod in Division VIa for which recent average fishing mortality was used to initiate VPA. Further details of the application of the tuning method are provided in the sections concerned with the various stocks.

The gears used to tune the respective stocks are indicated in the text-table below.

Nation	Gear	Species/Area							
		Cod		Haddock		Whiting		Saithe	
		IV	Via	IV	Via	IV	Via	IV	VI
England	Trawl	+							+
England	Seine	+							
France	Trawl							+	+
Scotland	Trawl	+	-	+	-	+	+	+	-
Scotland	Seine	+	-	+	-	+	+	-	-
Scotland	Light trawl	+	-	+	+	+	+	+	-
Scotland	<u>Nephrops</u> trawl	-	-	-	-	-	+	-	-

Note: + indicates data available and used by Group.

- indicates data available but not used by Group.

See stock sections for reasons for inclusion/exclusion of data.

The data referred to above can be found in

Tables 11.3 and 12.3 (cod)  
 Tables 15.3 and 16.3 (haddock)  
 Tables 19.3 and 20.3 (whiting)  
 Tables 23.3 and 24.3 (saithe).

Indices of abundance for saithe in the North Sea and Division VIa, respectively, derived from a multiplicative model were presented to the Group by J.B. Perodou. In principle, it should be possible to tune VPA results using this index. In practice, however, to do this requires estimates of partial exploited biomass and it was not possible at this meeting to derive these estimates. It is hoped that the method can be applied at next year's meeting. The indices for the North Sea and Division VIa are shown below.

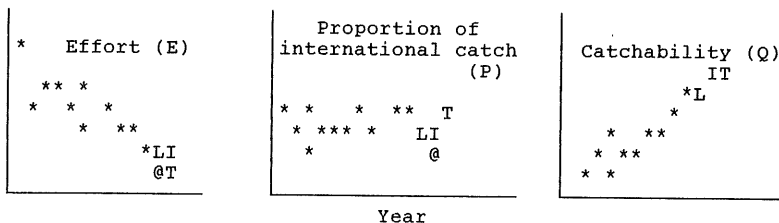
Year	Effective CPUE	
	IV	VIa
1974	0.50	0.16
1975	0.29	0.13
1976	0.45	0.16
1977	0.42	0.11
1978	0.35	0.11
1979	0.36	0.12
1980	0.34	0.10
1981	0.34	0.11
1982	0.45	0.16
1983	0.53	0.16
1984	0.60	0.15
1985	0.67	0.13

#### 4.1 An Alteration to the Catchability Tuning Program Used at Last Year's Meeting

At last year's meeting, the catchability tuning program embodied a feature whereby recent trends in catchability, effort and proportion of catch at age taken by each gear used in the analysis could be extrapolated to the current year and the TAC year. This allowed estimation of international F at age in each of these years and hence avoided the necessity to assume that the exploitation pattern in the intermediate year and the TAC would be the same as some recent average pattern.

The extrapolation was carried out using the Cleveland smoothing method described in the Appendix to last year's report.

For each age group (a) and for each gear used in the analysis (g), we, therefore, have the following graphs:



where

I = value estimated for the intermediate year and  
 T = value estimated for the TAC year.

An estimate of international F at age in the TAC year is, therefore, obtainable from:

$$F(a,T) = \frac{I}{g} E(g,T) \times \frac{Q(a,g,T)}{I} \frac{P(a,g,T)}{g}$$

To be consistent with this method of extrapolating for international F, the equivalent value in the last data year (L) was estimated by the same method. Thus, the actual catch and effort data in the last data year were replaced with Cleveland-smoothed estimates using observed data up to and including the last data year. Catchability in the last data year was estimated as explained in the Appendix to last year's report.

The extrapolation to the intermediate year and the TAC year was not well received at last year's meeting and, therefore, at this year's meeting, the observed catch and effort in the last data year were used to estimate international F. (In terms of the graphs, this means that the values of effort and proportion of catch denoted by "@" were used instead of those denoted by "L".)

Tuning of the VPA with 1984 as the last data year has been carried out to allow comparison with the results presented in last year's report. (To make a valid comparison, M was set at 0.2

for all ages.) Estimates of international F at age for 1984, using the methods of 1984 and 1985 indicated above, are shown in the text table below.

Age	Cod		Haddock		Whiting	
	1984	1985	1984	1985	1984	1985
2	1.25	1.13	0.69	0.88	0.39	0.40
3	1.21	1.08	0.95	1.39	0.87	0.76
4	0.81	0.92	0.98	1.31	0.72	0.67
5	0.80	0.76	0.89	0.86	0.76	0.74
6	0.79	0.88	0.82	0.78	1.06	1.04
7	0.75	0.78	0.84	0.89	0.96	0.96
8	0.72	0.89	0.78	0.81	-	-
9	0.76	1.17	0.87	1.07	-	-

For cod, the estimates of F at ages 2 and 3 obtained by the 1985 method are lower than those obtained by the 1984 method, while at higher ages only second decimal place differences occur. For haddock, the 1985 method produced higher results at ages 2 to 4 with only second decimal place differences at higher ages. For whiting, only second decimal place differences are in evidence. It is unlikely that any of these differences are of major importance either to the final VPA or the predictions carried out by the 1984 Working Group.

## 5 ESTIMATES OF RECRUITMENT

### 5.1 Indices Available

#### International Young Fish Surveys (IYFS)

All countries participating in the IYFS have provided the ICES Secretariat with exchange tapes holding the data for the 1983, 1984 and 1985 surveys. These data are checked, if necessary, corrected and stored in the ICES IYFS data base. Recently, software has been developed to retrieve data from the data base and to produce exchange tapes holding these data. Exchange tapes with data from the surveys of 1983, 1984 and 1985 were made available to the IJmuiden Institute one week before the meeting of the WG. In the course of the meeting, final 1- and 2-group indices for cod, haddock and whiting became available as a result of work carried out at IJmuiden. As decided earlier (Anon., 1985b), the IYFS indices for recruitment should be provided by the ICES Secretariat. The recalculation of the indices by ICES might result in minor revisions.

Usually there is not a great discrepancy between preliminary 1-group indices which are calculated shortly after the end of the survey and the final indices which are calculated using age-length keys. However, the final index, as calculated for 1-group cod in the 1984 survey, appeared to be twice as high as the preliminary figure as was used during last year's Working Group meeting (see also Section 11.3). What caused this difference could not be checked during the Working Group meeting.

For 1-group cod, haddock and whiting, preliminary indices were available for the 1986 survey.

IYFS indices are the arithmetic mean number per hour trawling per rectangle in standard areas as defined in Anon. (1985b) for cod and in Anon. (1981) for haddock and whiting.

ICES has been provided with the data required to produce indices for age groups older than the 1-group, but so far these have not been made available to the Group. Every effort should be made to do this for next year.

#### English Groundfish Surveys (EGFS)

A working paper by Harding and Macer (1986) was presented which gives a synopsis of the objectives of the EGFS, the area covered, the methods used and the processing of the data. The EGFS covers the whole North Sea and has been carried out annually in summer since 1977. The indices for cod, haddock and whiting from this survey are the numbers per 100 hrs trawling.

#### Dutch Groundfish Survey (DGFS)

In contrast to both the IYFS and the EGFS, this survey is restricted to the southeastern North Sea. The survey has been carried out each autumn since 1980. Because 0-group cod will have adopted their demersal stage of life by the time this survey is conducted, the catches of 0-group cod might be a good indication of year-class strength. DGFS indices are the arithmetic mean number per hour trawling per rectangle in Roundfish Area 6.

#### By-catch data from shrimp fisheries by the Federal Republic of Germany (FRGSF)

Indices for year-class strength of cod are derived from the combination of catches as 0-group in the second half of the year and as 1-group during the first half. FRGSF indices are the total by-catch of cod in the shrimp fisheries in millions. These indices are available from 1968 onwards.

### 5.2 Use of Indices

At previous meetings, estimates of numbers in the sea for recruiting year classes have been obtained from plots of survey index against VPA number. The implicit assumption in using this procedure is that survey catchability ( $Q$ ) has remained constant. This assumption was investigated by plotting  $Q$  against time for each set of survey data, with  $Q$  calculated as the ratio of survey index to VPA number for each age. The plots are shown in Figures 11.1, 15.2 and 19.2.

The justification of this procedure is as follows:

Let  $I = \text{survey index} = \text{catch/effort} \sim f \times N/E = QN$

where  $f = \text{fishing mortality rate generated by survey}$   
 $E = \text{fishing effort generated during survey}$   
 $N = \text{number of fish in sea during survey (estimated by VPA)}$   
 $Q = \text{catchability coefficient of survey}$

Hence  $I/N = Q$

The pattern of  $Q$  with time varies between surveys and between species, but even allowing for random fluctuations, it is clear that the assumption of constant  $Q$  is not valid. For several of the surveys, there are clear time trends in  $Q$ . In addition, a feature common to the plots for cod, whiting and, to a lesser extent, haddock, is the relatively high  $Q$  value for age 1 in 1984. Clearly, in estimating recruitment from survey indices, it is necessary to take account of the effects noted above. Various procedures for doing this were discussed, including for example the use of statistical curve fitting to enable predictions of  $Q$  to be made. However, it was decided to adopt a simpler method and assume that  $Q$  in 1984, 1985 and 1986 was the same as for recent years. For each plot, a period of relatively stable  $Q$  up to and including 1983 was chosen for averaging; the values obtained are given in Tables 11.10.1 - 11.10.3, 15.10 and 19.10.1 - 19.10.2.

Estimates of numbers in the sea for recruiting year classes were obtained by dividing the survey index by the value of recent mean  $Q$ ; these estimates are included in the tables.

No clear explanation of why  $Q$  has changed more or less systematically within many of the surveys can be provided at present. The fundamental point, however, is that  $Q$  has changed and this change must be taken into account when using the indices to estimate recent year-class abundances. In the case of the IYFS, it is possible that the northward shift in the area covered by the survey has decreased  $Q$  for cod and increased it for haddock. Other possibilities exist, however, both for IYFS and the other surveys and the changes noted in this report deserve detailed investigation.

## 6 RELATIONSHIP BETWEEN NORTH SEA AND WEST OF SCOTLAND STOCKS

Several working papers were presented to the Group. These included a review of the literature and also new information resulting from tagging experiments for cod and genetic typing of haddock. The main conclusions from these working papers can be summarised as follows:

- a) There is a continuous distribution of gadoid eggs, larvae and pelagic 0-group fish extending from the Hebrides to the North Sea.
- b) From what is known of the hydrography of the area, it seems likely that a proportion of the spawning products from west of  $40^{\circ}W$  (the Sub-area IV/VI boundary) are carried into the North Sea. However, the extent of this passive transport is not known.

- c) Tagging returns suggest a net westerly migration but this appears to be on a rather small scale, especially for cod and saithe.
- d) Genetic studies suggest that a single race of haddock is distributed from the Hebrides to the western half of Division IVa. A separate race occurs east of the Greenwich meridian while a third race occurs at Rockall.

The Group concluded that, although there is clearly some interchange between Divisions IVa and VIa, the extent to which this occurs is uncertain. In these circumstances, it was felt that it would not be appropriate at this stage to combine the assessments for the two areas.

### 7 CATCH OPTIONS FOR INDUSTRIAL FISHERIES

A letter (dated 20/1/86) from the Chairman of ACFM to the Chairman of this Working Group contained the following passage:

"In response to Section 18 of last year's report of the North Sea Roundfish Working Group, and in view of comments received at the Dialogue Meeting, ACFM agreed during its consultations at the Statutory Meeting in London to ask the North Sea Roundfish Working Group to provide various options for F for the industrial catches of haddock and whiting in the management options in its 1986 report."

The Group decided that appropriate options to present are:

- a) industrial F at 0.5 x current level
- b) industrial F at 1.0 x current level
- c) industrial F at 1.5 x current level

This request raised a question which had not been attended to at previous meetings. As explained in Section 18 of last year's report, human consumption F in the prediction years is rescaled from some recent average value to that in the last data year. To date, the Group has overlooked the fact that the same thing should be done with industrial F. This has been rectified at this meeting. The method employed for rescaling is indicated below each table of values of input for predictions.

Understandably, the Group received no guidance from ACFM on which options to implement. The Group is of the opinion that the options provided are adequate to allow interpolation in the range specified. However, if ACFM has any alternative suggestions, it would be advisable to inform the Group as soon as possible so that any implied changes to programs can be made in advance of the next meeting.

## 8 SAFE BIOLOGICAL LIMITS

The Group considered the question of safe biological limits and decided that it is possible to define these only in terms of historical observations. In previous reports of this Group, references have frequently been made to historical levels of spawning stock, recruitment and fishing mortality when discussing the state of the stocks and catch forecasts.

The specific questions asked by the Irish Sea and Bristol Channel Working Group are considered useful and have been answered for each stock. The questions are as follows:

- a) Is there any evidence from the stock/recruitment data that recruitment is reduced at the lowest levels of spawning stock which have been observed in the historic series?
- b) Is the spawning stock at a level lower than any previously observed?
- c) Does spawning stock biomass show a declining trend, which, taken with available evidence on recruitment, might indicate that a historically low level will be reached in the near future?
- d) What level of F in the current year would be needed to reduce the spawning biomass to a historically low level in the next year and what would the corresponding catch be in the current year?

For all of the stocks for which assessments are given in this report, the consequences of allowing spawning stock biomass to fall below historically observed levels are unknown and this situation should be assumed to be unsafe. If there is evidence of reduced recruitment at the lowest levels of spawning stock biomass, a higher level of spawning stock than the historical minimum needs to be chosen as "safe" although this choice will be to some extent arbitrary.

## 9 YIELD PER RECRUIT AND LONG-TERM POTENTIAL

### 9.1 Yield per Recruit

The Group decided that it would not present yield-(or biomass-) per-recruit calculations at this year's meeting and is of the opinion that the practice of performing such calculations routinely on a single-species basis should be abandoned. This decision is in accordance with the statement made by the ad hoc Multispecies Working Group (Section 4.4, page 21, Anon., 1986a):

"..... results of conventional assessments of yield per recruit are likely to be seriously misleading and should not be used [in making long-term assessments]. Consequently,  $F_{max}$  and  $F_{0.1}$  should not be used as biological reference points for predators."

(The text in square brackets has been inserted to indicate the context in which this statement was made.)



## 9.2 Long-Term Potential

A letter (dated 20/1/86) from the Chairman of ACFM to the Chairman of this Working Group noted that "ACFM should try to provide a description of the long term potential for each stock, and it was agreed to ask all Working Groups to include a paragraph on each stock in their reports. (If you cannot say anything about long-term potential, explain why; if you can only give some qualitative statement, give these!)"

Having decided that yield per recruit is not a valid estimator of long-term conditions and in the absence of discernable stock-recruit relationships for the stocks of interest to this Group, it is not possible to give any objective statement about long-term potential for conditions different to those which have been observed historically, e.g., from VPA results.

It seems reasonably safe to make the simplistic statement that, provided conditions remain within the historically observed range, and provided that the stock has not "collapsed" during this period, then, in the long term, the stocks and yields should fluctuate within the historically observed range.

Describing the long-term potential of a stock depends greatly on what is meant by potential. It is not clear whether potential in this context refers to size of catch, monetary value, food value, socio-economic consequences, etc. Unless some clearer guidance can be given to the Group, no useful statement on potential can be made. It should be added, however, that even with clearer guidance, the probability of being able to give advice of the type required is low at present.

## 10 FISHING EFFORT DATA

Figures 10.1 and 10.2 show the data on fishing effort available to the Group plotted as time series for each fleet. It should be noted that, despite considerable reduction in nominal fishing effort in many cases over the last 20 years, the fishing mortality rate has not reduced because catchability has been increased.

## 11 NORTH SEA COD

### 11.1 Catch Trends

Recent nominal landings are given in Tables 11.1 and 11.2 and graphed in Figure 11.2A. Provisional nominal landings in 1985 were 187,150 tonnes, a similar figure to the landings in 1984 of 187,852. Working Group figures for 1984 and 1985 are 206,000 tonnes and 190,000 tonnes, respectively. The Working Group estimate of landings in 1985 which were not officially reported is approximately 5,000 tonnes. The TAC's agreed between EEC and Norway in 1984 and 1985 were 215,000 tonnes and 250,000 tonnes, respectively. The status quo landings predicted by ACFM for 1985 were 216,000 tonnes.

### 11.2 Age Composition

The VPA input data for recent years given in Table 11.6 do not include discards or industrial fishery by-catches. Data for 1984 were revised and provisional data for 1985 were provided by Scotland, France, Denmark, Federal Republic of Germany, Netherlands, Belgium and England.

### 11.3 Recruitment

The method employed for deriving estimates of recruitment is described in Section 5.

#### 11.3.1 1983 year class in 1984 (age 1)

The following estimates of abundance (millions) were available:

IYFS	1,779
EGFS	1,087
DGFS	774
FRGSF	972

These estimates are considerably larger than the value of 527 millions estimated from the catchability-tuned VPA. For all the above data sets, the estimate of survey catchability for age 1 in 1984 is well above those for recent previous years (Figure 11.1). The most likely explanation for this is that the VPA estimate may be too low. If the survey estimates above are correct, F at age 1 in 1984 is indicated to be much greater than those previously estimated from VPA. It should also be noted that the IYFS value is almost twice that of the highest recorded year class (847 millions for the 1970 year class) and that a revised estimate provided by the IJmuiden Laboratory was double the value of the preliminary estimate. In view of these difficulties, it was decided to leave the VPA estimate unaltered.

#### 11.3.2 1983 year class in 1985 (age 2)

Estimates were available as follows (millions):

IYFS	216
EGFS	234
DGFS	221

There is thus very good agreement between these values, and they are also consistent with the estimate of 196 millions derived from VPA using an F of 1.03 obtained by catchability analysis, and it was decided to accept this estimate.

### 11.3.3 1984 year class in 1985 (age 1)

The estimates available (millions) for this year class were:

IYFS	41
EGFS	74
DGFS	23
FRGSF	20

Clearly this year class is extremely poor and all indications are that it is the smallest yet recorded. It was felt that the DGFS and FRGSF estimates might be rather too small, perhaps because they represent only the southern North Sea, and it was decided to take the average of the IYFS and EGFS estimates. This resulted in an estimate of 57 millions, which means that it is only about 15% of an average year class.

### 11.3.4 1985 year class in 1986 (age 1)

Two estimates were available (millions):

IYFS	791
DGFS	504

The IYFS estimate is based on a preliminary index. The DGFS estimate is based on catches of O-group fish correlated with VPA number at age 1. Both surveys indicate a strong year class and it was decided to accept the IYFS estimate, since the reliability of the DGFS estimate at age 0 is not yet sufficiently well known. The estimate of 791 millions is the second largest on record. It is a preliminary estimate and may be subject to revision after the 1986 EGFS and DGFS.

### 11.3.5 1986 and later year classes (age 1)

These were set at 412 millions, the mean value for the period 1966-85.

## 11.4 Weight at Age

The mean weight at age in the stock is given in Table 11.7 and it was assumed to be the same as that in the landings.

## 11.5 Fishing Mortalities in 1985

For ages 2 to 7, F values were determined using the catchability analysis method (Table 11.4) (see Section 4). A smoothed value of 0.9 was adopted for ages 8 and older to be in accordance with catchability-tuned values at lower ages. For ages 1 to 3, comparison with input F's estimated for 1984 at last year's meeting is not valid because higher values of M have been adopted this year (Table 11.5). However, for older ages the same value of M was used in both assessments and F's estimated this year for 1984 are higher than those estimated last year, by an average of approximately 25% (see Section 4.1).

### 11.6 Fishing Mortalities at the Oldest Age

Smoothed values were determined from inspection of F's averaged over ages 5 to 7. Account was taken of an increasing trend in F over these ages.

### 11.7 VPA Results

Fishing mortalities in recent years are given in Table 11.8 and mean F for ages 2 to 8 is graphed in Figure 11.2B. Last year this average was taken over the age range 3 to 8. It was thought advisable to include the 2-year group so as to reflect the recent increase in fishing mortality in the average. F has shown a steady increase over the whole period, and has doubled since 1966. Stock numbers and biomass are given in Tables 11.9 and 11.11.

Recruitment at age 1 is shown in Figure 11.2C. No trend is discernible but there are marked fluctuations which have become more frequent and of high dimension in recent years.

Total and spawning biomass are shown in Figure 11.2D. Biomass has declined to the lowest level yet recorded and this decline will continue until at least 1987. The Working Group's concern at this situation is set out in Section 11.9.

### 11.8 Catch Predictions

The input data are given in Table 11.12.

The results for catch prediction are given in Table 11.13. The catch predicted for 1986 assuming constant F is 167,000 tonnes, which is close to the TAC of 170,000 tonnes. The difference between the current prediction and that of 154,000 tonnes predicted for 1986 by ACFM last year is mainly due to the new information on the size of the 1985 year class. This had to be assumed as average in last year's assessment in the absence of firm information, but is now indicated to be very strong. This is extremely fortunate, because the TAC adopted for 1986 was well above that recommended by ACFM. If the 1985 year class had turned out to be of low abundance, the 1986 TAC, if taken, would have resulted in levels of biomass well below the historical minimum.

The status quo catch in 1987, assuming average recruitment at age 1, is 243,000 tonnes, but this prediction will be influenced by any revision to the estimate of the 1985 year class.

### 11.9 Safe Biological Limits

The spawning biomass is declining and is currently at a historic low level. Although no stock-recruitment relationship can be observed (Figure 11.3), the extreme fluctuations in recruitment now being observed would probably obscure any such relationship. It is possible that the low biomass levels are contributing to the unstable recruitment levels, and this in turn is leading to large fluctuations in catches.

The Working Group and ACFM have commented in previous reports on the steady increase in fishing mortality and the decline in spawning biomass in recent years in North Sea cod. Despite ACFM advice, repeated over a number of years, that fishing mortality should be reduced, the TAC's adopted have generally been too high to achieve that objective. This has resulted in spawning biomass being reduced to a historically low level. It is not known whether the current levels of spawning biomass will result in reduced recruitment, but there is certainly an increased risk of this. The 1984 year class is the poorest on record and it appears that recruitment fluctuations have become more extreme as spawning biomass has declined.

The situation at present, therefore, is that the spawning stock has declined to a size well below the apparently normal historical range. What will happen to the stock in the immediate future is, therefore, open to considerably more doubt than is usually the case and because of this, the Group believes that the best course of action is to rebuild the stock to levels within the normal historical range.

There are several steps which, in principle, could be taken, singly or in combination, to achieve this. These include closing areas to fishing, increases in mesh size, etc. None of these possibilities is free of problems in getting them implemented. The major problem with respect to the present situation is that if a process of scientific investigation followed by presentation of scientific argument to be commented on by administrators and fishermen were to be followed it is unlikely that anything would be implemented for at least one or two years. However, what is needed is rapid and effective action and the only means at present available to achieve this is to set and effectively enforce appropriate TAC's over the next few years.

#### 11.10 Long-Term Potential

The long-term potential of this stock must be viewed with considerable concern if fishing mortality is allowed to increase.

### 12 COD IN DIVISION VIa

#### 12.1 Catch Trends

Recent nominal landings are given in Table 12.1 and 12.2 and graphed in Figure 12.2A. Provisional nominal landings in 1985 were 17,603 tonnes, compared to 20,499 tonnes in 1984. The TAC for Sub-area VI in 1985 was 25,000 tonnes. The status quo catch predicted for 1985 in last year's assessment was 25,670 tonnes, compared to actual landings of approximately 17,600 tonnes. The reason for this discrepancy is that provisional age composition data for 1984 overestimated the numbers caught, particularly for ages 2 and 3.

#### 12.2 Age Composition

The VPA input data for recent years are given in Table 12.6 and do not include discards or industrial fishery by-catches. Data

for 1984 were revised and provisional data for 1985 were provided by Scotland, France, Ireland, and England.

### 12.3 Recruitment

#### 12.3.1 1984 year class in 1985

In the absence of other data, the abundance of this year class was determined from a plot of cpue for Scottish seiners against VPA (Figure 12.1B). This resulted in an estimate of 12.7 millions at age 1 (Table 12.10) and the F value was adjusted to correspond to this value.

#### 12.3.2 1985 year classes and later

These year classes were assumed to be of average strength. To take account of higher levels of recruitment in recent years (Figure 12.2C), the average was restricted to the period 1978-82. This results in a value of 14.7 millions.

### 12.4 Weight at Age

Mean weight at age in the stock (Table 12.7) was assumed to be the same as in the landings.

### 12.5 Fishing Mortalities in 1985

Plots of catchability against year for Scottish fleets showed a rather high degree of scatter with little trend. The F's estimated for 1985 by such plots are high compared to recent values. It was, therefore, decided to use average F's for VPA input, and the period 1980-83 was used to re-input iteratively until the values stabilised. The F value at age 1 was adjusted to correspond to estimated recruitment.

### 12.6 Fishing Mortalities on the Oldest Age

Smoothed values were determined from inspection of F's averaged over ages 5 to 7.

### 12.7 VPA Results

Fishing mortalities in recent years are given in Table 12.8, and mean F for ages 2-5 is graphed in Figure 12.2B. There is a trend of increasing F over the whole period. Stock numbers and biomasses are given in Tables 12.9 and 12.11, and biomasses are shown in Figure 12.2D, which shows that there was an increase over the period 1977-81. Recruitment at age 1 is shown by year in Figure 12.2C. An increasing trend in recruitment is apparent.

## 12.8 Catch Predictions

Input data are given in Table 12.12.

Status quo catch prediction (Table 12.13A) leads to a value of 21,000 tonnes in 1986, followed by 22,000 tonnes in 1987. The TAC for Sub-area VI in 1986 is 25,000 tonnes, which implies a 30% increase in F (Table 12.13B), assuming only a small proportion of the TAC is taken in Division VIb. If F then returns to the 1985 value in 1987, the predicted catch is 19,000 tonnes. The difference between the status quo catches predicted at last year's meeting (26,000 tonnes for 1985 and 25,000 tonnes for 1986) and the current predictions is mainly due to revisions of catch data for 1984, as previously explained.

## 12.9 Safe Biological Limits

Recent recruitment levels have been above those seen in the late 1960's and 1970's. The spawning stock is currently above the lowest observed level and is predicted to remain so through to 1988, given average recruitment (see Section 8).

## 12.10 Long-Term Potential

See Section 8.

## 13 COD IN DIVISION VIb

No age composition data are available from commercial landings from this stock. Nominal landings are small and are given in Table 13.1.

## 14 COD IN SUB-AREA VII

### 14.1 Cod in Divisions VIId,e

Age composition data were supplied for Division VIId in 1985 by England and France. There is as yet an insufficient time series of data to enable an analytical assessment to be made. It was not thought worthwhile to attempt simpler forms of catch forecast, since recruitment data are lacking. Historical landings data are given in Table 14.1.

### 14.2 Cod in Divisions VIIb,c and VIIq-k

No age composition data are available. Recruitment data are also lacking. Landings data are given in Table 14.2.

## 15 NORTH SEA HADDOCK

### 15.1 Catch Trends

Total international catches and total international discards as estimated by the Working Group are given in Tables 15.1 and 15.2 and shown plotted in Figure 15.3A for the period 1966-85. The TAC for 1985 was 207,000 tonnes and the provisional nominal landings were 168,000 tonnes (Table 15.1). Discards were estimated at 84,000 tonnes. Industrial by-catch in 1985 was about 6,000 tonnes which is the lowest value on record (Table 15.2).

### 15.2 Age Compositions

Age compositions for human consumption landings were provided by France, Federal Republic of Germany, England, Denmark, Netherlands and Scotland. Age compositions for industrial by-catch were provided by Norway and for discards by Scotland.

Denmark provided an estimate of its industrial by-catch age composition, but this was not based on sample data but on the age composition predicted by the Working Group last year. Because of problems with the assessment last year (Section 4.1), the Group did not accept these estimates but calculated new age compositions for 1984 and 1985 based on the mean proportion of the total international catch at age which was accounted for by industrial by-catch for the period 1975-83 (Figure 15.1) and the human consumption catches at age in 1984 and 1985. This age composition was then scaled to produce a sum of products weight (using historical weight-at-age values for Denmark) equal to the Danish total weight of haddock by-catch.

Total international catch-at-age data are given in Table 15.6.

### 15.3 Weights at Age

The total international mean weight-at-age data for the total catch are given in Table 15.7. These were also used as stock weights at age.

### 15.4 Recruitment

As described in Section 5, account was taken of the apparent change in catchability in both the IYFS and EGFS (Figure 15.2) by taking the means of the catchability (index/VPA) values for the period 1981-83 and dividing these into the indices for the years 1984 and 1985. The reason for taking a mean value of catchability rather than a value predicted from a regression was that it is believed that the increase in catchability for haddock is due to a general northward shift in survey coverage and that this cannot continue indefinitely. The period 1981-83 was chosen because the 1984 VPA estimate for age 1 is uncertain as there are doubts about catches at age for that year and for 1985. The predicted numbers at age 1 for 1984 to 1986 using both surveys are given in Table 15.10.



#### 15.4.1 1983 year class in 1984

The IYFS estimate of this year class is 5,967 millions, whereas the EGFS estimate is 5,035 millions. The mean of these is 5,501 millions at age 1 (44,260 millions at age 0) and this figure was adopted. This is the only year class since that of 1979 to be above the long-term average.

#### 15.4.2 1984 year class in 1985

The estimate of this year class from the IYFS is 1,257 millions and from the English survey is 1,529 millions at age 1. The mean of these values is 1,393 millions at age 1 (11,470 millions at age 0) and this was adopted for the assessment.

#### 15.4.3 1985 year class in 1986

As the EGFS has not yet taken place this year, only the IYFS estimate of 3,016 millions (25,680 millions at age 0) is available.

#### 15.4.4 1986 year classes and later

These were assumed to be of average abundance for the period 1966-85 excluding the very abundant 1967 year class (33,342 millions).

### 15.5 Fishing Mortality Rates

It was decided to adopt estimates of  $F$  in 1985 for ages 3 to 7 from the catchability analysis of three Scottish gears (Table 15.4). For ages 0, 1 and 2,  $F$  was adjusted to recover the estimates at age 1 of the abundance of the 1983, 1984 and 1985 year classes, respectively.  $F = 0.9$  was used for ages 8 and older, this being the value used on the oldest age groups in other years; this is the average of the series of terminal  $F$ 's obtained by tuning to average  $F$  for ages 5 to 7.

### 15.6 VPA Results

Estimates of fishing mortalities and corresponding stock numbers and biomasses are given in Tables 15.8, 15.9 and 15.11. Historical trends in fishing mortality, spawning stock biomass and recruitment can be seen in Figure 15.3.

Fishing mortality rates in 1985 are apparently considerably higher than those estimated for 1984 at last year's meeting. In this context, see Section 4.1.

According to this year's VPA, fishing mortality has increased since about 1982. This is consistent with an increase in Scottish seiner effort (Figure 10.1) for this period during which catchability increased and levelled off. Scottish seiners accounted for about 40% of the total international catch of haddock age 2-7 in 1985.

### 15.7 Catch Predictions

Input data for the catch predictions are shown in Table 15.12.

The predicted landings in 1986 of about 140,000 tonnes are much lower than last year's predicted value of 238,000 tonnes on which the agreed TAC of 230 000 tonnes was based.

There are three reasons for the change in the prediction:

- a) The estimate of the 1983 year-class abundance is reduced as a result of the new way in which survey data have been used at this year's meeting.
- b) Fishing mortality rates in 1985 are now estimated to be higher than was previously thought and this produces a lower stock estimate in 1986.
- c) The use of age-dependent (high) values of natural mortality rate is expected to produce lower catch forecasts (see 1985 Report of Methods Working Group, Anon., 1986b).

Because of the doubts about the age composition of catches in the industrial fishery in 1984 and 1985, the assessment and catch predictions should be treated with some caution. The predicted consequences of various levels of catch in the human consumption and industrial fisheries are given in Tables 15.13.1 to 15.13.3. Current levels of fishing mortality in both fisheries, if maintained, are predicted to produce declining total landings and a declining spawning stock until the beginning of 1988.

### 15.8 Safe Biological Limits

- 1) There is no evidence that recruitment to this stock is reduced at the lowest levels of spawning stock which have been observed (Figure 15.3D).
- 2) The spawning stock is not currently at a lower level than previously observed, but is probably fairly close to the minimum observed.
- 3) Spawning stock biomass is showing a declining trend but is not predicted to reach a historically low level in the near future. This assumes average recruitment for year classes 1986-88.
- 4) Levels of F well in excess of the estimated current value would be needed to reduce the spawning stock biomass to a historically low level, but this also assumes average recruitment for 1986-88.

## 16 HADDOCK IN DIVISION VIa

### 16.1 Catch Trends

Nominal landings in 1985 were 22,034 tonnes compared to 28,000 tonnes in 1984 (Table 16.1). The estimate of discarded catch in 1985 is 17,000 tonnes (Table 16.2). Figure 16.2A shows the historic trend in landings and discards. The TAC for 1985 for the whole of Sub-area VI was 36,000 tonnes.

### 16.2 Age Compositions

Age compositions for landings were provided by England, France, Ireland and Scotland and for discards by Scotland. The international catch-at-age data base (Table 16.6) was examined for inconsistencies but, barring amendment of the data on the part of the contributing nations, there is no logical reason to change the data base. Listings of the historical data base were made available to each contributing nation for checking before next year's meeting.

### 16.3 Weights at Age

Mean weight-at-age data for the total catch are given in Table 16.7. These were also used as stock weights at age.

### 16.4 Recruitment

Estimates of the 1984 and 1985 year classes at age 1 were derived from a linear regression (Table 16.10) of numbers at age 1 in Division VIa on numbers at age 1 in the North Sea using VPA results for the years 1966-84 (Figure 16.1).

#### 16.4.1 1985 year class in 1986

The estimated value is 99 million at age 1 (121 million at age 0).

#### 16.4.2 1984 year class in 1985

The estimated value is 58 million at age 1 (71 million at age 0).

#### 16.4.3 1986 year classes and later

These were assumed to be of average abundance for the period 1966 to 1985 excluding the abundant 1967 year class (171 million at age 0).

### 16.5 Fishing Mortality Rates

A preliminary run of the catchability analysis was made using four Scottish gears for ages 2-6. The most consistent and least scattered plots of catchability vs. year were those for light

trawlers and Nephrops trawlers. The latter gear, however, accounts for only a small proportion of the total international catch. It was decided to tune the VPA using only light trawl effort data over the age range 2-5 (Table 16.4). The results were accepted by the Group which noted that, while the data available for the catchability analysis appear to be poorer in Division VIa than in the North Sea, this does not mean that the data are so poor that the assessment should be rejected on those grounds.

The catchability-tuned F's in the last data year are considerably higher than those in recent years but are about similar to those in more distant years. A value of 0.9 was chosen as input for ages 6 to 8 in the last data year and at age 9 for each year because this value was in reasonable conformity with values at ages 4 and 5 in 1985 obtained from catchability tuning.

#### 16.6 VPA Results

Estimated fishing mortality rates, stock numbers and biomasses are shown in Tables 16.8 to 16.11 and Figure 16.2. Fishing mortality appears to have more than doubled since 1981, but this is not reflected in the fishing effort data (Figure 10.2) for the French or Scottish fleets (except for Scottish Nephrops trawlers which account for only a small proportion of the catch).

#### 16.7 Catch Prediction

Input data for catch prediction are shown in Table 16.12. The only option considered for 1986 was that fishing mortality would remain at the 1985 level. The TAC for 1986 is for the whole of Sub-area VI and the proportion to be assigned to Division VIa is not defined, so a prediction including a TAC constraint in 1986 cannot be run.

Results of the catch prediction are shown in Table 16.13. The status quo forecast is landings in 1986 of 34,000 tonnes and of 23,000 tonnes in 1987. Spawning stock biomass is expected to decline from 62,000 tonnes in 1986 to 33,000 tonnes in 1988.

#### 16.8 Safe Biological Limits

- 1) There is no evidence that recruitment is reduced at the lowest observed levels of spawning stock biomass.
- 2) The spawning stock is not currently at a level lower than the historical minimum.
- 3) Spawning biomass has declined in recent years as a result of the entry of many poor year classes into the stock and, assuming maintenance of current levels of fishing mortality in the immediate future, could decline to levels close to the historical minimum even assuming average recruitment in the period 1986 to 1988.

## 17 HADDOCK IN DIVISION VIb

### 17.1 Catch Trends (Table 17.1)

After a period of increased landings in 1980-81, when English freezer trawlers participated in the fishery, landings declined to a minimum level of 400 tonnes in 1983. Since then, renewed interest by English and Scottish vessels resulted in landings increasing to 2,499 tonnes in 1984 and 8,207 tonnes in 1985.

### 17.2 Age Compositions (Table 17.2)

Age compositions of landings were presented for 1985 for the English and Scottish fisheries. In addition, estimates of discards were available for the Scottish fishery. In Table 17.2, discards for the total fishery have been estimated by raising the Scottish discards by the ratio of the total international weight landed to Scottish weight landed. Age compositions of commercial landings are not available for the earlier years. The dominant year classes in the 1985 landings were those of 1976, 1980 and 1981. These year classes had previously been shown to be abundant by research vessel surveys.

### 17.3 Research Vessel Survey Data

Table 17.3 summarises abundance estimates from research vessel surveys conducted by Scotland and the Federal Republic of Germany. The surveys were made by a number of different vessels making a varied number of hauls in differing positions at different times of year. Until more critical processing of these data can be carried out, they can only serve to give an indication of the relative year-class strengths over the period covered by the observations.

Table 17.4 gives similar data for three English surveys in which the same 45 stations were fished in three successive years. The evidence from these surveys is that, after the abundant year classes of 1980 and 1981, the following two year classes were very poor ones. This is confirmed by the results of a Scottish survey in 1985 with the commercial trawler "Clarkwood". From this latter survey, there is evidence that the 1984 year class is another abundant one. In interpreting Tables 17.3 and 17.4, it should be noted that the abundance indices for different years or surveys are not directly comparable except perhaps for the three English surveys.

### 17.4 Fishing Prospects

With only a single year's commercial catch-at-age data, no analytical assessment is possible. The 1976 year class is now past making a significant contribution to the landings and in 1986 and 1987, the fishery will, to a large extent, be dependent on the 1980 and 1981 year classes. However, from 1986, the 1984 year class can be expected to make an increasing contribution to the fishery.

At present, there appears to be no reason to suggest that fishing should not be continued at recent levels. It is not possible, however, to provide catch forecasts.

## 18 HADDOCK IN SUB-AREA VII

Haddock landings from Divisions VIId,e and VIIB,c,g-k are given in Tables 18.1 and 18.2, respectively.

## 19 NORTH SEA WHITING

### 19.1 Catch Trends

Total international catches and total international landings as estimated by the Working Group are given in Tables 19.1 and 19.2 and Figure 19.3A. The provisional nominal landings for 1985 amount to 68,000 tonnes which is less than the predicted landings for 1985 of 117,000 tonnes given in last year's report and considerably lower than the 1985 TAC of 160,000 tonnes. This is mainly due to a considerably lower reported industrial by-catch of 15,000 tonnes for 1985 compared to the prediction of 46,000 tonnes.

### 19.2 Age Compositions (Table 19.6)

Age composition data for 1983 and 1984 were updated. Provisional age composition data for 1985 were prepared from data from the following sources:

Human consumption landings: England, France, Netherlands, Scotland;

Discards: Scotland

Industrial by-catch: Norway

No biological data on the age composition of the Danish industrial by-catch were available for 1985 and incomplete sampling in 1984 places doubt on the age compositions for that year. For 1985, the age composition of the Danish industrial by-catch was estimated by the Danish Fisheries Institute on the basis of the catch prediction in the 1985 report of this Working Group. These derived figures were included in the data base. For 1984, the age composition of the Danish industrial by-catch was derived by calculating the industrial catch at age as a proportion of the total international catch at age for the period 1974-83 (Figure 19.1). The average of these proportions was used to calculate the age composition for 1984 and this was included in the data base.

As data on discards were available only from Scotland, these data were raised to the total international level. In previous years, Scottish and Dutch data were available and it is likely that the absence of Dutch data for 1985 will significantly affect the estimated international discard age compositions. The Group views the absence of these data with considerable concern and notes that they are unlikely to be available for 1986. This will further seriously undermine the quality of the data base.

### 19.3 Mean Weight at Age

Mean weight-at-age data for total catch weights (used as stock weights) are given in Table 19.7.

### 19.4 Recruitment

The use of survey indices to estimate recruitment is discussed in Section 5. A plot of IYFS catchability for whiting at age 1 is given in Figure 19.2. The average catchability for the years 1971-83 was used to estimate the numbers of 1-year-old fish in 1984 and 1985 and the number of 0-group fish in 1985 as follows:

1983 year class in 1984:	3,979 million
1984 year class in 1985:	2,642 million
1985 year class in 1985:	39,127 million

Average recruitment at age 0 for the period 1966-85 was assumed for 1986 and 1987. Catchabilities from the EGFS appear erratic (Figure 19.2) and for this reason these indices were not used to estimate recruitment.

### 19.5 Fishing Mortalities (Table 19.8)

An approximate value of  $F$  on the oldest age group (age 9) was obtained by iteratively tuning the  $F$  at this age to the average of the ages 5-7 in each year. The values varied from year to year with no obvious trend. The mean value for all years at age 7 was 1.2 and this was used as input.

Values of  $F$  for ages 2 to 7 were obtained by the catchability method referred to in Section 4. The results of this analysis are shown in Table 19.4 and these tuned values of  $F$  were used as input to VPA.

The catchability-tuned  $F$  at age 2 in 1985 of 0.437 generated a population at age 1 in 1984 which indicated that the 1983 year class was poor and which led to an anomalous catchability value for the IYFS (Figure 19.2 and Table 19.10.1). The Group felt that this VPA value for the 1983 year class was wrong and was the result of deficient catch data in 1984 and 1985.  $F$  at age 2 in 1985 was, therefore, adjusted to a value of 0.145 which resulted in the VPA stock estimate at age 1 in 1984 in accordance with mean IYFS catchability calculated as described in Section 19.4. This value of  $F$  is much lower than recent historical values.

Clearly the adjustment of  $F$  at age 2 in 1985 does nothing to solve the basic problem of this assessment which is the lack of accurate age composition data. The Group spent much time to no avail in trying to correct this difficulty but felt that the result described above was the (very poor) best achievable. While the Group feels that the IYFS-based estimates of stock sizes in recent years are probably acceptable, it does not believe the recent exploitation pattern as implied by VPA is a true representation of events occurring in the fishery.

### 19.6 VPA Results

VPA results must be interpreted very carefully in view of what has been said in Sections 3 and 19.2 about M and problems with the age compositions.

Fishing mortalities and corresponding stock sizes are shown in Tables 19.8 and 19.9. Trends in fishing mortality rate, stock biomass and spawning stock biomass are shown in Figure 19.3 and Table 19.11. Recent trends in these figures are not regarded as reliable. There is apparently a decline in the industrial by-catch F in recent years but no sustained trend in the human consumption F.

Assuming that the indications of year-class strength from IYFS are correct, there appears to be an increase in total stock and spawning stock biomass in the last year. This is due to the good 1983 year class. Nevertheless, these biomasses are still at a very low level compared to earlier years.

### 19.7 Catch prediction

Inputs to catch prediction are given in Table 19.12 and results in 19.13. The status quo total landings for 1986 are expected to be 114,000 tonnes which is lower than last year's prediction and the agreed TAC of 135,000 tonnes. However, the industrial by-catch component of this catch is now estimated to be only 26,000 tonnes compared to the previous prediction of 50,000 tonnes, and there is a small improvement in the expected human consumption landings.

The status quo landings for 1987 are expected to be 127,000 tonnes of which 26,000 tonnes are expected in the industrial fishery. This increased predicted catch depends upon the 1983 and 1985 being good year classes and the apparent decline in industrial by-catch F.

### 19.8 Safe Biological Limits

- a) There is no indication that the spawning stock biomass has entered a range where low recruitment can be expected.
- b) Spawning stock biomass is at a low level but above the historical minimum. A small increase in spawning stock biomass may be expected in the prediction period.
- c) It seems unlikely that the level of F attainable in 1986 and 1987 could reduce the spawning stock biomass to the historical minimum.



## 20 WHITING IN DIVISION VIa

### 20.1 Catch Trends

The revised reported landings for 1984 were 16,000 tonnes, approximately the same as the provisional figure. The provisional landings for 1985 were 13,000 tonnes (Tables 20.1 and 20.2), which is well below the agreed TAC of 16,400 tonnes.

### 20.2 Age Compositions (Table 20.6)

Age Compositions for 1983 and 1984 were revised. Provisional age compositions for 1985 were compiled from Irish and Scottish data.

### 20.3 Weight at Age

Weight-at-age data for landings, which were also used as stock weights, are given in Table 20.7.

### 20.4 Fishing Mortalities

An approximate value of F on the oldest age group (age 7) was obtained by iteratively tuning the F at this age to the average of ages 5-6 in each year. These values varied from year to year with no obvious trend. The mean for all years at age 7 was 1.0 and this was used as input to VPA.

Having selected a value for F at age 7, catchability analysis was used to tune F on ages 2 to 5 in 1985 (see Tables 20.3 and 20.4). The annual catchability values when plotted against year showed some scatter. However, the tuned values appeared consistent with historical values and it was felt these catchability-tuned values provided as good an estimate of input F as any other method and they were adopted.

F at age 1 in 1985 was adjusted in line with recruitment estimates (see below).

### 20.5 Recruitment

Estimates of recruitment in Sub-area IV from VPA were plotted against comparable estimates for Division VIa (Figure 20.1 and Table 20.10) and the relationship was significant. It was used to estimate recruitment at age 1 in 1985 and in 1986. These are;

1984 year class in 1985:	55 million
1985 year class in 1986:	89 million
1986 and later year classes:	87 million (average 1966-85)

### 20.6 VPA Results

Estimated fishing mortalities and corresponding stock sizes are shown in Tables 20.8 and 20.9. The resulting spawning stock and total stock biomasses are given in Table 20.11.

## 20.7 Catch Prediction

Input data for short-term catch prediction are shown in Table 20.12.

Results of catch prediction are shown in Table 20.13. Forecast status quo landings in 1986 are 15,000 tonnes which is less than the agreed TAC of 16,400 tonnes. The status quo forecast for 1987 is also 15,000 tonnes.

## 20.8 Safe Biological Limits

Long term trend in catch, fishing mortality, stock biomass and spawning stock biomass are shown in Figure 20.2. Fishing mortality appears to be lower than in the 1970's while stock biomass has fluctuated with no obvious trend and at present is near the long term average.

Recruitment at age 1 is plotted against spawning stock biomass in Figure 20.3. For the range of stock sizes observed, there is, if anything, a negative stock-recruitment relationship. Recent year classes (1983 and 1985) are believed to be above average.

The considerations above suggest there is no cause for concern with this stock and that the fishery is in a state of equilibrium.

## 21 WHITING IN DIVISION VIb

Landings of whiting from Division VIb are insignificant (Table 21.1).

## 22 WHITING IN SUB-AREA VII

### 22.1 Whiting in Divisions VIIId,e

Landings data for 1984 have been revised from 7,229 tonnes to 7,798 tonnes. Provisional landings in 1985 are 5,140 tonnes (Table 22.1). Age composition data have been submitted by England and France for 1984 and 1985, covering 99% and 98%, respectively, of the landings

Due to lack of time, the required revisions of the data base were not made in advance of this meeting. It was decided that revisions including the possibility of separating data for Divisions VIIId and VIIe will be made by correspondence before the next meeting (Tables 22.2 and 22.3). In the absence of effort data, the low catches in 1985 made it invalid to run VPA by iteratively readjusting F in the last data year to some recent average as was done in previous meetings.

## 22.2 Whiting in Divisions VIIb,c,g-k (Table 22.4)

Landings prior to 1985 fluctuated between 5,000 and 10,000 tonnes. The provisional figure for 1985 is 2,126 tonnes, but this excludes landings by France which are included in the data for Divisions VIId,e.

## 23 SAITHE IN THE NORTH SEA (Sub-area IV and Division IIIa)

### 23.1 Catch Trends

Recent nominal landings are given in Table 23.1 and are plotted in Figure 23.1A. Landings were high in the early 1970's reaching a maximum of 320,000 tonnes in 1976. Subsequently landings declined to a minimum of 116,000 tonnes in 1979. Since then, landings have followed an increasing trend to reach 190,000 tonnes in 1984 and 193,000 tonnes in 1985 (both figures provisional). Some saithe are taken as by-catches in the industrial fisheries. Since 1976, this quantity has averaged 3,500 tonnes (Table 23.2). The agreed TAC for this stock in 1985 was 200,000 tonnes.

### 23.2 Age Compositions

Total international age compositions used as input to the VPA are given in Table 23.6. Data for 1983 and 1984 were updated and new data were added for 1985. In addition, there have been some revisions made to the data base for earlier years, but these have resulted in only minor modifications to the data. Data are currently being supplied by the following countries: Denmark, Federal Republic of Germany, France, Norway, UK (England) and UK (Scotland).

One important change resulting from the revision of the 1984 age composition data has been that the number (thousands) of 3-year-old fish caught in 1984 has been changed from 38,056 to 78,416.

### 23.3 Proportion Mature at Each Age

In previous assessments, it was assumed that the adult stock was composed of all fish of age 5 and older. This year, data for the proportion mature at each age were provided by Norway derived from observations made on a research vessel survey. The Group considered it preferable to adopt these data in the assessments, and a smoothed maturity ogive (Table 23.5) was used for all years for the calculation of spawning stock biomass.

### 23.4 Weight-at-Age Data

Since last year's meeting, various Working Group members have made available additional weight-at-age data for earlier years in the data base. As a result, it has become possible to reprocess the whole data series to provide annual data (Table 23.7) rather than a single average array being used for all years up to 1978 as in previous assessments.

## 23.5 Virtual Population Analysis

### 23.5.1 Fishing mortality in 1985 and on oldest age group

For the first time in the assessment of this stock, a tuning method has been used to determine the fishing mortality in the latest data year. Age compositions of catches with the associated effort were available for French trawlers, English trawlers fishing in Division IVa, and separately for Scottish trawlers, light trawlers, Nephrops trawlers and seiners. These data were used in the catchability analysis. After a preliminary analysis, it was decided to exclude from the analysis Scottish Nephrops trawlers and Scottish seiners which do not catch large quantities of saithe. For the remaining fleets, the tuning was applied to age groups 2-12 (Table 23.3). Results of the catchability analysis indicated that fishing mortality was decreasing in the oldest age groups and, on the basis of further trials, it was decided to use a value of 0.3 for VPA input F values for the oldest age group. After examination of the catchability plots, the Group agreed to adopt for VPA input the values of F for 1985 that were indicated by the catchability analysis (Table 23.4).

### 23.5.2 Results

Table 23.8 gives the values of fishing mortality estimated by VPA, and estimates of numbers of fish in the stock are given in Table 23.9. The catchability analysis for age group 2 indicated a value of F in 1985 of 0.05 but, as this value gave a stock size that was unrealistically low, the value of F was amended to 0.023 which gave a year class of average abundance for the period 1974-82. (These dates were chosen because data before 1974 were not very reliable and the VPA is not sufficiently converged after 1982.) For age group 1 in 1985, average year-class strength was assumed and the F value adjusted accordingly. Table 23.10 gives a summary of the trends in fishing mortality, biomass and recruitment as estimated by VPA.

The results indicate that, in recent years fishing mortality has been increasing from a low value of  $\bar{F}_{3-6} = 0.4$  in 1979 to 0.7 at present. Over this period, landings have also been increasing. Recruitment has been fluctuating but since 1978, the underlying trend has been upwards. Total stock biomass has remained relatively stable in the last decade but spawning stock biomass has been declining. These trends are illustrated in Figure 23.1, and a stock-recruitment plot is given in Figure 23.2.

### 23.6 Catch Predictions

Input data used for catch predictions are given in Table 23.11. No estimates of recruiting year classes were available and, therefore, both the 1986 and 1987 year classes were taken to be of average abundance.

The results of catch predictions are given in Tables 23.12.1 - 23.12.3.

Fishing mortality in 1986 is assumed to remain at the 1985 level and total landings of 217,000 tonnes are predicted for this year for which a TAC of 240,000 tonnes has been agreed. The status quo landings predicted for 1987 are 200,000 tonnes.

The current assessment differs from that made last year in that there has been a substantial revision in the number of 3-year-old fish caught in 1984. Also, this is the first assessment in which a tuning method has been used to estimate fishing mortality in the last data year. Compared with last year, the current estimates of fishing mortality are higher especially on the younger age groups. However, fishing by Norwegian trawlers has been increasing and in their catches age groups 3 to 6 predominate. Furthermore, the recent trend of increasing fishing mortality given by the current assessment is considered to be more realistic in view of the increases in landings. Last year, the 1982 year class was estimated as 570 million at age 1 compared with the current estimate of 399 million and as a result, catches for the prediction period are now lower than given last year.

### 23.7 Safe Biological Limits

Spawning stock biomass has been declining since 1974 and in 1985 reached the lowest level recorded since 1970. Lower levels of spawning stock biomass have been estimated in the 1960's, but the data for this period are considered to be less reliable than more recent data. No clear relationship of recruitment with spawning stock size can be discerned from Figure 23.2. The prediction for the immediate future is that year classes recruiting to the spawning stock will increase the spawning stock biomass above the 1985 level in 1986 and 1987.

## 24 SAITHE IN SUB-AREA VI

### 24.1 Catch Trends

Preliminary landings of saithe reported for 1983 were 24,000 tonnes compared with 26,000 tonnes in the preceding two years. The agreed TAC for 1985 was 27,800 tonnes. Landings followed an increasing trend in the 1960's and by the mid-1970's were averaging about 33,000 tonnes. From 1979, landings have been fairly steady at a lower level averaging about 23,000 tonnes (Tables 24.1 and 24.2, and Figure 24.1A).

### 24.2 Age Compositions

New age composition data for 1985 and revisions to the data sets for 1984 and 1983 were provided by the Federal Republic of Germany, France, England and Scotland. In addition, some minor revisions were made to the data base for earlier years. Age compositions of total international landings used in the assessments are given in Table 24.6.

### 24.3 Proportion Mature at Each Age

No data are yet available to determine a maturity ogive for this stock and, as in previous assessments, the adult stock has been taken to be all fish of age 5 and older (Table 25.5).

### 24.4 Weight-at-Age Data

Data of average weight at each age in the catch are given in Table 24.7. Additional data supplied by Working Group members has enabled this data base to be revised for earlier years. Weight at age in the stock was taken to be the same as in the catch.

### 24.5 Virtual Population Analysis

#### 24.5.1 Fishing mortality in 1985 and on the oldest age group

Fishing effort data together with the associated catch age compositions were available for French trawlers and for Scottish trawlers, light trawlers, Nephrops trawlers and seiners. This enabled a VPA tuning method to be applied to this stock for the first time and the method used was the catchability analysis. After preliminary trials, it was decided to reject from the analysis all fleets except for French trawlers which catch about 75% of the saithe from Sub-area VI, and the data for this fleet are given in Table 24.3. Tuning was attempted for age groups 2-12 and the resultant estimations of fishing mortality in 1985 are given in Table 24.4. The results indicated that fishing was at a lower level on the older age groups and it was decided to use a value of  $F = 0.3$  on age group 14 in the VPA.

#### 24.5.2 Results

A VPA was run using input values of  $F = 0.3$  on the oldest age group in each year and  $F$  values input for 1985 were those estimated by the catchability analysis method. These values together with VPA back-calculated values for earlier years are given in Table 24.8 and the corresponding values for the numbers in the stock at each age are given in Table 24.9.  $F$  values in 1985 on age groups 1 and 2 were adjusted to levels which gave average stock numbers. Table 24.10 gives a summary of the trends in fishing mortality, biomass and recruitment as estimated by VPA and these are presented graphically in Figure 24.1.

In the assessment made last year, an attempt was made to match the trend in fishing mortality calculated by VPA to the trend in fishing effort. The result of this procedure was to give very low estimates of fishing mortality in 1984, and the Working Group could not produce an analytical assessment in which it had any confidence. This year, the catchability analysis indicated that there has been a trend of increasing catchability which, if not taken into account, would result in an underestimate of fishing mortality.

#### 24.6 Catch Predictions

Input data used for catch predictions are given in Table 24.11. No estimates of the strengths of recruiting year classes were available and, therefore, both the 1986 and 1987 year classes were taken to be of average abundance.

The results of the catch predictions are given in Table 24.12. The level of fishing mortality in 1986 is assumed to remain at the 1985 level and the predicted catch for this year is 24,000 tonnes. The TAC agreed for 1986 is 27,800 tonnes. Predictions are given for a range of management options in 1987 and for that year, the status quo catch is expected to be 23,000 tonnes.

#### 24.7 Safe Biological Limits

The current assessment indicates that fishing mortality has been increasing in this stock apparently due to increasing catchability. Recruitment in recent years has remained relatively steady, but there has been a declining trend in spawning stock biomass. There is no clear relationship between spawning stock biomass and resultant recruitment (Figure 24.2). The high level of spawning stock biomass in the 1970's resulted from a succession of abundant year classes, but no improvement from the current low level is likely in the immediate future and indeed the catch prediction indicates that the decline will continue.

#### 25 QUARTERLY CATCH-AT-AGE DATA

At the 1985 meeting of the Multispecies Working Group, quarterly age compositions were constructed for cod, haddock, whiting and saithe. It became clear that there were serious deficiencies in the data available at that time, notably:

- 1) The sum of the quarterly data was not the same as the annual figure previously supplied to the Working Groups.
- 2) Quarterly weight at age was not always provided, only annual weights.
- 3) There were anomalies in the data leading to large sum of products discrepancies.
- 4) The total landed weight by quarter was not always available from Bulletin Statistique for some countries and for others showed wide discrepancies.

The Working Group felt that, in view of these difficulties, it would try during the course of the year to resolve the problems by correspondence with members of the appropriate national institutes.

## 26 ACKNOWLEDGEMENTS

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M. Easey, J. Hislop and A. Jamieson for contributing working papers on the relationship between Sub-area IV and Division VIa stocks,

A. Newton for contributing results on tagging experiments and surveys at Rockall (Division VIb), and

N. Daan for calculating IYFS indices during the course of the meeting.

## 27 METHODS OF CATCH PREDICTION

The conventional method of short-term catch prediction used by the Working Group was to use the F's in the last data year to generate the stock size at the start of the first prediction year. An average exploitation pattern was then used to carry the prediction forward. The Working Group on Methods of Fish Stock Assessment found that, for North Sea Haddock, this procedure was sensitive to changes in natural mortality. Consequently, they recommended that, rather than use the F's in the last data year, the average exploitation pattern used in the prediction should be applied to the populations in the last data year to generate the stock at the start of the first prediction year.

The Working Group was informed of this recommendation by letter shortly before the meeting and received draft copies of the Methods Working Group report at the meeting. The Working Group felt that it did not have time to fully consider the recommendation and noted:

- 1) the Methods Working Group had only tested the idea on one stock (North sea haddock) for one assessment, and
- 2) the Methods Working group itself felt further investigation was needed into the problem.

For these reasons, the Working Group decided to retain the established procedure at least for this year pending further investigation. The Working Group notes, however, that in view of the changes in M used this year in assessments, catch predictions may be somewhat lower than if the Methods Working Group procedure were adopted.



**28 REFERENCES**

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- Anon. 1986a. Report of the ad hoc Multispecies Assessment Working Group. ICES, Doc. C.M.1986/Assess:9.
- Anon. 1986b. Report of the Working Group on Methods of Fish Stock Assessments. ICES, Doc. C.M.1986/Assess:10.

**Table 11.1** Nominal catch (in tonnes) of COD in Sub-area IV, 1976-85.  
(Data for 1976-84 as officially reported to ICES.)

Country	1976	1977	1978	1979	1980
Belgium	7,483	10,346	17,473	12,576	9,630
Denmark	53,277	42,582	41,858	48,509	56,404
Faroe Islands	448	260	56	113	150
France	8,079	7,511	11,944	12,559	10,910
German Dem.Rep.	69	21	75	84	63
Germany, Fed.Rep.	24,445	22,663	37,040	20,411	26,343
Ireland	98	136	174	1	-
Netherlands	21,835	29,903	48,817	34,752	45,400
Norway <sup>2</sup>	1,877	1,449	2,747	3,575	4,506
Poland	2,961	381	115	142	28
Spain	14	-	-	-	-
Sweden	597	36	... <sup>3</sup>	298	293
UK (England & Wales)	46,475	35,424	59,127	54,923	49,951
UK (Scotland)	39,597	34,406	41,984	42,811	45,044
USSR	6,187	-	17	17	-
<b>Total IV</b>	<b>213,442</b>	<b>185,118</b>	<b>261,427</b>	<b>230,771</b>	<b>248,722</b>
<b>Total IVa</b>	<b>68,352</b>	<b>55,623</b>	<b>43,357</b>	<b>41,118</b>	<b>48,467</b>
<b>Total IVb</b>	<b>126,218</b>	<b>100,191</b>	<b>164,388</b>	<b>147,313</b>	<b>161,767</b>
<b>Total IVc</b>	<b>18,872</b>	<b>29,304</b>	<b>53,682</b>	<b>42,340</b>	<b>38,488</b>
<b>W.G. total</b>	<b>209,914</b>	<b>181,121</b>	<b>260,890</b>	<b>248,051</b>	<b>260,278</b>

Country	1981	1982	1983	1984	1985 <sup>1</sup>
Belgium	8,744	6,604	6,704	5,804	4,764
Denmark	64,968	61,454	48,828	37,528 <sup>1</sup>	40,868
Faroe Islands	38	65	361	73 <sup>1</sup>	-
France	11,369	8,399	7,159	8,129	7,902 <sup>4</sup>
German Dem.Rep.	-	-	-	-	-
Germany, Fed.Rep.	29,741	18,525	20,333	13,453	7,679
Ireland	-	-	-	-	-
Netherlands	51,281	36,490	34,111	25,460 <sup>1</sup>	30,205
Norway <sup>2</sup>	6,766	12,163	6,625	6,859 <sup>1</sup>	4,967
Poland	7	62	75	7	-
Spain	-	-	-	-	-
Sweden	321	453	422	575	729 <sup>5</sup>
UK (England & Wales)	59,856	54,277	53,860	35,605	29,482
UK (Scotland)	53,921	57,308	58,581	54,359	60,554
USSR	-	-	-	-	-
<b>Total IV</b>	<b>287,012</b>	<b>255,800</b>	<b>237,059</b>	<b>187,852</b>	<b>187,150</b>
<b>Total IVa</b>	<b>55,109</b>	<b>60,917</b>	<b>63,992</b>	<b>61,799</b>	-
<b>Total IVb</b>	<b>194,283</b>	<b>168,170</b>	<b>152,672</b>	<b>116,242</b>	-
<b>Total IVc</b>	<b>37,620</b>	<b>26,713</b>	<b>20,395</b>	<b>9,811</b>	-
<b>W.G. Total</b>	<b>300,599</b>	<b>255,934</b>	<b>229,499</b>	<b>206,014</b>	<b>190,253</b>

<sup>1</sup> Provisional.

<sup>2</sup> Figures from Norway do not include cod caught in Rec.2 fisheries.

<sup>3</sup> Included in Division IIIa.

<sup>4</sup> Includ Division IIa.

<sup>5</sup> Jan.-Nov.

Table 11.2 Annual Weight and Numbers of COD caught in IV between 1966 and 1985

Year	Weight ( 1000 tonnes )				Number ( millions )			
	Total	H.Con	Disc	By-cat	Total	H.Con	Disc	By-cat
1966	212	212	0	0	117	117	0	0
1967	242	242	0	0	127	127	0	0
1968	277	277	0	0	148	148	0	0
1969	194	194	0	0	77	77	0	0
1970	219	219	0	0	126	126	0	0
1971	315	315	0	0	226	226	0	0
1972	341	341	0	0	245	245	0	0
1973	228	228	0	0	126	126	0	0
1974	202	202	0	0	103	103	0	0
1975	185	185	0	0	103	103	0	0
1976	210	210	0	0	124	124	0	0
1977	181	181	0	0	136	136	0	0
1978	261	261	0	0	209	209	0	0
1979	248	248	0	0	169	169	0	0
1980	264	264	0	0	201	201	0	0
1981	301	301	0	0	237	237	0	0
1982	256	256	0	0	180	180	0	0
1983	229	229	0	0	173	173	0	0
1984	206	206	0	0	159	159	0	0
1985	190	190	0	0	144	144	0	0

Table 11.3 Catch at age data by nation and gear used in Q analysis  
Minimum age for Q analysis = 2  
Maximum age for Q analysis + 7

Nation : SCO Gear : SEI

Year	Effort	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7
1966	500668	7063	1301	584	430	68	32
1967	514618	8284	3377	511	292	123	38
1968	548642	8746	4593	969	241	142	74
1969	491435	3755	2716	1308	467	111	75
1970	426450	2890	3015	1055	470	113	22
1971	416144	8550	644	705	587	203	71
1972	392432	19051	3500	396	339	120	57
1973	414898	7446	6166	870	137	98	42
1974	349604	6286	1611	1085	252	54	38
1975	329432	8678	1784	556	471	79	9
1976	307165	14237	2890	370	179	113	37
1977	313913	4316	3069	714	177	51	35
1978	325246	14715	1386	851	202	48	23
1979	316419	8022	3257	383	345	67	44
1980	297227	5957	2341	929	144	90	33
1981	289672	13329	2355	699	205	18	11
1982	207730	4794	6024	822	291	151	25
1983	333168	13320	1814	1290	227	98	39
1984	388085	9955	3784	454	381	108	47
1985	381647	18265	2492	833	127	107	26

ctd.

Table 11.3 ctd.

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Nation : SCD Gear : LTR

Year	Effort	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7
1966	35841	267	63	31	11	2	1
1967	28022	261	81	12	9	4	1
1968	48238	300	139	35	9	4	3
1969	62666	491	241	86	23	6	4
1970	83529	302	397	93	33	10	2
1971	104901	1764	207	150	41	14	6
1972	121031	3926	705	111	50	6	2
1973	152422	1256	1899	202	20	23	12
1974	116982	1186	438	376	40	5	8
1975	161009	1558	776	120	113	6	1
1976	152419	3275	415	101	38	39	10
1977	224824	1808	774	118	75	24	13
1978	236929	5379	671	270	51	28	7
1979	207494	5845	1808	178	61	15	3
1980	333197	5356	2101	549	71	16	4
1981	251504	5237	1475	294	82	11	6
1982	250870	2940	2302	377	110	39	8
1983	244349	6293	1020	460	111	31	14
1984	240725	3023	1544	180	86	36	10
1985	267393	5944	865	294	39	21	4

Nation : SCD Gear : TRL

Year	Effort	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7
1966	194012	2838	1035	502	235	56	18
1967	215319	3667	1693	334	232	136	33
1968	218141	1938	1598	584	73	63	41
1969	123010	1256	834	561	172	29	26
1970	133445	303	1024	485	270	101	15
1971	174559	2147	320	578	160	64	37
1972	201493	5087	1632	183	317	76	43
1973	185241	1405	2630	471	61	67	28
1974	185432	1179	926	820	144	34	49
1975	152977	1597	431	265	272	38	9
1976	121841	1300	676	152	85	87	11
1977	144348	575	839	228	70	31	31
1978	135220	1424	286	182	64	16	12
1979	87467	914	447	74	47	23	12
1980	55475	850	379	127	20	20	8
1981	51553	928	388	114	51	14	6
1982	47889	306	389	73	17	6	3
1983	48339	1428	208	112	23	10	2
1984	34574	772	346	33	17	7	1
1985	32674	767	195	78	9	5	3

ctd.

Nation : ENG Gear : TRL

Year	Effort	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7
1966	683921	7365	4877	519	211	125	40
1967	676258	7677	3674	1420	281	183	93
1968	673249	10093	6140	1489	775	236	91
1969	613445	2164	4549	1475	486	230	70
1970	607370	2157	1261	1530	829	236	151
1971	616967	13787	1569	679	976	430	163
1972	644260	14630	4926	612	288	503	244
1973	603481	2361	5481	1626	461	190	133
1974	557947	4129	792	1925	617	157	68
1975	469958	2623	1156	303	738	267	44
1976	493436	6058	1508	727	163	395	100
1977	509862	1905	2013	616	320	98	127
1978	559930	10576	1093	987	338	117	57
1979	553020	7698	3341	393	403	99	54
1980	442036	3786	2106	865	122	114	38
1981	423658	12703	1886	535	250	38	48
1982	424272	3063	3802	587	298	179	35
1983	370646	13444	1024	939	132	88	48
1984	358387	3459	2656	267	217	42	32
1985	341850	8168	1046	532	72	54	16

Nation : ENG Gear : SEI

Year	Effort	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7
1966	240303	3775	3018	484	272	190	74
1967	226841	2875	1697	1358	244	192	122
1968	238150	4157	3680	1157	695	226	82
1969	234905	906	2683	1214	536	286	76
1970	198731	781	783	1147	662	202	112
1971	217199	5763	825	334	690	299	118
1972	226241	8388	3039	410	207	455	228
1973	237907	1968	3952	1225	174	127	102
1974	210623	2764	411	1085	487	116	40
1975	208508	2437	764	127	350	145	14
1976	211284	8523	895	479	116	290	84
1977	196103	2453	1577	245	182	60	103
1978	203382	12831	746	547	131	78	21
1979	187180	7004	2438	162	280	76	35
1980	201169	7760	1370	611	146	210	54
1981	185423	12689	1053	398	359	61	74
1982	183209	3191	2473	330	294	189	38
1983	171334	4564	603	563	209	152	94
1984	167699	1513	1215	147	290	72	50
1985	158323	3228	325	240	72	117	40

Table 11.4 Results of analysis of catchability coefficients for CBD in IV

F for named gears and total international F

Gear	Estimate	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7
SCD SEI	F(gear)	0.147	0.177	0.141	0.105	0.096	0.087
	Var F(gear)	0.00031	0.00051	0.00016	0.00011	0.00016	0.00014
	Propn(gear)	0.16613	0.15667	0.12353	0.10787	0.09719	0.09204
SCD TRL	F(gear)	0.008	0.010	0.007	0.004	0.006	0.004
	Var F(gear)	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
	Propn(gear)	0.00698	0.01227	0.01163	0.00774	0.00413	0.00858
SCD LTR	F(gear)	0.060	0.071	0.047	0.031	0.027	0.018
	Var F(gear)	0.00003	0.00002	0.00001	0.00001	0.00002	0.00001
	Propn(gear)	0.05407	0.05434	0.04354	0.03337	0.01906	0.01148
ENG TRL	F(gear)	0.073	0.081	0.065	0.049	0.046	0.062
	Var F(gear)	0.00010	0.00003	0.00002	0.00003	0.00004	0.00001
	Propn(gear)	0.07429	0.06575	0.07887	0.06108	0.04891	0.05019
ENG SEI	F(gear)	0.053	0.046	0.037	0.067	0.078	0.100
	Var F(gear)	0.00005	0.00001	0.00002	0.00002	0.00007	0.00009
	Propn(gear)	0.02936	0.02043	0.03558	0.06108	0.10596	0.12548
All above	F(gear)	0.342	0.386	0.297	0.256	0.253	0.270
	Var F(gear)	0.00050	0.00058	0.00022	0.00017	0.00029	0.00026
	Propn(gear)	0.33083	0.30945	0.29314	0.27114	0.27524	0.27778
Total	F	1.033	1.246	1.014	0.943	0.918	0.973
Internatl	Var F	0.00454	0.00604	0.00255	0.00232	0.00382	0.00332

Table 11.5 Values of Natural Mortality Rate and Proportion Mature at age

Age	Nat Mor	Mat.
1	0.800	0.010
2	0.350	0.050
3	0.250	0.230
4	0.200	0.620
5	0.200	0.860
6	0.200	1.000
7	0.200	1.000
8	0.200	1.000
9	0.200	1.000
10	0.200	1.000
11	0.200	1.000
12	0.200	1.000
13	0.200	1.000

Table 11.6 Total International Catch at Age (1000's) of COD in IV between 1966 and 1985

Age	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	Age
1	17450	10339	5601	2842	52719	42972	3692	24742	14690	30081	1
2	59861	67849	80549	21867	32813	148927	180833	30259	55617	42487	2
3	28578	31289	40916	30453	17886	16507	46369	52342	10765	17073	3
4	5922	10777	11906	13222	12904	6475	5474	13409	14937	4203	4
5	3235	3131	5838	4403	6092	6808	2627	2102	4365	6816	5
6	1224	1889	1359	2792	1705	2588	3084	1057	907	1863	6
7	457	850	836	567	930	856	1618	1010	414	405	7
8	354	340	297	407	202	439	589	466	373	176	8
9	121	132	145	142	180	219	376	76	313	206	9
10	54	38	107	45	95	74	108	55	76	86	10
11	54	3	17	61	22	66	7	74	149	45	11
12	26	14	6	10	17	24	10	58	25	7	12
13				5				22	5	5	13

Age	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	Age
1	5145	58279	26368	35319	59344	20416	61191	23395	62720	8086	1
2	90263	45947	156479	86133	98856	177309	56340	118144	60215	109944	2
3	16485	22823	13358	39843	29578	26739	50002	16932	27801	15909	3
4	6721	4300	8386	3584	9988	7352	6639	9869	3493	6745	4
5	1661	2099	2850	3188	1595	3829	3002	2584	3126	1179	5
6	2746	757	980	713	1164	757	1769	1235	956	1104	6
7	836	1029	383	371	411	571	333	575	413	319	7
8	120	335	376	131	191	135	204	142	233	158	8
9	59	238	141	145	71	65	68	83	57	70	9
10	57	23	33	39	54	37	23	22	43	12	10
11	22	9	15	2	18	17	10	16	13	18	11
12	16	43	22	13	6	1	5	2	4	2	12
13	1	35	2			3					13

Table 11.7 Total International Mean Weight at Age ( Kg. ) of COD in IV between 1966 and 1985

Age	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	Age
1	0.579	0.590	0.640	0.544	0.626	0.579	0.616	0.559	0.594	0.619	1
2	0.994	1.035	0.973	0.921	0.961	0.941	0.836	0.869	1.039	0.899	2
3	2.442	2.404	2.223	2.133	2.041	2.193	2.086	1.919	2.217	2.348	3
4	4.169	3.153	4.094	3.852	4.001	4.258	3.968	3.776	4.156	4.226	4
5	7.027	6.803	5.341	5.715	6.131	6.528	6.011	5.488	6.174	6.404	5
6	9.599	9.610	8.020	8.722	7.945	8.646	8.246	7.453	8.333	8.691	6
7	11.766	12.033	8.581	9.262	9.953	10.356	9.766	9.019	9.889	10.107	7
8	11.968	12.481	10.162	9.749	10.131	11.219	10.228	9.810	10.791	10.910	8
9	14.060	13.589	10.720	10.384	11.919	12.881	11.875	11.077	12.175	12.339	9
10	14.746	14.271	12.497	12.743	12.554	13.147	12.530	12.359	12.425	12.976	10
11	14.825	18.583	11.518	11.017	14.473	15.676	14.455	12.892	13.660	13.831	11
12	17.450	19.103	11.807	13.718	14.225	15.176	14.272	12.899	14.049	17.410	12
13				8.095				12.832	14.309	15.662	13

Age	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	Age
1	0.572	0.541	0.567	0.548	0.546	0.722	0.585	0.629	0.592	0.585	1
2	1.019	0.926	0.937	0.945	0.985	0.830	0.948	0.909	0.982	0.914	2
3	2.389	2.132	1.967	2.432	1.996	2.252	1.857	1.854	2.142	2.092	3
4	4.364	4.484	4.201	4.306	4.576	4.773	4.514	3.953	4.044	4.204	4
5	6.402	6.661	6.538	6.558	6.373	7.214	6.820	6.616	6.251	6.373	5
6	8.625	8.804	8.766	8.277	9.173	8.861	8.981	8.600	8.396	8.448	6
7	10.120	10.076	9.794	10.858	9.815	10.060	10.707	10.264	10.316	10.409	7
8	11.278	11.048	11.053	11.490	11.874	11.513	12.499	12.013	11.357	12.021	8
9	12.899	11.824	12.427	13.057	12.782	13.324	13.452	12.961	13.505	13.007	9
10	14.140	13.134	12.778	14.148	14.081	14.876	12.852	12.782	13.408	13.269	10
11	14.705	14.417	13.847	15.982	16.475	16.867	13.991	14.866	12.886	14.407	11
12	14.376	14.513	13.739	15.394	12.166	18.129	15.879	13.644	14.086	14.361	12
13	8.311	14.160	17.148			28.496					13



Table 11.8 Total International Fishing Mortality Rate at Age of COO in IV between 1966 and 1985

Age	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	Age
1	0.054	0.033	0.045	0.021	0.110	0.076	0.034	0.130	0.095	0.107	1
2	0.546	0.492	0.630	0.390	0.583	0.883	0.898	0.704	0.814	0.725	2
3	0.617	0.721	0.731	0.600	0.746	0.774	0.919	0.855	0.684	0.748	3
4	0.512	0.520	0.705	0.578	0.577	0.703	0.669	0.798	0.666	0.657	4
5	0.467	0.565	0.598	0.622	0.581	0.697	0.703	0.593	0.666	0.748	5
6	0.443	0.551	0.515	0.650	0.526	0.526	0.813	0.696	0.557	0.679	6
7	0.401	0.638	0.506	0.421	0.467	0.552	0.747	0.699	0.656	0.522	7
8	0.515	0.593	0.480	0.498	0.260	0.421	0.954	0.499	0.610	0.658	8
9	0.710	0.366	0.550	0.448	0.429	0.495	0.787	0.293	0.750	0.834	9
10	1.102	0.516	0.576	0.323	0.613	0.312	0.492	0.243	0.537	0.471	10
11	0.815	0.136	0.448	0.772	0.265	1.256	0.045	0.743	2.142	0.722	11
12	0.500	0.500	0.500	0.500	0.500	0.500	0.600	0.600	0.600	0.600	12
13	0.500	0.500	0.500	0.500	0.500	0.500	0.600	0.600	0.600	0.600	13

Age	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	Age
1	0.037	0.126	0.094	0.120	0.115	0.121	0.180	0.136	0.187	0.227	1
2	0.931	0.897	1.025	0.847	1.001	1.044	0.995	1.132	1.093	1.033	2
3	0.824	0.758	0.857	0.972	0.974	1.009	1.225	1.190	1.124	1.250	3
4	0.799	0.548	0.742	0.615	0.735	0.729	0.791	0.918	0.908	1.010	4
5	0.597	0.631	0.884	0.716	0.620	0.711	0.766	0.850	0.873	0.940	5
6	0.792	0.606	0.696	0.573	0.630	0.687	0.875	0.863	0.926	0.920	6
7	0.760	0.805	0.720	0.626	0.785	0.744	0.755	0.813	0.822	0.970	7
8	0.286	0.815	0.802	0.582	0.791	0.654	0.661	0.886	0.965	0.900	8
9	0.485	1.540	1.031	0.869	0.744	0.702	0.828	0.623	1.180	0.900	9
10	0.582	0.354	0.989	0.940	0.977	1.173	0.592	0.711	0.778	0.900	10
11	0.208	0.172	0.421	0.151	2.193	1.048	1.217	1.137	1.381	0.900	11
12	0.600	0.800	0.800	0.800	0.800	0.800	0.900	0.900	0.900	0.900	12
13	0.600	0.800	0.800	0.800	0.800	0.800	0.900	0.900	0.900	0.900	13

Table 11.9 Stock Numbers at Age (1000's) of COD in IV between 1966 and 1985

Age	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	Age
1	479028	461461	184755	196880	729266	846596	160063	292908	234047	426193	1
2	166043	203891	200614	79371	86611	293516	352490	69516	115598	95635	2
3	69248	67794	87812	75304	37873	34085	85548	101183	24221	36079	3
4	16167	29094	25663	32911	32171	13992	12244	26569	33528	9520	4
5	9500	7932	14168	10379	15114	14793	5674	5134	9798	14104	5
6	3744	4878	3693	6378	4562	6924	6032	2300	2323	4122	6
7	1514	1968	2303	1806	2727	2208	3351	2190	939	1090	7
8	962	830	851	1137	970	1399	1041	1300	891	399	8
9	259	470	375	431	566	613	752	328	646	396	9
10	87	104	267	177	226	302	306	280	200	250	10
11	105	24	51	123	105	100	181	153	180	96	11
12	71	38	17	27	46	66	23	142	60	17	12
13				13				54	11	12	13

Age	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	Age
1	206993	709091	426098	451498	786140	258708	533372	265290	527269	56988	1
2	172003	89658	280887	174352	179997	314790	103023	200185	104067	196476	2
3	32638	47793	25775	70994	52647	46593	78061	26855	45499	24575	3
4	13299	11151	17443	8520	20909	15478	13229	17856	6365	11515	4
5	4039	4896	5280	6798	3771	8205	6110	4911	5837	2102	5
6	5465	1821	2132	1785	2719	1661	3299	2324	1719	1995	6
7	1711	2026	814	870	824	1186	684	1125	803	558	7
8	530	655	742	324	381	308	461	263	409	289	8
9	169	326	237	272	148	142	131	195	89	128	9
10	141	85	57	69	94	58	57	47	86	22	10
11	128	64	49	17	22	29	15	26	19	32	11
12	38	85	44	26	12	2	8	4	7	4	12
13	3	69	5			6					13

Table 11.10.1 VPA at age 1 (millions) and survey indices at age 0 for North Sea COD.

Year	Year class	VPA	EGFS	DGFS
1977	1977	426	1,559	-
1978	1978	451	1,679	-
1979	1979	786	1,856	-
1980	1980	259	1,006	43.2
1981	1981	533	7,963	176.8
1982	1982	265	254	26.9
1983	1983	527	9,595	121.5
1984	1984	(57)	45	1.3
1985	1985	(790)	798	143.6

Table 11.10.2 VPA (millions), survey indices, catchability and estimates of year-class strength for North Sea COD: age 1.

Year	Year class	VPA	IYFS	EGFS	DGFS	FRGSF	IYFS/ VPA	EGFS/ VPA	DGFS/ VPA	FRGSF/ VPA
1969	1968	197	-	-	-	6.1	-	-	-	0.031
1970	1969	729	-	-	-	34.1	-	-	-	0.047
1971	1970	847	98.3	-	-	(90.4)	0.116	-	-	-
1972	1971	160	4.1	-	-	1.3	0.026	-	-	0.008
1973	1972	293	38.0	-	-	1.6	0.130	-	-	0.005
1974	1973	234	14.7	-	-	3.6	0.063	-	-	0.015
1975	1974	426	40.3	-	-	8.0	0.095	-	-	0.019
1976	1975	207	7.9	-	-	7.8	0.038	-	-	0.038
1977	1976	709	36.7	6,818	-	28.2	0.052	9.62	-	0.040
1978	1977	426	12.9	2,372	-	27.2	0.030	5.57	-	0.064
1979	1978	451	9.9	2,265	-	31.1	0.022	5.02	-	0.069
1980	1979	786	16.8	5,150	163.8	35.5	0.021	6.55	0.208	0.045
1981	1980	259	2.9	1,232	46.9	14.1	0.011	4.76	0.181	0.054
1982	1981	533	9.2	3,234	83.0	23.2	0.017	6.07	0.156	0.044
1983	1982	265	3.9	1,541	21.8	9.0	0.015	5.82	0.082	0.034
1984	1983	527	30.6	6,122	121.3	43.0	0.058	11.62	0.230	0.082
1985	1984	( 57)	0.7	419	3.6	0.9	-	-	-	-
1986	1985	(790)	13.6 <sup>1</sup>	-	-	-	-	-	-	-

Mean catchability:

0.017      5.63      0.157      0.044

Years included in mean:

1979-83    1978-83    1980-83    1980-83

	Year	Year class	IYFS	EGFS	DGFS	FRGSF	Adopted value
Estimated	1984	1983	1,779	1,087	774	972	527 <sup>2</sup>
year-class	1985	1984	41	74	23	20	57
strength	1986	1985	791	-	504 <sup>3</sup>	-	790

<sup>1</sup> Preliminary value.

<sup>2</sup> Value from VPA.

<sup>3</sup> Estimated at age 0.

Table 11.10.3 VPA (millions), survey indices, catchability and estimates of year-class strength for North Sea COD: age 2.

Year	Year class	VPA	IYFS	EGFS	DGFS	IYFS/ VPA	EGFS/ VPA	DGFS/ VPA
1971	1969	293	25.9	-	-	0.088	-	-
1972	1970	352	34.5	-	-	0.098	-	-
1973	1971	70	10.6	-	-	0.151	-	-
1974	1972	116	9.5	-	-	0.082	-	-
1975	1973	96	6.2	-	-	0.065	-	-
1976	1974	172	19.9	-	-	0.116	-	-
1977	1975	90	3.2	459	-	0.036	5.10	-
1978	1976	281	29.3	1,249	-	0.104	4.44	-
1979	1977	174	9.3	592	-	0.053	3.40	-
1980	1978	180	14.8	696	4.5	0.082	3.87	0.025
1981	1979	315	25.5	1,411	11.2	0.081	4.48	0.036
1982	1980	103	6.7	289	1.6	0.065	2.81	0.016
1983	1981	200	16.6	1,095	2.3	0.083	5.48	0.012
1984	1982	104	9.4	477	1.6	0.090	4.59	0.015
1985	1983	196	17.3	1,168	3.1	0.088	5.96	0.016

Mean catchability:	0.080	5.00	0.014
Years included in mean:	1980-84	1983-84	1982-84

	Year	Year class	IYFS	EGFS	DGFS	Adopted value
Estimated year-class strength	1985	1983	216	234	221	196 <sup>1</sup>

<sup>1</sup>Value from VPA.

Table 11.11 Mean Fishing Mortality, Biomass and Recruitment of COD in IV between 1966 and 1985

Year	Mean Fishing Mortality			Biomass		Recruits	
	Ages 2 to 8		Ages 1 to 1	1000 tonnes		Age 1	
	H.Con	Disc	By-cat	Total	Sp St	Y.C.	Million
1966	0.500	0.000	0.000	819	222	65	479
1967	0.583	0.000	0.000	882	244	66	461
1968	0.595	0.000	0.000	755	252	67	185
1969	0.537	0.000	0.000	606	251	68	197
1970	0.534	0.000	0.000	924	271	69	729
1971	0.651	0.000	0.000	1110	269	70	847
1972	0.815	0.000	0.000	763	225	71	160
1973	0.692	0.000	0.000	608	197	72	293
1974	0.665	0.000	0.000	565	210	73	234
1975	0.677	0.000	0.000	626	190	74	426
1976	0.713	0.000	0.000	533	163	75	207
1977	0.723	0.000	0.000	703	142	76	709
1978	0.818	0.000	0.000	703	142	77	426
1979	0.705	0.000	0.000	699	145	78	451
1980	0.791	0.000	0.000	872	159	79	786
1981	0.797	0.000	0.000	720	169	80	259
1982	0.867	0.000	0.000	702	160	81	533
1983	0.950	0.000	0.000	540	132	82	265
1984	0.959	0.000	0.000	604	108	83	527
1985	1.003	0.000	0.000	355	91	84	57
Mean recruits at age 1 for period 1966 to 1985							412

Table 11.12 Input for catch prediction of COD in IV

1985				Values used in Prediction									
Stock and Fishing Mortality				F at age, Mean Wt. and Propn. Retained by Consumption Fishery									
Age	Stock Number	Fishing Mortality		Ind	Scaled mean F 1980 to 1985			Mean values for period 1980 to 1985 Mean Weight (Kg.)			Stock	Prop. Ret.	
		H.Con.	Disc		H.Con.	Disc	Ind	H.Con.	Disc	Ind			
1	56988	0.227			0.181			0.610			0.610	1.000	
2	196476	1.033			1.177			0.928			0.928	1.000	
3	24575	1.250			1.266			2.032			2.032	1.000	
4	11515	1.010			0.952			4.344			4.344	1.000	
5	2102	0.940			0.890			6.608			6.608	1.000	
6	1995	0.920			0.916			8.743			8.743	1.000	
7	558	0.970			0.914			10.262			10.262	1.000	
8	289	0.900			0.908			11.879			11.879	1.000	
9	128	0.900			0.931			13.172			13.172	1.000	
10	22	0.900			0.959			13.545			13.545	1.000	
11	32	0.900			1.472			14.916			14.916	1.000	
12	4	0.900			0.972			14.711			14.711	1.000	
13		0.900			0.972			28.496			28.496	1.000	
Mean F		Age 2 to 8	Age 1		Age 2 to 8	Age 1							
Unscaled		1.003	0.000		0.894	0.000							
Scaled					1.003	0.000							

Recruits at age 1 in 1986 = 790000

Recruits at age 1 in 1987 = 411632

Recruits at age 1 in 1988 = 411632

N at age and proportion mature at age are as shown in Table 11.5.

Mean F for ages 2 to 8 in 1985 for human consumption landings + discards = 1.003.  
Human consumption + discard F-at-age values in prediction are mean values for the period 1980 to 1985 rescaled to produce a mean value of F for ages 2 to 8 equal to that for 1985

Mean F for ages 1 to 1 in 1985 for small-mesh fisheries = 0.000.  
Industrial fishery F-at-age in the prediction are averages for the period 1980 to 1985, rescaled to produce a mean value of F for ages 1 to 1 equal to that for 1985

Table 11.13 Predicted Catches and Biomasses ( 1000's of tonnes ) of COD in IV 1986 to 1987

	1985		1986		Year 1987							
	Jan	Jan	Jan	Jan	Jan	Jan	Jan	Jan	Jan	Jan	Jan	Jan
Biomass												
Total	355	664	610	610	610	610	610	610	610	610	610	610
Spawning	91	80	74	74	74	74	74	74	74	74	74	74
Mean F												
Ages												
Human Cons. 2 to 8	1.00	1.00	1.00	0.20	0.40	0.60	0.80	1.00	1.20	1.00	1.00	1.00
Small-mesh 1 to 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mean F(Year)/Mean F(1985)												
Human Consumption	1.00	1.00	0.20	0.40	0.60	0.80	1.00	1.20	1.00	1.00	1.00	1.00
Catch weight												
Human Consumption	190	167	0	69	125	172	210	243	270	0	0	0
Discards	0	0	0	0	0	0	0	0	0	0	0	0
Small-mesh Fisheries	0	0	0	0	0	0	0	0	0	0	0	0
Total landings	190	167	0	69	125	172	210	243	270	0	0	0
Total catch	190	167	0	69	125	172	210	243	270	0	0	0
Biomass Jan of Year+1												
Total	664	610	948	835	744	671	611	563	524	0	0	0
Spawning	80	74	196	160	131	107	88	73	61	0	0	0

**Table 12.1** Nominal catch (in tonnes) of COD in Division VIa, 1976-85. (Data for 1976-84 as officially reported to Ices.)

Country	1976	1977	1978	1979	1980
Belgium	71	-	-	4	57 <sup>2</sup>
Denmark	-	-	-	-	27 <sup>2</sup>
Faroe Islands	39	43	-	40	3
France	5,611	3,583	4,499	4,590	5,495
German Dem. Rep.	-	-	-	-	-
Germany, Fed. Rep.	1	3	31	40	1
Ireland	1,341	984	1,214	2,237	2,331
Netherlands	11	5	3	20	1
Norway	22	29	40	32	48
Poland	18	-	-	-	-
Spain	15	20 <sup>2</sup>	108 <sup>2</sup>	-	-
Sweden	-	-	-	-	-
UK (England and Wales)	2,742	2,434	2,082	2,348	2,302
UK (Scotland)	7,475	5,513	5,539	6,929	7,603
UK (Northern Ireland)	13	5	5	2	2
USSR	46	-	-	-	-
<b>Total</b>	<b>17,405</b>	<b>12,619</b>	<b>13,521</b>	<b>16,242</b>	<b>17,870</b>

Country	1981	1982	1983	1984	1985
Belgium	30	35	21	22 <sub>1</sub>	48
Denmark	-	3	-	- <sub>1</sub>	-
Faroe Islands	-	2	-	-	-
France	7,601	7,160	8,140	7,637	6,851 <sup>4</sup>
German Dem. Rep.	-	-	-	-	-
Germany, Fed. Rep.	21	8	205	75	146 <sup>5</sup>
Ireland	2,725	3,527	2,695	2,316	2,151 <sup>5</sup>
Netherlands	-	-	-	-	-
Norway	40	238	267 <sup>1</sup>	242 <sub>1</sub>	205
Poland	-	-	-	-	-
Spain	-	41	52	-	-
Sweden	-	1	-	-	-
UK (England and Wales)	3,187 <sup>3</sup>	2,948	1,141	692	214
UK (Scotland)	10,339	7,969	8,933	9,438	7,973
UK (Northern Ireland)	7	33	37	32	15
USSR	-	-	-	-	-
<b>Total</b>	<b>23,950</b>	<b>21,965</b>	<b>21,491</b>	<b>20,499</b>	<b>17,603</b>

<sup>1</sup> Provisional.

<sup>2</sup> Includes Division VIb.

<sup>3</sup> Including 37 tonnes caught in Sub-area VI and landed abroad.

<sup>4</sup> Includes Divisions VIb and Vb.

<sup>5</sup> Includes Division VIb.



Table 12.2 Annual Weight and Numbers of COD caught in VIA between 1966 and 1985

Year	Weight ( 1000 tonnes )				Number ( millions )			
	Total	H.Con	Disc	By-cat	Total	H.Con	Disc	By-cat
1966	17	17	0	0	23	23	0	0
1967	23	23	0	0	31	31	0	0
1968	24	24	0	0	32	32	0	0
1969	22	22	0	0	28	28	0	0
1970	13	13	0	0	17	17	0	0
1971	11	11	0	0	14	14	0	0
1972	15	15	0	0	21	21	0	0
1973	12	12	0	0	17	17	0	0
1974	14	14	0	0	19	19	0	0
1975	13	13	0	0	18	18	0	0
1976	17	17	0	0	25	25	0	0
1977	13	13	0	0	18	18	0	0
1978	14	14	0	0	18	18	0	0
1979	16	16	0	0	22	22	0	0
1980	18	18	0	0	25	25	0	0
1981	24	24	0	0	36	36	0	0
1982	22	22	0	0	30	30	0	0
1983	21	21	0	0	10	10	0	0
1984	21	21	0	0	8	8	0	0
1985	18	18	0	0	9	9	0	0

Table 12.3 Catch at age data by nation and gear used in Q analysis

Minimum age for Q analysis = 2

Maximum age for Q analysis = 7

Nation : S.U Gear : SEI

Year	Effort	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7
1966	156511	535	127	238	218	17	14
1967	158708	530	780	234	94	43	7
1968	150094	175	734	369	34	24	17
1969	140718	692	314	423	115	26	12
1970	95629	444	428	77	48	9	3
1971	98748	265	114	102	26	19	2
1972	70741	255	186	52	32	3	2
1973	59596	237	147	34	10	11	15
1974	56448	204	69	49	17	6	2
1975	56420	239	102	35	12	5	1
1976	57090	225	90	61	10	10	1
1977	41920	121	111	22	11	5	2
1978	33617	135	64	42	13	4	2
1979	39465	115	197	25	19	5	1
1980	38640	223	75	37	13	4	1
1981	37208	410	130	42	8	1	1
1982	36689	138	137	32	14	4	1
1983	38080	413	65	59	15	5	2
1984	29561	55	79	26	17	10	1
1985	26261	145	27	23	5	5	1

(ctd.)

Table 12.3 ctd.

Nation : SCD Gear : TRL

Year	Effort	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7
1966	71525	1164	149	209	195	16	14
1967	54231	539	597	50	58	44	7
1968	50061	237	511	328	22	29	18
1969	42058	135	191	364	136	16	15
1970	40572	35	190	123	119	42	7
1971	41234	179	23	141	50	33	14
1972	55536	486	155	31	87	11	9
1973	51153	52	180	70	13	29	12
1974	45899	192	100	228	29	10	12
1975	37080	175	82	40	59	13	3
1976	35307	204	149	49	39	41	7
1977	33948	69	75	27	12	9	6
1978	51582	256	76	108	53	20	9
1979	33373	107	101	33	28	15	4
1980	19660	141	75	36	7	6	2
1981	13753	170	83	16	2		
1982	14194	31	111	25	3		1
1983	23056	222	27	46	15	14	3
1984	20061	93	95	14	20	9	2
1985	9516	101	17	16	1	2	

Nation : SCD Gear : LTR

Year	Effort	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7
1966	40539	113	20	40	34	2	2
1967	80916	140	250	82	30	13	2
1968	65348	40	164	91	8	7	4
1969	106856	130	116	198	61	10	3
1970	118881	242	298	87	62	9	2
1971	129187	183	86	107	24	4	4
1972	142244	387	330	92	59	19	6
1973	91151	142	214	118	28	21	1
1974	88651	372	140	125	38	6	7
1975	132353	326	224	99	41	10	1
1976	139225	464	317	105	45	31	11
1977	143574	186	389	157	60	9	3
1978	127387	402	185	134	33	8	3
1979	99803	187	485	57	31	6	
1980	121211	699	328	129	34	10	5
1981	165002	1125	524	183	31	4	3
1982	135280	368	616	164	46	6	2
1983	112332	1161	196	164	51	18	6
1984	132217	593	419	85	94	31	7
1985	141916	1300	219	132	21	22	6

ctd.

Table 12.3 ctd.

Nation : SCD Gear : NTR

Year	Effort	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7
1966	116972	124	17	29	23	2	3
1967	135811	111	108	30	11	6	1
1968	166713	35	134	67	7	4	4
1969	155131	146	69	65	20	4	2
1970	134891	98	160	30	17	4	1
1971	127638	552	57	44	9	24	1
1972	184997	462	214	40	14	6	2
1973	215031	242	141	61	20	16	1
1974	186342	448	85	58	19	4	2
1975	203053	250	125	34	11	9	
1976	224347	336	124	49	14	8	1
1977	196403	200	251	42	16	2	2
1978	219562	171	61	45	13	3	2
1979	273713	184	165	34	18	3	1
1980	254147	329	123	36	6	2	1
1981	286461	415	180	31	6	1	
1982	289902	124	163	39	6	2	
1983	293396	419	55	25	7	1	
1984	315418	192	95	16	11	5	
1985	383472	394	49	24	4	1	1

Table 12.4 Results of analysis of catchability coefficients for COD in VIA

F for named gears and total international F

Gear	Estimate	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7
	F(gear)	0.024	0.027	0.031	0.030	0.034	0.006
SCD SEI	Var F(gear)	0.00002	0.00002	0.00062	0.00003	0.00003	0.00010
	Propn(gear)	0.03066	0.01882	0.02164	0.03290	0.02054	0.01523
	F(gear)	0.010	0.013	0.010	0.009	0.023	0.022
SCD TRL	Var F(gear)	0.00000	0.00000	0.00001	0.00092	0.00006	0.00005
	Propn(gear)	0.02126	0.01192	0.01506	0.00687	0.01191	0.00000
	F(gear)	0.152	0.168	0.148	0.145	0.132	0.167
SCD LTR	Var F(gear)	0.00031	0.00043	0.00020	0.00047	0.00058	0.00215
	Propn(gear)	0.27466	0.15083	0.12182	0.14338	0.13059	0.09956
	F(gear)	0.024	0.033	0.021	0.014	-0.006	0.011
SCD NTR	Var F(gear)	0.00044	0.00033	0.00006	0.00019	0.00029	0.00022
	Propn(gear)	0.08334	0.03377	0.02265	0.02645	0.00574	0.01531
	F(gear)	0.209	0.241	0.210	0.197	0.183	0.207
All above	Var F(gear)	0.00077	0.00079	0.00029	0.00070	0.00097	0.00252
	Propn(gear)	0.40994	0.21534	0.18118	0.20960	0.17678	0.13009
Total	F	0.511	1.120	1.161	0.941	1.036	1.590
Internatl	Var F	0.00457	0.01704	0.00892	0.01582	0.03096	0.14864

Table 12.5 Values of Natural Mortality Rate and Proportion Mature at age

Age	Nat Mor	Mat.
1	0.200	0.000
2	0.200	0.520
3	0.200	0.860
4	0.200	1.000
5	0.200	1.000
6	0.200	1.000
7	0.200	1.000
8	0.200	1.000
9	0.200	1.000
10	0.200	1.000

Table 12.6 Total International Catch at Age (1000's) of COD in VIA between 1966 and 1985

Age	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	Age
1	384	261	333	64	256	235	735	1015	843	1207	1
2	2883	2571	1364	1974	1176	1771	2891	1524	2318	1898	2
3	629	3705	3289	1332	1638	487	1591	1442	778	1187	3
4	999	670	1838	1943	571	763	409	583	1068	533	4
5	825	442	215	759	476	223	501	161	288	325	5
6	78	264	171	149	153	198	108	193	72	90	6
7	43	43	124	94	26	64	70	63	76	12	7
8	5	21	19	65	21	15	24	28	13	13	8
9	1	1	6	12	23	7	12	10	9	9	9
10	3	2	1	4	4	4	4	3	5	1	10

Age	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	Age
1	970	1262	723	929	1195	460	1827	2335	2143	1396	1
2	3682	1311	1761	1613	3294	7015	1673	4515	2360	4732	2
3	1467	1636	999	2125	2001	3221	3206	1118	2564	1449	3
4	638	622	695	682	796	905	1189	1400	448	1080	4
5	256	268	286	343	191	182	367	468	555	148	5
6	215	87	97	133	77	30	111	148	185	171	6
7	44	57	47	33	27	17	22	40	40	64	7
8	7	11	18	16	8	3	10	16	14	10	8
9	4	4	8	16	1	1	1	2	5	6	9
10	1	5	1	4	1	0	1	1	1	1	10



Table 12.9: Stock Numbers at Age (1000's) of COD in VIA between 1966 and 1985

Age	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	Age
1	15285	6661	9364	3974	7642	10461	6301	8513	8294	11450	1
2	13320	12167	5218	7366	3196	6025	8352	4497	6055	6031	2
3	2422	8313	7649	3047	4258	1563	3344	4247	2316	2882	3
4	2234	1418	3495	3323	1305	2020	842	1317	2185	1198	4
5	1706	937	563	1224	994	558	971	325	557	836	5
6	226	660	372	269	329	389	258	348	122	200	6
7	97	116	304	152	88	133	142	114	113	36	7
8	8	4	56	138	41	48	52	54	38	26	8
9	4	2	15	29	55	15	26	21	19	20	9
10	7	4	4		9	8	10	7	11	2	10

Age	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	Age
1	6543	9809	9545	15091	20891	6100	16043	10227	17835	12701	1
2	8287	4483	6894	7162	11516	16026	4579	11488	6274	12671	2
3	3235	3495	2494	4062	4414	6472	6851	2250	5365	3023	3
4	1298	1338	1401	1148	1432	1827	2427	2747	845	2104	4
5	505	494	540	528	334	464	689	926	1001	293	5
6	393	186	165	187	129	104	217	237	342	326	6
7	83	131	75	49	36	36	58	79	63	115	7
8	18	29	56	20	11	6	15	28	29	16	8
9	9	9	14	30	2	2	2	4	9	11	9
10	3	11	2	7	1	1	2	2			10

Table 12.10 VPA numbers (millions) for cod in the North Sea and to the West of Scotland age 1.

Year	Year Class	VPA IV	VPA VIA
1966	1965	479	15.3
1967	1966	461	6.7
1968	1967	185	9.4
1969	1968	197	4.0
1970	1969	729	7.6
1971	1970	847	10.5
1972	1971	160	6.3
1973	1972	293	8.5
1974	1973	234	8.3
1975	1974	426	11.5
1976	1975	207	6.5
1977	1976	709	9.8
1978	1977	426	9.5
1979	1978	451	15.1
1980	1979	786	20.9
1981	1980	259	6.1
1982	1981	533	16.0
1983	1982	265	10.2
1984	1983	527	17.8
1985	1984	57	12.7

Table 12.11 Mean Fishing Mortality, Bioass and Recruitment of COD in VIA between 1966 and 1985

Year	Mean Fishing Mortality			Bioass		Recruits	
	Ages 2 to 5		Ages 1 to 11	1000 tonnes		Age 1	
	H.Con	Disc	By-cat	Total	Sp St	Y.C.	Million
1966	0.506	0.000	0.000	62	40	65	15
1967	0.594	0.000	0.000	65	48	66	7
1968	0.590	0.000	0.000	63	49	67	9
1969	0.779	0.000	0.000	47	38	68	4
1970	0.612	0.000	0.000	34	27	69	8
1971	0.478	0.000	0.000	37	25	70	10
1972	0.697	0.000	0.000	36	26	71	6
1973	0.591	0.000	0.000	34	25	72	9
1974	0.647	0.000	0.000	35	26	73	8
1975	0.559	0.000	0.000	39	27	74	11
1976	0.728	0.000	0.000	40	29	75	7
1977	0.676	0.000	0.000	33	23	76	10
1978	0.635	0.000	0.000	38	26	77	10
1979	0.843	0.000	0.000	43	26	78	15
1980	0.738	0.000	0.000	54	31	79	21
1981	0.692	0.000	0.000	54	39	80	6
1982	0.714	0.000	0.000	55	38	81	16
1983	0.737	0.000	0.000	48	34	82	10
1984	0.762	0.000	0.000	54	34	83	19
1985	0.720	0.000	0.000	47	30	84	13
Mean recruits at age 1 for period 1966 to 1985							11

Table 12.12 Input for catch prediction of COD in VIA

1985				Values used in Prediction							
Stock and Fishing Mortality				F at age, Mean Wt. and Propn. Retained by Consumption Fishery							
Age	Stock Number	Fishing Mortality		Scaled mean F 1980 to 1985			Mean values for period 1980 to 1985 Mean Weight (Kg.)				
		H.Con.	Disc	H.Con.	Disc	Ind	H.Con.	Disc	Ind	Stock	Prop.
1	12701	0.129		0.140			0.638			0.638	1.000
2	12671	0.525		0.520			1.306			1.306	1.000
3	3023	0.739		0.731			2.886			2.886	1.000
4	2104	0.818		0.817			4.915			4.915	1.000
5	293	0.798		0.811			6.774			6.774	1.000
6	326	0.844		0.843			8.289			8.289	1.000
7	115	0.923		0.952			9.686			9.686	1.000
8	16	1.183		1.098			10.338			10.338	1.000
9	11	0.900		0.891			10.667			10.667	1.000
10		0.900		0.891			10.917			10.917	1.000
Mean F	Age 2 to 5	Age 1	Age 2 to 5	Age 1	Age 2 to 5	Age 1					
Unscaled		0.720		0.000		0.727				0.000	
Scaled						0.720				0.000	

Recruits at age 1 in 1986 = 14700  
 Recruits at age 1 in 1987 = 14700  
 Recruits at age 1 in 1988 = 14700

M at age and proportion mature at age are as shown in Table 12.5.

Mean F for ages 2 to 5 in 1985 for human consumption landings + discards = 0.720.  
 Human consumption + discard F-at-age values in prediction are mean values for the period 1980 to 1985 rescaled to produce a mean value of F for ages 2 to 5 equal to that for 1985

Mean F for ages 1 to 1 in 1985 for small-mesh fisheries = 0.000.  
 Industrial fishery F-at-age in the prediction are averages for the period 1980 to 1985.  
 rescaled to produce a mean value of F for ages 1 to 1 equal to that for 1985



Table 12.13A Predicted Catches and Biomasses ( 1000's of tonnes ) of COD in VIA 1986 to 1987

	1985		1986		Year								
					1987								
Biomass 1 Jan of Year													
Total	47	52	54	54	54	54	54	54	54	54	54	54	54
Spawning	30	35	36	36	36	36	36	36	36	36	36	36	36
Mean F	Ages												
Human Cons.	2 to 5	10.72	10.72	10.00	10.14	10.29	10.43	10.58	10.72	10.86	10.00	10.00	10.00
Small-mesh	1 to 1	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
Mean F(Year)/Mean F(1985)											F0.1	Fmax	
Human Consumption		1.00	1.00	10.00	10.20	10.40	10.60	10.80	1.00	1.20	10.00	10.00	10.00
Catch weight													
Human Consumption		18	21	0	6	10	15	18	22	24	0	0	0
Discards		0	0	0	0	0	0	0	0	0	0	0	0
Small-mesh Fisheries		0	0	0	0	0	0	0	0	0	0	0	0
Total landings		18	21	0	6	10	15	18	22	24	0	0	0
Total catch		18	21	0	6	10	15	18	22	24	0	0	0
Biomass 1 Jan of Year+1													
Total		52	54	87	79	72	65	60	55	51	0	0	0
Spawning		35	36	67	59	52	46	41	37	33	0	0	0

Table 12.13B Predicted Catches and Biomasses ( 1000's of tonnes ) of COD in VIA 1986 to 1987

	1985		1986		Year								
					1987								
Biomass 1 Jan of Year													
Total	47	52	48	48	48	48	48	48	48	48	48	48	48
Spawning	30	35	31	31	31	31	31	31	31	31	31	31	31
Mean F	Ages												
Human Cons.	2 to 5	10.72	10.94	10.00	10.14	10.29	10.43	10.58	10.72	10.86	10.00	10.00	10.00
Small-mesh	1 to 1	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
Mean F(Year)/Mean F(1985)											F0.1	Fmax	
Human Consumption		1.00	1.30	10.00	10.20	10.40	10.60	10.80	1.00	1.20	10.00	10.00	10.00
Catch weight													
Human Consumption		18	25	0	5	9	13	16	19	21	0	0	0
Discards		0	0	0	0	0	0	0	0	0	0	0	0
Small-mesh Fisheries		0	0	0	0	0	0	0	0	0	0	0	0
Total landings		18	25	0	5	9	13	16	19	21	0	0	0
Total catch		18	25	0	5	9	13	16	19	21	0	0	0
Biomass 1 Jan of Year+1													
Total		52	48	79	72	66	60	56	51	47	0	0	0
Spawning		35	31	59	53	47	42	37	33	30	0	0	0

**Table 13.1** Nominal catch (in tonnes) of COD in Division VIb, 1976-85. (Data for 1976-84 as officially reported to ICES.)

Country	1976	1977	1978	1979	1980
Belgium	1	-	-	-	- <sub>2</sub>
Denmark	-	-	-	-	-
Faroe Islands	22	40	10	92	75
France	4	3	1	2	1
Germany, Fed. Rep.	-	-	-	111	136
Ireland	-	-	3	-	-
Norway	8	3 <sub>2</sub>	69 <sub>2</sub>	138	80
Spain	-	-	-	-	33
UK (England and Wales)	77	89	285	129	1
UK (Scotland)	61	33	384	198	370
USSR	1,398	-	-	-	-
<b>Total</b>	<b>1,571</b>	<b>168</b>	<b>752</b>	<b>670</b>	<b>696</b>

Country	1981	1982	1983	1984	1985 <sup>1</sup>
Belgium	-	-	-	-	-
Denmark	-	-	-	-	-
Faroe Islands	2	77	112	18	- <sub>2</sub>
France	4	27	97	9	- <sub>2</sub>
Germany, Fed. Rep.	443	+	195	-	- <sub>2</sub>
Ireland	-	-	-	-	-
Norway	134	51	462 <sup>1</sup>	373 <sup>1</sup>	203
Spain	70	58	42	-	-
UK (England and Wales)	67	3	163	161	111
UK (Scotland)	143	157	35	221	437
USSR	-	-	-	-	-
<b>Total</b>	<b>863</b>	<b>373</b>	<b>1,106</b>	<b>782</b>	<b>754</b>

<sup>1</sup> Provisional.

<sup>2</sup> Included in Division VIa.

Table 14.1 Nominal catch (in tonnes) of COD in Divisions VIId and VIIe, 1976-85. (Data for 1976-84 as officially reported to ICES.)

Country	1976	1977	1978	1979	1980
Belgium	65	53	435	699	163
Denmark	1,506	1,120	2,160	2,052	660 <sup>2</sup>
France	1,646	5,185	8,044	4,848	4,001
Netherlands	2	1	+	-	-
UK (England and Wales)	142	581	654	485	365
UK (Scotland)	-	-	-	+	-
USSR	4	-	-	-	-
Total	3,365	6,940	11,293	8,084	5,189

Country	1981	1982	1983	1984	1985 <sup>1</sup>
Belgium	363	293	389	346	537
Denmark	-	-	-	-	-
France	4,486	3,349	3,369	2,882	7,740 <sup>3</sup>
Netherlands	4	1	4	- <sup>1</sup>	-
UK (England and Wales)	428	568	650	518	565
UK (Scotland)	-	-	-	-	-
USSR	-	-	-	-	-
Total	5,281	4,211	4,412	3,746	8,842

<sup>1</sup> Provisional.

<sup>2</sup> Includes Divisions VIId,c.

<sup>3</sup> Includes all of Sub-areas VII (except Division VIIa) and VIII.

Table 14.2 Nominal catch (in tonnes) of COD in Divisions VIIb,c and VIIg-k, 1976-85. (Data for 1976-84 as officially reported to ICES.)

Country	1976	1977	1978	1979	1980
Belgium	159	85	52	51	110 <sub>3</sub>
Denmark	-	-	-	18	-
France	3,196	1,972	2,192 <sub>2</sub>	2,918	4,475
Germany, Fed. Rep.	-	-	3 <sub>2</sub>	-	7
Ireland	506	315	323	552	1,028
Netherlands	46	291	279	-	5
Norway	-	+	-	-	-
Poland	40	6	-	2	-
Spain	1,140	51	11	-	17
UK (England and Wales)	44	33	28	33	83
UK (Scotland)	-	-	2	1	12
USSR	203	-	-	-	-
<b>Total</b>	<b>5,234</b>	<b>2,753</b>	<b>2,890</b>	<b>3,575</b>	<b>5,737</b>

Country	1981	1982	1983	1984	1985 <sup>1</sup>
Belgium	198	97	113	144	197
Denmark	-	-	-	-	- <sub>3</sub>
France	6,803	5,041	4,668	4,881	-
Germany, Fed. Rep.	-	-	-	-	-
Ireland	1,542	1,906	1,466	1,415	776
Netherlands	-	+	80	-	-
Norway	-	-	4	1 <sup>1</sup>	25
Poland	-	-	-	-	-
Spain	37	29	28	-	-
UK (England and Wales)	288	419	103	489	223
UK (Scotland)	+	-	-	45	-
USSR	-	-	-	-	-
<b>Total</b>	<b>8,868</b>	<b>7,492</b>	<b>6,462</b>	<b>6,975</b>	<b>1,221</b>

<sup>1</sup> Provisional.

<sup>2</sup> Catch in Division VIIg only.

<sup>3</sup> Included in Divisions VIId-e.

**Table 15.1** Nominal catch (in tonnes) of HADDOCK in Sub-area IV, 1976-85. (Data for 1976-84 as officially reported to ICES.)

Country	1976	1977	1978	1979	1980
Belgium	2,166	2,293	1,295	732	1,414
Denmark	46,899	20,069	8,093	8,248	12,928
Faroe Islands	183	385	12	7	27
France	5,500	6,914	5,122	7,208	7,407
German Dem. Rep.	20	8	37	12	36
Germany, Fed. Rep.	3,433	3,744	2,589	2,549	2,354
Ireland	31	53	101	-	-
Netherlands	1,728	1,598	857	955	1,557
Norway <sup>2</sup>	367	374	609	968	1,191
Poland	1,155	485	62	106	59
Sweden	2,455	113	- <sup>3</sup>	907	1,165
UK (England and Wales)	17,238	17,167	12,200	10,774	12,195
UK (Scotland)	80,576	89,465	58,406	54,119	64,058
USSR	42,852	8,010	54	18	-
<b>Total IV</b>	<b>204,603</b>	<b>150,678</b>	<b>89,437</b>	<b>86,603</b>	<b>104,391</b>
<b>Total IVA</b>	<b>138,591</b>	<b>116,577</b>	<b>57,886</b>	<b>51,741</b>	<b>64,886</b>
<b>Total IVb</b>	<b>65,594</b>	<b>34,030</b>	<b>31,457</b>	<b>34,361</b>	<b>39,072</b>
<b>Total IVc</b>	<b>418</b>	<b>71</b>	<b>94</b>	<b>501</b>	<b>433</b>
<b>WG total incl.discards</b>	<b>368,327</b>	<b>207,788</b>	<b>163,890</b>	<b>141,858</b>	<b>217,107</b>
Country	1981	1982	1983	1984	1985 <sup>1</sup>
Belgium	1,217	966	985	494	718
Denmark	13,198	22,704	25,653	16,320 <sup>1</sup>	24,111
Faroe Islands	46	6	51	23 <sup>1</sup>	-
France	11,966	15,988	11,250	8,103	7,236 <sup>4</sup>
German Dem. Rep.	-	-	-	-	-
Germany, Fed. Rep.	3,387	4,510	3,654	2,571	2,832
Ireland	-	-	-	-	-
Netherlands	2,279	1,021	1,722	1,052 <sup>1</sup>	3,381
Norway <sup>2</sup>	2,283	2,888	3,862	3,484 <sup>1</sup>	3,210
Poland	31	317	150	17	-
Sweden	1,301	1,874	1,360	1,518	1,894 <sup>5</sup>
UK (England and Wales)	14,570	16,403	15,476	12,340	13,451
UK (Scotland)	82,798	107,773	100,390	87,479	111,546
USSR	-	-	-	-	-
<b>Total</b>	<b>133,076</b>	<b>174,450</b>	<b>164,553</b>	<b>133,401</b>	<b>168,379</b>
<b>Total IVA</b>	<b>82,996</b>	<b>109,341</b>	<b>102,094</b>	<b>88,613<sup>1</sup></b>	<b>-</b>
<b>Total IVb</b>	<b>49,197</b>	<b>64,833</b>	<b>62,144</b>	<b>44,747<sup>1</sup></b>	<b>-</b>
<b>Total IVc</b>	<b>833</b>	<b>276</b>	<b>315</b>	<b>41<sup>1</sup></b>	<b>-</b>
<b>WG total incl.discards</b>	<b>206,930</b>	<b>225,789</b>	<b>232,203</b>	<b>213,252</b>	<b>251,752</b>

<sup>1</sup> Provisional.

<sup>2</sup> Figures from Norway do not include haddock caught in Rec. 2 fisheries.

<sup>3</sup> Included in Division IIIa.

<sup>4</sup> Includes Division IIa.

<sup>5</sup> Jan-Nov.

Table 15.2 Annual Weight and Numbers of Haddock caught in IV between 1966 and 1985

Year	Weight ( 1000 tonnes )				Number ( millions )			
	Total	H.Con	Disc	By-cat	Total	H.Con	Disc	By-cat
1966	345	226	74	47	3128	467	490	2232
1967	245	147	78	21	1420	272	448	700
1968	302	105	162	34	1617	221	838	558
1969	929	531	266	338	4903	910	1203	1890
1970	806	525	101	180	3382	1245	515	1622
1971	444	235	177	32	2669	473	1282	914
1972	351	193	128	30	1722	428	760	534
1973	395	175	115	11	1286	449	660	171
1974	364	150	167	48	2384	357	1091	936
1975	448	147	260	41	2958	362	1862	734
1976	368	166	154	48	1633	398	788	447
1977	217	137	44	35	896	320	226	350
1978	173	86	77	10	1045	192	419	433
1979	142	84	-2	16	1463	190	288	985
1980	217	99	95	22	1451	219	545	687
1981	207	130	60	17	1353	275	299	779
1982	226	166	41	19	970	310	181	480
1983	232	155	64	13	1238	286	378	574
1984	213	128	75	10	865	246	412	207
1985	252	162	84	6	977	375	448	154

Table 15.3 Catch at age data by nation and gear used in Q analysis

Minimum age for Q analysis = 2

Maximum age for Q analysis + 7

Nation : SCD Gear : SEI

Year	Effort	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7
1966	500668	6223	1158	85922	1082	87	35
1967	514854	28195	1180	862	45337	360	45
1968	548642	153074	5926	515	409	17787	71
1969	491435	322896	30588	1069	272	215	3495
1970	426563	20402	205829	6994	85	154	36
1971	416144	21374	13554	108817	2462	82	36
1972	392432	167635	9213	4693	39758	911	53
1973	414898	193251	69361	1972	1043	9872	351
1974	349604	48342	86495	13184	441	234	2390
1975	329432	161728	15612	25837	3708	151	110
1976	307165	329389	57469	2529	8069	1026	54
1977	313913	37093	130091	12895	1684	1480	347
1978	325246	69033	14340	44152	2366	482	673
1979	316419	78815	17215	3040	8073	648	70
1980	297227	128306	26205	3393	501	2415	123
1981	289672	134260	55726	5181	702	102	579
1982	297730	30969	118898	14297	682	145	39
1983	333168	77289	30414	50115	6394	583	119
1984	388085	63391	49286	9426	14977	1594	254
1985	381647	163067	32968	15945	2289	2838	308

ctd.

Table 15.3 ctd.

Nation : SCO Gear : TRL

Year	Effort	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7
1966	194012	1544	1143	55864	752	66	31
1967	215319	13358	838	767	43193	512	9
1968	218141	75530	3650	372	519	12810	49
1969	123010	56898	14068	519	225	322	1486
1970	133445	4771	92681	2917	153	83	26
1971	174559	5343	7806	83058	1808	122	34
1972	201493	76451	4199	4120	31678	735	32
1973	182541	51518	37304	832	851	6405	149
1974	185432	12502	34222	7336	166	207	1562
1975	152977	51400	5715	14221	1923	73	57
1976	121841	26814	20099	1311	3065	596	16
1977	144348	3538	36969	7624	451	1006	179
1978	135220	9910	2194	17293	1781	169	332
1979	87467	13866	4089	756	4587	336	57
1980	55475	20664	5687	1065	192	1159	104
1981	51553	23582	12374	1122	100	12	320
1982	47889	2865	20239	3249	147	58	49
1983	48339	6808	2303	7683	1183	169	21
1984	34574	2995	3717	776	1910	293	15
1985	32674	16139	1191	864	162	348	54

Nation : SCO Gear : LTR

Year	Effort	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7
1966	35841	121	36	1248	17	1	1
1967	28022	441	20	16	468	2	
1968	48239	3153	121	21	38	235	1
1969	63666	20607	1002	34	10	8	87
1970	83529	934	18151	368	4	5	1
1971	104901	3052	1553	16025	347	12	18
1972	121031	20277	2495	1083	7919	137	13
1973	152422	34299	9429	242	203	1591	48
1974	116982	8695	14943	2336	31	21	283
1975	161009	26964	2450	5213	520	13	14
1976	152419	59426	11343	637	1757	328	7
1977	224824	6441	41122	3492	390	787	99
1978	236929	11471	2914	12279	774	110	167
1979	287494	23135	4109	714	3644	203	20
1980	333197	46282	8062	755	197	1015	61
1981	251504	58146	13653	1518	161	20	320
1982	250870	10170	33463	3937	133	67	7
1983	244349	48680	6955	11807	1258	124	27
1984	240725	22191	13375	2074	3392	402	98
1985	267393	57136	4905	2782	412	871	127

Table 15.4 Results of analysis of catchability coefficients for HADDOCK in IV

F for named gears and total international F

Gear	Estimate	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7
	F(gear)	0.327	0.573	0.579	0.488	0.396	0.351
SCG SEI	Var F(gear)	0.00324	0.00223	0.00134	0.00310	0.00263	0.00230
	Propn(gear)	0.29563	0.48996	0.48475	0.45954	0.39648	0.33545
	F(gear)	0.017	0.042	0.056	0.057	0.067	0.072
SCG TRL	Var F(gear)	0.00001	0.00003	0.00003	0.00006	0.00010	0.00018
	Propn(gear)	0.02926	0.01770	0.02626	0.03246	0.04864	0.05865
	F(gear)	0.116	0.122	0.119	0.105	0.103	0.109
SCG LTR	Var F(gear)	0.00015	0.00013	0.00013	0.00034	0.00039	0.00045
	Propn(gear)	0.10359	0.07289	0.08457	0.08267	0.12172	0.13800
	F(gear)	0.460	0.736	0.754	0.650	0.566	0.533
All above:	Var F(gear)	0.00340	0.00239	0.00150	0.00350	0.00311	0.00293
	Propn(gear)	0.42848	0.58055	0.59558	0.57467	0.56685	0.53211
Total	F	1.073	1.268	1.266	1.130	0.998	1.001
Internatl:	Var F	0.01851	0.00711	0.00423	0.01059	0.00969	0.01034

Table 15.5 Values of Natural Mortality Rate and Proportion Mature at age

Age	Nat Mor	Mat.
0	2.050	0.000
1	1.450	0.010
2	0.350	0.320
3	0.250	0.710
4	0.250	0.870
5	0.200	0.950
6	0.200	1.000
7	0.200	1.000
8	0.200	1.000
9	0.200	1.000
10	0.200	1.000
11	0.200	1.000



Table 15.6 Total International Catch at Age (1000's) of HADDOCK in IV between 1966 and 1985

Age	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	Age
0	1666972	305249	11105	72559	924601	330674	240896	59873	601412	44947	0
1	1005889	837010	1096962	20469	266147	1809963	675831	364824	1213866	2096826	1
2	25640	89979	438696	3574797	218293	70735	584076	567131	174389	632672	2
3	6412	4853	19538	303070	1906573	47224	40150	237498	326659	57630	3
4	411562	3576	1940	7584	57362	397328	20948	6099	53137	106048	4
5	9954	177394	2519	2407	1176	10288	155922	4399	1832	15320	5
6	1043	2437	45804	2512	1195	458	3516	38829	1320	952	6
7	599	214	324	19099	256	193	188	1237	10672	601	7
8	164	216	40	200	5946	146	33	106	236	2628	8
9	89	57	13	24	67	1578	27	28	23	258	9
10	23	33	5	7	11	159	402	108	31	61	10
11	2				19	3	11	48	3	11	11

Age	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	Age
0	167174	114908	294902	841391	374946	646340	278692	635670	95484	137869	0
1	167642	250173	458325	345753	682216	134459	275373	153450	431613	173898	1
2	1045667	103583	141475	198939	323179	413329	83699	238435	159811	551589	2
3	206685	376478	28437	39818	69878	139259	286750	72309	119681	67287	3
4	9629	39325	109108	7139	10021	14663	40511	119638	22200	32894	4
5	30530	3944	8579	26932	1818	1901	3229	16406	32003	4981	5
6	4792	6014	1187	2135	7842	376	700	1691	3635	7158	6
7	186	1136	1912	248	579	2478	273	266	586	919	7
8	67	115	385	451	116	130	799	64	77	183	8
9	683	24	113	136	155	63	29	176	34	63	9
10	51	163	23	52	71	22	15	47	92	31	10
11	3	2	52	14	25	32	8	6	17	91	11

Table 15.7 Total International Mean Weight at Age ( Kg. ) of HADDOCK in IV between 1966 and 1985

Age	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	Age
0	0.010	0.011	0.010	0.011	0.013	0.011	0.024	0.044	0.024	0.021	0
1	0.088	0.115	0.126	0.063	0.073	0.106	0.116	0.112	0.128	0.101	1
2	0.247	0.281	0.253	0.216	0.222	0.247	0.242	0.241	0.226	0.241	2
3	0.367	0.461	0.509	0.406	0.353	0.362	0.388	0.372	0.343	0.356	3
4	0.533	0.594	0.731	0.799	0.735	0.505	0.506	0.585	0.548	0.450	4
5	0.949	0.639	0.857	0.891	0.873	0.887	0.606	0.648	0.891	0.680	5
6	1.265	1.057	0.837	1.032	1.191	1.267	1.000	0.724	0.895	1.245	6
7	1.525	1.501	1.606	1.094	1.361	1.534	1.366	1.044	0.953	1.124	7
8	1.938	1.922	2.260	2.040	1.437	1.337	2.241	1.302	1.513	1.093	8
9	1.727	2.069	2.702	3.034	2.571	1.275	2.006	2.796	2.315	1.720	9
10	2.963	2.348	2.073	3.264	3.950	1.969	1.651	1.726	2.508	2.217	10
11	2.040				3.869	4.306	2.899	2.020	4.152	2.854	11

Age	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	Age
0	0.013	0.019	0.010	0.009	0.012	0.009	0.011	0.022	0.010	0.013	0
1	0.125	0.108	0.141	0.095	0.104	0.074	0.100	0.134	0.141	0.150	1
2	0.224	0.240	0.250	0.291	0.284	0.262	0.292	0.294	0.298	0.281	2
3	0.400	0.346	0.415	0.443	0.487	0.474	0.461	0.446	0.486	0.487	3
4	0.508	0.599	0.444	0.635	0.730	0.735	0.786	0.648	0.673	0.669	4
5	0.580	0.609	0.694	0.659	1.038	1.131	1.168	0.911	0.804	0.863	5
6	0.893	0.753	0.709	0.924	0.925	1.456	1.456	1.278	1.100	1.046	6
7	1.877	1.096	0.924	1.173	1.377	1.148	1.678	1.215	1.128	1.459	7
8	1.736	1.708	1.302	1.167	1.621	1.583	1.452	1.950	1.929	1.801	8
9	1.235	1.977	1.806	1.455	1.597	1.690	2.624	1.429	2.462	2.306	9
10	2.335	1.608	1.923	2.639	1.710	1.531	2.173	1.484	1.871	2.253	10
11	2.528	3.189	1.800	1.618	3.269	1.464	1.870	1.843	2.454	2.072	11



Table 15.9 Stock Numbers at Age (1000's) of HADDOCK in IV between 1966 and 1985

Age	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	Age
0	53697100	298919400	13109130	9408414	67662480	60009320	16508000	55759520	101541100	8638152	0
1	2320544	6413758	38388940	1684239	1189278	8431911	7625340	2052592	7160069	12890130	1
2	52604	154787	1144128	8520588	386002	167410	1217078	1494560	326447	1162509	2
3	24525	16157	37002	446051	3075562	95047	60030	381034	587435	88309	3
4	845412	13497	8348	11926	87864	755774	33135	12343	92568	175528	4
5	15399	301895	7387	4805	2773	19212	245076	7807	4332	26272	5
6	1569	4189	89555	3787	1788	1219	6568	62441	2479	1908	6
7	975	362	1264	32494	879	406	588	2247	16679	854	7
8	267	267	106	744	9635	490	160	313	739	4197	8
9	172	73	29	51	430	2612	270	101	161	393	9
10	42	61	9	12	20	291	737	197	58	111	10
11	4				34	6	20	88	6	20	11

Age	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	Age
0	12352836	19484560	29995870	54291480	11905590	23896900	13832490	44203470	11069840	23617070	0
1	1098444	1539864	2473608	3772522	6735850	1420461	2882609	1696955	5499035	1396247	1
2	2128801	185920	254437	385896	734566	1292539	274771	556541	331305	1101644	2
3	305412	647523	46984	64517	110015	253205	570268	124608	196949	103077	3
4	19328	60832	179788	12115	16000	25651	76950	195922	34714	50389	4
5	45420	6716	13620	46119	3285	3848	7332	24905	49648	7970	5
6	7895	10177	1994	3545	13826	1071	1454	3117	5865	12291	6
7	714	2210	2989	579	1007	4345	541	566	1047	1578	7
8	169	417	797	753	252	309	1355	200	226	336	8
9	1105	78	239	309	216	103	137	399	106	116	9
10	93	299	42	95	131	41	28	86	169	57	10
11	6	4	95	25	46	58	15	11	31	167	11

**Table 15.10** VPA (millions), survey indices, catchability and estimates of year-class strength for 1-year-old haddock in Sub-area IV (low catch).

Year	VPA	IYFS	EGFS	IYFS/VPA	EGFS/VPA
1970	1,189	28	-	0.024	-
1971	8,432	835	-	0.101	-
1972	7,625	740	-	0.097	-
1973	2,053	187	-	0.091	-
1974	7,160	1,072	-	0.150	-
1975	12,890	1,168	-	0.091	-
1976	1,098	177	-	0.161	-
1977	1,540	162	6,634	0.105	4.308
1978	2,474	385	12,605	0.156	5.095
1979	3,773	480	29,691	0.127	7.869
1980	6,736	896	62,392	0.133	9.263
1981	1,420	268	17,036	0.189	11.997
1982	2,893	526	31,501	0.182	10.927
1983	1,697	304	21,762	0.179	12.824
1984	4,909	1,092	60,008	0.222	12.224
1985	-	230 <sup>1</sup>	18,216	-	-
1986	-	552 <sup>1</sup>	-	-	-

Mean catchability 1981-83: 0.183 11.916

	Year	IYFS	EGFS	Mean
Estimated	1984	5,967	5,035	5,501
year-class strength	1985	1,257	1,529	1,393
	1986	3,016	-	-

<sup>1</sup> Preliminary.

Table 15.11 Mean Fishing Mortality, Biomass and Recruitment of HADDOCK in IV between 1966 and 1985

Year	Mean Fishing Mortality			Biomass 1000 tonnes	Recruits Age 0		
	H.Con 2 to 6	Disc Ages 0 to 3	By-cat Ages 0 to 3		Total	Sp St	Y.C. Million
1966	0.686	0.103	0.257	1247	424	66	53697
1967	0.609	0.142	0.053	4316	223	67	7298919
1968	0.476	0.090	0.057	5357	243	68	13109
1969	0.757	0.093	0.200	2289	772	69	9408
1970	0.761	0.124	0.270	2220	875	70	67662
1971	0.602	0.110	0.080	2052	402	71	60009
1972	0.903	0.148	0.053	1767	285	72	16508
1973	0.782	0.130	0.035	3224	278	73	55760
1974	0.637	0.145	0.103	3695	244	74	7101541
1975	0.759	0.209	0.087	1892	219	75	8638
1976	0.822	0.159	0.125	941	284	76	12353
1977	0.805	0.134	0.174	860	222	77	19485
1978	0.861	0.194	0.063	814	122	78	29996
1979	0.913	0.089	0.057	1047	101	79	54291
1980	0.835	0.084	0.088	1136	140	80	11906
1981	0.623	0.090	0.068	814	223	81	23897
1982	0.587	0.070	0.072	857	282	82	13832
1983	0.818	0.151	0.054	1569	232	83	44203
1984	0.952	0.113	0.038	1151	174	84	11070
1985	0.972	0.108	0.023	932	189	85	23617
Mean recruits at age 0 for period 1966 to 1985							33210

Table 15.12 Input for catch prediction of HADDOCK in IV

Age	1985				Values used in Prediction							
	Stock and Fishing Mortality				F at age, Mean Wt. and Propn. Retained by Consumption Fishery							
	Stock Number	Fishing Mortality			Scaled mean F 1980 to 1985			Mean values for period 1980 to 1985				
H.Con.		Disc	Ind	H.Con.	Disc	Ind	Mean Weight (Kg.)			Stock	Prop.	
							H.Con.	Disc	Ind	Stock	Ret.	
0	23617070		0.092	0.012		0.002	0.016		0.058	0.010	0.013	
1	1396247	0.005	0.238	0.017	0.006	0.136	0.032	0.299	0.168	0.042	0.117	0.049
2	1101644	0.419	0.418	0.028	0.342	0.400	0.019	0.372	0.229	0.188	0.285	0.460
3	103077	1.121	0.116	0.033	1.039	0.164	0.024	0.510	0.294	0.372	0.474	0.858
4	50389	1.243	0.006	0.021	1.249	0.028	0.019	0.721	0.392	0.581	0.707	0.977
5	7970	1.078	0.001	0.051	1.132	0.013	0.013	1.004	0.544	0.766	0.986	0.991
6	12291	0.996	0.001	0.002	1.023	0.011	0.001	1.216	0.606	0.952	1.210	0.990
7	1578	1.000			1.077		0.001	1.334		1.592	1.334	1.000
8	336	0.900			0.825			1.723			1.723	1.000
9	116	0.900			0.960		0.001	2.018		1.796	2.018	1.000
10	57	0.900			1.080			1.837			1.837	1.000
11	167	0.900			1.080			2.162			2.162	1.000
	Mean F	Age 2 to 6	Age 0 3	Age 2 to 6	Age 0 3							
	Unscaled	1.080	0.023	0.900	0.057							
	Scaled			1.080	0.023							

Recruits at age 0 in 1986 = 33210000

Recruits at age 0 in 1987 = 33210000

Recruits at age 0 in 1988 = 33210000

M at age and propn mature at age are as shown in Table 15.5.

Mean F for ages 2 to 6 in 1985 for human consumption landings + discards = 1.080.  
Human consumption + discard F-at-age values in prediction are mean values for the period 1980 to 1985 rescaled to produce a mean value of F for ages 2 to 6 equal to that for 1985

Mean F for ages 0 to 3 in 1985 for small-mesh fisheries = 0.023.  
Industrial fishery F-at-age in the prediction are averages for the period 1980 to 1985, rescaled to produce a mean value of F for ages 0 to 3 equal to that for 1985

Table 15.13.1 Predicted Catches and Biomasses ( 1000's of tonnes ) of HADDOCK in IV 1986 to 1987

	Year												
	1985			1986			1987						
Biomass 1 Jan of Year													
Total	932	1039	1189	1189	1189	1189	1189	1189	1189	1189	1189	1189	1189
Spawning	189	169	144	144	144	144	144	144	144	144	144	144	144
Mean F	Ages												
Human Cons.	2 to 6	1.08	1.08	10.00	10.22	10.43	10.65	10.86	11.08	11.30	10.00	10.00	10.00
Small-mesh	0 to 3	10.02	10.02	10.01	10.01	10.01	10.01	10.01	10.01	10.01	10.00	10.00	10.00
Mean F(Year)/Mean F(1985)											F0.1	Fmax	
Human Consumption	11.00	11.00	10.00	10.20	10.40	10.60	10.80	11.00	11.20	10.00	10.00	10.00	
Small-mesh Fishery	11.00	11.00	10.50	10.50	10.50	10.50	10.50	10.50	10.50	10.00	10.00	10.00	
Catch weight													
Human Consumption	162	135	0	32	58	80	99	114	127	0	0	0	0
Discards	84	58	0	20	38	54	70	85	99	0	0	0	0
Small-mesh Fisheries	6	6	4	4	4	4	4	4	4	3	0	0	0
Total landings	168	141	4	36	62	84	102	117	130	0	0	0	0
Total catch	252	199	4	56	100	138	172	202	229	0	0	0	0
Biomass 1 Jan of Year†													
Total	11039	11189	11507	11448	11398	11355	11319	11288	11261	0	0	0	0
Spawning	169	144	336	292	255	225	200	178	161	0	0	0	0

Table 15.13.2 Predicted Catches and Biomasses ( 1000's of tonnes ) of HADDOCK in IV 1986 to 1987

	Year												
	1985			1986			1987						
Biomass 1 Jan of Year													
Total	932	1039	1189	1189	1189	1189	1189	1189	1189	1189	1189	1189	1189
Spawning	189	169	144	144	144	144	144	144	144	144	144	144	144
Mean F	Ages												
Human Cons.	2 to 6	1.08	1.08	10.00	10.22	10.43	10.65	10.86	11.08	11.30	10.00	10.00	10.00
Small-mesh	0 to 3	10.02	10.02	10.02	10.02	10.02	10.02	10.02	10.02	10.02	10.00	10.00	10.00
Mean F(Year)/Mean F(1985)											F0.1	Fmax	
Human Consumption	11.00	11.00	10.00	10.20	10.40	10.60	10.80	11.00	11.20	10.00	10.00	10.00	
Small-mesh Fishery	11.00	11.00	11.00	11.00	11.00	11.00	11.00	11.00	11.00	10.00	10.00	10.00	
Catch weight													
Human Consumption	162	135	0	32	58	80	98	113	126	0	0	0	0
Discards	84	58	0	19	37	54	70	84	98	0	0	0	0
Small-mesh Fisheries	6	6	8	8	8	7	7	7	7	0	0	0	0
Total landings	168	141	8	40	66	87	105	120	133	0	0	0	0
Total catch	252	199	8	59	103	142	175	205	231	0	0	0	0
Biomass 1 Jan of Year†													
Total	11039	11189	11496	11437	11387	11345	11309	11279	11252	0	0	0	0
Spawning	169	144	333	289	253	222	197	176	159	0	0	0	0





**Table 16.1** Nominal catch (in tonnes) of HADDOCK in Division VIa, 1976-85. (Data for 1976-84 as officially reported to ICES.)

Country	1976	1977	1978	1979	1980
Belgium	45	-	-	2	3
Denmark	13	-	-	37	-
Faroe Islands	-	-	-	2	-
France	3,026	3,401	4,255	4,786	2,808
German Dem. Rep.	-	-	-	-	-
Germany, Fed. Rep.	30	+	20	2	3
Ireland	1,115	616	441	877	726
Netherlands	30	28	13	2	2
Norway	3	7	13	9	16
Poland	-	-	-	-	-
Spain	-	-	-	-	-
UK (England & Wales)	1,971	3,827	2,805	1,654	1,279
UK (Scotland)	11,992	11,422	9,629	7,459	8,198
UK (Northern Ireland)	-	-	-	-	+
USSR	533	-	-	-	-
<b>Total</b>	<b>18,758</b>	<b>19,301</b>	<b>17,176</b>	<b>14,830</b>	<b>13,935</b>
<b>WG total incl.discards</b>	<b>34,071</b>	<b>23,657</b>	<b>19,510</b>	<b>28,847</b>	<b>17,478</b>

Country	1981	1982	1983	1984	1985 <sup>1</sup>
Belgium	1	2	1	6 <sub>1</sub>	8
Denmark	-	+	-	-	-
Faroe Islands	-	-	-	-	-
France	3,403	3,760	4,520	4,240	3,467 <sup>3</sup>
German Dem. Rep.	-	-	-	-	-
Germany, Fed. Rep.	7	71	65	83	72 <sup>2</sup>
Ireland	1,891	4,402	3,450	3,932 <sub>1</sub>	3,085 <sup>2</sup>
Netherlands	3	391	25	-	-
Norway	29	37	68	32 <sup>1</sup>	75
Poland	-	-	-	-	-
Spain	-	97	201	-	-
UK (England & Wales)	1,052	2,035	1,376	1,042	338
UK (Scotland)	12,051	19,249	21,593	18,472	14,989
UK (Northern Ireland)	-	1	4	5	-
USSR	-	-	-	-	-
<b>Total</b>	<b>18,437</b>	<b>30,045</b>	<b>31,303</b>	<b>27,812</b>	<b>22,034</b>
<b>WG total incl.discards</b>	<b>33,306</b>	<b>39,681</b>	<b>37,630</b>	<b>46,364</b>	<b>41,737</b>

<sup>1</sup> Provisional.

<sup>2</sup> Includes Division VIb.

<sup>3</sup> Includes Divisions VIb and Vb.

Table 16.2 Annual Weight and Numbers of HADDOCK caught in VIA between 1966 and 1985

Year	Weight ( 1000 tonnes )				Number ( millions )			
	Total	H.Con	Disc	By-cat	Total	H.Con	Disc	By-cat
1966	31	30	1	0	89	80	9	0
1967	28	20	7	0	133	53	79	0
1968	46	20	25	0	233	55	178	0
1969	51	26	25	0	232	88	144	0
1970	40	34	6	0	163	117	47	0
1971	58	46	12	0	225	132	93	0
1972	57	41	16	0	237	127	110	0
1973	40	29	11	0	179	86	92	0
1974	33	18	15	0	207	50	157	0
1975	47	14	33	0	280	41	240	0
1976	34	19	15	0	155	59	96	0
1977	24	19	4	0	88	58	30	0
1978	20	17	2	0	67	48	19	0
1979	29	15	14	0	135	41	95	0
1980	17	13	5	0	72	38	34	0
1981	33	18	15	0	142	58	84	0
1982	40	30	10	0	144	87	57	0
1983	36	29	7	0	83	49	34	0
1984	46	30	16	0	153	48	105	0
1985	42	24	17	0	121	39	81	0

Table 16.3

Nation : SCD Gear : LTR

Year	Effort	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6
1966	40538		3		702	21	
1967	80916	429	1326	73	7	188	7
1968	65348	2445	514	132	9	13	82
1969	106856		6101	273	82	5	8
1970	118881	558	61	7189	94	18	4
1971	129187	12857	427	324	7716	30	21
1972	142244	1479	20885	447	197	4635	45
1973	91151	559	1172	1396	9	19	726
1974	88651	5163	950	706	425	4	13
1975	132353	20271	4526	476	360	320	8
1976	139225	2067	11483	2003	172	209	119
1977	143574	1150	363	3581	661	95	68
1978	127387	2561	206	157	1412	205	33
1979	99803	10347	2420	163	33	803	59
1980	121211	4938	3869	1035	184	38	500
1981	165002	28	14863	4468	423	40	8
1982	135280	4954	959	17379	1722	71	10
1983	112332	3169	5747	1345	10272	662	62
1984	132217	25422	2210	3687	810	6080	366
1985	141916	3096	16248	902	690	214	1752

Table 16.4 Results of analysis of catchability coefficients for HADDOCK in VIA

F for named gears and total international F

Gear	Estimate	Age 2	Age 3	Age 4	Age 5
	F(gear)	0.126	0.169	0.156	0.122
SCD LTR	Var F(gear)	0.00092	0.00072	0.00041	0.00033
	Propn(gear)	0.22271	0.20372	0.14469	0.10680
	F(gear)	0.126	0.169	0.156	0.122
All above:	Var F(gear)	0.00092	0.00072	0.00041	0.00033
	Propn(gear)	0.22271	0.20372	0.14469	0.10680
Total	F	0.566	0.832	1.076	1.140
Internatl:	Var F	0.01856	0.01737	0.01965	0.02934

F at highest age = 0.9

F in 1985, ages 6, 7, 8 = 0.9.

Table 16.5 Values of Natural Mortality Rate and Proportion Mature at age

Age	Nat Mor	Mat.
0	0.200	0.000
1	0.200	0.000
2	0.200	0.570
3	0.200	1.000
4	0.200	1.000
5	0.200	1.000
6	0.200	1.000
7	0.200	1.000
8	0.200	1.000
9	0.200	1.000

Table 16.6 Total International Catch at Age (1000's) of HADDOCK in VIA between 1966 and 1985

Age	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	Age
0	5953	4012	271	2742	17189	6604	14215	19589	63698	6849	0
1	1595	19185	129418	84	6317	71481	20713	47387	68837	179349	1
2	529	19332	38393	160706	519	3915	85141	16907	11562	34957	2
3	1113	951	3079	10260	95114	3328	2718	19477	10757	3339	3
4	47431	265	356	1434	2770	79966	2336	258	6317	3350	4
5	1926	24979	681	268	173	545	53823	1222	83	1882	5
6	64	400	14063	379	89	127	504	33193	447	95	6
7	32	9	727	4576	145	7	50	150	11463	98	7
8	57	14	43	191	585	20	19	32	104	3454	8
9		4	9	9	13	175		6	34	72	9

Age	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	Age
0	4227	4552	571	5697	13	764	136	2084	269	157	0
1	24337	13109	15942	70070	22729	251	15492	14524	98976	22380	1
2	72330	3468	2095	17282	21927	83911	5019	20233	8626	72956	2
3	15224	35948	971	1865	5636	20697	73676	6040	12910	4427	3
4	1588	5705	24357	470	922	1768	8167	36122	6242	4766	4
5	1491	680	2938	9863	143	194	898	3398	22790	2006	5
6	868	495	351	833	3082	39	108	597	2449	12755	6
7	21	308	247	114	229	822	272	41	371	1199	7
8	7	28	338	145	22	39	288	194	43	79	8
9	1103	11	7	28	5	14	31	195	44	4	9

Table 16.7 Total International Mean Weight at Age ( Kg. ) of HADDOCK in VIA between 1966 and 1985

Age	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	Age
0	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0
1	0.162	0.160	0.159	0.158	0.161	0.160	0.160	0.159	0.159	0.159	1
2	0.251	0.266	0.264	0.243	0.230	0.248	0.249	0.251	0.248	0.260	2
3	0.555	0.569	0.567	0.526	0.368	0.341	0.380	0.384	0.368	0.428	3
4	0.572	0.573	0.823	0.916	0.812	0.546	0.530	0.597	0.527	0.581	4
5	1.041	0.667	0.731	1.042	1.283	1.040	0.546	0.512	0.764	0.832	5
6	1.125	1.177	0.811	1.024	1.262	1.313	0.984	0.571	0.685	1.027	6
7	1.325	1.844	1.430	0.999	1.043	1.651	1.499	1.185	0.798	1.001	7
8	1.522	1.611	1.903	1.569	1.342	1.426	1.538	1.704	1.142	1.009	8
9		2.355	2.516	2.065	1.791	1.466		2.202	1.319	1.190	9

Age	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	Age
0	0.040	0.040	0.068	0.032	0.077	0.082	0.038	0.050	0.059	0.020	0
1	0.159	0.161	0.134	0.182	0.134	0.252	0.157	0.178	0.149	0.147	1
2	0.256	0.274	0.278	0.325	0.319	0.245	0.273	0.282	0.319	0.261	2
3	0.459	0.406	0.388	0.457	0.572	0.467	0.376	0.461	0.456	0.493	3
4	0.592	0.684	0.516	0.730	0.719	0.887	0.746	0.557	0.688	0.656	4
5	0.831	0.800	0.827	0.777	0.998	0.975	1.126	1.002	0.667	0.783	5
6	1.095	1.128	1.045	1.040	0.985	1.376	1.539	1.370	1.087	0.848	6
7	1.585	1.337	1.152	1.491	1.143	1.294	1.549	1.716	1.392	1.168	7
8	1.084	1.117	1.399	1.944	1.565	1.347	1.514	1.558	2.075	1.302	8
9	1.243	1.394	2.126	1.735	1.632	1.366	1.738	1.556	1.882	1.829	9

Table 16.8 Total International Fishing Mortality Rate at Age of HADDOCK in VIA between 1966 and 1985

Age	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	Age
0	0.053	0.037	0.002	0.130	0.061	0.075	0.151	0.100	0.123	0.157	0
1	0.050	0.242	0.159	0.006	0.492	0.384	0.352	1.060	0.591	0.594	1
2	0.193	1.340	1.078	0.302	0.046	0.654	1.115	0.545	0.831	0.691	2
3	0.377	0.625	0.805	1.003	0.294	0.460	1.484	0.857	0.821	0.614	3
4	0.571	0.144	0.507	1.200	0.845	0.431	0.691	0.512	0.771	0.664	4
5	0.639	0.681	0.656	0.922	0.423	0.388	0.584	1.002	0.305	0.553	5
6	0.429	0.259	1.099	0.985	0.945	0.640	0.759	0.902	1.448	0.690	6
7	0.734	0.095	1.045	1.561	1.496	0.159	0.571	0.536	0.960	1.982	7
8	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900	8
9	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900	9

Age	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	Age
0	0.152	0.067	0.000	0.011	0.000	0.009	0.003	0.006	0.004	0.001	0
1	1.286	0.953	0.351	0.559	0.057	0.008	0.242	0.504	0.395	0.548	1
2	0.511	0.617	0.377	0.805	0.339	0.309	0.207	0.570	0.643	0.570	2
3	0.754	0.518	0.347	0.684	0.681	0.622	0.489	0.411	0.904	0.830	3
4	0.677	0.725	0.820	0.281	0.895	0.470	0.538	0.474	1.007	1.080	4
5	0.718	0.706	1.095	0.985	0.129	0.468	0.465	0.450	0.627	1.140	5
6	0.537	0.556	1.033	1.164	1.022	0.048	0.520	0.654	0.691	0.900	6
7	0.317	0.369	0.603	1.261	1.334	0.871	0.522	0.382	1.187	0.900	7
8	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900	8
9	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900	9

Table 16.9 Stock Numbers at Age (1000's) of HADDOCK in VIA between 1966 and 1985

Age	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	Age
0	126461	1228143	190031	247411	3193921	1007101	1116651	2274111	6046391	519351	0
1	363051	981651	9692971	155331	177841	2459851	764971	786161	1685221	4376141	1
2	33121	282841	631101	6769951	126411	89011	1372341	440281	222911	763961	2
3	38821	22361	60661	175911	4098321	98821	37881	368271	209111	79471	3
4	1192241	21791	9801	22211	52851	2500411	51071	7041	128021	75341	4
5	44531	551681	15451	4831	5481	18591	1329951	20961	3451	48471	5
6	2001	19251	228551	6571	1571	2941	10331	607341	6301	2081	6
7	671	1071	12161	62341	2011	501	1271	3961	201801	12171	7
8	1051	261	791	3501	10711	371	351	591	1901	63281	8
9		81	161	161	251	3211		111	621	1321	9

Age	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	Age
0	329521	771421	2184661	5544551	444101	976151	491781	4086071	711381	1210911	0
1	363501	231701	590511	1788141	4488041	363481	792301	401411	3326571	580001	1
2	1978571	82271	73121	340301	836861	3469371	295331	509301	198531	1835321	2
3	313281	972041	36341	41051	124561	488201	2086361	196611	235921	85451	3
4	35211	120661	473881	21031	16951	51641	214651	1047991	106771	78251	4
5	31751	14641	47871	170901	13001	5671	26431	102621	534261	31951	5
6	22841	12681	5921	13111	52241	9361	2911	13591	55551	233671	6
7	861	10931	5951	1721	3351	15391	7301	1421	5781	21971	7
8	141	511	6181	2671	401	721	5271	3551	791	1441	8
9	20211	211	121	521	91	251	561	3571	801	71	9

Table 16.10 VPA Number of HADDOCK in VIA at Age 1 vs. VPA Number at Age 1 in IV

Yr.Cl. Year	IV	VIA	Est 1	Est 2	Est 3
1965 in 1966	2.3	36	81	54	73
1966 in 1967	6.4	98	187	169	214
1967 in 1968	38.4	969	1012	1267	972
1968 in 1969	1.7	16	64	37	37
1969 in 1970	1.2	18	52	25	10
1970 in 1971	8.4	246	239	230	254
1971 in 1972	7.6	76	218	206	221
1972 in 1973	2.0	79	74	47	57
1973 in 1974	7.2	169	206	192	219
1974 in 1975	12.9	438	354	371	403
1975 in 1976	1.1	36	50	23	5
1976 in 1977	1.5	23	61	34	29
1977 in 1978	2.5	59	85	58	82
1978 in 1979	3.8	179	118	93	169
1979 in 1980	6.7	449	195	179	217
1980 in 1981	1.4	36	58	31	22
1981 in 1982	2.9	79	96	70	109
1982 in 1983	1.7	40	66	39	40
1983 in 1984	5.6	333	164	144	205
1984 in 1985	1.4		58	31	22
1985 in 1986	3.0		99	73	117
Coefficient of Determination			0.86	0.77	0.89

Values of  $t$  in 1985 corresponding to each recruitment estimator

Age	Est 1	Est 2	Est 3
0	0.001	0.002	0.001
1	0.548	1.503	$\times 1.701412E+38$

$$\text{Est 1 } VPA_{VIA} = A + B VPA_{IV} \quad A = 21.152 \quad B = 25.799$$

$$\text{Est 2 } VPA_{VIA} = A + VPA_{IV} \quad B : A = 20.906 \quad B = 1.125$$

Est 3 = Cleveland's nonparametric estimator using 14 nearest neighbours.

Est 1 chosen.

Table 16.11 Mean Fishing Mortality, Biomass and Recruitment of HADDOCK in VIA between 1966 and 1985

Year	Mean Fishing Mortality			Biomass		Recruits	
	Ages 2 to 6		Age 1 to 11	1000 tonnes		Age 0	
	H.Con	Disc	By-cat	Total	Sp St	Y.C.	Million
1966	0.413	0.029	0.000	87	76	66	126
1967	0.404	0.205	0.000	114	46	67	1228
1968	0.656	0.173	0.000	197	35	68	19
1969	0.808	0.074	0.000	187	113	69	25
1970	0.493	0.018	0.000	176	159	70	319
1971	0.403	0.112	0.000	188	144	71	101
1972	0.718	0.208	0.000	129	97	72	112
1973	0.658	0.105	0.000	84	57	73	227
1974	0.683	0.152	0.000	88	35	74	605
1975	0.522	0.120	0.000	110	30	75	52
1976	0.539	0.100	0.000	82	53	76	33
1977	0.528	0.097	0.000	61	53	77	77
1978	0.673	0.062	0.000	57	33	78	218
1979	0.711	0.073	0.000	80	25	79	554
1980	0.577	0.036	0.000	106	30	80	44
1981	0.306	0.077	0.000	134	80	81	98
1982	0.375	0.069	0.000	122	104	82	49
1983	0.401	0.110	0.000	123	89	83	409
1984	0.658	0.116	0.000	121	64	84	71
1985	0.797	0.107	0.000	93	62	85	121
Mean recruits at age 0 for period 1966 to 1985							224



Table 16.12 Input for catch prediction of HADDOCK in VIA

1985				Values used in Prediction									
Stock and Fishing Mortality				F at age, Mean Wt. and Propn. Retained by Consumption Fishery									
Age	Stock Number	Fishing Mortality			Scaled mean F 1980 to 1985			Mean values for period 1980 to 1985					
		H.Con.	Disc	Ind	H.Con.	Disc	Ind	Mean Weight (Kg.)		Stock	Prop.		
0	121091		0.001			0.006			0.054		0.054		
1	58000	0.016	0.532		0.016	0.420		0.310	0.139		0.170	0.171	
2	183532	0.109	0.461		0.225	0.432		0.376	0.236		0.283	0.340	
3	8545	0.787	0.043		0.815	0.165		0.508	0.301		0.471	0.812	
4	7825	1.064	0.016		1.087	0.024		0.716	0.338		0.709	0.979	
5	3195	1.136	0.004		0.799	0.018		0.933	0.412		0.925	0.981	
6	23367	0.889	0.011		0.952	0.003		1.202	0.353		1.201	0.998	
7	2197	0.900			1.294			1.377			1.377	1.000	
8	144	0.900			1.345			1.560			1.560	1.000	
9	7	0.900			1.345			1.667			1.667	1.000	
Mean F				Age 2 to 6	Age 1 to 1	Age 2 to 6	Age 1 to 1						
Unscaled				0.904	0.000	0.605	0.000						
Scaled						0.904	0.000						

Recruits at age 0 in 1986 = 171000  
 Recruits at age 0 in 1987 = 171000  
 Recruits at age 0 in 1988 = 171000

M at age and proportion mature at age are as shown in Table 16.5.

Mean F for ages 2 to 6 in 1985 for human consumption landings + discards = 0.904.  
 Human consumption + discard F-at-age values in prediction are mean values for the period 1980 to 1985 rescaled to produce a mean value of F for ages 2 to 6 equal to that for 1985

Mean F for ages 1 to 1 in 1985 for small-mesh fisheries = 0.000.  
 Industrial fishery F-at-age in the prediction are averages for the period 1980 to 1985.  
 rescaled to produce a mean value of F for ages 1 to 1 equal to that for 1985

Table 16.13 Predicted Catches and Biomasses (1000's of tonnes) of HADDOCK in VIA 1986 to 1987

	1985		1986		Year 1987												
Biomass 1 Jan of Year																	
Total	93	91	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77
Spanning	62	62	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38
Mean F	Ages																
Human Cons.	2 to 6	10.90	10.90	10.00	10.18	10.36	10.54	10.72	10.90	11.08	10.00	10.00	10.00	10.00	10.00	10.00	10.00
Small-mesh	1 to 1	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
Mean F(Year)/Mean F(1985)																	
Human Consumption		1.00	1.00	1.00	1.020	1.040	1.060	1.080	1.100	1.120	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Catch weight																	
Human Consumption		24	34	0	6	12	16	20	23	25	0	0	0	0	0	0	0
Discards		17	8	0	2	4	6	8	9	11	0	0	0	0	0	0	0
Small-mesh Fisheries		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total landings		24	34	0	6	12	16	20	23	25	0	0	0	0	0	0	0
Total catch		42	43	0	9	16	22	27	32	36	0	0	0	0	0	0	0
Biomass 1 Jan of Year†																	
Total		91	77	116	105	96	88	81	75	70	0	0	0	0	0	0	0
Spanning		62	38	70	59	51	44	38	33	38	0	0	0	0	0	0	0

Table 17.1 Nominal catch (in tonnes) of HADDOCK in Division VIb, 1976-85. (Data for 1976-84 as officially reported to ICES).

Country	1976	1977	1978	1979	1980
Belgium	33	-	-	-	-
Faroe Islands	8	3	11	20	5
France	4	4	3	4	1
Germany, Fed. Rep.	-	-	-	-	17
Ireland	-	-	61	-	-
Norway	-	+	4	16	2
Spain	-	-	-	-	6
UK (England & Wales)	2,111	2,694	2,365	1,654	6,261
UK (Scotland)	640	297	2,060	548	1,051
USSR	40,474	-	-	-	-
<b>Total</b>	<b>43,243</b>	<b>2,998</b>	<b>4,504</b>	<b>2,242</b>	<b>7,343</b>

Country	1981	1982	1983	1984	1985 <sup>1</sup>
Belgium	-	-	-	-	-
Faroe Islands	1	21	3	3 <sup>1</sup>	-
France	10	32	48	12	- <sub>2</sub>
Germany, Fed. Rep.	-	4	1	-	- <sub>2</sub>
Ireland	-	-	-	-	- <sub>2</sub>
Norway	10	3	20	42 <sup>1</sup>	29
Spain	88	121	79	-	-
UK (England & Wales)	9,005	3,736	113	788	1,781
UK (Scotland)	27	5	136	1,654	6,397
USSR	-	-	-	-	-
<b>Total</b>	<b>9,141</b>	<b>3,922</b>	<b>400</b>	<b>2,499</b>	<b>8,207</b>

<sup>1</sup> Provisional.

<sup>2</sup> Included in Division VIa.

Table 17.2 HADDOCK in Division VIb, Rockall.  
Age composition in 1985 from the commercial fishery.

Age	Human Consumption						Discards			
	England		Scotland		Eng. & Scot.		Total Int.	Scotland		Total Int.
	$N \times 10^{-3}$	$\bar{W}$	$N \times 10^{-3}$	$\bar{W}$	$N \times 10^{-3}$	$\bar{W}$	$N \times 10^{-3}$	$N \times 10^{-3}$	$\bar{W}$	$N \times 10^{-3}$
1	-	-	-	-	-	-	-	914	0.10	1,173
2	3	0.29	55	0.35	58	0.35	58	459	0.22	589
3	149	0.42	524	0.49	673	0.47	675	42	0.28	54
4	2,217	0.51	9,302	0.50	11,519	0.50	11,560	2,948	0.32	3,782
5	828	0.58	2,457	0.52	3,285	0.54	3,297	491	0.37	630
6	30	0.63	80	0.67	110	0.49	110	-	0.82	-
7	2	0.96	3	1.34	5	1.19	5	-	-	-
8	3	1.08	59	0.76	62	0.78	62	-	-	-
9	102	0.80	93	0.92	195	0.86	196	106	0.32	136
10	1	1.17	-	-	1	1.17	1	-	-	-
11	1	1.60	2	1.27	3	1.38	3	-	-	-
12	-	-	1	1.37	1	1.38	1	-	-	-
13+	-	-	-	-	-	-	-	-	-	-
Total	3,336	-	12,576	-	15,912	-	15,968	4,960	-	6,364
Tonnes	1,781	-	6,397	-	8,178	-	8,207	1,363	-	1,749

<sup>1</sup>SOP's corrected.

Table 17.3 HADDOCK. Division VIb - Rockall - Scottish and German trawl surveys.  
Numbers per 10 hours fishing (weighted average of surveys).

Survey Year	Vessel	Age									Hauls
		0	1	2	3	4	5	6	7	8+	
1967	E	9	11	153	115	124	150	174	168	215	38
1968	E	21,302	69	11	76	66	66	60	50	58	51
1969	E	-	7,431	78	8	28	25	13	19	29	24
1970	E	[-]	11	9,746	68	25	27	22	20	34	23
1971	-	-	-	-	-	-	-	-	-	-	-
1972	-	-	-	-	-	-	-	-	-	-	-
1973	-	-	-	-	-	-	-	-	-	-	-
1974	H	42,250	5,410	400	180	20	50	-	20	-	1
1975	-	-	-	-	-	-	-	-	-	-	-
1976	-	-	-	-	-	-	-	-	-	-	-
1977	H	-	6,117	13,581	2,587	4,366	54	-	80	163	5
1978	-	-	-	-	-	-	-	-	-	-	-
1979	EH	-	212	819	6,110	686	843	119	-	3	16
1980	?	-	-	75	1,309	15,357	82	1,583	604	428	?
1981	RH	39,329	32,098	16,596	613	1,675	17,320	-	236	808	45+
1982	SH	[-]	30,094	20,923	136	104	737	3,306	176	280	30
1983	-	-	-	-	-	-	-	-	-	-	-
1984	-	-	-	-	-	-	-	-	-	-	-
1985	C	489	51,284	214	31	4,218	676	1	2	145	23

] Indicates surveys early in year before 0-group are available.

Vessel Key

- = "Explorer"
- = "Walter Herwig"
- = "G.A. Reay"
- = "Scotia"
- = "Clarkwood"

Table 17.4 HADDOCK. Division VIb - Rockall English trawl survey.  
Numbers per 10 hours fishing.

Year	Age									
	0	1	2	3	4	5	6	7	8	9
1981	78,658	21,256	72	36	1,221	5,709	-	93	122	13
1982	-	21,504	15,513	410	346	1,461	5,068	-	444	255
1983	1	6	18,541	7,961	233	24	193	1,210	-	57

Table 18.1 Nominal catch (in tonnes) of HADDOCK in Divisions VIIId and VIIe, 1976-85. (Data for 1976-84 as officially reported to ICES).

Country	1976	1977	1978	1979	1980
Belgium	+	1	-	1	+
Denmark	-	2	22	21	15
France	405	438	356	333	298
Ireland	-	4	-	-	+
Netherlands	-	-	-	-	-
UK (England and Wales)	45	29	22	51	59
Total	450	474	400	406	372

Country	1981	1982	1983	1984	1985 <sup>1</sup>
Belgium	2	1	1	-	3
Denmark	-	-	-	-	-
France	421	344	232	273	3,209 <sup>2</sup>
Ireland	-	-	-	-	-
Netherlands	-	94	1	- <sup>1</sup>	-
UK (England and Wales)	119	60	41	26	27
Total	542	499	275	299	3,239

<sup>1</sup> Provisional.

<sup>2</sup> Includes all of Sub-areas VII and VIII.

**Table 18.2** Nominal catch (in tonnes) of HADDOCK in Divisions VIIb,c and VIIg-k, 1976-85. (Data for 1976-84 as officially reported to ICES).

Country	1976	1977	1978	1979	1980
Belgium	19	13	5	2	2
Denmark	-	-	-	1	-
France	3,726	2,244	1,479	1,931	2,219
Germany, Fed. Rep.	3	-	-	-	-
Ireland	287	153	111	155	274
Netherlands	14	1	-	16	-
Norway	-	-	-	-	-
Spain	-	294	-	-	5
UK (England and Wales)	24	18	13	19	50
UK (Scotland)	-	-	8	22	56
USSR	183	-	-	-	-
<b>Total</b>	<b>4,256</b>	<b>2,273</b>	<b>1,616</b>	<b>2,146</b>	<b>2,606</b>

Country	1981	1982	1983	1984	1985 <sup>1</sup>
Belgium	3	3	1	-	2
Denmark	-	-	-	-	-
France	2,571	2,005	2,588	3,001	- <sup>2</sup>
Germany, Fed. Rep.	-	-	-	-	-
Ireland	679	904	941	646	573
Netherlands	-	7	-	- <sup>1</sup>	-
Norway	-	-	57	17 <sup>1</sup>	46
Spain	277	248	167	-	-
UK (England and Wales)	92	182	23	309	45
UK (Scotland)	4	-	-	63	-
USSR	-	-	-	-	-
<b>Total</b>	<b>3,626</b>	<b>3,349</b>	<b>3,777</b>	<b>4,036</b>	<b>664</b>

<sup>1</sup> Provisional.

<sup>2</sup> Included in Divisions VIIId,e.

Table 19.1 Nominal catch (in tonnes) of WHITING in Sub-area IV, 1976-85. (Data for 1976-84 as officially reported to ICES).

Country	1976	1977	1978	1979	1980
Belgium	2,640	3,275	3,304	3,941	3,153
Denmark	116,973	46,479	15,741	41,965	17,916
Faroe Islands	1,262	472	42	581	21
France	19,557	17,592	22,525	27,590	23,626
German Dem. Rep.	18	-	22	5	-
Germany, Fed. Rep.	302	461	348	1,280	1,267
Ireland	4	9	38	-	-
Netherlands	12,274	9,406	11,030	13,417	14,389
Norway	71	33	64	49	27
Poland	509	445	8	3	1
Spain	18	-	-	-	-
Sweden	153	341	- <sup>2</sup>	31	16
UK (England and Wales)	5,112	6,185	7,542	7,581	6,778
UK (Scotland)	26,167	33,017	42,779	44,841	42,218
USSR	5,612	2,413	-	-	-
Total Sub-area IV	190,672	120,128	103,443	141,284	109,412
Total Division IVa	100,001	61,499	42,837	48,554	42,529
Total Division IVb	69,908	42,911	40,943	68,775	41,156
Total Division IVc	20,763	15,718	19,663	23,955	25,727
WG total incl.discards	358,161	345,539	179,192	236,712	215,979

Country	1981	1982	1983	1984	1985 <sup>1</sup>
Belgium	2,623	2,272	2,864	2,798	2,167
Denmark	16,430	27,043	18,054	19,735 <sup>1</sup>	12,000
Faroe Islands	12	57	18	8 <sup>1</sup>	-
France	24,744	23,780	21,263	19,209	17,909 <sup>4</sup>
German Dem. Rep.	-	-	-	-	-
Germany, Fed. Rep.	601	223	317	286	261
Ireland	-	-	-	-	-
Netherlands	14,600	12,218	10,935	8,767 <sup>1</sup>	6,885
Norway	27	17	39	80 <sup>1</sup>	85
Poland	-	-	1	2	-
Spain	-	-	-	-	-
Sweden	9	11	44	53	22 <sup>3</sup>
UK (England and Wales)	5,964	4,743	4,366	5,017	4,850
UK (Scotland)	31,399	29,640	41,248	42,967	30,298
USSR	-	-	-	-	-
Total Sub-area IV	96,409	100,004	99,149	98,922	74,477
Total Division IVa	33,799	35,665	47,110	51,966 <sup>1</sup>	-
Total Division IVb	40,145	45,311	35,288	41,312 <sup>1</sup>	-
Total Division IVc	22,465	19,028	16,751	5,644 <sup>1</sup>	-
WG total incl.discards	182,272	131,881	154,236	-	-

<sup>1</sup> Provisional.

<sup>2</sup> Included in Division IIIa.

<sup>3</sup> Jan-Nov.

<sup>4</sup> Includes Division IIa.

Table 19.2 Annual Weight and Numbers of WHITING caught in IV between 1966 and 1985

Year	Weight ( 1000 tonnes )				Number ( millions )			
	Total	H.Con	Disc	By-cat	Total	H.Con	Disc	By-cat
1966	240	105	84	51	1334	366	546	422
1967	234	68	143	23	1579	246	1103	231
1968	261	88	115	58	1646	299	754	593
1969	324	57	115	152	2803	204	626	1974
1970	268	79	74	115	2507	272	381	1854
1971	192	58	63	72	2118	184	458	1475
1972	188	60	67	61	1927	177	398	1352
1973	266	66	110	90	2164	232	659	1273
1974	290	75	85	130	2572	249	477	1846
1975	300	79	135	86	1965	247	699	1018
1976	358	74	134	150	2269	240	633	1396
1977	346	74	165	106	2485	266	555	1663
1978	179	86	35	55	1729	323	242	1165
1979	237	99	78	59	1885	348	652	886
1980	216	93	78	46	1445	325	476	644
1981	181	79	35	67	1395	255	211	929
1982	131	72	26	33	739	238	167	333
1983	154	81	50	24	1328	261	370	697
1984	139	78	40	21	855	250	322	283
1985	96	53	28	15	686	178	223	279

Table 19.3 Catch at age data by nation and gear used in  $\theta$  analysis

Minimum age for  $\theta$  analysis = 2  
 Maximum age for  $\theta$  analysis = 7

Nation : SCD Gear : TRL

Year	Effort	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7
1966	194012	2792	867	13467	1430	138	54
1967	215319	7764	5071	792	10631	817	118
1968	218141	21139	6637	3078	267	4229	287
1969	123010	11623	6576	1453	564	45	935
1970	133445	274	14338	2377	347	114	4
1971	174559	2519	453	13095	1484	179	52
1972	201493	7642	2421	307	7895	868	95
1973	185241	16097	4608	794	82	2170	216
1974	185432	17080	7424	987	207	35	533
1975	152977	5987	13288	2166	279	42	7
1976	121841	8120	2848	3928	691	121	14
1977	144348	6341	13056	1521	2332	211	26
1978	135220	12979	15591	8632	550	752	71
1979	87467	14814	11068	7828	2945	166	212
1980	55475	10603	10100	3441	2396	875	30
1981	51553	6656	8102	3501	552	544	105
1982	47889	886	6626	2714	932	195	70
1983	48339	1114	3203	7485	1597	558	52
1984	34574	1561	1502	1157	2429	487	80
1985	32674	3418	1703	527	401	636	88

ctd.



Table 19.3 ctd.

Nation : SCO Gear : SEI

Year	Effort	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7
1966	500668	47443	8605	82291	7236	723	293
1967	514854	56306	21666	2880	24824	2040	233
1968	548642	112615	17163	6305	698	6852	570
1969	491435	70980	25683	4178	1599	110	1742
1970	426563	3377	50806	8738	1086	553	38
1971	416144	22237	3628	32919	3858	520	172
1972	392432	27826	4850	346	14887	2587	1760
1973	414998	49677	12693	2514	245	4100	467
1974	349604	55720	25559	4326	720	102	1175
1975	329432	31191	39772	10131	835	103	19
1976	307165	67580	12457	10886	1890	284	43
1977	313913	50660	37036	3336	2528	371	31
1978	325246	29308	43711	15396	1058	1409	201
1979	316419	41092	28124	14745	6084	677	156
1980	297227	73704	37658	11915	9368	2556	260
1981	289672	22244	25048	10552	2402	2084	374
1982	297730	7032	26194	13117	2713	539	277
1983	333168	14957	21690	34199	9831	2155	407
1984	388035	24016	20670	14986	21269	4715	960
1985	381647	20243	19696	8956	4796	8013	1363

Nation : SCO Gear : LTR

Year	Effort	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7
1966	35841	1254	162	1665	125	11	5
1967	28022	1156	410	66	409	46	4
1968	48238	3277	542	196	35	181	14
1969	63666	5074	1678	267	88	7	102
1970	83529	1350	4916	1089	127	67	4
1971	104901	3085	610	6131	769	124	61
1972	121031	10222	1785	335	4154	508	80
1973	152422	15192	3507	716	73	1430	183
1974	116982	16612	5208	774	148	15	423
1975	161008	13339	18383	3497	424	34	5
1976	152419	30121	5298	5248	876	195	18
1977	224824	29945	24840	1664	2419	460	34
1978	236944	19910	30722	14473	956	1612	635
1979	287494	42910	23155	17996	4058	377	286
1980	333197	58382	38436	9525	9430	1864	144
1981	251504	19069	21550	9706	1777	1455	310
1982	250970	8197	26681	12945	3334	647	339
1983	244349	17926	12535	19234	6124	1217	183
1984	240775	16048	10784	6307	9019	2371	479
1985	267393	9359	7614	3085	1333	2901	443

Table 19.4 Results of analysis of catchability coefficients for WHITING in 19

F for named gears and total international F

Gear	Estimate	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7
	F(gear)	0.004	0.016	0.028	0.035	0.050	0.037
SCO TRL	Var F(gear)	0.00009	0.00000	0.00001	0.00002	0.00008	0.00006
	Propn(gear)	0.02332	0.02180	0.01425	0.02988	0.03613	0.02906
	F(gear)	0.051	0.144	0.231	0.284	0.364	0.296
SCO SEI	Var F(gear)	0.00011	0.00025	0.00066	0.00129	0.00372	0.00697
	Propn(gear)	0.13823	0.25210	0.24221	0.35752	0.45549	0.45007
	F(gear)	0.043	0.094	0.143	0.172	0.220	0.244
SCO LTR	Var F(gear)	0.00003	0.00008	0.00028	0.00033	0.00177	0.00918
	Propn(gear)	0.06385	0.09746	0.08344	0.09938	0.16490	0.14634
	F(gear)	0.098	0.254	0.402	0.491	0.634	0.577
All above	Var F(gear)	0.00015	0.00033	0.00095	0.00185	0.00557	0.01620
	Propn(gear)	0.22540	0.37135	0.33990	0.48678	0.65652	0.62547
Total	F	0.437*	0.683	1.181	1.009	0.966	0.922
Internatl	Var F	0.00291	0.00239	0.00620	0.00696	0.01292	0.04142

\* Not used in assessment.

Table 19.5 Values of Natural Mortality Rate and Proportion Mature at age

Age	Nat Mor	Mat.
0	2.250	0.000
1	0.950	0.110
2	0.450	0.920
3	0.350	1.000
4	0.300	1.000
5	0.250	1.000
6	0.250	1.000
7	0.200	1.000
8	0.200	1.000
9	0.200	1.000
10	0.200	1.000

Table 19.6 Total International Catch at Age (1000's) of WHITING in IV between 1966 and 1985

Age	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	Age
0	84279	177436	104751	1206087	1187095	1232837	553711	175647	571415	238839	0
1	516853	971232	828855	374122	606631	620700	938136	1153017	755217	954764	1
2	342260	213111	516865	1019744	82358	106187	314925	660397	975999	403599	2
3	92701	119813	108548	154798	563090	18145	44793	131353	226168	295629	3
4	250807	23128	47737	27811	50200	123135	7445	18039	31516	53896	4
5	36933	65886	7170	12712	11023	13021	56265	5404	4660	8792	5
6	8347	7520	29652	1664	3577	2191	7933	17226	1163	7524	6
7	1486	809	1845	5658	1162	653	3284	2375	5496	109	7
8	333	122	93	621	1302	162	243	345	325	1303	8
9	128	31	23	34	131	408	67	118	47	132	9
10		3	5	1	16	26	641	50	20	21	10

Age	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	Age
0	424725	667358	687251	476388	332221	516817	100400	668570	114979	185956	0
1	478364	1019667	418866	618700	268943	160561	189667	201325	333409	197806	1
2	1111503	480805	335869	463937	427299	332043	102501	168470	167913	146588	2
3	162626	261890	203546	210759	268838	261197	229821	107975	118946	78128	3
4	75259	13459	69034	86158	80782	90632	83286	133391	46103	36977	4
5	13000	18273	7601	24995	57361	21493	24425	37121	56834	13414	5
6	2651	4628	5369	3089	7931	10067	6297	8656	13815	17592	6
7	556	405	1409	1147	808	1735	1691	1711	2750	3028	7
8	21	167	245	187	517	236	360	699	379	887	8
9	271	4	7	14	42	41	58	81	159	95	9
10	23	135	7	1	12	35	23	33	22	14	10

Table 19.7 Total International Mean Weight at Age ( Kg. ) of WHITING in IV between 1966 and 1985

Age	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	Age
0	0.072	0.062	0.038	0.043	0.020	0.036	0.022	0.027	0.026	0.030	0
1	0.109	0.118	0.112	0.097	0.110	0.116	0.071	0.084	0.070	0.100	1
2	0.187	0.198	0.187	0.173	0.203	0.219	0.200	0.166	0.149	0.215	2
3	0.249	0.268	0.294	0.261	0.240	0.285	0.282	0.277	0.257	0.277	3
4	0.288	0.331	0.358	0.362	0.348	0.318	0.388	0.371	0.381	0.376	4
5	0.360	0.340	0.484	0.414	0.455	0.433	0.418	0.439	0.469	0.470	5
6	0.434	0.426	0.447	0.416	0.452	0.531	0.520	0.462	0.519	0.356	6
7	0.473	0.495	0.620	0.535	0.512	0.637	0.575	0.550	0.541	0.817	7
8	0.697	0.625	0.730	0.670	0.628	0.560	0.748	0.738	0.786	0.596	8
9	0.694	0.621	0.779	0.787	0.785	0.728	0.801	0.860	1.032	0.712	9
10		0.486	0.842	1.236	0.802	0.729	0.822	0.846	0.966	1.022	10

Age	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	Age
0	0.019	0.022	0.010	0.009	0.013	0.011	0.029	0.014	0.017	0.014	0
1	0.107	0.117	0.074	0.098	0.076	0.082	0.060	0.105	0.086	0.094	1
2	0.194	0.212	0.185	0.165	0.176	0.165	0.181	0.188	0.183	0.187	2
3	0.297	0.326	0.240	0.260	0.246	0.241	0.254	0.274	0.273	0.268	3
4	0.363	0.397	0.338	0.318	0.325	0.333	0.313	0.323	0.342	0.324	4
5	0.446	0.466	0.462	0.436	0.333	0.417	0.386	0.381	0.384	0.393	5
6	0.524	0.495	0.462	0.496	0.476	0.437	0.494	0.427	0.397	0.430	6
7	0.481	0.534	0.515	0.544	0.492	0.573	0.532	0.461	0.473	0.470	7
8	0.460	0.341	0.689	0.614	0.594	0.654	0.717	0.532	0.570	0.422	8
9	0.693	0.916	0.742	0.668	0.570	0.835	0.734	0.700	0.536	0.488	9
10	0.911	0.441	1.828	0.737	0.795	1.051	1.153	0.513	0.850	0.636	10



Table 19.9 Stock Numbers at Age (1000's) of WHITING in IV between 1966 and 1985

Age	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	Age
0	41635528	82930168	9726986	18927814	29966714	51120288	66743424	33371154	66937564	42452612	0
1	2308193	4366031	8693784	997580	1684420	2849324	5064705	6888457	3470839	6904258	1
2	815875	592647	1124600	2871722	174735	308102	741282	1410765	1988725	903466	2
3	168855	256186	212688	319750	1040330	48174	114047	229822	392281	520014	3
4	458465	43736	82677	61494	99041	275712	19043	43610	55524	93261	4
5	56506	129575	13006	21351	22129	31218	100493	7816	17080	14774	5
6	10448	12321	43900	3939	5681	7691	12998	29708	1464	9231	6
7	1800	1071	3125	8790	1622	1350	4076	3297	8288	155	7
8	416	175	165	919	2183	303	487	461	604	1921	8
9	198	49	36	53	203	631	104	182	74	205	9
10		5	7	2	25	41	992	77	31	2	10

Age	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	Age
0	42717588	42654576	45421440	41339292	15636925	17630958	15235415	39424232	25362674	39127468	0
1	4411315	4390302	4320067	4606414	4231483	1560876	1723063	1579263	3979375	2642787	1
2	2108534	1423449	1106828	1422914	1417339	1476647	508732	554361	492155	1341364	2
3	265456	495720	534309	444317	546758	571098	681771	244074	222350	183468	3
4	126850	55787	136378	209371	141052	166096	188971	291245	83662	60020	4
5	24046	31146	15010	43060	82372	36955	47131	69790	103429	23375	5
6	3934	7496	8511	5111	11990	15098	10255	15581	22269	31475	6
7	834	792	1857	2015	1322	2537	3130	2570	4662	5464	7
8	31	191	287	282	630	365	543	1057	590	1374	8
9	420	71	11	22	65	63	90	126	247	1471	9
10	36	209	11	2	19	54	36	51	34	22	10

Table 19.10.1 VPA (millions), survey indices, catchability and estimates of year-class strength for 1-year-old WHITING in Sub-area IV.

Year	VPA	IYFS	EGFS	IYFS/VPA	EGFS/VPA
1970	1,684	69	-	0.041	-
1971	2,849	274	-	0.096	-
1972	5,065	332	-	0.066	-
1973	6,888	1,156	-	0.166	-
1974	3,471	322	-	0.093	-
1975	6,904	893	-	0.129	-
1976	4,411	679	-	0.154	-
1977	4,390	418	21,969	0.095	5,004
1978	4,320	513	24,632	0.119	5,702
1979	4,606	457	20,019	0.099	4,346
1980	4,231	692	30,044	0.164	7,101
1981	1,561	227	26,603	0.145	17,042
1982	1,723	161	27,704	0.093	16,079
1983	1,579	128	11,813	0.081	7,481
1984	1,812 <sup>1</sup>	437	50,319	0.241	27,770
1985	-	290	15,739	-	-
1986	-	447	-	-	-

Mean catchability 1971-83: 0.1101 8.965 (1977-83)

	Year	IYFS	EGFS	Mean
Estimated year class strength	1984	3,969	5,613	4,791
	1985	2,634	1,756	2,195
	1986	4,060	-	-

<sup>1</sup> Value obtained using catchability-tuned F.  
Not used in assessment.

Table 19.10.2 VPA (millions), survey indices, catchability for North Sea WHITING at age 2 (low catch).

Year	VPA	IYFS	EGFS	IYFS/VPA	EGFS/VPA
1970	174	77	-	0.443	-
1971	308	31	-	0.101	-
1972	741	190	-	0.256	-
1973	1,410	763	-	0.541	-
1974	1,989	496	-	0.249	-
1975	903	153	-	0.169	-
1976	2,109	535	-	0.254	-
1977	1,423	219	6,531	0.154	4,590
1978	1,107	293	5,482	0.265	4,952
1979	1,423	183	7,441	0.129	5,229
1980	1,417	391	15,040	0.276	10,614
1981	1,477	485	30,646	0.328	20,749
1982	509	232	7,928	0.456	15,576
1983	554	129	10,855	0.233	19,594
1984	492	-	10,790	-	21,931
1985	1,341	-	16,879	-	12,587

Table 19.11 Mean Fishing Mortality, Biomass and Recruitment of WHITING in IV between 1966 and 1985

Year	Mean Fishing Mortality			Biomass		Recruits	
	Ages 2 to 6		Age 0 to 4	1000 tonnes		Age 0	
	H.Con	Disc	By-cat	Total	Sp St	Y.C.	Million
1966	0.908	0.175	0.132	3618	368	66	41636
1967	0.614	0.203	0.033	5881	298	67	82930
1968	0.727	0.226	0.073	1675	421	68	9727
1969	0.409	0.195	0.284	1523	589	69	18928
1970	0.606	0.231	0.242	1125	352	70	29967
1971	0.412	0.135	0.064	2380	219	71	51120
1972	0.582	0.141	0.117	2064	268	72	66743
1973	0.685	0.170	0.161	1819	378	73	33371
1974	0.606	0.139	0.300	2411	435	74	66938
1975	0.864	0.227	0.146	2368	446	75	42453
1976	0.670	0.173	0.278	1846	566	76	42718
1977	0.596	0.127	0.219	1972	537	77	42655
1978	0.607	0.082	0.105	1171	410	78	45421
1979	0.632	0.075	0.105	1251	471	79	41339
1980	0.713	0.228	0.094	994	479	80	15637
1981	0.635	0.082	0.169	783	454	81	17631
1982	0.477	0.098	0.097	895	354	82	15235
1983	0.552	0.145	0.065	1037	310	83	39424
1984	0.708	0.129	0.075	1016	261	84	25363
1985	0.669	0.073	0.049	1154	352	85	39127
Mean recruits at age 0 for period 1966 to 1985							38418

Table 19.12 Input for catch prediction of WHITING in IV

Age	1985			Values used in Prediction								
	Stock and Fishing Mortality			F at age, Mean Wt. and Propn. Retained by Consumption Fishery								
Age	Stock Number	Fishing Mortality			Scaled mean F 1980 to 1985			Mean values for period 1980 to 1985			Stock	Ret.
		H.Con.	Disc	Ind	H.Con.	Disc	Ind	H.Con.	Disc	Ind		
0	39127468	0.060	0.001	0.011	0.000	0.002	0.018	0.138	0.041	0.015	0.017	0.001
1	2642787	0.001	0.092	0.029	0.004	0.079	0.038	0.195	0.108	0.052	0.084	0.062
2	1741364	0.057	0.047	0.041	0.097	0.161	0.058	0.236	0.168	0.148	0.180	0.413
3	187468	0.469	0.128	0.086	0.411	0.171	0.084	0.282	0.212	0.263	0.259	0.697
4	60029	1.009	0.092	0.080	0.711	0.119	0.049	0.337	0.241	0.379	0.327	0.849
5	23375	0.903	0.055	0.051	0.846	0.110	0.033	0.392	0.263	0.460	0.382	0.892
6	31475	0.908	0.042	0.015	1.025	0.061	0.022	0.448	0.263	0.541	0.444	0.945
7	5464	0.895	0.019	0.098	1.048	0.018	0.005	0.504	0.268	0.498	0.500	0.982
8	1374	1.200			1.347	0.003		0.582	0.365		0.582	0.998
9	147	1.200			1.185			0.644			0.644	1.000
10	22	1.200			1.185			0.833			0.833	1.000
	Mean F	Age 2 to 6	Age 0-4	Age 2 to 6	Age 0-4							
	Unscaled	0.742	0.049		0.752	0.092						
	Scaled				0.742	0.049						

Recruits at age 0 in 1986 = 38418144

Recruits at age 0 in 1987 = 38418144

Recruits at age 0 in 1988 = 38418144

M at age and proportion mature at age are as shown in Table 19.5.

Mean F for ages 2 to 6 in 1985 for human consumption landings + discards = 0.742.  
 Human consumption + discard F-at-age values in prediction are mean values for the period 1980 to 1985 rescaled to produce a mean value of F for ages 2 to 6 equal to that for 1985

Mean F for ages 0 to 4 in 1985 for small-mesh fisheries = 0.049.  
 Industrial fishery F-at-age in the prediction are averages for the period 1980 to 1985.  
 rescaled to produce a mean value of F for ages 0 to 4 equal to that for 1985



Table 19.13.1 Predicted Catches and Biomasses ( 1000's of tonnes ) of WHITING in IV 1986 to 1987

		Year									
		1985		1986		1987					
Biomass 1 Jan of Year											
Total		1154	1370	1430	1430	1430	1430	1430	1430	1430	1430
Spawning		352	414	476	476	476	476	476	476	476	476
Mean F	Ages										
Human Cons.	2 to 6	0.74	0.74	0.00	0.15	0.30	0.45	0.59	0.74	0.89	0.00
Small-mesh	0 to 4	0.05	0.05	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.00
Mean F (Year)/Mean F (1985)											F0.1 Fmax
Human Consumption		11.00	11.00	10.00	10.20	10.40	10.60	10.80	11.00	11.20	10.00
Small-mesh Fishery		11.00	11.00	10.50	10.50	10.50	10.50	10.50	10.50	10.50	10.00
Catch weight											
Human Consumption		53	89	0	25	48	68	86	102	117	0
Discards		28	57	0	14	27	39	51	62	73	0
Small-mesh Fisheries		15	26	15	15	15	14	14	13	13	0
Total landings		68	114	15	40	63	82	100	116	130	0
Total catch		96	171	15	54	90	122	151	178	203	0
Biomass 1 Jan of Year+1											
Total		1370	1430	1647	1608	1572	1540	1511	1484	1460	0
Spawning		414	476	688	649	614	582	553	527	503	0

Table 19.13.2 Predicted Catches and Biomasses ( 1000's of tonnes ) of WHITING in IV 1986 to 1987

		Year									
		1985		1986		1987					
Biomass 1 Jan of Year											
Total		1154	1370	1430	1430	1430	1430	1430	1430	1430	1430
Spawning		352	414	476	476	476	476	476	476	476	476
Mean F	Ages										
Human Cons.	2 to 6	0.74	0.74	0.00	0.15	0.30	0.45	0.59	0.74	0.89	0.00
Small-mesh	0 to 4	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.00
Mean F (Year)/Mean F (1985)											F0.1 Fmax
Human Consumption		11.00	11.00	10.00	10.20	10.40	10.60	10.80	11.00	11.20	10.00
Small-mesh Fishery		11.00	11.00	11.00	11.00	11.00	11.00	11.00	11.00	11.00	10.00
Catch weight											
Human Consumption		53	89	0	25	47	67	85	101	116	0
Discards		28	57	0	14	27	39	50	61	72	0
Small-mesh Fisheries		15	26	31	30	29	28	27	26	26	0
Total landings		68	114	31	55	76	95	112	127	141	0
Total catch		96	171	31	68	103	134	163	189	213	0
Biomass 1 Jan of Year+1											
Total		1370	1430	1627	1588	1554	1523	1494	1469	1445	0
Spawning		414	476	671	633	599	568	540	515	491	0

Table 19.13.3 Predicted Catches and Biomasses ( 1000's of tonnes ) of WHITING in IV 1986 to 1987

	1985		1986		Year 1987								
Biomass 1 Jan of Year													
Total	1154	1370	1430	1430	1430	1430	1430	1430	1430	1430	1430	1430	1430
Spawning	352	414	476	476	476	476	476	476	476	476	476	476	476
Mean F	Ages												
Human Cons.	2 to 6	10.74	10.74	10.00	10.15	10.30	10.45	10.59	10.74	10.89	10.00	10.00	10.00
Small-mesh	0 to 4	10.05	10.05	10.07	10.07	10.07	10.07	10.07	10.07	10.07	10.00	10.00	10.00
Mean F(Year)/Mean F(1985)											F0.1	Fmax	
Human Consumption		11.00	11.00	10.00	10.20	10.40	10.60	10.80	1.00	11.20	10.00	10.00	
Small-mesh Fishery		11.00	11.00	11.50	11.50	11.50	11.50	11.50	11.50	11.50	10.00	10.00	
Catch weight													
Human Consumption		53	89	0	25	47	67	84	100	114	0	0	
Discards		28	57	0	14	26	36	50	61	71	0	0	
Small-mesh Fisheries		15	26	45	44	43	41	40	39	38	0	0	
Total landings		68	114	45	69	89	108	124	139	152	0	0	
Total catch		96	171	45	82	116	146	174	200	223	0	0	
Biomass 1 Jan of Year+1													
Total		11370	1430	11607	11570	11536	11506	11478	11453	11430	0	0	
Spawning		414	476	654	617	584	554	527	502	480	0	0	

Table 20.1. Nominal catch (in tonnes) of WHITING in Division VIa, 1976-85. (Data for 1976-84 as officially reported to ICES).

Country	1976	1977	1978	1979	1980
Belgium	14	-	-	-	+
Denmark	-	-	119	92	32 <sup>2</sup>
Faroe Islands	2	-	-	770	-
France	3,655	3,395	3,610	2,779	2,609
German, Dem.Rep.	31	-	-	-	-
Germany, Fed.Rep.	1	1	2	4	1
Ireland	3,255	2,752	2,080	2,791	4,407
Netherlands	255	78	23	17	2
Norway	1	-	-	-	-
Spain	821	763 <sup>2</sup>	-	-	-
U.K. (England & Wales)	244	520	669	320	227
U.K. (Scotland)	16,658	9,873	8,174	10,613	7,386
U.K. (N. Ireland)	-	-	-	-	-
<b>Total</b>	<b>24,937</b>	<b>17,382</b>	<b>14,677</b>	<b>17,386</b>	<b>14,664</b>
<b>W.G. total</b>	<b>24,937</b>	<b>17,411</b>	<b>14,677</b>	<b>17,081</b>	<b>12,816</b>

Country	1981	1982	1983	1984	1985 <sup>1</sup>
Belgium	-	2	-	-	2
Denmark	-	+	-	- <sub>1</sub>	-
Faroe Islands	-	-	-	-	-
France	1,637	1,798	2,029	1,887	1,920 <sup>3</sup>
German Dem.Rep.	-	-	-	-	-
Germany, Fed.Rep.	49	53	43	6	22 <sup>2</sup>
Ireland	8,148	3,406	3,578	3,454 <sub>1</sub>	1,826
Netherlands	6	285	811	-	-
Norway	-	-	-	-	-
Spain	-	99	76	-	-
U.K. (England & Wales)	145	166	157	162	49
U.K. (Scotland)	8,519	8,419	10,019	11,270	9,010
U.K. (N. Ireland)	-	7	52	40	13
<b>Total</b>	<b>18,504</b>	<b>14,235</b>	<b>16,765</b>	<b>16,819</b>	<b>12,842</b>
<b>W.G. total</b>	<b>12,203</b>	<b>13,871</b>	<b>15,971</b>	<b>15,902</b>	

<sup>1</sup> Provisional.

<sup>2</sup> Includes Division VIb.

<sup>3</sup> Includes Divisions VIb and Vb.

Table 20.2 Annual Weight and Numbers of WHITING caught in VIA between 1966 and 1985

Year	Weight ( 1000 tonnes )				Number ( millions )			
	Total	H.Con	Disc	By-cat	Total	H.Con	Disc	By-cat
1966	16	16	0	0	45	45	0	0
1967	16	18	0	0	58	58	0	0
1968	14	14	0	0	42	42	0	0
1969	12	12	0	0	41	41	0	0
1970	11	11	0	0	40	40	0	0
1971	16	16	0	0	52	52	0	0
1972	15	15	0	0	50	50	0	0
1973	17	17	0	0	62	62	0	0
1974	17	17	0	0	72	72	0	0
1975	20	20	0	0	71	71	0	0
1976	25	25	0	0	90	90	0	0
1977	17	17	0	0	63	63	0	0
1978	15	15	0	0	54	54	0	0
1979	17	17	0	0	61	61	0	0
1980	13	13	0	0	45	45	0	0
1981	12	12	0	0	46	46	0	0
1982	14	14	0	0	48	48	0	0
1983	16	16	0	0	49	49	0	0
1984	16	16	0	0	50	50	0	0
1985	13	13	0	0	46	46	0	0

Table 20.3 Catch at age data by nation and gear used in Q analysis

Minimum age for Q analysis = 2  
 Maximum age for Q analysis + 5

Nation : SGO Gear : TRL

Year	Effort	Age 2	Age 3	Age 4	Age 5
1966	71525	375	91	4616	298
1967	54231	628	842	38	1550
1968	50001	1245	773	597	39
1969	42058	1748	952	269	143
1970	40572	13	2024	464	64
1971	41234	133	98	3035	167
1972	55536	474	235	56	1274
1973	51153	995	626	223	47
1974	45899	1817	905	192	56
1975	37080	326	1530	217	31
1976	35307	1733	808	1172	160
1977	33948	376	2033	229	450
1978	51582	642	719	2453	246
1979	33373	2112	1826	899	714
1980	19660	386	1182	494	301
1981	13753	967	1117	490	150
1982	14194	133	1431	853	115
1983	23056	435	545	2442	555
1984	20061	419	507	266	1426
1985	9516	215	251	156	87

ctd.

Table 20.3 ctd.

Nation : SCD Gear : SEI

Year	Effort	Age 2	Age 3	Age 4	Age 5
1966	156511	6933	1171	11421	705
1967	158208	13282	4618	321	5308
1968	150094	8005	3909	1247	129
1969	140718	10632	3180	914	403
1970	95629	1123	7184	714	189
1971	98748	3612	1957	13059	464
1972	70741	4184	919	523	3020
1973	59596	9522	1610	332	94
1974	56448	15537	2824	254	21
1975	56420	5020	10288	513	36
1976	57080	17153	4936	4309	272
1977	41920	2762	5415	517	895
1978	33599	2994	730	1070	66
1979	38465	10403	3312	316	380
1980	38640	2471	3682	952	247
1981	37208	3751	2444	997	398
1982	36689	812	5316	988	228
1983	38080	1305	1335	4496	1149
1984	29561	1444	1019	327	1912
1985	26261	3624	934	275	164

Table 20.3 ctd.

Nation : SCD Gear : LTR

Year	Effort	Age 2	Age 3	Age 4	Age 5
1966	40538	489	133	4971	318
1967	80916	2724	1359	92	2350
1968	65348	1887	1557	617	49
1969	106856	4797	1830	525	267
1970	118881	2441	6606	625	135
1971	129187	2510	859	8970	324
1972	142244	2582	1433	305	5206
1973	91151	6988	564	135	41
1974	88651	8592	1464	144	16
1975	132353	3626	8623	760	76
1976	139225	8385	2933	4974	394
1977	143574	2344	4965	703	1078
1978	127387	3563	1449	1798	128
1979	99803	7540	2226	306	287
1980	121211	2926	3622	893	138
1981	165002	6628	3838	1296	472
1982	135280	1476	8245	1714	315
1983	112332	2016	2209	7388	1676
1984	132217	2900	2320	987	4699
1985	141916	6157	1839	515	344

Table 20.3 ctd.

Nation : SCD Gear : HTP

Year	Effort	Age 2	Age 3	Age 4	Age 5
1966	116972	549	133	703	43
1967	135811	1267	387	14	310
1968	166713	1145	561	145	12
1969	155131	1572	376	139	42
1970	134891	362	1174	114	30
1971	127638	270	206	1275	58
1972	184997	1170	204	64	702
1973	215031	3238	423	152	24
1974	186342	3245	566	79	11
1975	203053	1607	2463	287	34
1976	224347	2552	773	1028	120
1977	196403	837	1247	152	278
1978	219562	1337	382	559	110
1979	273713	2276	760	144	211
1980	254147	1004	1102	220	32
1981	286461	2943	931	411	97
1982	288902	326	2330	421	96
1983	293396	804	430	1170	204
1984	312938	532	389	116	814
1985	383472	1935	456	220	90

Table 20.4 Results of analysis of catchability coefficients for WHITING in VIA

F for named gears and total international F

Gear	Estimate	Age 2	Age 3	Age 4	Age 5
	F(gear)	0.007	0.024	0.038	0.050
SCD TRL	Var F(gear)	0.00000	0.00061	0.00004	0.00008
	Propn(gear)	0.00874	0.03243	0.06253	0.05400
	F(gear)	0.035	0.071	0.057	0.106
SCD SEI	Var F(gear)	0.00024	0.00032	0.00019	0.00034
	Propn(gear)	0.14756	0.12052	0.11956	0.10180
	F(gear)	0.070	0.168	0.159	0.219
SCD LTR	Var F(gear)	0.00069	0.00063	0.00076	0.00329
	Propn(gear)	0.25071	0.23735	0.20678	0.21355
	F(gear)	0.013	0.029	0.010	0.032
SCD NTR	Var F(gear)	0.00013	0.00010	0.00038	0.00082
	Propn(gear)	0.07579	0.05887	0.08843	0.05606
	F(gear)	0.125	0.292	0.262	0.407
All above	Var F(gear)	0.00106	0.00106	0.00137	0.00453
	Propn(gear)	0.48580	0.44918	0.46830	0.42541
Total	F	0.257	0.650	0.560	0.956
Internatl	Var F	0.00451	0.00526	0.00626	0.02503

Table 20.5 Values of Natural Mortality Rate and Proportion Mature at age

Age	Nat Mor	Mat.
1	0.200	0.000
2	0.200	1.000
3	0.200	1.000
4	0.200	1.000
5	0.200	1.000
6	0.200	1.000
7	0.200	1.000
8	0.200	1.000

Table 20.6 Total International Catch at Age (1000's) of WHITING in VIA between 1966 and 1985

Age	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	Age
1	1685	5169	7265	873	730	2387	16777	14078	9083	14917	1
2	10544	26023	16484	25174	6423	8617	12028	36142	51036	16778	2
3	2229	10619	9239	8644	28065	4122	4013	5592	10049	36318	3
4	28185	697	3656	2566	3241	34784	1363	1461	1166	2819	4
5	1861	14574	324	1206	670	1338	14796	357	180	281	5
6	186	789	5036	118	214	240	793	4292	52	57	6
7	36	113	328	2113	16	70	77	277	817	7	7
8	10	13	22	210	472	1	28	26	31	235	8

Age	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	Age
1	8500	16120	17670	6334	11650	3593	2991	3418	7209	5167	1
2	46421	13376	18175	34221	11378	24395	5783	7094	12765	24558	2
3	15757	25144	6682	13282	14860	11297	29094	8040	8221	7749	3
4	17423	3127	9400	3407	4155	4611	6821	22757	4387	2489	4
5	1508	4719	941	3488	1244	1518	2043	6070	14825	1611	5
6	66	292	1433	276	1085	452	803	1439	1953	3503	6
7	13	13	63	374	84	197	254	399	723	403	7
8		3	1	10	101	5	77	131	94	64	8

Table 20.7 Total International Mean Weight at Age ( Kg. ) of WHITING in VIA between 1966 and 1985

Age	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	Age
1	0.238	0.204	0.206	0.178	0.205	0.209	0.211	0.196	0.193	0.209	1
2	0.243	0.240	0.263	0.223	0.203	0.247	0.258	0.235	0.215	0.245	2
3	0.325	0.319	0.366	0.335	0.274	0.276	0.345	0.362	0.317	0.305	3
4	0.374	0.424	0.444	0.500	0.382	0.316	0.368	0.479	0.444	0.471	4
5	0.610	0.412	0.554	0.570	0.519	0.426	0.426	0.485	0.591	0.651	5
6	0.720	0.639	0.538	0.649	0.619	0.551	0.494	0.532	0.641	0.615	6
7	0.818	0.822	0.701	0.618	0.664	0.696	0.603	0.654	0.574	0.841	7
8	0.873	0.878	0.853	0.725	0.666	1.028	0.717	0.748	0.843	0.713	8

Age	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	Age
1	0.201	0.200	0.199	0.218	0.172	0.192	0.184	0.216	0.216	0.188	1
2	0.242	0.244	0.235	0.232	0.242	0.228	0.220	0.249	0.259	0.241	2
3	0.309	0.296	0.286	0.306	0.330	0.289	0.276	0.280	0.313	0.301	3
4	0.361	0.392	0.389	0.404	0.420	0.382	0.352	0.340	0.371	0.403	4
5	0.497	0.431	0.516	0.536	0.492	0.409	0.505	0.409	0.412	0.413	5
6	0.687	0.629	0.549	0.678	0.595	0.409	0.513	0.494	0.458	0.450	6
7	1.050	0.848	0.602	0.694	0.722	0.542	0.503	0.526	0.438	0.525	7
8		1.160	0.973	0.644	0.876	0.751	0.603	0.441	0.601	0.521	8

Table 20.8 Total International Fishing Mortality Rate at Age of WHITING in VIA between 1966 and 1985

Age	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	Age
1	0.032	0.108	0.039	0.049	0.037	0.089	0.221	0.083	0.160	0.116	1
2	0.404	0.923	0.585	0.184	0.601	0.762	0.835	1.027	0.478	0.493	2
3	0.871	0.933	1.067	0.709	0.320	1.025	1.042	1.330	0.940	0.757	3
4	0.642	0.759	1.044	1.041	0.641	0.834	1.271	1.654	1.234	0.768	4
5	0.729	0.837	1.028	1.339	0.880	0.604	1.121	1.684	1.032	1.261	5
6	0.619	0.810	0.805	1.578	0.951	0.962	0.910	1.310	1.558	1.184	6
7	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	7
8	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	8

Age	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	Age
1	0.204	0.250	0.191	0.095	0.070	0.105	0.091	0.083	0.053	0.109	1
2	0.620	0.566	0.493	0.681	0.246	0.204	0.244	0.323	0.498	0.257	2
3	1.282	0.834	0.624	0.832	0.728	0.411	0.398	0.627	0.768	0.650	3
4	1.078	1.006	0.902	0.772	0.688	0.523	0.470	0.626	0.865	0.560	4
5	1.378	1.627	1.013	1.084	0.734	0.584	0.466	1.038	1.158	0.956	5
6	1.281	1.217	1.092	0.991	1.345	0.656	0.716	0.710	1.252	1.000	6
7	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	7
8	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	8

Table 20.9 Stock Numbers at Age (1000's) of WHITING in VIA between 1966 and 1985

Age	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	Age
1	59188	55374	209704	19936	22305	30868	93067	19495	67580	150515	1
2	34782	46939	40675	165133	15534	17603	23120	61097	146913	47146	2
3	4169	19016	15274	18555	112528	6973	6725	8212	17915	74544	3
4	64935	1428	6122	4303	7474	66912	2048	1942	1779	5728	4
5	3918	27972	548	1765	1244	3222	23789	470	304	424	5
6	440	1547	9915	160	379	423	1442	635	72	89	6
7	61	194	563	3628	27	120	132	475	1404	121	7
8	17	23	38	360	810	21	48	44	54	403	8

Age	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	Age
1	50660	80173	111761	77015	190536	39839	37727	47230	153355	55000	1
2	109782	33824	51139	75591	57342	145486	29377	28191	35585	119050	2
3	23567	48375	15723	25584	31320	36711	97152	18849	16707	17698	3
4	28630	5352	17201	6898	9112	12380	19921	53432	8244	6346	4
5	2176	7975	1603	5716	2608	3749	6007	10196	23400	2843	5
6	98	449	2337	477	1584	1025	1712	3086	2957	6015	6
7	22	22	109	642	145	338	436	685	1242	692	7
8		5	3	18	173	8	132	225	161	109	8



Table 20.10 VPA Number of WHITING in VIA at Age 1 vs. VPA Number at Age 1 in IV

Yr.Cl. Year	IV	VIA	Est 1	Est 2	Est 3
1965 in 1966	2308.0	59	49	47	49
1966 in 1967	4366.0	55	100	92	96
1967 in 1968	8694.0	210	207	192	214
1968 in 1969	998.0	20	17	19	21
1969 in 1970	1684.0	22	34	33	35
1970 in 1971	2849.0	31	63	58	67
1971 in 1972	5065.0	93	118	108	115
1972 in 1973	6888.0	195	163	150	164
1973 in 1974	3471.0	68	78	72	80
1974 in 1975	6904.0	151	163	150	164
1975 in 1976	4411.0	51	101	93	96
1976 in 1977	4390.0	80	101	93	96
1977 in 1978	4320.0	112	99	91	95
1978 in 1979	4613.0	77	106	98	101
1979 in 1980	4260.0	191	98	90	94
1980 in 1981	1589.0	40	32	31	33
1981 in 1982	1847.0	38	38	37	38
1982 in 1983	1813.0	47	37	36	37
1983 in 1984	3847.0	153	87	81	88
1984 in 1985	2540.0		55	52	55
1985 in 1986	3928.0		89	82	89
Coefficient of Determination			0.67	0.66	0.68

Values of F in 1985 corresponding to each recruitment estimator

Age	Est 1	Est 2	Est 3
1	0.109	0.116	0.109

Est 1 VPA = A + B \* IV : A = -7.650 B = 0.025

Est 2 VPA = A \* IV ^ B : A = 0.012 B = 1.066

Est 3 = Cleveland's nonparametric estimator using 14 nearest neighbours

Est 1 chosen

Table 20.11 Mean Fishing Mortality, Biomass and Recruitment of WHITING in VIA between 1966 and 1985

Year	Mean Fishing Mortality			Biomass 1000 tonnes	Recruits		
	H.Con	Disc	By-cat		Total	Sp St	Y.C.
1966	0.639	0.000	0.000	51	37	65	59
1967	0.872	0.000	0.000	42	31	66	55
1968	0.899	0.000	0.000	68	25	67	210
1969	0.645	0.000	0.000	52	49	68	20
1970	0.521	0.000	0.000	43	38	69	22
1971	0.874	0.000	0.000	36	29	70	31
1972	1.049	0.000	0.000	40	20	71	93
1973	1.337	0.000	0.000	61	22	72	195
1974	0.884	0.000	0.000	52	39	73	68
1975	0.673	0.000	0.000	69	38	74	151
1976	0.993	0.000	0.000	56	45	75	51
1977	0.802	0.000	0.000	44	28	76	80
1978	0.673	0.000	0.000	48	25	77	112
1979	0.762	0.000	0.000	49	32	78	77
1980	0.554	0.000	0.000	63	31	79	191
1981	0.379	0.000	0.000	58	51	80	40
1982	0.370	0.000	0.000	51	44	81	38
1983	0.525	0.000	0.000	47	37	82	47
1984	0.710	0.000	0.000	62	29	83	153
1985	0.489	0.000	0.000	51	41	84	55
Mean recruits at age 1 for period 1966 to 1985							87

Table 20.12 Input for catch prediction of WHITING in VIA

1985				Values used in Prediction								
Stock and Fishing Mortality				F at age, Mean Wt. and Propn. Retained by Consumption Fishery								
Age	Stock Number	Fishing Mortality			Scaled mean F 1980 to 1985			Mean values for period 1980 to 1985 Mean Weight (kg.)			Stock	Prop. Ret.
		H.Con.	Disc	Ind	H.Con.	Disc	Ind	H.Con.	Disc	Ind		
1	55000	0.109			0.083			0.195			0.195	1.000
2	119050	0.257			0.286			0.240			0.240	1.000
3	17698	0.650			0.578			0.298			0.298	1.000
4	6346	0.560			0.602			0.378			0.378	1.000
5	2843	0.956			0.797			0.440			0.440	1.000
6	6015	1.000			0.917			0.486			0.486	1.000
7	692	1.000			0.969			0.543			0.543	1.000
8	109	1.000			0.969			0.632			0.632	1.000
Mean F		Age 2 to 4	Age 0 to 0	Age 2 to 4	Age 0 to 0							
Unscaled		0.489	0.000	0.505	0.000							
Scaled				0.489	0.000							

Recruits at age 1 in 1986 = 89000

Recruits at age 1 in 1987 = 87339

Recruits at age 1 in 1988 = 87339

M at age and proportion mature at age are as shown in Table 20.5.

Mean F for ages 2 to 4 in 1985 for human consumption landings + discards = 0.489.  
Human consumption + discard F-at-age values in prediction are mean values for the period 1980 to 1985 rescaled to produce a mean value of F for ages 2 to 4 equal to that for 1985

Mean F for ages 0 to 0 in 1985 for small-mesh fisheries = 0.000.  
Industrial fishery F-at-age in the prediction are averages for the period 1980 to 1985, rescaled to produce a mean value of F for ages 0 to 0 equal to that for 1985

Table 20.13 Predicted Catches and Biomasses ( 1000's of tonnes ) of WHITING in VIA 1986 to 1987

	1985		1986		Year 1987								
	1	2	3	4	5	6	7	8	9	10	11	12	
Biomass Jan of Year													
Total	51	55	56	55	56	56	56	56	56	56	56	56	56
Spanning	41	38	39	39	39	39	39	39	39	39	39	39	39
Mean F													
Ages													
Human Cons. 2 to 4	0.49	0.49	0.00	0.10	0.20	0.29	0.39	0.49	0.59	0.00	0.00	0.00	0.00
Small-mesh 0 to 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
Mean F(Year)/Mean F(1985)												F0.1	Fmax
Human Consumption	1.00	1.00	0.00	0.20	0.40	0.60	0.80	1.00	1.20	0.00	0.00	0.00	0.00
Catch weight													
Human Consumption	13	15	0	4	7	10	12	15	17	0	0	0	0
Discards	0	0	0	0	0	0	0	0	0	0	0	0	0
Small-mesh Fisheries	0	0	0	0	0	0	0	0	0	0	0	0	0
Total landings	13	15	0	4	7	10	12	15	17	0	0	0	0
Total catch	13	15	0	4	7	10	12	15	17	0	0	0	0
Biomass Jan of Year+1													
Total	55	56	73	69	66	62	60	57	55	0	0	0	0
Spanning	38	39	56	52	49	45	43	40	38	0	0	0	0

Table 21.1 Nominal catch (in tonnes) of WHITING in Division VIb, 1976-85. (Data for 1976-84 as officially reported to ICES).

Country	1976	1977	1978	1979	1980
Denmark	-	-	-	-	- <sup>2</sup>
France	-	-	-	-	3
Germany, Fed.Rep.	-	-	-	-	-
Ireland	-	-	1	-	-
Spain	-	- <sup>2</sup>	-	-	-
U.K. (England & Wales)	3	2	5	1	+
U.K. (Scotland)	15	5	24	2	59
<b>Total</b>	<b>18</b>	<b>7</b>	<b>30</b>	<b>3</b>	<b>62</b>

Country	1981	1982	1983	1984	1985 <sup>1</sup>
Denmark	-	-	-	-	-
France	-	-	-	3	- <sup>2</sup>
Germany, Fed.Rep.	-	-	-	-	- <sup>2</sup>
Ireland	-	-	-	-	-
Spain	196	112	88	-	-
U.K. (England & Wales)	-	-	-	2	-
U.K. (Scotland)	+	-	5	25	-
<b>Total</b>	<b>196</b>	<b>112</b>	<b>93</b>	<b>30</b>	<b>6</b>

<sup>1</sup> Provisional.

<sup>2</sup> Included in Division VIa.

Table 22.1 Nominal catch (in tonnes) of WHITING in Divisions VIId and VIIE in 1976-85. (Data for 1976-84 as officially reported to ICES.)

Country	1976	1977	1978	1979	1980
Belgium	103	36	85	92	85
Denmark	18	-	1	2,585	6
France	8,390	8,886	8,010	5,352	7,690
Ireland	-	11	12	-	13
Netherlands	5	1	2	1	2
UK (England & Wales)	1,504	1,342	1,038	930	839
Total	10,020	10,276	9,148	8,960	8,635

Country	1981	1982	1983	1984	1985
Belgium	102	101	94	83	105
Denmark	2	-	-	- <sup>1</sup>	
France	8,842	8,051	5,708	7,239	10,821 <sup>2</sup>
Ireland	-	-	-	-	-
Netherlands	2	70	399	- <sup>1</sup>	
UK (England & Wales)	1,136	1,222	1,210	811	561
Total	10,084	9,444	7,411	8,133	11,487

<sup>1</sup>Provisional.

<sup>2</sup>Includes all of Sub-areas VII (except Division VIIa) and VIII.

Table 22.2 SUM OF PRODUCTS CHECK

WHITING IN THE ENGLISH CHANNEL (FISHING AREAS VIIIE AND VIID)  
CATEGORY: TOTAL

Revised

CATCH IN NUMBERS		UNIT: thousands									
-----		1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
J	140	0	150	0	33	0	0	0	0	3	0
1	12727	13847	19949	7535	4575	2764	7789	4343	4804	701	
2	7313	13004	9201	7982	11628	10670	12863	13324	13151	12478	
3	5074	2835	4049	4542	5103	10831	13487	6766	11783	7770	
4	1410	843	1556	2482	2037	8200	2639	2412	2448	1173	
5	521	253	433	639	523	3217	1105	620	1134	490	
6	74	46	88	95	58	1044	387	152	336	72	
7	0	8	0	10	0	687	102	48	22	6	
8	0	0	0	0	8	1	8	3	11	28	
9+	0	0	0	0	0	0	4	2	0	0	
TOTAL	27259	30836	36026	23081	23765	37414	38382	27670	33692	22718	

Table 22.3

MEAN WEIGHT AT AGE IN THE CATCH

UNIT: kilogram

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
0	.218	.000	.150	.000	.195	.000	.000	.000	.158	.000
1	.280	.258	.207	.299	.282	.157	.173	.190	.151	.214
2	.374	.347	.260	.379	.336	.233	.209	.228	.205	.185
3	.479	.496	.346	.435	.436	.259	.282	.292	.260	.268
4	.594	.642	.412	.518	.461	.297	.348	.341	.352	.345
5	.696	.749	.668	.594	.538	.370	.407	.364	.296	.301
6	.742	.850	.711	1.052	.633	.455	.417	.546	.338	.408
7	.000	.955	.000	.479	.000	.382	.415	.499	.454	.519
8	.000	.000	.000	.686	.915	1.082	.773	.709	.433	.419
9+	.000	.000	.000	.686	.000	.000	.484	1.087	.000	.000

Table 22.4 Nominal catch (in tonnes) of WHITING in Divisions VIIb,c and VIig-k, in 1976-85. (Data for 1976-84 as officially reported to ICES).

Country	1976	1977	1978	1979	1980
Belgium	97	60	37	26	31
France	4,731	3,962	3,868	4,127	5,603
Germany, Fed. Rep.	-	1	45	-	+
Ireland	1,980	1,201	1,172	2,674	3,710
Netherlands	112	86	63	3	4
Spain	2,772	-	-	-	-
UK (England and Wales)	21	26	38	23	60
UK (Scotland)	-	2	1	1	80
USSR	2	-	-	-	-
<b>Total</b>	<b>9,715</b>	<b>5,338</b>	<b>5,224</b>	<b>6,854</b>	<b>9,488</b>

Country	1981	1982	1983	1984	1985 <sup>1</sup>
Belgium	61	28	47	71	66
France	5,922	4,767	5,218	2,698	- <sup>2</sup>
Germany, Fed. Rep.	-	-	-	-	-
Ireland	3,612	4,073	2,714	2,171	1,927
Netherlands	21	78	363	169 <sup>1</sup>	-
Spain	-	85	91	-	-
UK (England and Wales)	257	153	68	153	133
UK (Scotland)	1	-	-	4	-
USSR	-	-	-	-	-
<b>Total</b>	<b>9,874</b>	<b>9,184</b>	<b>8,501</b>	<b>5,266</b>	<b>2,126</b>

<sup>1</sup>Provisional.

<sup>2</sup>Included in Divisions VIId,e.



**Table 23.1** Nominal catch (tonnes) of SAITHE in Sub-area IV and Division IIIa 1976-85. (Data for 1976-84 from Bulletin Statistique).

Country	1976	1977	1978	1979	1980
Belgium	127	107	44	14	13
Denmark	15,111	17,334	10,372	10,461	10,370
Faroe Islands	425	318	213	407	1,020
France	32,552	41,022	38,122	40,983	37,306
German Dem. Rep.	2,088	2,430	2,404	1,504	925
Germany, Fed. Rep.	38,698	26,860	25,982	18,780	11,095
Ireland	119	126	88	-	-
Netherlands	6,101	7,270	5,135	1,466	245
Norway	17,856	14,949	17,627	17,575	47,959
Poland	35,819	12,378	5,661	6,104	2,404
Sweden	1,271	1,275	990	211	342
UK (England and Wales)	6,300	6,822	8,382	6,256	4,879
UK (Scotland)	13,034	11,366	14,330	6,257	6,525
USSR	83,669	46,385	10,161	2,015	-
Sub-total	253,170	188,642	139,511	114,033	123,083
By catch from industrial fisheries:					
Denmark <sup>2</sup>	53,684	1,805	72	493	-
Norway <sup>2</sup>	13,082	4,392	2,494	1,142	363
Total	319,936	194,839	142,077	115,668	123,446

Country	1981	1982	1983	1984	1985 <sup>1</sup>
Belgium	12	4	7	32	13
Denmark	6,454	10,114	10,530	8,449	8,993
Faroe Islands	614	746	806	105 <sup>1</sup>	-
France	42,649	47,064	38,782	43,592	44,157 <sup>3</sup>
German Dem. Rep.	-	-	-	-	-
Germany, Fed. Rep.	8,246	13,517	13,649	25,262	21,070
Ireland	-	-	-	-	-
Netherlands	123	36	112	181 <sup>1</sup>	145
Norway	55,882	70,464	78,135	90,497	93,406
Poland	698	793	415	413	-
Sweden	156	372	548	522	1,728 <sup>4</sup>
UK (England and Wales)	4,309	5,627	6,845	8,183	5,411
UK (Scotland)	6,529	8,136	6,321	6,970	9,734
USSR	-	-	-	-	-
Sub-total	125,672	156,873	156,150	184,206	184,657
By catch from industrial fisheries:					
Denmark <sup>2</sup>	-	-	-	-	-
Norway <sup>2</sup>	1,280	5,003	1,445	5,616	7,895
Total	126,952	161,876	157,595	189,822	192,552

<sup>1</sup> Preliminary.

<sup>2</sup> Data from national labs.

<sup>3</sup> Includes Division IIa.

<sup>4</sup> Jan-Nov.

Table 23.2 Annual Weight and Numbers of SAITHE caught in IV between 1970 and 1985.

Year	Weight ( 1000 tonnes )				Number ( millions )			
	Total	H.Con	Disc	By-cat	Total	H.Con	Disc	By-cat
1970	222	163	0	59	142	95	0	47
1971	253	218	0	35	176	143	0	33
1972	246	218	0	28	176	153	0	23
1973	226	195	0	31	169	142	0	27
1974	273	231	0	42	165	120	0	45
1975	278	240	0	38	189	142	0	47
1976	320	253	0	67	310	223	0	87
1977	196	190	0	6	121	117	0	4
1978	142	140	0	3	100	98	0	2
1979	116	114	0	2	68	67	0	1
1980	123	123	0	0	65	64	0	0
1981	127	126	0	1	72	71	0	2
1982	169	164	0	5	110	105	0	5
1983	173	171	0	1	115	114	0	1
1984	198	192	0	6	170	164	0	6
1985	186	178	0	8	189	178	0	11

Saithe in Sub-area IV.  
 Table 23.3 Catch at age data by nation and gear used in Q analysis  
 Minimum age for Q analysis = 2  
 Maximum age for Q analysis + 12

Nation : SCD Gear : TRL

Year	Effort	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12
1974	185432	1352	2198	572	227	326	188	104	45	42	25	12
1975	152977	2684	1877	424	160	64	151	95	31	24	10	11
1976	121841	1372	4969	1168	131	77	21	28	26	13	4	4
1977	144348	597	1787	1705	141	75	39	34	52	59	12	4
1978	135220	2242	1751	1455	1030	144	27	18	9	23	27	8
1979	87467	392	1214	307	266	202	30	9	5	7	6	6
1980	55475	354	211	127	54	51	40	7	6	5	7	8
1981	51553	360	667	58	88	38	29	14	3	2	4	4
1982	47889	435	707	936	51	28	11	11	4	1	1	1
1983	48339	340	483	115	169	78	30	14	8	8	1	1
1984	34574	314	480	144	106	132	12	11	4	2	2	1
1985	32674	557	1728	353	101	66	73	3	4			1

Nation : SCD Gear : LTR

Year	Effort	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12
1974	116982	232	175	55	17	24	19	3	7	10	11	6
1975	161009	541	196	36	30	15	28	22	15	2	2	1
1976	152419	404	278	148	47	43	17	38	36	18	1	1
1977	224824	276	156	249	17	5	6	5	14	11	7	1
1978	236929	1050	93	31	35	5	6	4	4	17	11	6
1979	287494	382	126	13	14	21	6	5	4	2	11	8
1980	333197	880	37	25	44	22	22	5	2	3	10	8
1981	251504	1027	198	13	14	7	8	9	3	4	5	3
1982	250870	1379	441	130	13	12	6	4	6	1		1
1983	244349	915	390	45	40	12	12	4	7	4	2	1
1984	240775	428	153	57	20	47	14	16	9	5	6	3
1985	267393	229	636	217	44	19	26	9	6	3	3	3

Nation : FRA Gear : ALL

Year	Effort	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12
1974	44937		2045	1758	3195	1982	497	405	65	10	39	33
1975	46202	2064	4279	2670	1186	706	783	897	266	59	39	15
1976	59066	2290	8900	4365	1707	874	857	868	387	72	51	40
1977	68287	364	6042	6318	3082	1466	1142	864	377	86	70	55
1978	62627	166	807	5405	6103	1804	452	390	204	81	111	120
1979	68906	423	831	5364	6822	2381	528	358	163	63	79	83
1980	61681	588	2519	4980	3970	2129	538	257	186	78	86	18
1981	70037	3826	6370	5689	3584	2112	649	346	181	59	58	50
1982	67479	1390	5275	8777	5819	2561	591	232	135	45	45	39
1983	62530	966	4379	7006	10272	975	291	65	35	25	15	7
1984	56492	59	3469	10760	5501	4290	212	159	18	53	23	10
1985	47431		4756	14689	4316	1635	550	20	14	22	22	16

ctd.

Table 23.3 ctd.      Saithe in Sub-area IV.  
 Catch at age by nation and gear used  
 in analysis.

Nation : ENG    Gear : TRL

Year	Effort	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12
1974	72830	352	559	438	165	260	156	89	24	21	15	11
1975	80614	787	641	235	105	61	73	79	40	16	12	7
1976	93424	737	2896	591	118	72	34	75	36	34	10	7
1977	117180	1175	941	717	128	32	26	20	21	23	11	4
1978	115899	1933	1567	647	444	92	39	34	29	59	56	27
1979	70427	521	1038	266	144	119	32	21	13	12	23	18
1980	40962	426	334	100	43	69	28	7	4	2	2	4
1981	39671	665	1113	153	91	32	27	23	7	4	2	2
1982	33539	969	936	865	81	66	8	9	5	1	1	1
1983	35033	476	1021	146	143	31	31	10	7	10	3	2
1984	32216	436	643	119	80	78	17	7	1		1	1
1985	13867	51	316	128	33	12	16	2	3			

Table 23.4 Results of analysis of catchability coefficients for SAIHE in IV

F for named gears and total international F												
Gear	Estimate	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12
F(gear)	0.001	0.003	0.003	0.004	0.010	0.007	0.007	0.006	0.005	0.004		0.002
SDO TRL Var F(gear)	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Propn(gear)	0.14145	0.01544	0.00656	0.00879	0.01449	0.03114	0.00649	0.01705	0.00000	0.00000		0.01370
F(gear)	0.004	0.004	0.001	0.001	0.003	0.008	0.010	0.014	0.008	0.011		0.016
SDO LTR Var F(gear)	0.00001	0.00000	0.00000	0.00000	0.00000	0.00000	0.00001	0.00001	0.00000	0.00000	0.00000	0.00002
Propn(gear)	0.05829	0.00568	0.00404	0.00382	0.00429	0.01122	0.02104	0.02764	0.03731	0.0398		0.04443
F(gear)	0.001	0.004	0.002	0.002	0.003	0.005	0.003	0.002	0.002	0.002		0.003
ENG TRL Var F(gear)	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Propn(gear)	0.01295	0.00282	0.00238	0.00288	0.00265	0.00684	0.00481	0.01421	0.00000	0.00000		0.00000
F(gear)	0.005	0.037	0.196	0.294	0.247	0.108	0.067	0.035	0.072	0.042		0.053
FRA ALL Var F(gear)	0.00003	0.00012	0.00061	0.00125	0.00060	0.00051	0.00041	0.00043	0.00015	0.0002		0.00025
Propn(gear)	0.00000	0.04249	0.27344	0.37651	0.36067	0.23503	0.04784	0.06633	0.28142	0.3032		0.24521
F(gear)	0.011	0.048	0.203	0.302	0.263	0.128	0.088	0.057	0.086	0.078		0.073
ALL above Var F(gear)	0.00004	0.00012	0.00061	0.00126	0.00061	0.00051	0.00042	0.00044	0.00016	0.0002		0.00027
Propn(gear)	0.21270	0.06643	0.28643	0.39200	0.38210	0.28422	0.09017	0.12523	0.31873	0.3430		0.30335
Total F	0.050	0.719	0.708	0.770	0.888	0.449	1.098	0.452	0.270	0.228		0.242
Internatl Var F	0.00087	0.02744	0.00746	0.00817	0.00417	0.00633	0.06551	0.02790	0.00156	0.0018		0.00297

Table 23.5 Values of Natural Mortality Rate and Proportion Mature at age

Age	Nat Mor	Nat.
1	0.200	0.000
2	0.200	0.000
3	0.200	0.000
4	0.200	0.150
5	0.200	0.700
6	0.200	0.900
7	0.200	1.000
8	0.200	1.000
9	0.200	1.000
10	0.200	1.000
11	0.200	1.000
12	0.200	1.000
13	0.200	1.000
14	0.200	1.000
15	0.200	1.000

Table 23.6 Total International Catch at Age (1000's) of SAITHE in IV between 1970 and 1985

Age	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	Age
1	234	594	379	4416	3947	312	235	2015	1204	870	1
2	2228	10773	20189	31275	16150	71766	31335	12708	16244	16968	2
3	34392	68424	40162	47388	61201	50672	199669	22740	29341	10196	3
4	74326	53349	62290	32955	31387	23406	50339	52143	27118	14818	4
5	13194	30846	23108	24967	12123	9005	9902	13066	17062	12864	5
6	11529	3650	20779	15228	20080	6706	5137	4738	3755	7393	6
7	3654	3783	3363	7998	13734	12650	3317	3215	1133	2640	7
8	1596	2481	2790	1689	4308	8650	4845	3059	1046	873	8
9	278	1574	1550	1165	988	3304	3003	3517	689	470	9
10	80	322	993	977	473	1097	1066	1926	692	282	10
11	24	187	229	569	281	619	414	900	604	404	11
12	15	9	117	256	175	254	249	347	398	344	12
13	4	6	26	77	106	276	124	344	196	157	13
14	4	2	41	28	30	77	164	123	90	54	14
15	18	9	39	19	30	25	111	131	95	99	15

Age	1980	1981	1982	1983	1984	1985	Age
1	997	5591	1615	265	74	346	1
2	18625	17892	24805	34191	32760	3937	2
3	11082	19277	25015	23571	78416	111942	3
4	10954	9079	35590	18793	31752	53719	4
5	9507	7092	10980	26032	11808	11464	5
6	6298	4393	6776	4673	12356	4533	6
7	4455	3185	1900	4444	1318	2340	7
8	974	3252	1432	1262	1063	416	8
9	499	667	1045	895	255	211	9
10	399	291	311	303	180	78	10
11	307	388	112	205	97	73	11
12	190	343	134	76	71	66	12
13	214	292	102	89	28	21	13
14	143	249	147	38	40	23	14
15	82	330	147	102	56	31	15

Table 23.7 Total International Mean Weight at Age ( Kg. ) of SAITHE in IV between 1970 and 1985

Age	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	Age
1	0.434	0.495	0.304	0.154	0.268	0.198	0.461	0.429	0.353	0.437	1
2	0.697	0.609	0.510	0.392	0.494	0.494	0.501	0.424	0.513	0.387	2
3	0.931	0.838	0.743	0.780	0.849	0.887	0.690	0.759	0.752	0.910	3
4	1.442	1.357	1.158	1.407	1.556	1.497	1.302	1.254	1.262	1.469	4
5	2.073	2.203	1.897	1.575	2.489	2.478	2.175	1.903	2.051	2.189	5
6	2.708	3.007	2.364	2.543	2.729	3.275	3.036	3.110	3.347	3.026	6
7	3.598	3.804	3.869	3.339	3.353	3.684	4.007	4.151	4.660	3.904	7
8	4.420	4.635	4.184	4.657	4.386	4.190	4.325	4.556	5.292	5.030	8
9	5.615	5.168	4.543	4.502	5.538	5.481	4.981	4.787	5.727	5.885	9
10	5.826	5.629	5.538	5.601	6.407	6.827	6.008	5.181	6.069	6.258	10
11	6.698	5.476	7.319	5.788	7.640	7.347	6.901	6.494	6.726	6.774	11
12	7.212	6.555	6.693	7.466	8.500	7.719	7.422	7.400	7.674	7.617	12
13	9.170	7.680	9.258	7.264	9.098	8.495	8.017	8.696	8.601	8.081	13
14	8.874	9.350	7.931	8.593	11.841	10.668	8.105	8.948	9.699	8.200	14
15	8.854	9.260	8.170	8.744	8.521	10.198	8.732	8.979	9.104	8.699	15

Age	1980	1981	1982	1983	1984	1985	Age
1	0.297	0.285	0.273	0.422	0.185	0.163	1
2	0.463	0.556	0.542	0.460	0.491	0.465	2
3	0.963	0.897	1.089	0.966	0.711	0.654	3
4	1.798	1.625	1.516	1.703	1.610	1.183	4
5	2.447	2.489	2.292	2.126	2.234	1.895	5
6	3.274	3.356	3.004	3.076	2.701	2.773	6
7	4.690	4.418	3.983	3.569	3.857	3.446	7
8	5.620	5.354	4.891	4.567	4.542	4.658	8
9	6.302	6.338	5.765	5.383	5.961	5.171	9
10	7.436	7.233	6.513	6.223	7.147	6.609	10
11	7.835	7.525	7.510	6.913	7.758	7.377	11
12	7.912	7.996	7.848	7.693	7.427	8.000	12
13	8.442	8.664	8.102	9.236	8.189	8.350	13
14	8.946	8.267	8.407	7.805	8.401	8.354	14
15	9.609	8.829	9.304	10.035	9.339	8.838	15





Table 23.9 Stock Numbers at Age (1000's) of SAITHE in IV between 1970 and 1985

Age	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	Age	
1	236173	234227	242703	274994	633712	210612	147046	123940	108321	251866	1	
2	383454	193150	191232	198366	221158	515274	172153	120179	99653	87598	2	
3	273174	311933	148416	138368	134247	166501	357222	112746	86938	66964	3	
4	208442	192665	193862	85445	70811	55249	90852	114836	71852	44876	4	
5	39408	104064	109838	102855	40455	29930	24307	29591	47445	34546	5	
6	31899	20435	57517	69145	61773	22243	16424	11042	12551	23560	6	
7	15837	15789	13445	28476	42918	32568	12193	8839	4805	6906	7	
8	10184	9682	9526	7986	16133	22821	15341	7004	4356	2915	8	
9	2772	2772	6901	5698	5295	5020	9340	10939	8214	3001	2627	9
10	964	2019	4235	3274	3288	3221	4686	6260	3581	1837	10	
11	299	717	1363	2575	1803	2266	1654	2878	3397	2309	11	
12	286	223	419	910	1596	1223	1300	982	1549	2237	12	
13	13	221	175	238	515	1149	773	840	493	911	13	
14	16	7	175	120	126	326	693	521	380	229	14	
15	77	39	165	81	127	108	470	557	401	421	15	

Age	1980	1981	1982	1983	1984	1985	Age
1	159210	192864	386210	399465	233318	249933	1
2	205425	129450	152856	314742	326815	190958	2
3	56453	151392	89866	102814	226868	238038	3
4	45643	36250	106580	51116	62987	115463	4
5	23455	27524	21521	55352	25017	23259	5
6	16764	10698	16164	7826	22079	9942	6
7	12657	8085	4829	7175	2257	7085	7
8	3291	6371	3769	2254	1932	677	8
9	1604	1820	2317	1804	723	636	9
10	1727	865	893	963	679	363	10
11	1250	1056	448	452	517	395	11
12	1527	748	517	266	187	336	12
13	1522	1079	306	303	150	89	13
14	605	1053	621	159	168	97	14
15	348	1400	624	434	235	132	15

Table 23.10 Mean Fishing Mortality, Biomass and Recruitment of SAITHE in IV between 1970 and 1985

Year	Mean Fishing Mortality		Biomass		Recruits		
	Ages 3 to 6	Ages 0 to 4	1000 tonnes	Age 1			
	H.Con	Disc	By-cat	Total	Sp St	Y.C. Million	
1970	0.332	0.000	0.056	1221	308	69	236
1971	0.271	0.000	0.035	1207	414	70	234
1972	0.346	0.000	0.034	1009	460	71	243
1973	0.310	0.000	0.073	886	489	72	275
1974	0.401	0.000	0.121	1071	537	73	634
1975	0.362	0.000	0.085	1003	459	74	211
1976	0.616	0.000	0.095	857	334	75	147
1977	0.541	0.000	0.010	608	275	76	124
1978	0.465	0.000	0.005	515	250	77	108
1979	0.386	0.000	0.005	532	241	78	252
1980	0.414	0.000	0.002	535	246	79	159
1981	0.347	0.000	0.003	558	221	80	193
1982	0.544	0.000	0.014	623	180	81	386
1983	0.636	0.000	0.003	707	182	82	399
1984	0.713	0.000	0.014	619	145	83	233
1985	0.690	0.000	0.019	535	118	84	250
Mean recruits at age 1 for period 1970 to 1985							255

Table 23.11 Input for catch prediction of SAITHE in IV

Age	1985			Values used in Prediction								
	Stock and Fishing Mortality			F at age, Mean Wt. and Propn. Retained by Consumption Fishery								
	Stock Number	Fishing Mortality		Scaled mean F 1980 to 1985			Mean values for period 1980 to 1985 Mean Weight (Kg.)			Prop.		
H.Con.		Disc	Ind	H.Con.	Disc	Ind	H.Con.	Disc	Ind	Stock	Ret.	
1	249933	0.002			0.009		0.000	0.273		0.194	0.271	1.000
2	190958	0.023		0.000	0.148		0.006	0.497		0.437	0.496	1.000
3	238038	0.673		0.046	0.436		0.046	0.889		0.700	0.880	1.000
4	115463	0.657		0.051	0.614		0.045	1.580		1.348	1.572	1.000
5	23259	0.746		0.024	0.805		0.015	2.251		2.160	2.247	1.000
6	9942	0.685		0.003	0.907		0.004	3.031		2.770	3.031	1.000
7	7085	0.448		0.001	0.862		0.001	3.994		3.580	3.994	1.000
8	677	1.090		0.008	0.965		0.004	4.939		4.947	4.939	1.000
9	636	0.452			0.686		0.002	5.820		5.970	5.820	1.000
10	363	0.270			0.467		0.000	6.860		5.970	6.860	1.000
11	395	0.228			0.473			7.486			7.486	1.000
12	336	0.242			0.482			7.812			7.812	1.000
13	89	0.300			0.392			8.497			8.497	1.000
14	97	0.300			0.372			8.363			8.363	1.000
15	132	0.300			0.372			9.326			9.326	1.000
	Mean F	Age 3 to 6	Age 0 4	Age 3 to 6	Age 0 4							
	Unscaled	0.690	0.019	0.557	0.009							
	Scaled			0.690	0.019							

Recruits at age 1 in 1986 = 255287  
 Recruits at age 1 in 1987 = 255287  
 Recruits at age 1 in 1988 = 255287

M at age and proportion mature at age as shown in Table 23.5.

Mean F for ages 3 to 6 in 1985 for human consumption landings + discards = 0.690.  
 Human consumption + discard F-at-age values in prediction are mean values for the period 1980 to 1985  
 rescaled to produce a mean value of F for ages 3 to 6 equal to that for 1985

Mean F for ages 0 to 4 in 1985 for small-mesh fisheries = 0.019.  
 Industrial fishery F-at-age in the prediction are averages for the period 1980 to 1985.  
 rescaled to produce a mean value of F for ages 0 to 4 equal to that for 1985

Table 23.12.1 Predicted Catches and Biomasses ( 1000's of tonnes ) of SAITHE in IV 1986 to 1987

	1985		1986		Year 1987								
Biomass 1 Jan of Year													
Total	535	630	592	592	592	592	592	592	592	592	592	592	592
Spawning	118	164	158	158	158	158	158	158	158	158	158	158	158
Mean F													
Ages													
Human Cons.	3 to 6	0.69	0.69	0.00	0.14	0.28	0.41	0.55	0.69	0.83	0.00	0.00	0.00
Small-mesh	0 to 4	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00
Mean F(Year)/Mean F(1985)											F0.1	Fmax	
Human Consumption	1.00	1.00	0.00	0.20	0.40	0.60	0.80	1.00	1.20	0.00	0.00	0.00	0.00
Small-mesh Fishery	1.00	1.00	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.00	0.00	0.00	0.00
Catch weight													
Human Consumption	178	208	0	49	92	130	164	194	220	0	0	0	0
Discards	0	0	0	0	0	0	0	0	0	0	0	0	0
Small-mesh Fisheries	8	9	5	5	5	4	4	4	4	0	0	0	0
Total landings	186	217	5	54	97	134	168	198	224	0	0	0	0
Total catch	186	217	5	54	97	134	168	198	224	0	0	0	0
Biomass 1 Jan of Year+1													
Total	630	592	824	760	704	635	611	572	537	0	0	0	0
Spawning	164	158	297	257	223	193	168	146	127	0	0	0	0



**Table 24.1** Nominal catch (tonnes) of SAITHE IN Sub-area VI from 1976-85. (Data for 1976-84 from Bulletin Statistique.)

Country	1976	1977	1978	1979	1980
Belgium	95	-	-	1	2
Denmark	3	-	-	-	-
Faroe Islands	7	11	-	14	4
France	29,216	19,686	21,519	15,662	15,427
German Dem. Rep.	3	-	-	-	-
Germany, Fed. Rep.	511	254	604	131	49
Ireland	375	240	266	246	295
Netherlands	547	531	623	256	91
Norway	17	91	122	20	62
Poland	91	-	-	-	-
Spain	1,012	346	-	-	-
UK (England and Wales)	1,560	2,758	3,193	1,765	1,594
UK (Northern Ireland)	13	9	27	11	9
UK (Scotland)	5,807	4,628	5,181	3,602	2,902
USSR	2,550	-	-	-	-
<b>Total</b>	<b>41,807</b>	<b>28,554</b>	<b>31,535</b>	<b>21,708</b>	<b>20,435</b>

Country	1981	1982	1983	1984	1985 <sup>1</sup>
Belgium	2	-	-	-	2
Denmark	-	4	-	- <sup>1</sup>	-
Faroe Islands	3	5	-	- <sup>1</sup>	-
France	16,654	17,102	13,470	19,706	16,829 <sup>2</sup>
German Dem. Rep.	-	-	-	-	-
Germany, Fed. Rep.	581	441	179	713	1,983
Ireland	250	322	698	599	558
Netherlands	-	-	32	- <sup>1</sup>	-
Norway	25	19	55	60 <sup>1</sup>	22
Poland	-	-	-	-	-
Spain	120	243	330	-	-
UK (England and Wales)	1,364	1,966	2,760	1,800	1,345
UK (Northern Ireland)	10	7	12	49	9
UK (Scotland)	3,117	2,141	2,642	3,170	2,996
USSR	-	-	-	-	-
<b>Total</b>	<b>22,126</b>	<b>22,250</b>	<b>26,178</b>	<b>26,097</b>	<b>23,744</b>

<sup>1</sup> Preliminary.

<sup>2</sup> Includes Division vb.

Table 24.2 Annual Weight and Numbers of SAITHE caught in VI between 1970 and 1985

Year	Weight ( 1000 tonnes )				Number ( millions )			
	Total	H.Con	Disc	By-cat	Total	H.Con	Disc	By-cat
1970	15	15	0	0	8	8	0	0
1971	20	20	0	0	11	11	0	0
1972	29	29	0	0	19	19	0	0
1973	34	34	0	0	23	23	0	0
1974	36	36	0	0	18	18	0	0
1975	31	31	0	0	16	16	0	0
1976	42	42	0	0	20	20	0	0
1977	27	27	0	0	13	13	0	0
1978	33	33	0	0	16	16	0	0
1979	22	22	0	0	7	7	0	0
1980	22	22	0	0	8	8	0	0
1981	24	24	0	0	11	11	0	0
1982	24	24	0	0	11	11	0	0
1983	29	29	0	0	14	14	0	0
1984	22	22	0	0	13	13	0	0
1985	25	25	0	0	14	14	0	0

Table 24.3 Catch at age data by nation and gear used in Q analysis

Minimum age for Q analysis = 2  
 Maximum age for Q analysis + 12

Nation : FRA Gear : ALL

Year	Effort	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12
1974	70557	109	2177	1487	465	425	631	491	307	316	140	88
1975	66411	523	1919	1133	896	559	768	515	135	54	63	63
1976	90042	670	4038	1319	1297	846	524	413	446	269	334	151
1977	71393	127	1056	1469	1184	544	451	315	224	242	216	84
1978	83500	476	1880	1674	919	518	154	143	94	188	260	203
1979	65600	92	1148	885	650	357	244	107	159	124	131	104
1980	60976	243	2262	601	463	424	352	167	59	92	140	121
1981	60628	435	2045	1455	507	371	305	185	133	114	113	106
1982	54098	313	2795	1157	1047	438	319	193	117	57	42	56
1983	62295	335	2951	1842	676	633	454	135	86	74	49	60
1984	60036	440	2675	2153	721	542	240	109	43	30	8	3
1985	70976	1166	3318	2293	1196	965	465	140	77	38	16	4

Table 24.4 Results of analysis of catchability coefficients for SAITHE in VI

F for named gears and total international F

Gear	Estimate	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12
F(gear)	0.028	0.340	0.429	0.352	0.582	0.812	0.674	0.614	0.674	0.347		0.224
FRA ALL Var F(gear)	0.00003	0.00078	0.00087	0.00533	0.00250	0.00711	0.00537	0.00878	0.02043	0.0025		0.00634
Propn(gear)	0.52845	0.69004	0.76453	0.86444	0.82434	0.80715	0.79238	0.82157	0.80968	0.7474		0.44606
F(gear)	0.028	0.340	0.429	0.352	0.582	0.812	0.674	0.614	0.674	0.347		0.224
All above Var F(gear)	0.00003	0.00078	0.00087	0.00533	0.00250	0.00711	0.00537	0.00878	0.02043	0.0025		0.00634
Propn(gear)	0.52845	0.69004	0.76453	0.86444	0.82434	0.80715	0.79238	0.82157	0.80968	0.7474		0.44606
Total F	0.053	0.492	0.560	0.407	0.706	1.006	0.850	0.747	0.832	0.464		0.503
Internat'l Var F	0.00011	0.00165	0.00149	0.00713	0.00369	0.01091	0.00855	0.01301	0.03116	0.0045		0.03187

Table 24.5 Values of Natural Mortality Rate and Proportion Mature at age

Age	Nat Mor	Mat.
1	0.200	0.000
2	0.200	0.000
3	0.200	0.000
4	0.200	0.000
5	0.200	1.000
6	0.200	1.000
7	0.200	1.000
8	0.200	1.000
9	0.200	1.000
10	0.200	1.000
11	0.200	1.000
12	0.200	1.000
13	0.200	1.000
14	0.200	1.000
15	0.200	1.000

Table 24.6 Total International Catch at Age (1000's) of SAITHE in VI between 1970 and 1985

Age	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	Age
1			51	292	806	23	35	157	38	9	1
2	33	382	3644	6557	3656	2465	2776	1234	5047	969	2
3	2857	1385	7913	6944	5737	6315	8154	4571	4634	1828	3
4	2335	4444	3805	4743	2353	2458	2721	2697	2411	1194	4
5	1605	1891	2209	1882	2000	1314	1794	1673	1350	1151	5
6	599	1085	428	833	608	860	1116	737	715	708	6
7	240	465	309	430	932	1007	659	559	309	368	7
8	196	362	154	311	891	707	517	385	263	156	8
9	41	300	91	192	489	197	583	290	161	191	9
10	57	52	81	201	418	87	323	290	301	152	10
11	20	93	24	125	190	86	397	273	377	164	11
12	20	21	21	73	126	85	178	99	264	137	12
13	12	31	10	19	35	45	177	52	207	131	13
14	4	10	9	21	36	13	186	102	83	110	14
15	8	31	18	15	56	25	101	106	84	62	15

Age	1980	1981	1982	1983	1984	1985	Age
1	45	148	38	42	147	5	1
2	1005	2449	1308	4026	2932	2206	2
3	3335	3911	4491	4879	5484	4809	3
4	942	1977	1641	2624	2403	2999	4
5	677	588	1240	852	876	1384	5
6	632	410	568	775	681	1171	6
7	469	341	384	513	300	576	7
8	194	223	244	161	139	177	8
9	91	153	136	107	56	94	9
10	113	120	72	94	46	47	10
11	172	127	50	58	16	21	11
12	140	115	63	65	7	9	12
13	188	129	67	62	12	18	13
14	84	91	76	95	24	23	14
15	119	91	132	136	54	78	15



Table 24.7 Total International Mean Weight at Age ( Kg. ) of SAITHE in VI between 1970 and 1985

Age	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	Age
1			0.507	0.311	0.309	0.460	0.444	0.383	0.412	0.513	1
2	0.592	0.640	0.764	0.621	0.590	0.737	0.681	0.577	0.490	0.700	2
3	1.066	0.935	1.139	1.102	0.987	0.939	1.005	0.794	1.091	1.323	3
4	1.401	1.240	1.815	1.400	1.622	1.504	1.442	1.353	1.674	1.980	4
5	1.954	1.762	2.631	2.516	1.743	2.575	2.732	2.207	2.583	2.405	5
6	2.911	2.697	2.598	3.080	3.534	3.497	3.230	3.199	3.813	3.366	6
7	3.622	3.454	2.579	3.694	4.542	4.779	4.174	4.253	4.657	4.609	7
8	4.816	4.626	5.018	4.833	5.038	5.589	4.930	5.030	5.278	5.815	8
9	6.178	5.196	6.118	6.705	6.066	6.522	5.785	5.829	5.979	6.967	9
10	6.425	5.816	7.320	7.329	7.370	7.119	6.405	6.518	6.853	7.559	10
11	6.770	6.948	7.709	7.951	8.011	8.002	6.944	6.884	7.692	8.387	11
12	7.510	7.755	7.662	8.986	8.981	9.030	7.823	7.931	9.072	9.187	12
13	8.309	8.287	9.522	9.274	9.830	8.995	8.592	8.736	10.030	10.154	13
14	8.290	8.267	10.488	10.550	10.567	10.638	9.477	9.604	10.961	11.091	14
15	8.684	8.661	11.377	11.550	11.969	11.883	10.296	10.590	9.548	11.734	15

Age	1980	1981	1982	1983	1984	1985	Age
1	0.417	0.460	0.432	0.378	0.472	0.372	1
2	0.650	0.676	0.717	0.665	0.723	0.683	2
3	1.165	1.096	1.078	1.246	1.109	1.030	3
4	1.932	1.699	1.779	1.833	1.786	1.659	4
5	2.651	2.963	2.736	3.074	2.663	2.608	5
6	3.560	4.047	3.946	3.642	3.503	3.229	6
7	4.560	5.115	5.348	5.036	4.714	4.319	7
8	5.531	6.240	6.197	6.285	5.791	5.982	8
9	6.524	7.222	7.765	6.975	7.609	7.467	9
10	7.902	8.304	9.148	8.160	9.028	8.938	10
11	8.680	8.473	9.374	8.802	8.832	9.707	11
12	9.482	9.311	10.411	9.827	9.988	9.331	12
13	9.753	10.121	10.580	11.254	11.291	10.384	13
14	10.774	10.978	10.779	12.055	11.597	12.092	14
15	11.957	12.314	12.130	13.153	12.452	12.987	15



Table 24.9 Stock Numbers at Age (1000's) of SAITHE in VI between 1970 and 1985

Age	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	Age
1	45188	36276	35354	31288	32666	24394	17462	18366	18518	18409	1
2	28266	36997	29700	28899	25353	26017	19951	14265	14895	15127	2
3	30200	23113	29945	21033	17766	18003	19078	13834	10567	7671	3
4	16775	22150	17674	17410	10994	9400	9081	8330	7228	4510	4
5	11875	11630	14137	11048	9995	6885	5489	4993	4402	3756	5
6	5828	8097	7819	9586	7351	6383	4454	2885	2588	2393	6
7	4414	4231	5652	6016	7097	5470	4452	2644	1700	1477	7
8	4068	3397	3045	4349	4537	4971	3572	3051	1662	1114	8
9	538	3154	2455	2354	3279	2914	3433	2459	2151	1124	9
10	595	404	2312	1928	1754	2245	2208	2286	1752	1616	10
11	228	436	284	1820	1397	1060	1759	1516	1610	1164	11
12	119	168	273	211	1377	972	791	1084	996	980	12
13	67	79	119	205	107	1014	720	487	798	578	13
14	17	44	37	89	151	57	789	430	352	467	14
15	35	131	74	66	238	104	426	448	356	262	15

Age	1980	1981	1982	1983	1984	1985	Age
1	24913	24791	28334	24189	23650	23477	1
2	15064	20356	20163	23164	19766	19231	2
3	11511	11427	14460	15328	15341	13543	3
4	4637	6431	5851	7810	8173	7646	4
5	2620	2949	3491	3316	4041	4535	5
6	2043	1537	1885	1747	1949	2521	6
7	1324	1105	890	1034	738	986	7
8	879	664	599	386	389	336	8
9	772	545	344	272	172	194	9
10	749	550	309	159	127	90	10
11	1186	511	342	188	47	63	11
12	805	816	305	235	102	25	12
13	679	533	564	193	134	77	13
14	356	387	321	402	103	99	14
15	503	387	560	574	228	331	15

Table 24.10 Mean Fishing Mortality, Biomass and Recruitment of SAITHE in VI between 1970 and 1985

Year	Mean Fishing Mortality			Biomass 1000 tonnes	Recruits		
	Ages 3 to 6		Ages 0 to 4		Age 1		
	H.Con	Disc	By-cat	Total	Sp	St	Y.C. Million
1970	0.145	0.000	0.000	159	86	69	45
1971	0.168	0.000	0.000	171	98	70	36
1972	0.216	0.000	0.000	235	128	71	35
1973	0.278	0.000	0.000	226	150	72	31
1974	0.262	0.000	0.000	221	160	73	33
1975	0.305	0.000	0.000	219	157	74	24
1976	0.448	0.000	0.000	190	136	75	17
1977	0.418	0.000	0.000	146	108	76	18
1978	0.469	0.000	0.000	138	99	77	19
1979	0.362	0.000	0.000	122	83	78	18
1980	0.346	0.000	0.000	113	70	79	25
1981	0.368	0.000	0.000	107	60	80	25
1982	0.419	0.000	0.000	106	54	81	28
1983	0.470	0.000	0.000	104	46	82	24
1984	0.410	0.000	0.000	90	33	83	24
1985	0.541	0.000	0.000	84	36	84	23
Mean recruits at age 1 for period 1970 to 1985							27

Table 24.11 input for catch prediction of SAITHE in VI

Age	1985				Values used in Prediction							
	Stock and Fishing Mortality				F at age, Mean Mt. and Propn. Retained by Consumption Fishery							
	Stock Number	Fishing Mortality			Scaled mean F 1980 to 1985			Mean values for period 1980 to 1985				
		H.Con.	Disc	Ind	H.Con.	Disc	Ind	Mean Weight (Kg.)			Stock	Prop.
							H.Con.	Disc	Ind		Ret.	
1	23477	0.000			0.004			0.412			0.412	1.000
2	19231	0.135			0.173			0.686			0.686	1.000
3	13543	0.492			0.569			1.121			1.121	1.000
4	7646	0.560			0.517			1.781			1.781	1.000
5	4535	0.407			0.441			2.783			2.783	1.000
6	2521	0.706			0.638			3.655			3.655	1.000
7	986	1.006			0.828			4.848			4.848	1.000
8	336	0.850			0.695			6.004			6.004	1.000
9	194	0.747			0.599			7.260			7.260	1.000
10	90	0.832			0.656			8.580			8.580	1.000
11	63	0.464			0.420			8.978			8.978	1.000
12	25	0.503			0.336			9.725			9.725	1.000
13	77	0.300			0.349			10.564			10.564	1.000
14	99	0.300			0.381			11.379			11.379	1.000
15	331	0.300			0.381			12.499			12.499	1.000
Mean F	Age 3 to 6	Age 0 to 4	Age 3 to 6	Age 0 to 4								
Unscaled	0.541	0.000	0.426	0.000								
Scaled			0.541	0.000								

Recruits at age 1 in 1986 = 26705

Recruits at age 1 in 1987 = 26705

Recruits at age 1 in 1988 = 26705

M at age and proportion mature at age are as shown in Table 24.5.

Mean F for ages 3 to 6 in 1985 for human consumption landings + discards = 0.541.  
Human consumption + discard F-at-age values in prediction are mean values for the period 1980 to 1985 rescaled to produce a mean value of F for ages 3 to 6 equal to that for 1985

Mean F for ages 0 to 4 in 1985 for small-mesh fisheries = 0.000.  
Industrial fishery F-at-age in the prediction are averages for the period 1980 to 1985, rescaled to produce a mean value of F for ages 0 to 4 equal to that for 1985

Table 24.12 Predicted Catches and Biomasses ( 1000's of tonnes ) of SAI THE in VI 1986 to 1987

	1985		1986		Year								
					1987		1987		1987		1987		
Biomass 1 Jan of Year													
Total	84	81	78	78	78	78	78	78	78	78	78	78	78
Spawning	36	29	26	26	26	26	26	26	26	26	26	26	26
Mean F	Ages												
Human Cons.	3 to 6	10.54	10.54	10.00	10.11	10.22	10.32	10.43	10.54	10.65	10.00	10.00	10.00
Small-mesh	0 to 4	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
Mean F(Year)/Mean F(1985)												F0.1	Fmax
Human Consumption	1.00	1.00	1.00	1.020	1.040	1.060	1.080	1.100	1.120	1.00	1.00	1.00	1.00
Catch weight													
Human Consumption	25	24	0	6	11	15	19	23	26	0	0	0	0
Discards	0	0	0	0	0	0	0	0	0	0	0	0	0
Small-mesh Fisheries	0	0	0	0	0	0	0	0	0	0	0	0	0
Total landings	25	24	0	6	11	15	19	23	26	0	0	0	0
Total catch	25	24	0	6	11	15	19	23	26	0	0	0	0
Biomass 1 Jan of Year+1													
Total	81	78	106	99	93	87	82	77	73	0	0	0	0
Spawning	29	26	41	37	33	29	26	23	21	0	0	0	0

Figure 10. Trends in average 200 maximum trawls in the North Sea.

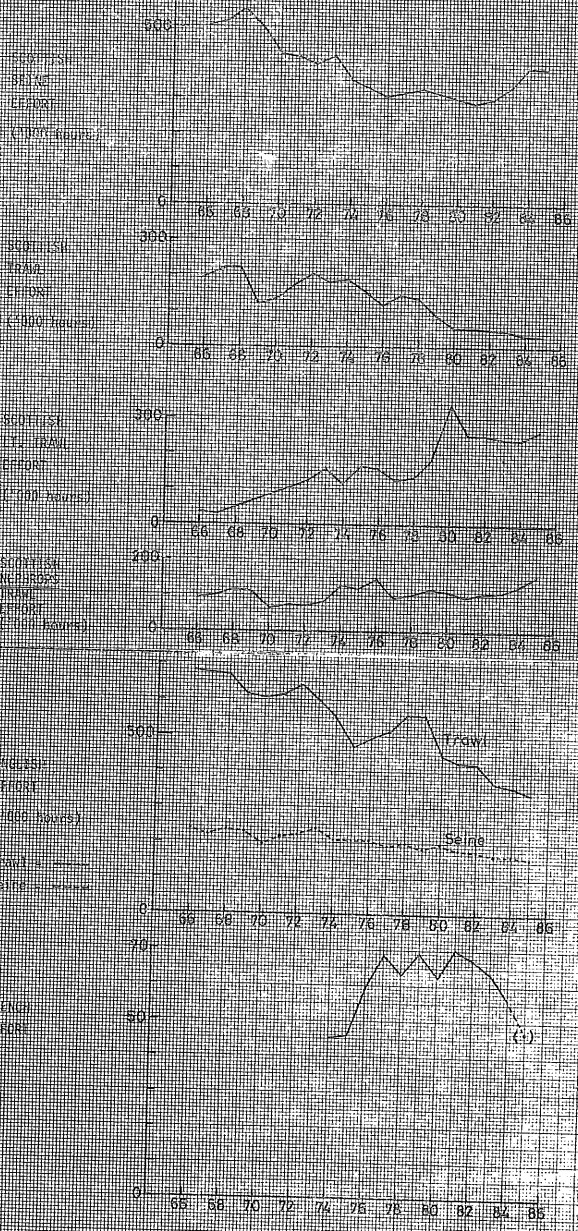


Figure 10.2 Trends in effort for various fleets in Division VIIa.

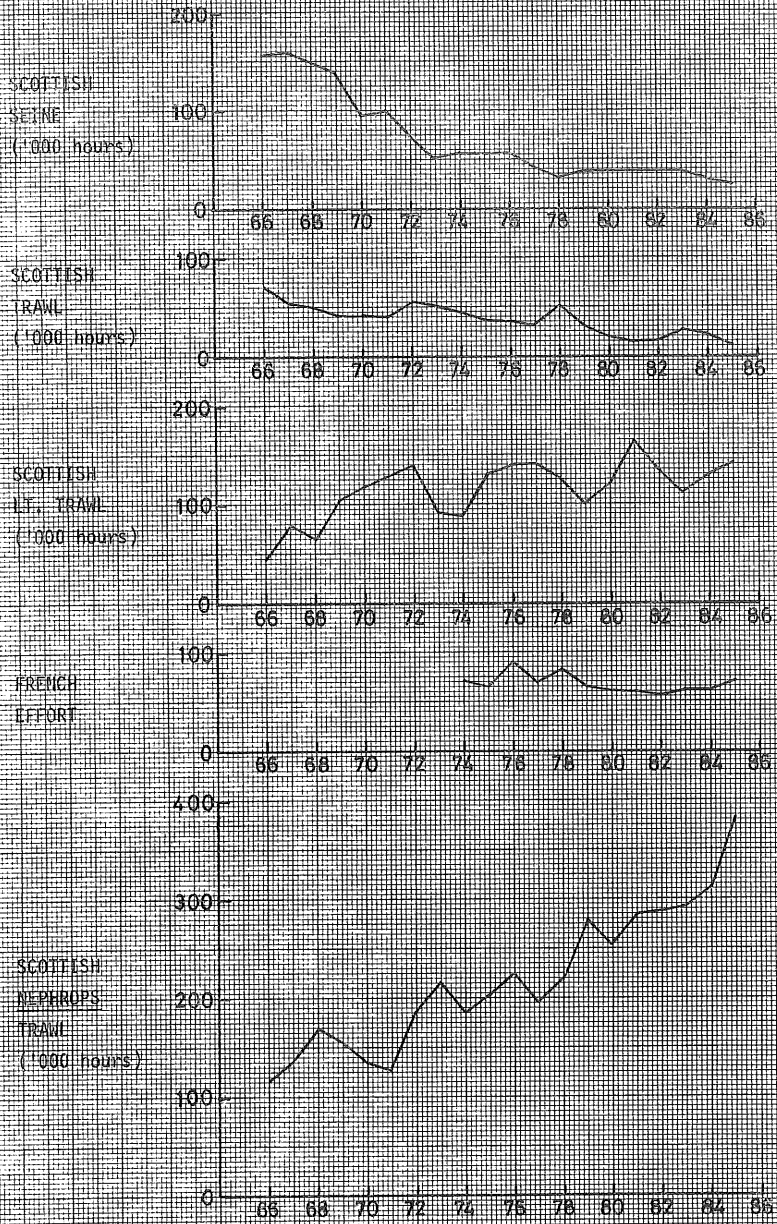
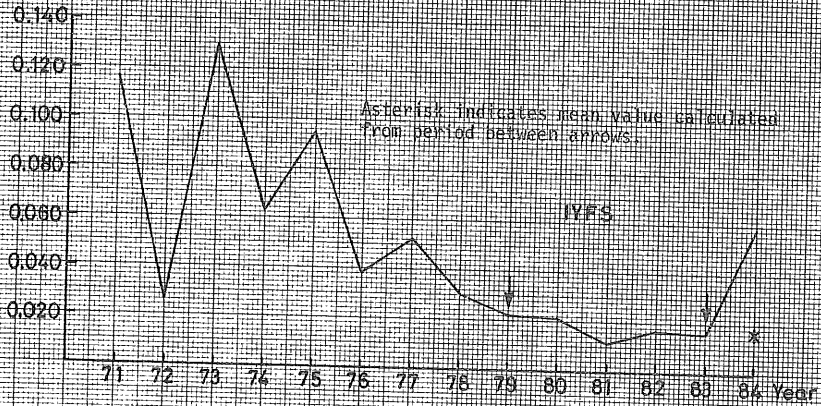


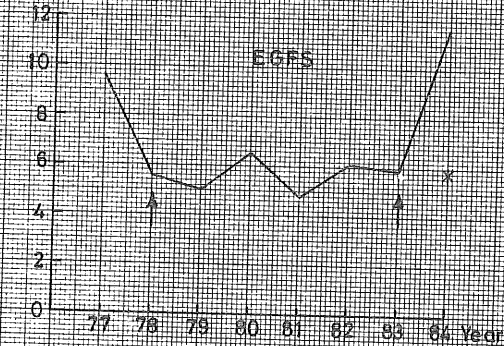


Fig. 11.1A. Catchability of North Sea Cod at age 1.

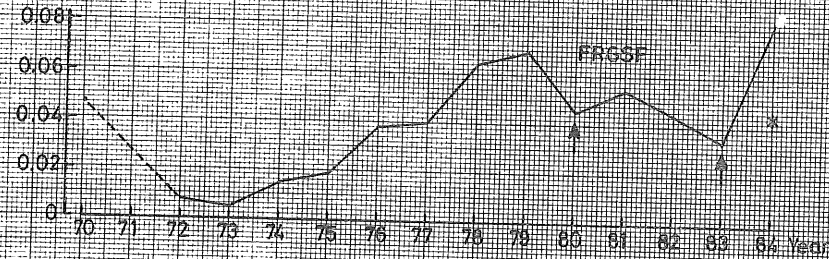
IYFS/VPA



EGFS/VPA



FRGSF/VPA



DGFS/VPA

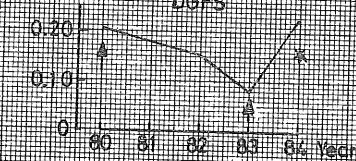


Figure 11. (B) Catchability of North Sea cod at age 2.

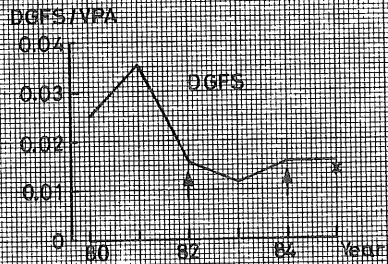
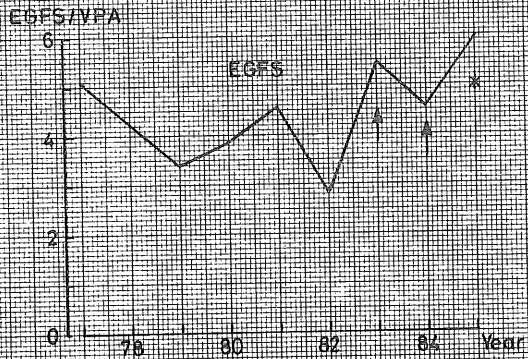
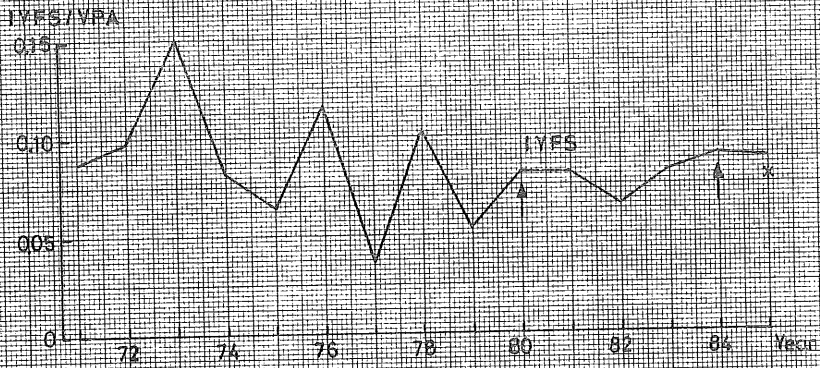


Figure 11-2 000 - North Sea

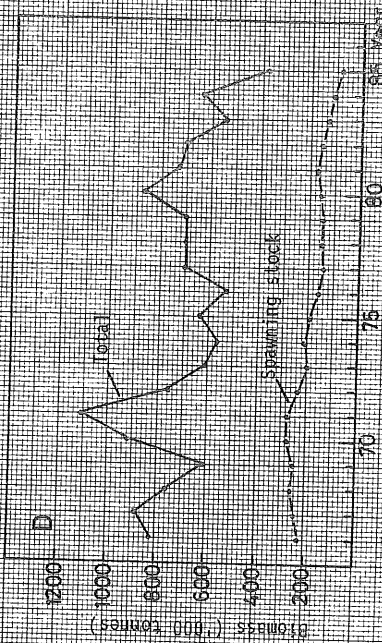
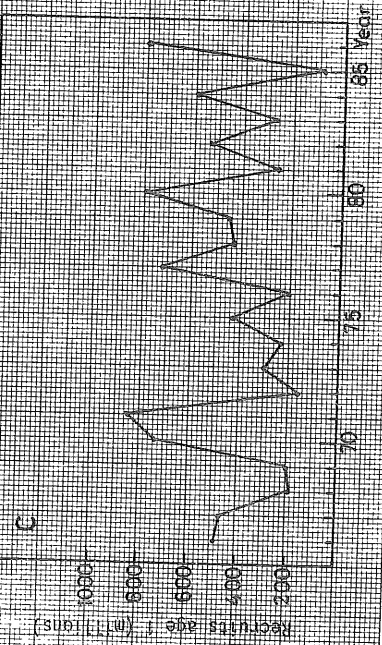
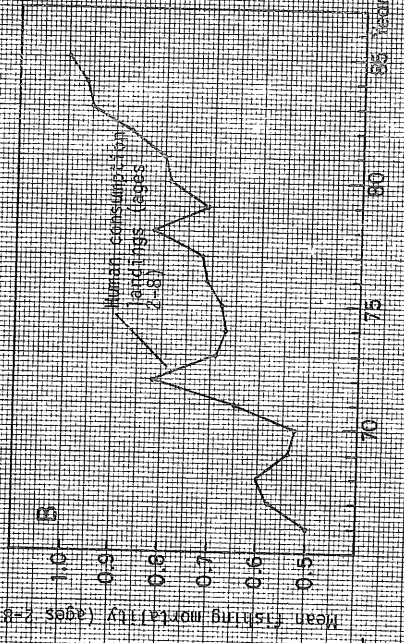
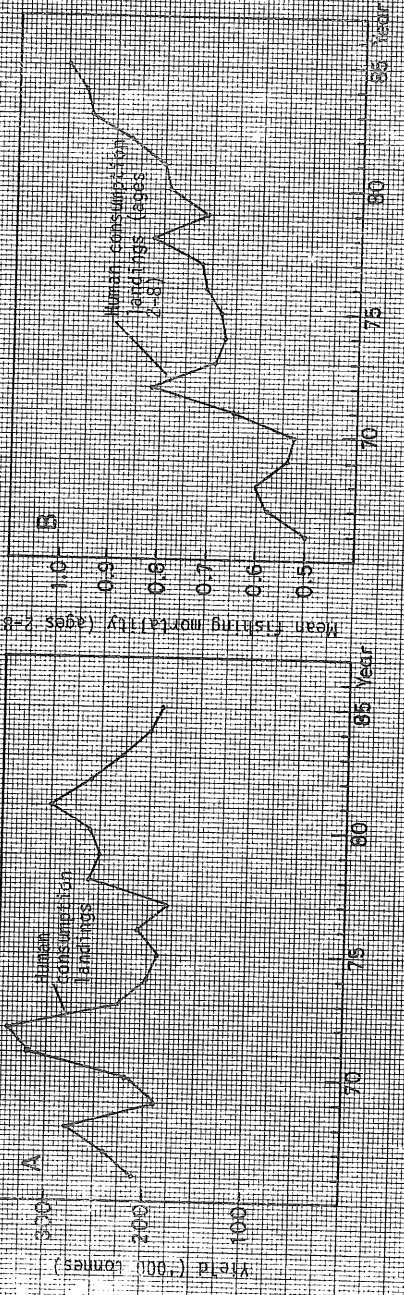


Figure 11.3. COD in Sub-area IV.  
Relation between SSB and recruitment.

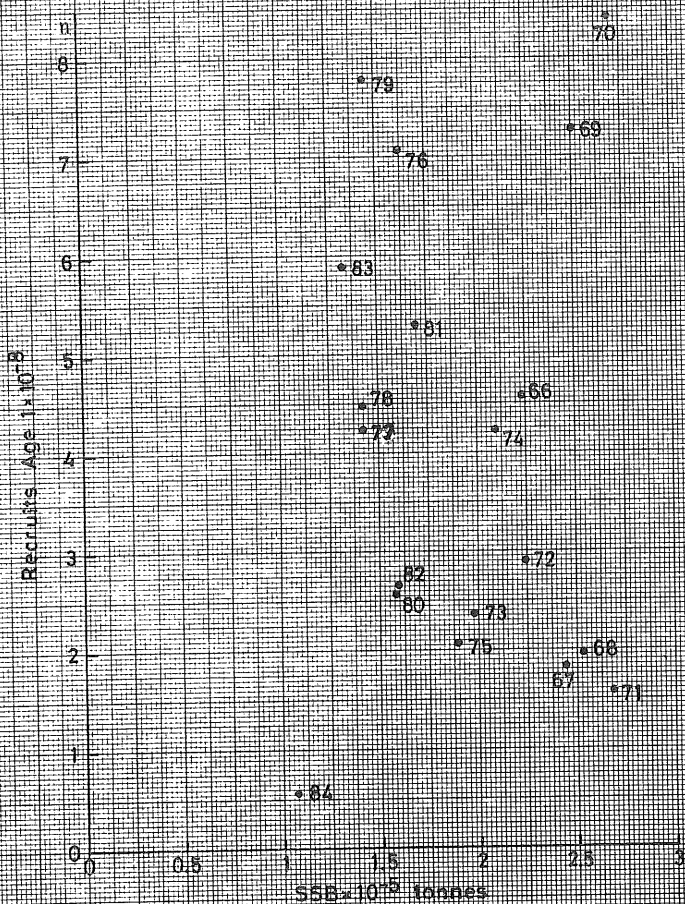


Figure 32.1A Relation between YPA numbers for cod in the North Sea and to the West of Scotland at age 1.

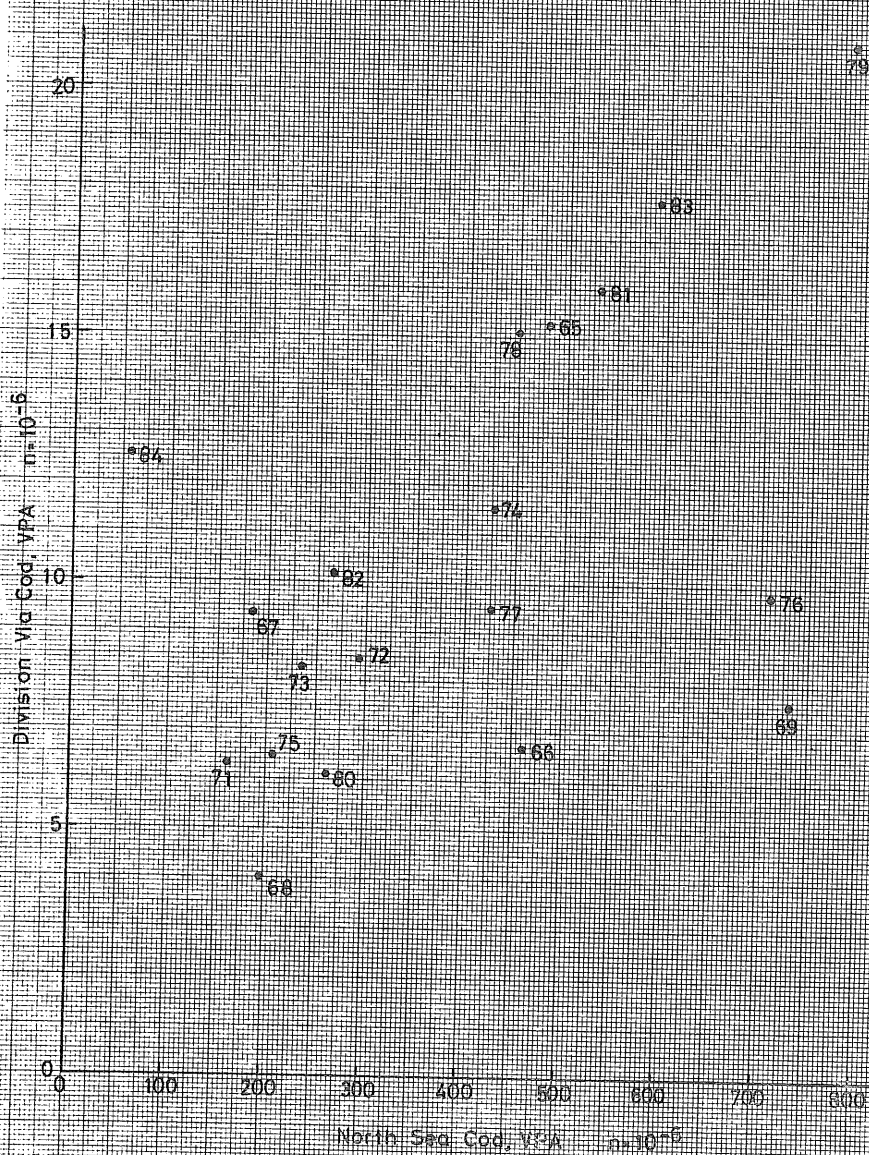
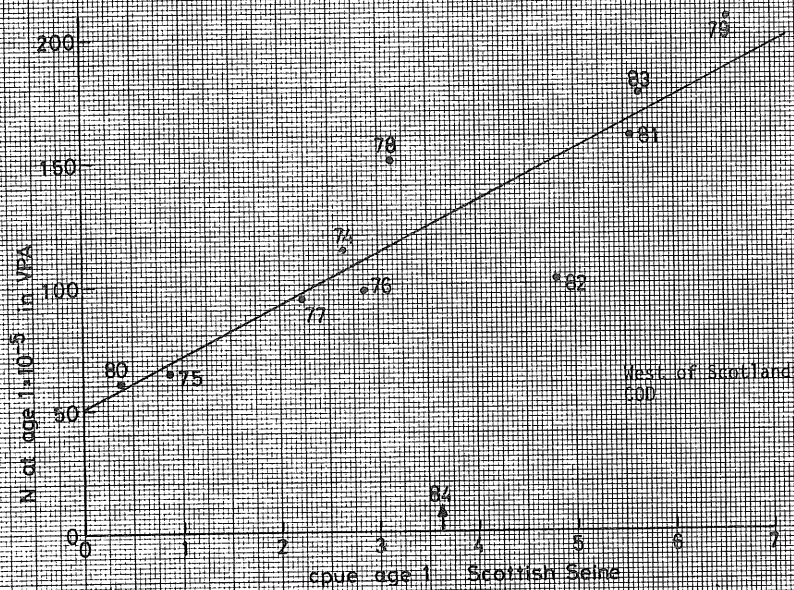


Figure 12.10



$$y = 20.88 x + 51.0$$

$$r = 0.89 \quad n = 10$$

Figure 12.2 (b) West of Scotland

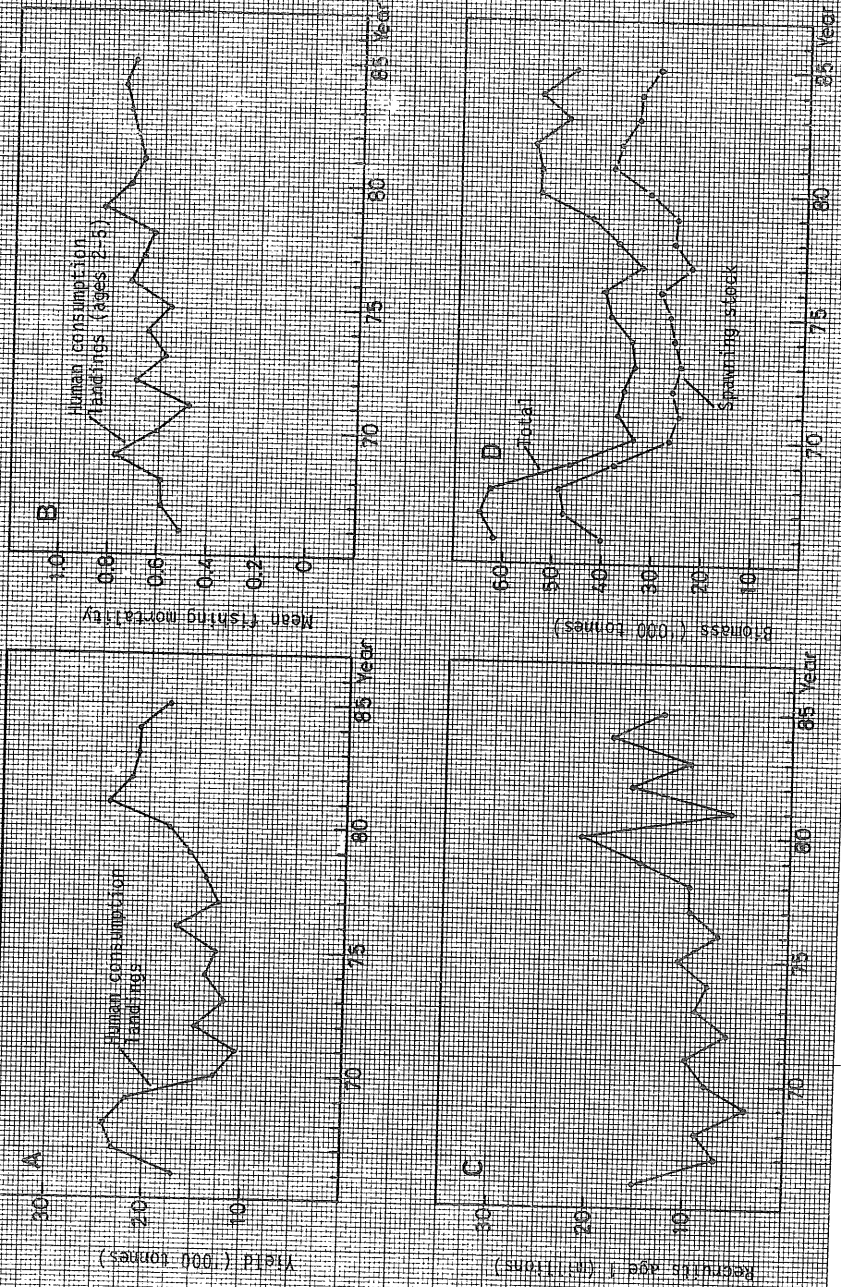


Figure 12.3 COD in Division VII.  
Relation between SSB and recruitment.

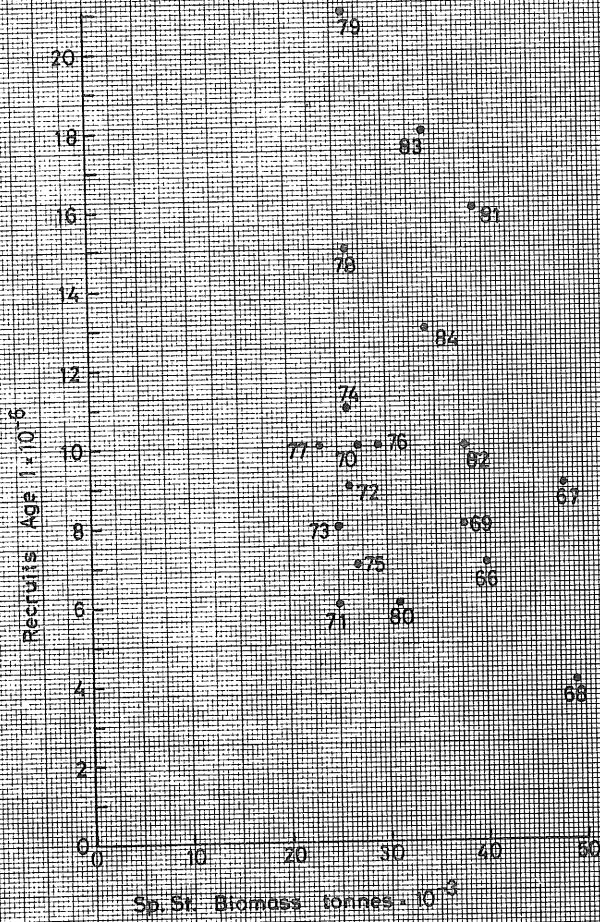




Figure 15.1 Proportion of total catch number accounted for by industrial catch for North Sea haddock.

**HADDOCK**  
IV

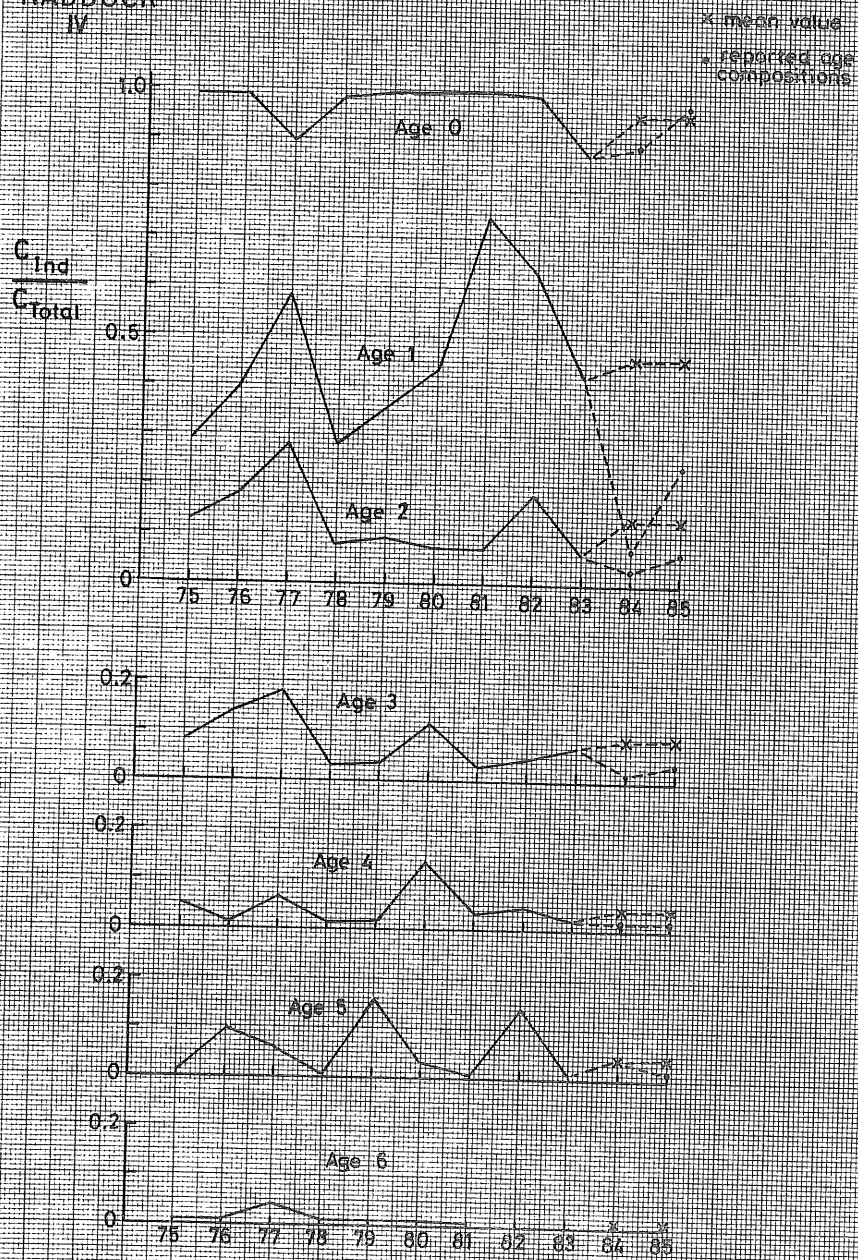


Figure 15.2. Catchability of North Sea haddock as age 1

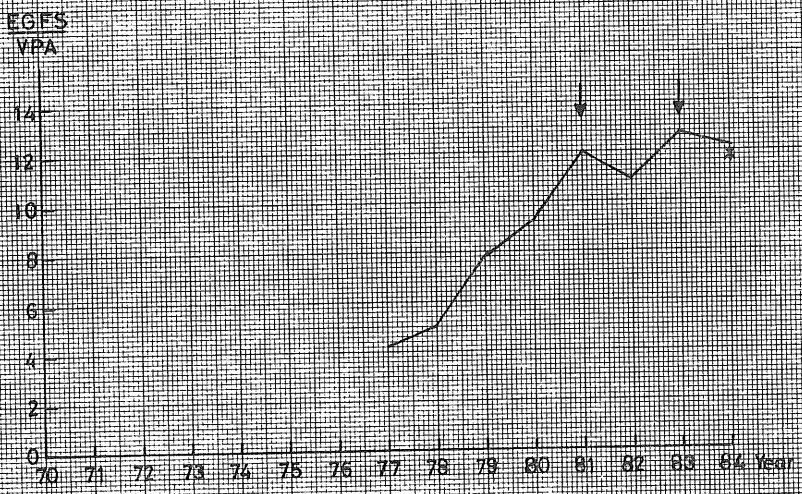
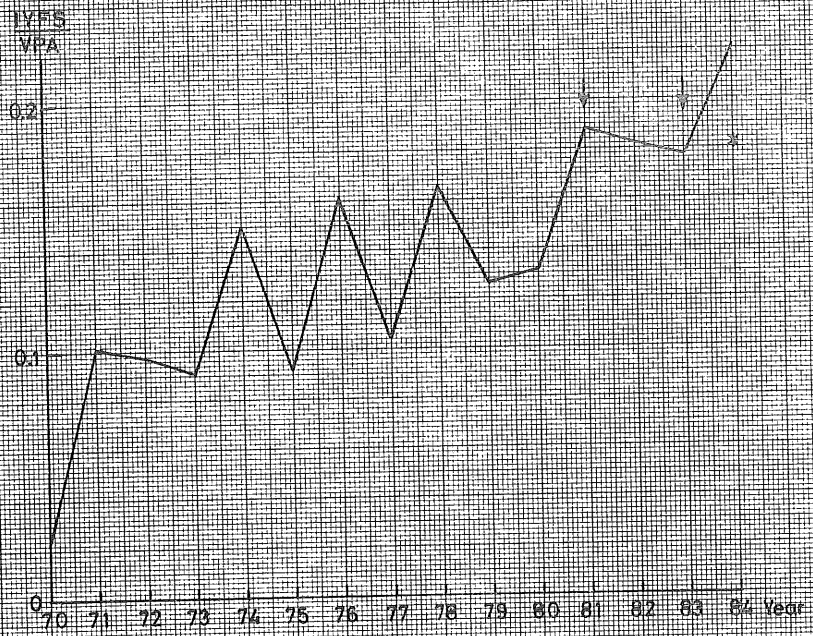




Figure 16.4 NORTH SEA HADDOCK

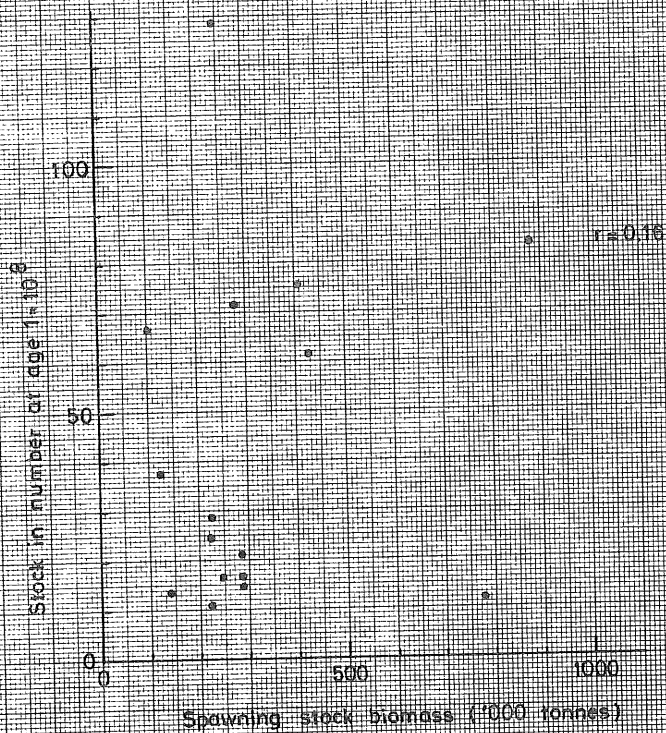


Figure 16. Haddock.  
Relation between VPA stock numbers at age  
in the North Sea and west of Scotland.

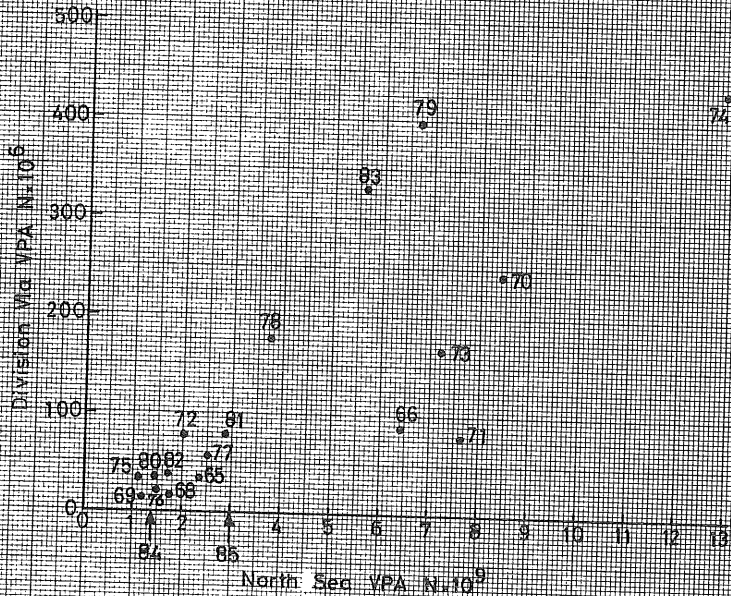


Figure 16.12 **WABOBY - West of Scotland**

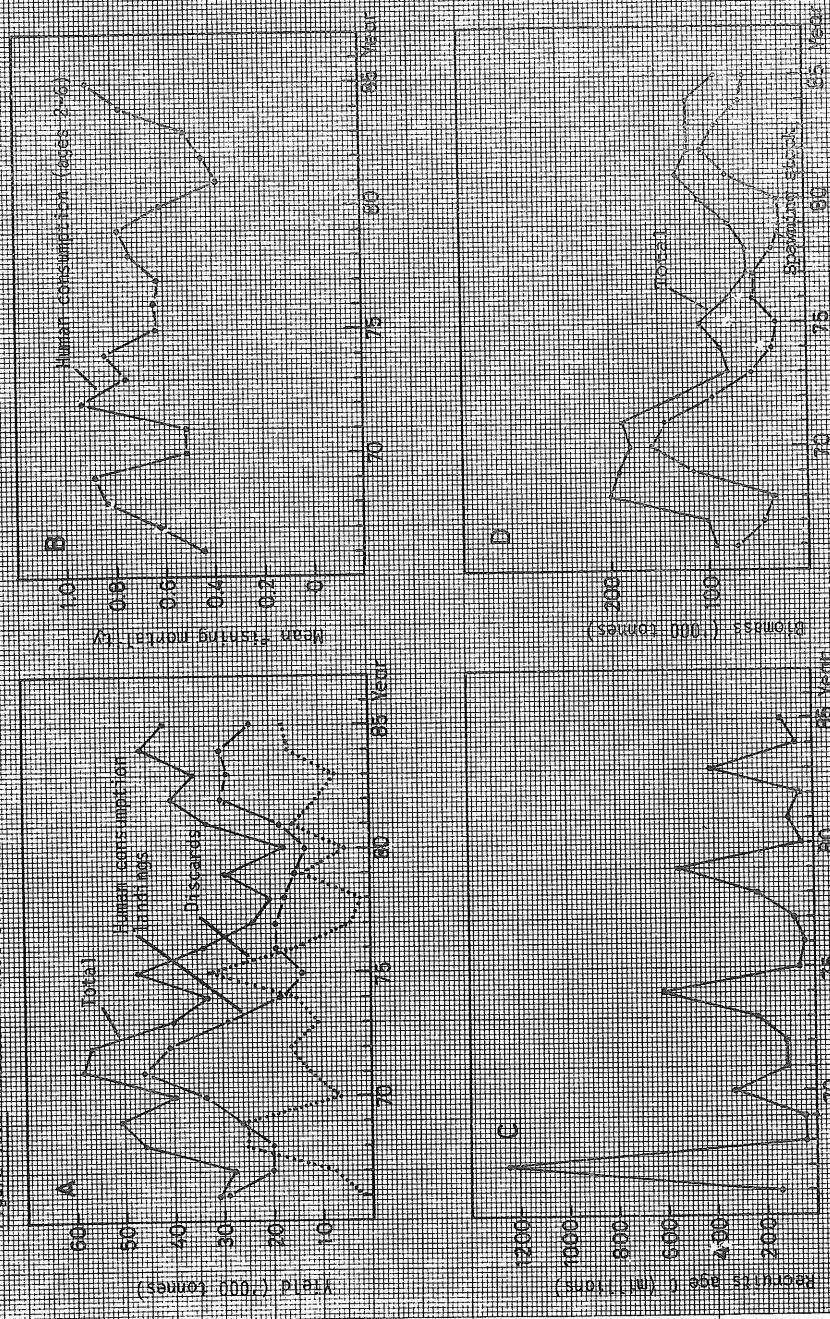
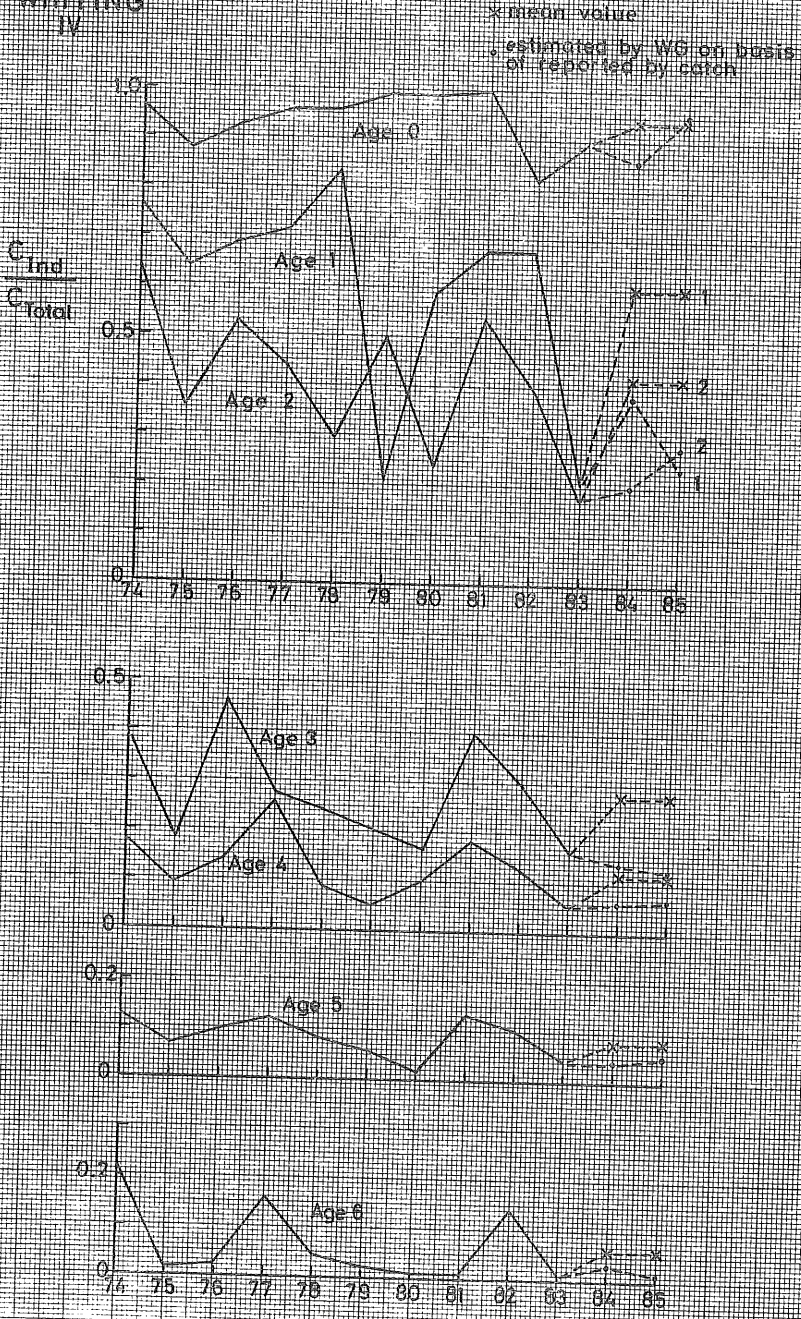


Figure 19.1

WHITING  
IV



154 Figure 19.2 Catchability of North Sea whiting at age 1.

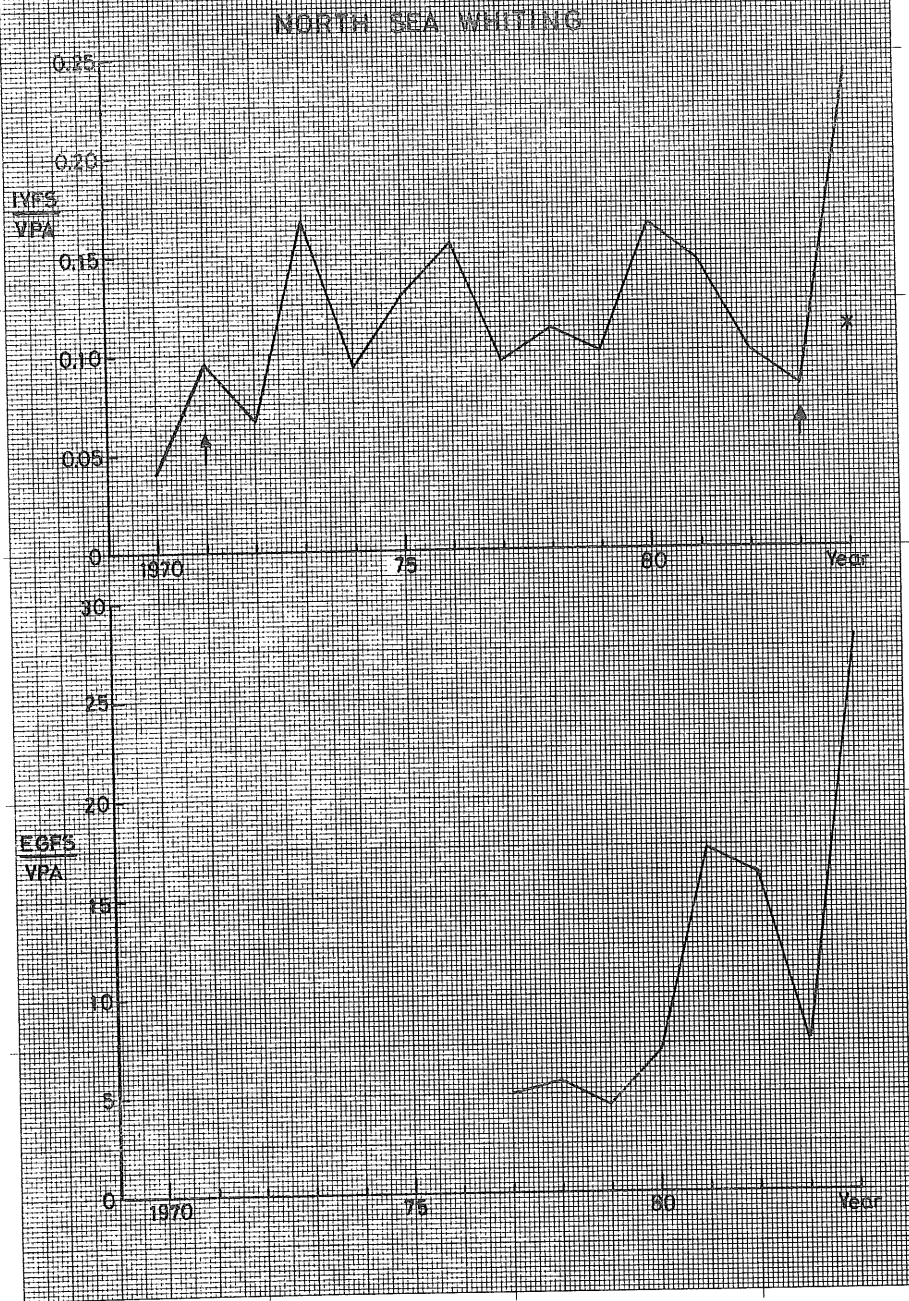




Figure 19.3. WHITING - North Sea.

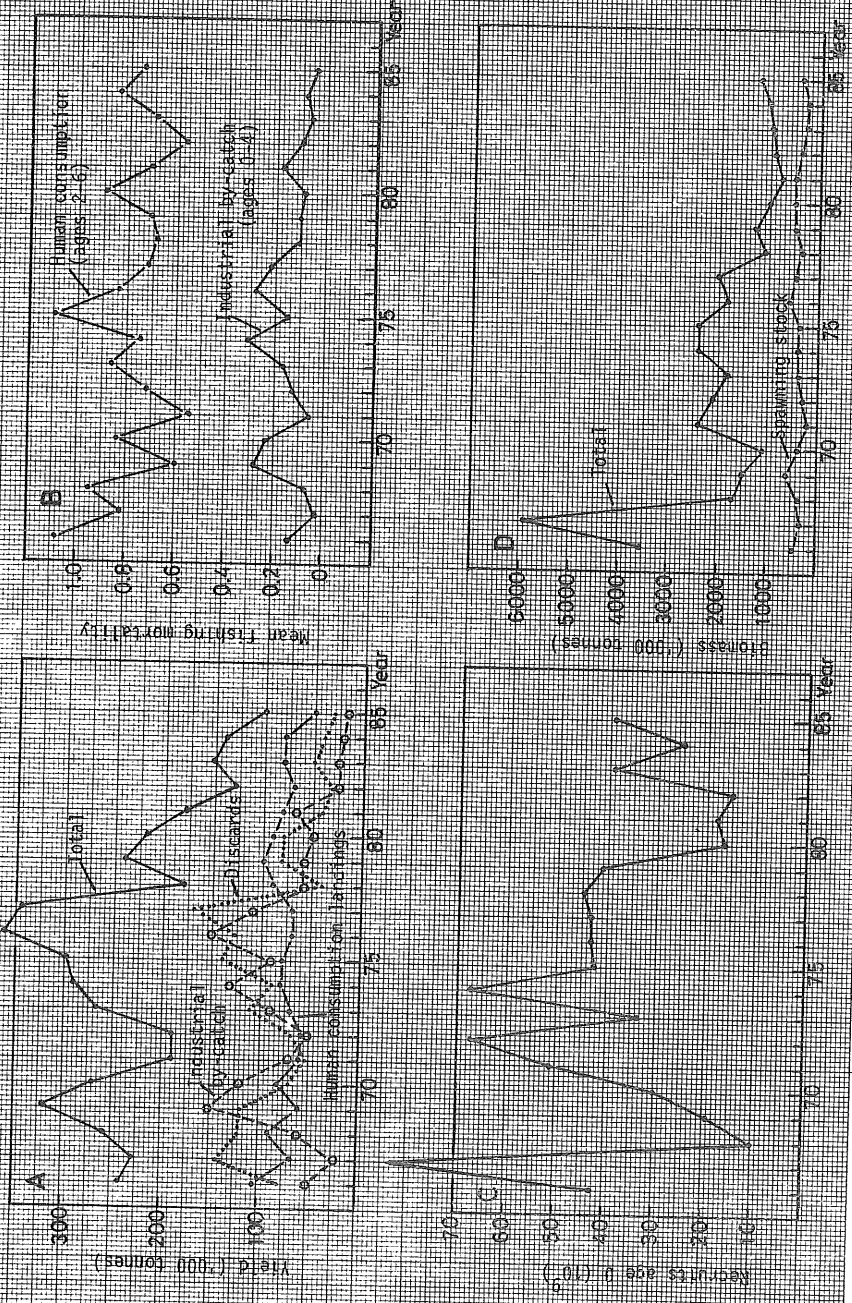


Figure 19.1

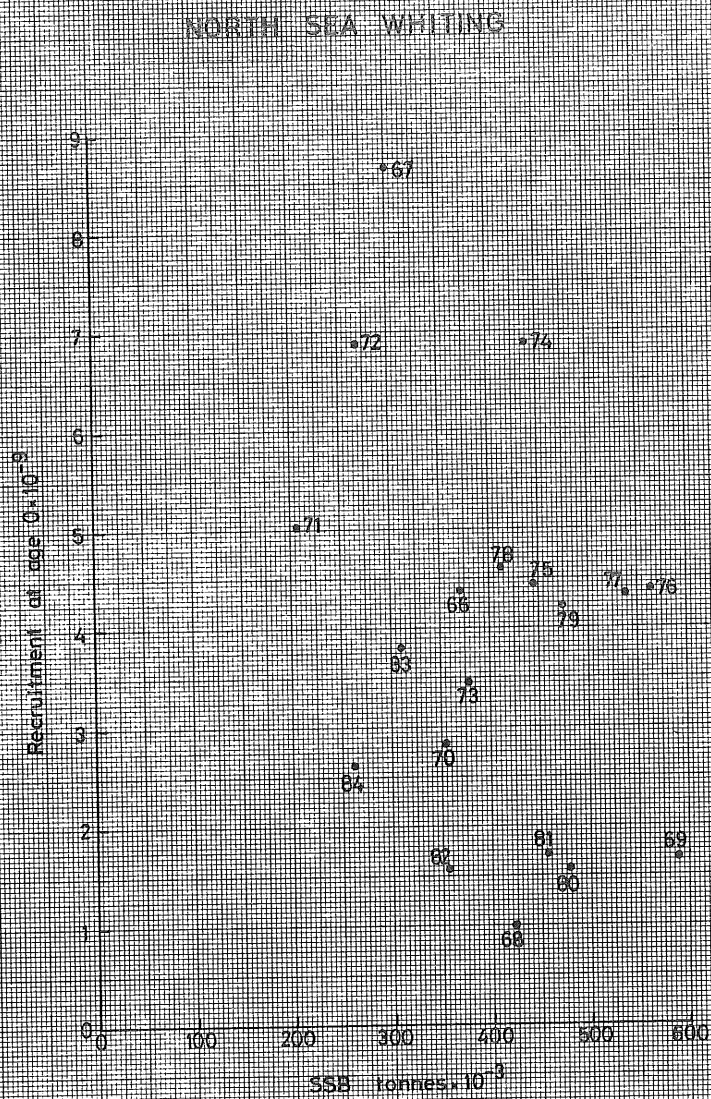


Figure 20.1 Relation between WVA stock numbers at age 1 in the North Sea and in west of Scotland (year-class indicated).

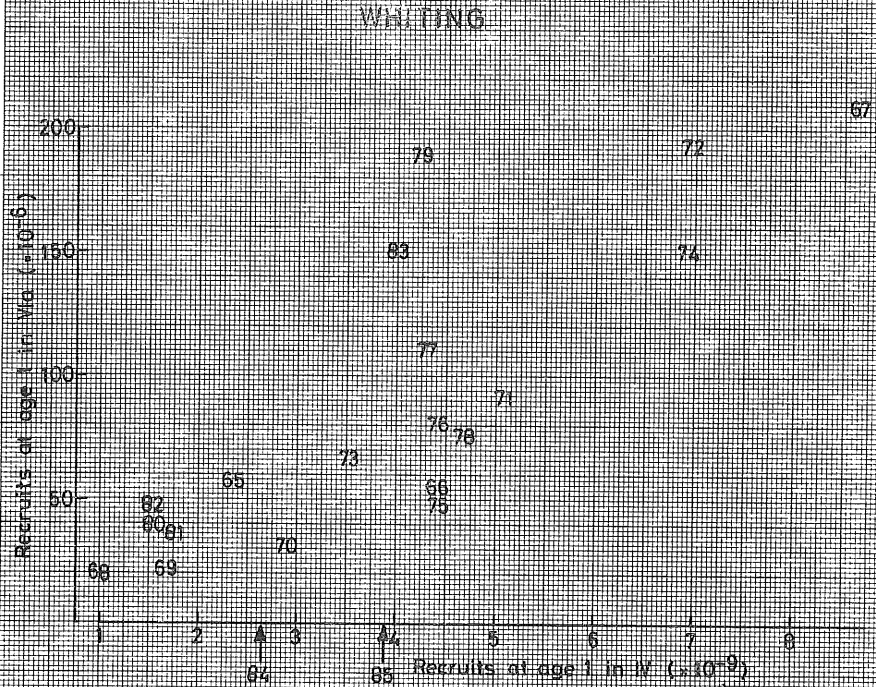


Figure 20.2. **WATLING** - West of Scotland.

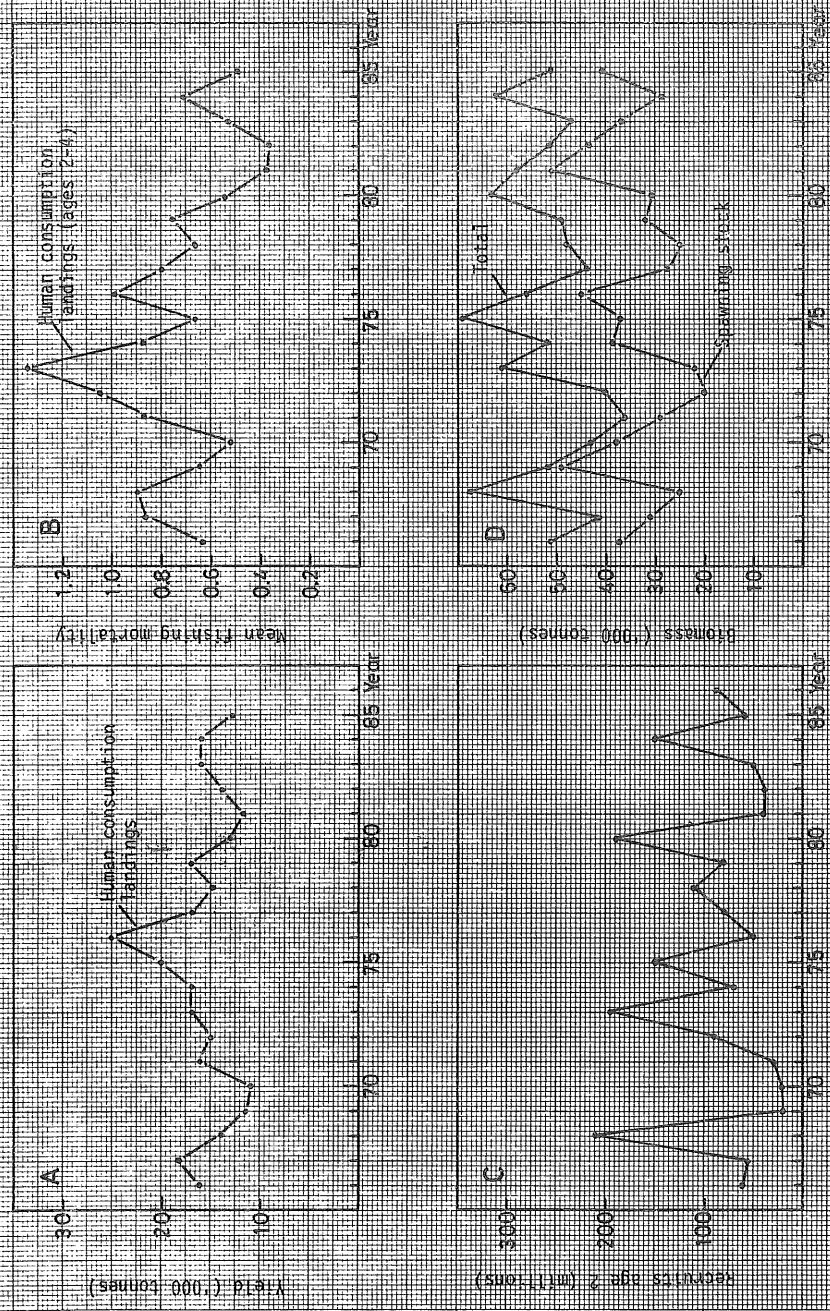


Figure 20.3 WHITING in VLO

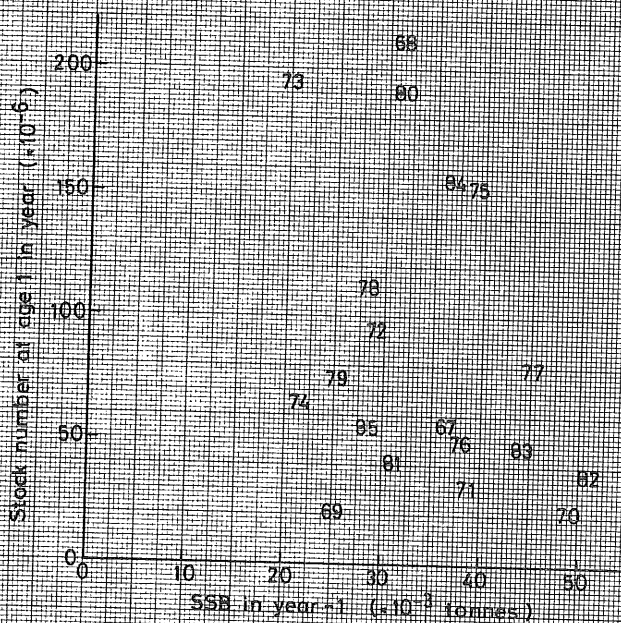


Figure 23.1 SAFTS - North Sea.

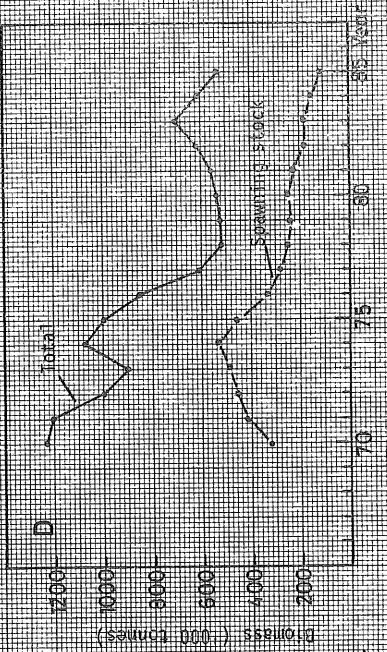
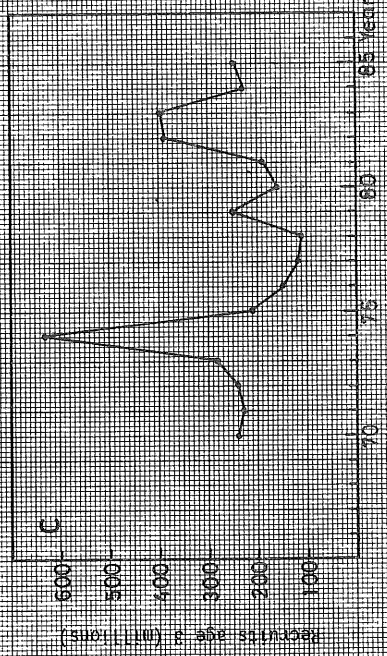
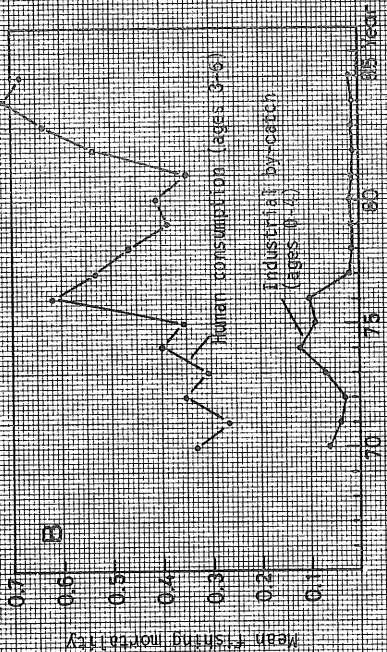
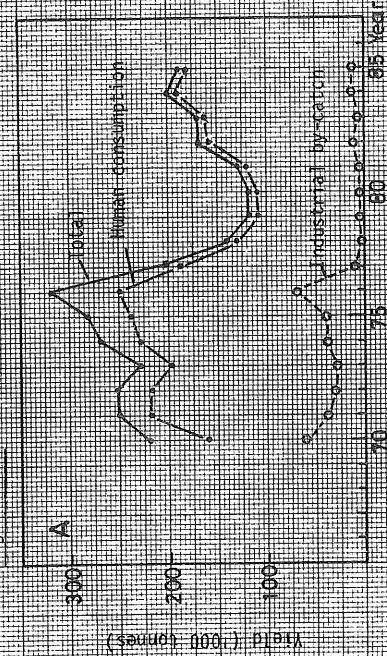


Figure 23.2 Relation between SSB and recruitment  
Sardine in Sub-area IV.

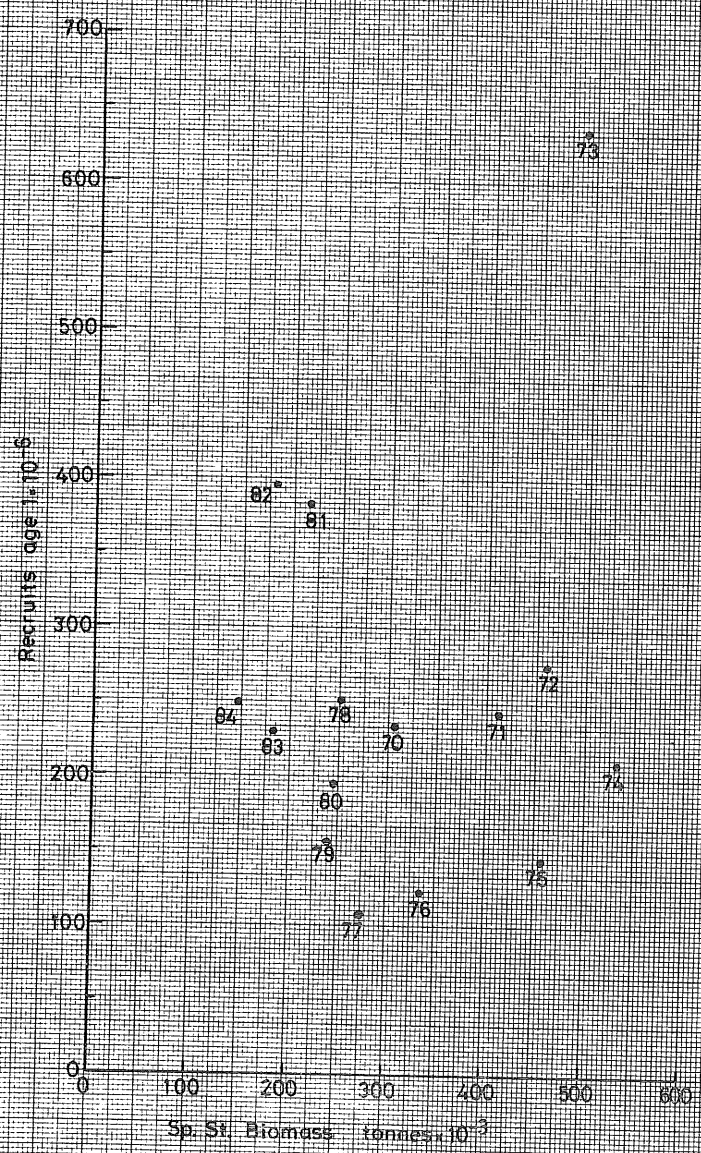


Figure 24.1 SALTIE - West of Scot land.

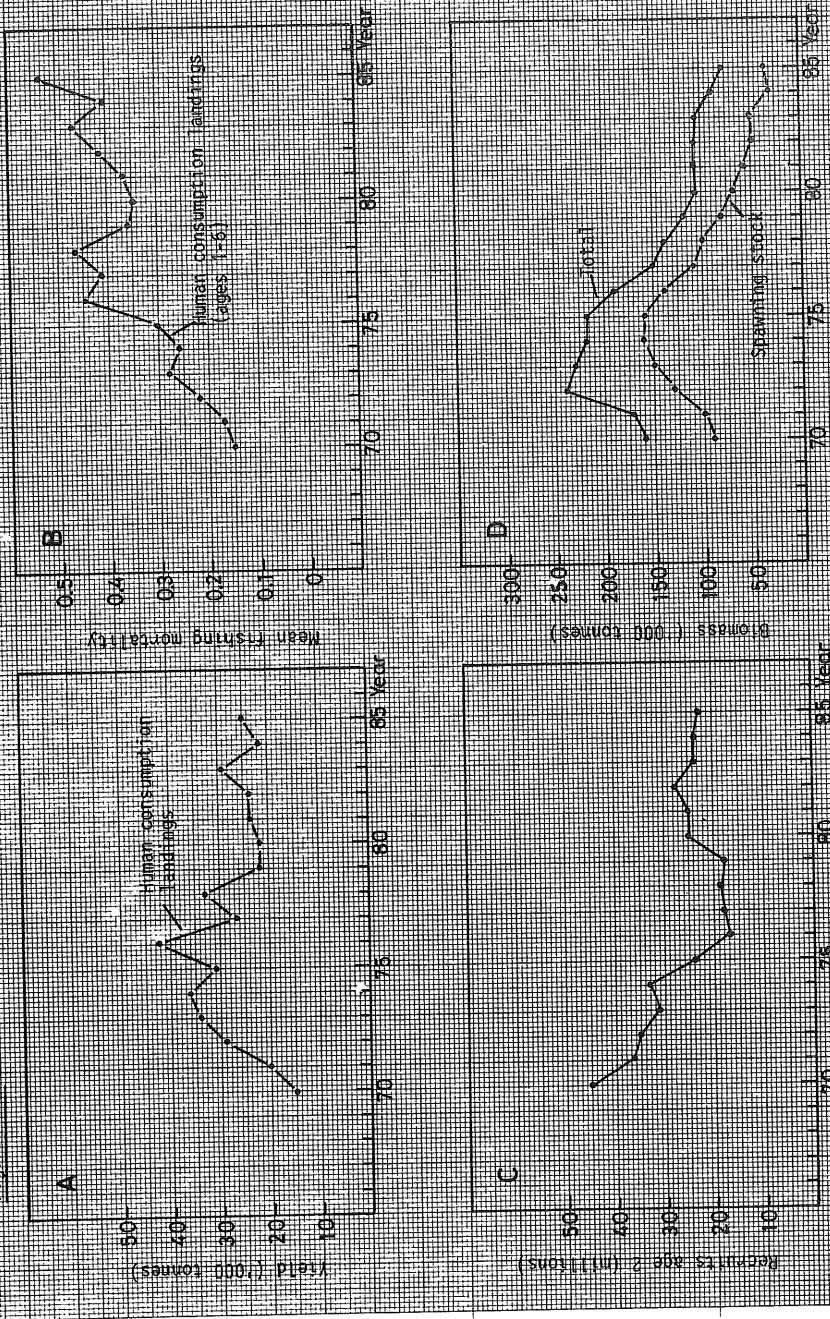




Figure 24.2 SAITHE in Sub-area VI.  
Relation between SSB and recruitment.

