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International Council for the
Exploration of the Sea

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*REPORT OF THE WORKING GROUP ON REDFISH AND GREENLAND
HALIBUT IN REGION 1*

Copenhagen, 22 - 27 February 1984

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REPORT OF THE WORKING GROUP ON REDFISH AND GREENLAND HALIBUT
IN REGION I

1. PARTICIPANTS AND TERMS OF REFERENCE

1.1 Participants

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E Lukmanov	USSR
J Magnusson	Iceland
J Møller Jensen	Denmark
N Prusova	USSR
K Randa	Norway
C Rørvik (Chairman)	Norway
H Schulz	Federal Republic of Germany
A Schumacher	Federal Republic of Germany
A Sigurdsson	Iceland

Mr K Hoydal attended the meeting as the ICES Statistician.

1.2 Terms of Reference

At the last Statutory Meeting the Council adopted the following resolution (C.Res. 1983/2:8:15):

The Working Group on Redfish and Greenland Halibut (Chairman, Mr C Rørvik) should meet at the ICES headquarters from 22-27 February 1984 to:

- (i) consider the findings of the Redfish Age-Reading Workshop.
- (ii) assess catch options for redfish and Greenland halibut in Region 1 for 1985 and, where meaningful, for 1986.
- (iii) evaluate available data, including information on cod, in relation to the "Mentella box" and the present mesh size regulation,
- (iv) analyse the effect of the changes in the data sets of weight at age and age at first maturity on the time series of the stock and spawning stock biomass.

2. REDFISH IN THE NORTH-EAST ARCTIC REGION (Sub-areas I and II)

2.1 Status of the Fisheries (Tables 1 - 5)

The redfish catches in the Sub-areas I and II increased from 102 372 tonnes in 1981 to 131 527 tonnes in 1982. The preliminary catch figure for 1983 is 117 149 tonnes, which is 32 149 tonnes above the level recommended by ACFM for 1983 of 85 000 tonnes. The 1983 catch is close to the agreed TAC for 1983 of 117 000 tonnes.

In Sub-area I the total catch increased from 2 565 tonnes in 1982 to 4 821 tonnes in 1983 (Table 2). In Division IIa the total catch increased from 79 151 tonnes in 1982 to 98 857 tonnes in 1983 (Table 3), and in Division IIb the catch decreased from 49 811 tonnes in 1982 to 13 471 tonnes in 1983 (Table 4).

Redfish catches were split into Sebastes mentella and Sebastes marinus on the same area basis as in earlier assessments. In Sub-area I all the USSR catches were reported to be S.mentella while the Norwegian catches were assumed to be S.marinus. In Division IIa the whole catch of the German Democratic Republic and 95% of the USSR catches were recorded as S.mentella, while all catches taken by other countries were assumed to be S.marinus. All catches taken in Division IIb were recorded as S.mentella.

Compared to 1982, the total landings in 1983 of S.marinus increased from 16 341 tonnes in 1982 to 18 128 tonnes in 1983, and those of S.mentella decreased from 115 186 tonnes to 99 021 in 1983 (Table 5). Thus, the TAC recommended by ACFM of 15 000 tonnes on S.marinus was exceeded by about 20% , while the recommended catch level for S.mentella of 70 000 tonnes was exceeded by about 40%.

2.2 Catch per Unit Effort (Table 6)

Catch per hour trawling data were available for the USSR S.mentella fishery for the period 1965-1983 from side trawlers (RT) and for 1980 to 1983 from stern trawlers (PST) (Table 6). The cpue value for side trawlers of 0.80 in 1983 is considerably above the value of 0.63 in 1982 which partly could be an effect of the change of minimum legal mesh size from 125 mm to 100 mm in the "Mentella box" (see also Section 6 below). The value for the stern trawlers (PST) shows an increase from 1.05 in 1982 to 1.09 in 1983. Using the side trawler (RT) cpue values as a standard, the total effort for the period 1965-1983 was derived. On this basis (RT) the total effort in 1983 was about 32% lower than in 1982.

The catch per unit effort for the German Democratic Republic S.mentella fishery, both for bottom trawl (OTB) and mid-water trawl (OTH) could not be given in 1983 due to a change in the

fishery. Instead a new catch per unit effort data for the category "freezer trawlers" in Division IIA were given for 1981-1983 (Table 6). This time series is too short to be used in the assessment.

2.3 Recruitment (Table 7)

From the International 0-group Survey, which began in the Barents Sea in 1965, it is seen that only year classes 1967 and 1968 have been estimated as very poor. The other year classes are all average or above average. The 1979-1983 year classes are the most abundant ones observed in the 0-group survey.

It should be noted that there is disagreement between the results from the International 0-group Surveys and the annual USSR Young Fish Surveys for the year classes 1973-1976. In the USSR Young Fish Surveys these year classes are recorded as poor. This is supported by the age-length composition of the USSR commercial catches in 1980-1983. During these years the weight of the above year classes only made up 6-10% of the catches.

According to the preliminary data from the USSR Young Fish Survey the yearclasses 1973 - 1976 are poor. In the International 0-group Survey the year classes 1981-1983 were recorded as strong and this corresponds to the results from the USSR Young Fish Surveys carried out in 1982-1984.

2.4 Age Composition (Tables 8 and 11)

Catch in numbers per age group for both S. marinus and S. mentella were adjusted to the revised total catch figures for 1981 and 1982.

For 1983, age composition data and age/length keys for S. marinus landings were available from the Federal Republic of Germany and USSR for Division IIA. The total age composition was calculated by applying the Federal Republic of Germany age composition to the total catch of all countries except for USSR (Table 8).

Age compositions of S. mentella for 1983 were available for the catches of the German Democratic Republic and the USSR. The sum of these were raised to the total landings in 1983 (Table 11). The age compositions of the S. mentella catches available in 1983 represent more than 99% of the total landings.

2.5 Mean Weight at Age (Tables 9 and 10)

For 1983, mean weights at age for S. mentella were available for the German Democratic Republic and the USSR landings. The mean weight at age for the age groups 6-10 in 1983 given by the USSR differed greatly from the ones used in previous assessments. These data were mostly based on samples taken in Sub-area I where only 4% of the USSR catch were taken, and they may therefore not be representative for the total landings. It

was decided to use the mean weight at age used in last years assessment for the age groups 6-10 and the USSR mean weight at age for the age groups 11-24+ (Table 9). The 1983 data were used for the catch projections. The SOP correction factor for these mean weights at age are given in Table 10, but none of them differs greatly from 1.0.

2.6 Proportion of Mature Fish at Age (Table 14)

Data were available from the German Democratic Republic and the USSR on S. mentella. These data differed greatly from the ones used in last years assessment, giving a much lower age at first maturity. These data were presented as averages over several years, and if used as presented, they would have created a discontinuity in the calculation of the spawning stock biomass. In order to utilize these data they need to be presented on a yearly basis for each sex separately. The Group therefore decided to use the maturation curve from last year's report (Table 14).

2.7 Assessment (Sebastes marinus)

As last year, no effort data were available for S. marinus on which to estimate fishing mortality in 1983.

It is therefore impossible for the Group to assess whether the trend in catches (Table 5) reflects a trend in stocksize or just a trend in fishing effort. The catches may also reflect the TAC set for the different years.

2.8 Assessment (Sebastes mentella)

2.8.1 Parameters Used (Figure 1)

As a first attempt fishing mortality in 1983 was estimated as 0.22 from the relationship of average F on the 8 to 19 year olds to total effort in USSR units given in last year's report and the total effort figure for 1983 (Table 6). From a VPA using this estimate and a recalculation of the linear regression between mean fishing mortality and total effort for the period 1965-1979 (Figure 1) a final estimate of $F(0-19) = 0.23$ was derived.

Fishing mortality for the age groups 6-9 were calculated assuming an average recruitment level (1965-1979) at age 6 in 1980-1983. F-values for the age groups 10 and older were calculated according to the average exploitation pattern in the period 1974-1980.

Natural mortality of 0.10 was used as in previous assessments.

2.8.2 Fishing Mortality (Table 12, Figure 2)

Estimates of fishing mortality from the VPA are given in Table 12. The mean fishing mortalities on age groups 8-19 was low in the period 1965-1974, fluctuating around 0.08. An increase to an average level of 0.50 was recorded for the period 1975-1977, with a peak of 0.55 in 1976. From 1978 to 1982 the fishing mortality remained fairly stable at a level of 0.20. A decrease down to 0.23 was observed in 1983 (Figure 2).

However, since the minimum mesh size in the "Mentella box" was decreased from 125 mm in 1982 to 100 mm in 1983, the total effort and subsequently the fishing mortality in 1983 might have been underestimated. The Group was, however, unable to assess the magnitude of this possible bias (See also Section 2.2)

2.8.3 Stock Size (Table 13, Figure 2)

Estimates of stock size in numbers from the VPA, total stock biomass and spawning stock biomass are given in Table 13.

The result from the VPA (Figure 2) show that the total biomass increased steadily from about 300 000 tonnes in 1965 to about 1 million tonnes in 1975. It decreased continuously to about 670 000 tonnes by 1979 and remained fairly stable up to 1983.

The spawning stock biomass shows a similar increase from about 120 000 tonnes in 1965 to about 300 000 tonnes in 1975. By 1979 it decreased to about 130 000 tonnes and then increased to about 250 000 tonnes in 1983.

2.8.4 Yield per Recruit (Figure 3)

Due to the revision of the mean weight at age data on the older ages and a minor change in the exploitation pattern on the 6-9 years old the Group decided to recalculate yield per recruit. The results of these calculations are $F_{0.1} = 0.075$ and $F_{max} = 0.15$ when the last age group was considered as a plus group, $F_{0.1} = 0.11$ and $F_{max} = 0.18$ when the last age group was taken as a plus group. The input parameters used in these calculations are given in Table 14. The resulting two yield per recruit curves are given in Figure 3.

The estimated mean fishing mortality in 1983 of 0.23 is above the F_{max} level on both of the two yield per recruit curves.

2.8.5 Catch Projections (Table 14, Figure 4)

Based on the estimated stock size in the beginning of 1984, catch projections were made for 1985 and 1986, using the parameters in Table 14. Furthermore the average recruitment (1965 - 1979) of 437 millions at age 6 was applied in the projections 1984-1987.

For 1984 it was assumed that the TAC of 90 000 tonnes will be

taken. The fishing mortality required to achieve this catch is at a level of $F(8-19) = 0.21$.

The result from the catch projections are shown in Figure 4. The catch in 1985, total stock biomass and spawning stock biomass at the beginning of 1986 are plotted against fishing mortality in 1985.

In its terms of reference the Working Group was requested to provide projections of catch and stock size for 1986 and 1987 respectively, if meaningful. In view of the apparent stability of the total biomass and stock numbers in recent years the Working Group felt that a projection beyond 1985 could indicate likely catch levels for 1986 and their consequences on spawning stock biomass. However, the limited time available did not allow to cover all possible combinations of options for the two years in the projection for 1986(7). Therefore the options for 1986 are given under the assumption that the target fishing mortality for the management in 1985 will be maintained in 1986.

For selected values of fishing mortality in 1985 and 1986, the results are summarized in the text table below.

It can be seen that continuing fishing at the 1984 level of fishing mortality in 1985 and 1986 will give a slight increase in the total stock biomass and keep the spawning stock biomass nearly stable up to the beginning of 1987. Fishing at the $F_{0.1}$ or F_{max} level in 1985 and 1986 will give an increase in both total stock biomass and spawning stock biomass.

Management Options for 1985 and 1986

Species: <i>Sebastes mentella</i>					Area: ICES Sub-areas IIa and IIb									
1984					Management	1985				1986			1987	
Stock biom. (6+)	Spawning stock biom.	F (0-19)	Catch (6+)	Option for 1985 1986	Stock biom. (6+)	Spawning stock biom.	F (0-19)	Catch (6+)	Stock biom. (6+)	Spawning stock biom.	Catch (6+)	Stock biom. (6+)	Spawning stock biom.	
690	256	0.21	90	F 0.1	709	206	0.11	51	771	302	58	821	335	
				F max			0.18	81	737	278	87	754	285	
				F 1985 =F 1984			0.21	93	724	269	96	729	267	
				x)										
				F 0.1			0.075	36	788	314	43	856	361	
				x)										
				F max			0.15	67	753	289	74	785	308	

Weights in thousand tonnes

x) last age group assumed to be a plus group

3. REDFISH IN SUB-AREAS V AND XIV

3.1 Status of the Fisheries (Tables 15 - 18)

The total catch from the Irminger Sea redfish stock complex increased in 1981 from 146 000 tonnes to 229 000 tonnes in 1982 and decreased slightly to 225 000 tonnes in 1983. This rise in catch figures over the last two years compared with the years before, originated from catches in the new fishery, based on the stock of S.mentella type oceanic.

The total catch of redfish, excluding catch figures from the new fishery, decreased slightly from 169 000 tonnes in 1982 to 164 000 tonnes in 1983. The catches in Division Va increased by about 8 000 tonnes, whereas in Sub-areas XIV, the catches decreased by about 12 000 tonnes. In Division Vb, the catch was almost the same as in 1982.

In Division Va (Iceland), the Icelandic fleet increased the fishing effort in 1983, compared with 1982. This resulted in an increase in the Icelandic catch from 115 051 tonnes in 1982 to about 123 000 tonnes in 1983. The increase in the fishing effort on redfish was mainly due to restrictions in the cod fishery and reduced availability of cod in 1983. The fishery in the Rosengarten area was resumed in 1983 after 4-5 years with minor fishing in that area.

In Division Vb (Faroes), the catches increased slightly from 8 871 tonnes in 1982 to 9 200 tonnes in 1983, mainly due to an increase in the Faroese catches from 4 000 tonnes in 1982 to 4 600 tonnes in 1983, whereas the catch taken by the Federal Republic of Germany fleet decreased slightly by about 200 tonnes to 4 400 tonnes in 1983.

In Sub-area XIV (East Greenland), the total catch (excl. S.mentella type oceanic) increased by 12 000 tonnes from 42 815 tonnes in 1982 to 30 800 tonnes in 1983. The catches in the East Greenland waters were exclusively taken by the fleet of the Federal Republic of Germany. The reduction in the catch was mainly due to the reduction in the number of vessels participating in the fishery.

The fishery on the S.mentella type oceanic stock took place outside the 200 nm zone in Sub-areas XII and XIV, and the catches amounted to 60 581 tonnes in 1982 and about 60 000 tonnes in 1983. These catches are not included in the present assessments (See Section 3.7).

3.2 Recruitment of Redfish in the Irminger Sea

In 1983 0-group redfish were mainly distributed in the central region of the Irminger Sea, while the East Greenland shelf area, where the heaviest concentrations of 0-group redfish are usually observed, was almost devoid of redfish fry. Very few 0-group redfish were present in the Dohrnbank region as well as south of 60 N. In the Icelandic area, redfish fry were mainly

observed off the north coast of Iceland.

No areas with abundance in excess of 1 000 individuals per nm^2 were observed. The abundance index of 0-group redfish, 0.7×10^6 fish per nm^2 , is the lowest on record since 1970. In general the 0-group redfish were smaller than previous years.

The year to year fluctuations in the abundance of 0-group redfish, as estimated in the surveys, are shown in the text table below.

<u>Number of 0-group redfish $\times 10^6$ / nautical mile²</u>	
1970	8.6
1971	12.6
1972	31.1
1973	74.0
1974	23.6
1975	12.6
1976	5.8
1977	13.0
1978	6.5
1979	1.3
1980	3.0
1981	9.0
1982	2.7
1983	0.7

The analysis of redfish fry by species indicated that the proportion of S. marinus in 1983 amounted to 47%, 43% and 46% in 1980 to 1982. However, the proportions within the different regions in the Irminger Sea are very variable from year to year.

3.3 Splitting Catches into S. marinus and S. mentella (Tables 18-21)

In Division Va, the Icelandic catch was allocated to S. marinus and S. mentella components in proportions 69.8% to 30.2% based on observations of landings. The catches of Belgium, Norway and the Faroes are in accordance with their fisheries allocated to S. marinus.

In Division Vb the Federal Republic of Germany catch was S. mentella according to observations on landings. The proportions of S. marinus and S. mentella catches of the Faroe Islands were 66.52% and 33.48% respectively. These figures were derived from observations on landings. The estimated catch of France was allocated as reported last year, i.e., 76.54% S. marinus and 23.46% S. mentella.

In Sub-area XIV, the catch of the Federal Republic of Germany was allocated in the same proportions as observed in the landings, i.e., 50.68% and 49.32% for S. marinus and S. mentella, respectively.

3.4 Length and Age Compositions (Tables 22, 26)

Division Va

Length frequencies from the Icelandic catches in 1983 were available for both species and were used to calculate the length distribution of the catch in numbers for the respective species.

For S. marinus in Division Va, the Icelandic age/length key was combined with the age/length key used in 1983 for the younger and older age groups, since it did not cover all length frequencies. For S. mentella in Division Va, Icelandic data was available. These data were used to calculate the number at age.

Division Vb

Faroese data on length frequencies for both species were available for Division Vb; the Federal Republic of Germany age/length key was applied for S. mentella, whereas for S. marinus the combined Icelandic age/length key for Division Va was used to calculate the numbers at age.

Sub-area XIV

Federal Republic of Germany data on length composition of the 1983 catches as well as the corresponding age/length keys were available for both species, and used to calculate the length and age distributions of the total catch.

The combined age compositions of the total catches in Sub-areas V and XIV are given in Table 22 for S. marinus and in Table 26 for S. mentella.

3.5 Assessment of *Sebastes marinus*

3.5.1 Weight at Age (Table 25)

Comparison of the nominal catch in 1983 with the calculated catch using mean weights at age from the previous assessment (SOP-check) resulted in a deviation of 9%.

No new direct observations on mean weight at age in the catch were available. However, data on average weight per cm-group originating from an extensive sampling programme carried out by Iceland in 1979 covering commercial catches as well as research vessel catches have been used to calculate average weight per age group by means of an age/length key. The resulting data were very similar to those used previously as mean weights for the stock. The SOP-check showed differences of -3% and -1% for the years 1982 and 1983 respectively. Since the difference in 1981 was -6% as in the previous assessment the Working Group agreed to use the new data from 1982 onwards for both catch and stock (Table 25).

3.5.2 Proportions of Mature Fish at Age (Table 25)

Icelandic data on proportions of mature fish at age obtained in 1983 show only minor differences compared to those used in the previous assessments, and there was no reason for a revision.

3.5.3 VPA (Tables 23 and 24, Figure 5 and 6)

Catch per unit effort data from the Icelandic fishery have been used to calculate total effort in the redfish fishery in Sub-Areas V and XIV (see text table below). Total effort has been allocated to S. marinus and S. mentella according to their proportions in the catches.

Year	cpue kg/hr trawling*)	Total effort	<u>S. marinus</u>	<u>S. mentella</u>
			effort	effort
		1000 hours trawling		
1978	1 034	63.7	46.2	17.5
1979	1 148	85.3	65.4	19.9
1980	1 180	94.4	74.7	22.7
1981	1 168	124.7	86.7	38.0
1982	1 146	147.2	107.5	39.7
1983	1 062	155.1	100.1	55.0

*) for landings where redfish make up 70% or more.

The resulting effort figures for S. marinus have been used to estimate fishing mortality for that species in 1983. This approach was accepted by the Working Group as the cpue figures cover more than 2/3 of the total S. marinus catch.

The calculation was done in the following way:

An initial VPA was performed with the average fishing mortality on age groups 14 to 23 derived from the catch projection in the 1983 assessment corresponding to the catch of 106 300 tonnes in 1983, i.e. 0.275. From a regression based on the average $F(14-23)$ and the effort for the years 1978 - 1982 mean F corresponding to the effort for 1983 was estimated as 0.286 (see Figure 5). The nature of the data and the method used made a finer tuning of the estimate not very meaningful and therefore an average $F(14-23)$ of 0.28 was the agreed estimate for 1983.

It was indicated in the discussion that a part of the Icelandic fishery for redfish since 1978 had shifted to fishing grounds which have not been fished regularly by Icelandic vessels. Therefore the respective Icelandic fishermen have gone through some learning processes particularly in 1978 and 1979 until they became fully familiar with these fishing grounds. For this reason it is quite likely that the average catch per unit effort could have been higher in those years. As a consequence the effort in 1978-79 might be slightly overestimated and hence

fishing mortality estimates based on these data are on the conservative side and not likely to be underestimated.

The exploitation pattern as revised in the 1983 assessment for age groups 10 and older was inspected on the basis of the average F per age group for 1975-79 but no reason for a further revision was indicated.

In the VPA the numbers at age 7 in the stock appeared to be unrealistically high for the years 1980 to 1983. Small changes in the fourth decimal of the F -values on age groups 7-10 in 1983 result in large changes in the stock numbers of the respective year classes. Therefore, average recruitment over 1975-79 was used to calibrate fishing mortality on age groups 7 to 10 in 1983 and to adjust the exploitation pattern accordingly. The catch projection for 1985 is only marginally affected by this approach since both F and mean weights are small on these age groups; however the total biomass estimates might be somewhat biased.

As in previous assessments natural mortality of 0.10 was used.

The results of the VPA (Tables 23, 24 and Figure 6) show an increasing trend of fishing mortality in recent years following the trend in catches with a slight reduction in the 1983 estimate. Total biomass (7+) increased continuously from a stable level of about 0.8 million tonnes in the 1967-1972 period to about 1.2 million tonnes by 1979 and remained at this level. Although some stability might be artificially introduced by using average recruitment from 1980 onwards.

3.5.4 Yield per Recruit Curve (Table 25, Figure 7)

A new Y/R curve was calculated using the revised average weight at age figures and with the oldest age group as plus-group. $F_{0.1}$ is 0.03 as in the previous assessment. The curve has a maximum at F of 0.05.

In view of the very low fishing mortality associated with these reference points the Y/R curve was also calculated with the oldest age group not as a plus group. Under this assumption the reference points $F_{0.1}$ and F_{max} are 0.05 and 0.10 respectively.

3.5.5 Catch Projection and Management Options (Table 25, Figure 8)

In its terms of reference the Working Group was requested to extend the usual projection of catch and stock size for the following year (i.e. 1985 and 1986 respectively) to 1986 and 1987 respectively if meaningful. In view of the apparent stability of the total biomass and stock numbers in recent years the Working Group felt that a projection beyond 1985 could indicate likely catch levels for 1986 and their consequences on spawning stock biomass. However, the limited time available did not allow to cover all possible combinations of options for the two years in the projection for 1986(7). Therefore the options for 1986 are given under the condition

that the target fishing mortality for the management in 1985 will be maintained in 1986.

The basic data for the projection of catches in 1985(6) and for the stock size at the beginning of 1986(7) are given in Table 25. Average recruitment of 7 year old fish over the period, i.e. 350 millions, was used in the catch projection.

In the absence of any indication of the likely total catch level of S. marinus from the Irminger Sea stock complex in 1984, a catch of 110 000 tonnes was assumed to be taken in that year. The results of catch projections are given in Figure 8 and some management options are given in the text table below.

Fishing at the 1983 level of exploitation in 1985 and 1986 would allow to maintain the present catch level and would also maintain the spawning stock biomass at its stable level around 420 000 tonnes. The high level of total biomass would be kept at about the present level over that period.

The options associated with reference points on the Y/R curve result in unrealistically low catch levels which have never been recorded in the fishery.

Note on the option table:

The options in the text table below refer to a catch level in 1984 of 110 000 tonnes. The weights given in the table (and in Figure 8) can be corrected by adding (if the catch is below 110 000 tonnes) or subtracting (if the catch is higher than 110 000 tonnes) the following percentages for each 10 000 tonnes deviation:

Catch:	3.6 %
Spawning stock biomass:	2.3 %
Total biomass (7+):	1.1 %

Management Options for 1985 and 1986

Species: Sebastes marinus

Area: ICES Sub-areas V and XIW

1984				Management	1985				1986			1987	
Stock biom. ling (7+)	Spawn- ling F (14-)	Catch ling (7+)		option for 1985 and 1986	Stock biom. ling (7+)	Spawn- ling F (14-)	Catch ling (7+)	Stock biom. ling (7+)	Spawn- ling F (14-)	Catch ling (7+)	Stock biom. ling (7+)	Spawn- ling F (14-)	
1125	423	0.30	110	F	1110	423	0.03	12	1200	510	14	1280	590
				0.1									
				F			0.05	20	1190	500	26	1260	570
				max									
				F=			0.20	104	1100	430	105	1090	430
				=F									
				1983									
				F=0.75			0.21	80	1130	450	84	1140	460
				xF									
				1983									
				*****			*****	*****	*****	*****	*****	*****	*****
				2)									
				F			0.05	20	1190	500	26	1260	570
				0.1									
				2)									
				F			0.10	40	1170	480	47	1220	530
				max									

Weights in thousand tonnes

- 1) expected catch estimated by the Working Group
 2) if last age group in Y/R calculation is NOT a + group

3.6 Assessment of Sebastes mentella (Tables 26 - 28, Figure 9)

The assessment of S. marinus was based on the estimated effort for this species in the Icelandic fishery. An attempt was made to apply the same approach to S. mentella (see Section 3.5.3). The intercept of the regression line (see Figure 9) was relatively large and accounted for about half the fishing mortality estimated from the line. Furthermore, the estimate of F for 1983 had to be made by extrapolation beyond the points used in calculating the regression.

Therefore, the Working Group was not able to assess the S. mentella stock with sufficient reliability. The VPA-tables and the corresponding regression are given in Tables 26 to 28 and in Figure 9 for illustration purposes.

3.7 Note on the Mentella Type Oceanic Stock in Sub-areas V - XIV

At its last meeting the Working Group urged that relevant data on this stock should be provided to make an assessment of this stock possible in the future.

The Working Group appreciated that USSR data on this stock were submitted to this years meeting. The documents include data from the fishery in 1982 and 1983 and will be presented at the ICES Statutory Meeting in 1984. Some Icelandic data were also available. The time series, however, is too short to allow an assessment of this stock to be made at present.

3.8 Historic Catch Levels (Figure 10)

The total annual catch of redfish S. marinus and S. mentella in Sub-area V and XIV is shown in Figure 10 for the years 1949-1983.

The great fluctuations over longer periods are associated with rather complex interaction in changes of effort and availability of redfish in the area. In the fifties the very high catches were maintained by discoveries of new fishing grounds in Icelandic and East Greenland waters. In the late fifties and early sixties a great part of the effort was removed from Sub-Areas V and XIV because of reduced availability of redfish in the Irminger Sea region as well as good fishing opportunities in other areas.

The increase in catch in the sixties was associated with the decline in (mainly) the Arctic cod fisheries, causing increased effort in the Irminger Sea region. There was a great decline in the catches in the late sixties until late seventies, in spite of increased efficiency of the fleet during that period. One reason was again the diversion of fishing effort, mainly of freezer trawlers of the Federal Republic of Germany, to the fishery on cod and also herring on Georges Bank and less availability of redfish in the Irminger Sea region.

The short-time increase in 1975-1976 was due to the USSR catch of small redfish at East Greenland. The extreme decline in the late seventies is inter alia associated with the extention of the fishing zone at Iceland. Since then there has been a great increase in effort by the Icelandic fleet at least (see Section 3.1).

Considering this complex situation without reliable information on total effort until in the later years, the Working Group feels that little can be said about the sustained yield on the basis of the historical catches.

4. GREENLAND HALIBUT IN SUB-AREAS I AND II

4.1 Status of the Fisheries (Tables 29 - 32)

The nominal catches by country for Sub-area I and Divisions IIa and IIb are given in Tables 29, 30 and 31. In Table 32 the catches are summarized for Sub-areas I and II. The total catch in 1982 was 16 733 tonnes, i.e. 39% above the TAC of 12 000 tonnes for that year. In 1983, the total catch was 22 342 tonnes according to the preliminary catch figures, i.e. 5 342 tonnes (31%) above the TAC of 17 000 tonnes.

4.2 Catch per Unit Effort and Effort Data (Table 33)

The cpue data available to this years meeting was the data from USSR sidetrawlers (1965 - 1983) and the USSR sterntrawlers (1980 - 1983). The previously used cpue-series from German Democratic Republic trawlers stops in 1980 due to a change in fishing strategy, and it has therefore not been included in this year's assessment.

A new series of cpue data from the Norwegian freshfish trawlers was made available to this meeting. The difference being that while the old series only utilized the data from the period September to November in three main fishing areas as described in CM 1981/G:7, the present series utilized all the data from the directed fishery for Greenland halibut by the freshfish trawlers, i.e. during the whole year and in all of the relevant areas within Sub-areas I and II.

The series given in previous reports was calculated by weighing the observations by effort. The series given in the present report is calculated by utilizing the statistical package GLIM (NAG). A linear model is used:

$$\log(\text{Catch})_{i,j,k} = \log(Y)_i + \log(M)_j + \log(A)_k + \log(\text{Effort})_{i,j,k}$$

Y is the catch per unit effort index for year i after it has been corrected for the changes in availability due to seasonal effects (Month j) and areas affects (Area k, which represents statistical areas as used in the Norwegian fishery). Y, M and A are treated as factors (qualitative covariates). The cpue index (Y) was standardized relative to the Norwegian statistical area 39 (south west of Bear Island) in October, which is an important fishing area during the main season in the autumn. It was assumed that $\log(\text{Catch})$ is normally distributed. By this analysis one may correct for possible redistribution of the fleet, either between areas or parts of the year, that may affect the total cpue series.

The USSR and the Norwegian cpue data (Table 33) follow each other closely, the latter on the average being 13% larger for the period 1973-1983. The cpue series used in the assessment was taken as the mean values of the two series (Table 33), and

from this series the total effort and the catch per hour trawling of 7 years and older was calculated (Table 33).

4.3 Mean Weights (Tables 34 and 35)

For the years 1970 - 1981 the group accepted the series used in last years assessment. The values for 1982 and 1983 were estimated from the biological sampling done by USSR, GDR and Norway. The different national series were weighted by the national catches they represent. The results are given in Table 34. With these mean weights the SOP differs by 1.7% and 4.8% from the nominal catches in 1982 and 1983 respectively (Table 35). This was considered to be satisfactory close.

4.4 VPA

4.4.1 Age Compositions (Table 36)

The age compositions for 1982 and 1983 (Table 36) were estimated utilizing the available catch at age data from the GDR fishery (1983), the Norwegian fishery (1982-1983) and the USSR fishery (1982-1983). The age compositions available accounted for 93% and 99% of the catches in 1982 and 1983 respectively.

The group noted, however, that due to the early date for this Working Group meeting, and the fact that the main fishery for Greenland halibut in the Barents Sea takes place in the autumn, it had not been possible to utilize all of the biological material collected in 1983. This also limits the amount of data that could be utilized in estimating the cpue for the commercial fleet in 1983.

4.4.2 Input Parameters and Results (Tables 37-38, Figures 11-14)

As in previous reports, a constant natural mortality of 0.15 was used, and the unweighted average fishing mortality on the 7 to 11 year olds was selected as the standard.

The relation used in assessing the input F_s on age groups 6 and older, were a regression of the $F(7-11)$ against total effort (Figure 11), and setting the exploitation pattern on these age groups close to the average for 1970-1979.

For the age groups 3 to 5 the input F_s were selected on the basis that the estimated number of 3 year olds in the stock in the last three years (1981 - 1983) become close to the average of the 3 year olds in the period 1970 - 1979 (32.8 millions).

On the basis of the Figures 11 to 13 this was found to be an acceptable procedure. The results of the VPA are given in Tables 37 and 38, and shown in Figure 14.

4.5 Yield per Recruit (Figure 15)

The new exploitation pattern and the mean weights used for 1983 only gave about 10% relative change in the estimates of the $F_{0.1}$ and F_{max} values. While the values of yield per recruit were somewhat higher at the reference points, the estimated average recruitment was somewhat lower than the one used in last year's assessment, the product being almost unchanged. The Group therefore saw no reason to change the reference values of $F_{0.1}$ and F_{max} , which has remained unchanged since 1982. The Y/R and the SSB/R curves are shown in Figure 15.

The yield and the spawning stock under equilibrium conditions, as given in last year's report, are given with some additions in the text table below. The recruitment being constant at the same level as in the 1970's. As for the values of $F_{0.1}$ and F_{max} these are to be considered as longterm reference values.

F(7-11)	Sustainable Yield (tonnes)	Spawning stock biomass (SSB)(tonnes)
	1)	
$F_{0.1} = 0.12$	23 800	112 000
	1)	
$F_{max} = 0.20$	25 400	75 000
	1)	
$F_{83} = 0.27$	25 100	51 000
	2)	
$F_{0.1} = 0.07$	24 700	200 000
	2)	
$F_{max} = 0.14$	26 700	110 000
	2)	
$F_{83} = 0.27$	25 300	51 000

- 1) The oldest age group (16) is not a plus group.
- 2) The oldest age group (16+) is a plus group.

4.6 Catch Projections (Table 39, Figure 16)

The Working Group has sufficient confidence in the assessment that it warrants to make projection for two years (however, see also comments in Section 8).

Catch projections for 1985 and 1986 were made using the parameters given in Table 39. For each management option in 1985 the prognosis was carried forward to 1987 with the catch option in 1986 being equal to the one in 1985.

The catch in 1985 and 1986 for seven alternative fishing mortalities, the resulting stock biomass (3 years and older), and the spawning stock biomass (9 years and older) in 1986 and 1987 are given in the text table below. The same parameters for 1985 and 1986, as a function of the fishing mortality in 1985, are shown in Figure 16.

Looking at both the cpue (Table 33) and the VPA results (Figure 14), the stock appears to have decreased from 1965 up to about 1978. Since that time, an increasing trend seems to have occurred. Except for one, all the options for 1985 and 1986 given in the text table above, implies that the total stock and the spawning stock will continue to increase up to 1987. However, if the fishing mortality in 1985 and 1986 will be at the 1983 level, the prognosis predicts a stable situation or a slight downward trend in the total stock and the spawning stock in the period 1985-87.

Management Options for 1985 and 1986

Species: Greenland halibut

Area: ICES Sub areas I-II

1984				Management	1985				1986			1987	
Stock biom. (3+)	Spawn- ling stock biom.	F (7-11)	Catch (3+)	option for 1985 and 1986	Stock biom. (3+)	Spawn- ling stock biom.	F (7-11)	Catch (3+)	Stock biom. (3+)	Spawn- ling stock biom.	Catch (3+)	Stock biom. (3+)	Spawn- ling stock biom.
147	54	.18	17 ^{*)}	F 0.1	156	56	.12	14	168	69	10	181	73
				TAC 85			.15	17	165	66	17	175	75
				=TAC 84									
				F 1985			.18	19	162	64	21	168	70
				=F 1984									
				F 11									
				F max			.20	22	159	62	23	163	66
				F 1985			.27	28	152	57	28	150	56
				=F 1983									

				F 21			.07	8	175	73	10	194	90
				F 0.1			.14	16	166	67	18	176	76
				F max									

Weights in thousand tonnes

*) expected catch estimated by the Working Group

1) The oldest age group (16) is not a plus group

2) The oldest age group (16+) is a plus group

5. GREENLAND HALIBUT IN SUB-AREAS V AND XIV

5.1 Status of Fisheries (Tables 40 - 43)

The total nominal catch figures by country for the Divisions Va and Vb, Sub-area XIV, and Sub-areas V and XIV combined, are presented in Tables 40 - 43 for the years 1974 to 1983. During this period, the total catch ranged from 6 045 tonnes (1976) to 36 283 tonnes (1974). Of the total catch of 30 560 tonnes in 1983 93% was taken by Icelandic vessels. The catches were almost exclusively taken by otter trawl with only a minor proportion of the Icelandic catch taken by longliners.

5.2 Effort and Catch per Unit Effort (Table 44)

Catch per unit effort data from Icelandic trawlers were available for the period 1978-1983 in the months January to August. These data were combined with the same statistical method that was used to analyse the data on catch and effort by Norwegian freshfish trawlers in the Barents Sea (Section 4.2). The only difference being that the factor accounting for area was not taken into account, as the basic data for the Icelandic trawlers were given for one area only.

After leaving the spawning area on the continental slopes off West Iceland in the last half of April and May, the Greenland halibut concentrates along a cold water front further north. This is the area where the trawlers have taken most of their Greenland halibut catches in recent years. However, the quality of the fish in these catches have been rather unsuitable for human consumption and therefore catches had to be partly processed by fishmeal plants. For this reason it was totally prohibited to fish in this area in April and May during the 1983 season. As a result of this the trawlers had to fish in other areas with lower concentrations of Greenland halibut.

Therefore, the catch and effort data for April and May 1983 were excluded from the analysis above. The resulting cpue series, which is standardized relative to May, are given in Table 44.

5.3 Weight at Age (Table 45)

The mean weights in 1983 were derived from the same data that were used to construct the Icelandic age/length key.

5.4 Proportion of mature fish at age (Table 46)

The proportion mature at age in the 1983 catch was estimated from the Icelandic biological sampling program.

5.5 VPA

5.5.1 Age Composition (Table 47)

The catch in number per age for 1982 was adjusted according to the final catch data. For the year 1983, length compositions and age/length keys were available from Division Va (for Iceland) and Sub-area XIV (for the Federal Republic of Germany). As the age/length relation in both sets of data was almost identical and the catch in Sub-area XIV was very small, the Icelandic data were used to calculate the age composition for the total catch from Sub-areas V and XIV (Table 47).

5.5.2 Input Parameters and Results (Tables 48-49, Figures 17-18)

As in previous years the natural mortality was assumed to be 0.15. The mean fishing mortality on the age groups 8-13 in 1983 was estimated from the line through point of the mean values of $F(8-13)$ and total effort in the years 1978 to 1982, and the origin (Figure 17). The exploitation pattern in 1983 was taken to be close to the average for 1978 - 82. The input F on the 4 year olds in 1983 was, however, slightly adjusted in order to generate a recruitment at age 4 close to the mean of the years 1975-1979.

The results of the VPA are given in the Tables 48 and 49, and Figure 18. The total stock biomass staid almost constant at about 260 000 tonnes in 1982 and 1983. The spawning stock biomass shows a slightly decreasing trend from 97 000 tonnes in 1980 to about 87 000 tonnes in 1983.

5.6 Yield per Recruit (Figure 19)

The yield and spawning stock per recruit curves as given in last year's report, are shown in Figure 19. This curve has a $F_{0.1}$ point of 0.14. There is no maximum on the yield per recruit curve within a reasonable range of fishing mortality.

5.7 Catch Projection (Table 50, Figure 20)

Catch projection for the years 1985 and 1986 were made, using the parameters given in Table 50. For the catch projection it was assumed that the total catches in 1984 will be 32 000 tonnes. Projected catches in 1985 and the corresponding total biomass and spawning stock biomass at the beginning of 1986 are plotted against the mean F in 1985 in Figure 20.

For a selection of alternative fishing mortalities in 1985 and 1986, the results are summarized in the text table below. In these options the F_s in 1986 remain unchanged from the ones in 1985.

Management Options for 1985 and 1986

Species: Greenland halibut

Area: ICES Sub-areas V and XIV

1984				Management	1985				1986			1987	
Stock biom. ling (4+)	Spawn- ling biom. ling (0-13)	F (0-13)	Catch (4+)	option for 1985 and 1986	Stock biom. ling (4+)	Spawn- ling biom. ling (0-13)	F (0-13)	Catch (4+)	Stock biom. ling (4+)	Spawn- ling biom. ling (4+)	Catch (4+)	Stock biom. ling (4+)	Spawn- ling biom. ling (4+)
265	91	0.28	32	F 0.1	266	92	0.21	25	275	98	26	281	103
				F 1985									
				=F 1984			0.28	32	267	93	32	267	92
				*)									
				F 0.1			0.14	17	263	104	19	297	115

Weights in thousand tonnes.

*) last age group (18) assumed to be a plus group

With a fishing mortality of 0.21 in 1985, which equals $F_{0.1}$ when the last age group is a plus group, the total stock and the spawning stock would be allowed to increase slightly from 1984 to 1987, and the catch would be at 25 000 tonnes.

However, the Working Group considered the present prognosis to be subject to more uncertainty compared to the other stocks assessed by the Working Group. Therefore, the prediction for 1986 should be treated with the appropriate caution.

6. THE "Mentella BOX"

6.1 The Distribution of Cod

The material available on the distribution of cod in and around the "Mentella box" was a paper by L.M. Shestova and E.G. Lukmanov (ICES C.M.1983/G:23) and the 1983 report of the Arctic Fisheries Working Group (ICES C.M. 1984/Assess:3). This limited material suggested that bycatch of cod in the directed fishery for redfish in the "Mentella box" might only marginally affect the cod stock.

6.2 Optimum Mesh Size

A document by K.G. Konstantinov, V.G. Kovalenko, L.S. Lugovaya, E.G. Lukmanov, K.N. Nikeshin and V.L. Tretyak (ICES C.M. 1983/B:13) was presented which deals with the problem of optimum mesh size in the redfish fishery. For these evaluations there are several critical parameters.

One very important parameter for the calculation of maximum yield per recruit at different size at first capture is the natural mortality. Values of it used ranges from 0.10, as used by this Working Group, to 0.25, as used by V.A. Chekhova, K.G. Konstantinov and I.S. Shafran 1977 (ICNAF Res.doc. 77/V1/3) for younger ages. In order to get a better idea how the natural mortality may change with age and length, detailed material on predation on redfish by other species should be made available.

Another parameter is the relation between the spawning stock and recruitment. Lower mesh sizes would decrease the recruitment to and hence the size of the spawning stock, and might affect future recruitment and the long term yield. In order to improve our understanding of this relationship we need better estimates of the spawning stock and the recruitment. This requires further studies on the maturation process as well as good age samples of the catch and improved young fish surveys.

The escapement from the trawl is a further problem. It is known that when fishing for redfish the trawl easily gets clogged and thereby drastically reduces its selectivity. This is particularly important when the catches are large. This means that in experiments for determining the selectivity of the trawls it may be crucial that the duration of the tows are similar to those in a commercial fishery.

It is also known from experiments that increased mesh size in the trawl may increase the filtering capacity of the trawl which may result in higher catches of larger specimens. This would to some extent reduce the calculated immediate losses due to an increase in the mesh size. Existing data should be analysed in terms of cpue to see if this phenomenon does occur.

The Group considers that the existing material should be fully analysed in order to address the problems above and thereby giving a better basis for an advice on optimum mesh size.

7. REDFISH AGE-READING WORKSHOP

The Group considered the findings of the Redfish Age-Reading Workshop (CM 1984/G:2) which critically reviewed the age validation procedures presently used. The technique of comparisons between different structures (otoliths and scales) from the same fish is shown to yield valid comparisons. The results of the present study indicate that no revision of techniques for ageing redfish presently used in the North-East Atlantic is required.

8. TIMING AND THE DURATION OF THE WORKING GROUP MEETING

For some stocks the main fishery takes part at the end of the year, and it may only be possible to use a limited part of the data that subsequently will become available, e.g. Greenland halibut in Sub-areas I and II (see Section 4.4 above). This implies that the expected quality of the prognosis is below what may otherwise have been the case. This has some bearing on the considerations of the possibilities for making sufficient reliable assessments for two years ahead (see ii) in terms of reference in Section 1.2).

The number of days allocated to the Working Group, i.e. 6 days including a Sunday, and the last being a Monday, implied that the typing of the first draft of the report had to be done by the members of the Working Group over the weekend. The Working Group thus had to work on a severe time schedule, and decided to give priority to the first three items on the terms of reference (Section 1.2).

Therefore, item iv) in the terms of reference was only briefly considered. In general it was felt that the effects on the evaluation of the prospects of the stocks concerned, from changes in mean weights and maturity data are relatively small. Although this may warrant a closer look on these problems at the next meeting of the Working Group, when it hopefully will have more working days allocated for its work.

Concerning the general request to the Working Groups for a review of the the present state of knowledge on growth rates and retention lengths for the different stocks (ICES C.M. 1983/Assess:22) and the examination of the log-residuals of the catch at age (ICES C.M. 1983/Assess:22 Addendum), the Working Group had, alas, to defer this to a later meeting.

Table 1. Nominal catch of REDFISH (in tonnes) by countries (Sub-area I, Divisions IIa and IIb combined). (As reported officially to ICES.)

Country	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983 ^{*)}
Belgium	30	28	2	1	-	-	-	-	-	-
Faroe Islands	6	67	137	8	1	-	-	206	-	-
France	1 116	-	-	660	3 608	1 142	1 297	537	841	-
German Dem.Rep.	28 275	28 020	22 636	17 614	16 165	16 162	8 448	4 614	4 463	3 394
Germany, Fed.Rep.	6 597	5 182	7 894	7 231	11 483	11 913	7 992	4 688	3 182	3 275
Netherlands	-	-	127	-	-	-	-	-	-	-
Norway	7 055	4 966	7 305	7 381	7 802	9 025	8 472	9 249	10 020 ²⁾	11 051 ²⁾
Poland	1 269	4 711	4 137	175	2 957	261	87	26	-	-
Portugal	-	331	3 463	1 480	378	1 100	271	-	-	...
Spain	-	1 194	3 398	-	-	1 375	1 965	930
U.K.	3 509	2 746	4 961	6 330	3 390	1 756	1 307	470	336	-
USSR	48 787	230 950	263 546	144 993	78 092	70 451	72 802	81 652	112 685	99 429
Total	96 644	278 195	317 606	185 873	124 172 ¹⁾	113 620 ¹⁾	102 765 ¹⁾	102 372	131 527	117 149

*) Provisional data

1) The total figure used by the Working Group for assessments (including catches by non-members)

2) National statistics

Table 2. Nominal catch of REDFISH (in tonnes) by countries in Sub-area I.
(As reported officially to ICES.)

Country	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983 ^{*)}
Belgium	30	-	2	1	-	-	-	-	-	-
Faroe Islands	6	-	-	-	-	-	-	-	-	-
France	26	-	-	149	27	7	1	16	-	-
German Dem.Rep.	358	201	90	-	-	-	-	-	-	-
Germany, Fed.Rep.	1 086	483	635	786	+	-	-	7	10	-
Netherlands	-	-	-	-	-	-	-	-	-	-
Norway	194	482	739	1 181	1 333	1 374	736	543	728 ¹⁾	793 ¹⁾
Poland	-	93	47	-	-	-	-	-	-	-
Portugal	-	331	478	55	8	-	170	-	-	...
Spain	-	820	301	-	-	-	-	-
U.K.	1 320	1 048	1 392	1 686	959	462	295	61	77	-
USSR	9 318	30 750	12 411	13 154	2 575	639	33	1 220	1 750	4 023
Total	12 338	34 208	16 095	17 012	4 902	2 482	1 235	1 847	2 565	4 821

*) Provisional data
1) National statistics.

Table 3. Nominal catch of REDFISH (in tonnes) by countries in Division IIa.
(As reported officially to ICES.)

Country	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983 ^{*)}
Faroe Islands	-	67	137	8	1	-	-	206	-	-
France	980	-	-	478	3 575	1 134	1 296	521	841	-
German Dem.Rep.	27 153	22 778	16 921	12 688	12 933	12 439	7 460	2 205	2 760	2 500
Germany, Fed.Rep.	4 167	4 623	6 722	4 764	11 482	11 913	7 992	4 681	3 172	3 275
Netherlands	-	-	127	-	-	-	-	-	-	-
Norway	6 837	4 444	6 515	6 050	6 369	7 637	7 734	8 704	9 119 ¹⁾	10 250 ¹⁾
Poland	869	920	217	47	2 477	261	78	26	-	-
Portugal	-	-	2 849	1 249	352	1 100	89	-	-	...
Spain	-	153	2 082	-	-	1 125	1 500	620
U.K.	1 991	1 621	2 919	4 064	2 067	1 195	967	409	259	-
USSR	14	39 138	20 307	94 639	31 783	29 519	46 762	56 130	63 000	82 832
Total	42 011	73 384	58 796	123 987	71 039	66 323	73 878	73 502	79 151	98 857

^{*)} Provisional data

¹⁾ National statistics.

Table 4. Nominal catch of REDFISH (in tonnes) by countries in Division IIb.
(As reported officially to ICES)

Country	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983 ^{x)}
Belgium	-	28	-	-	-	-	-	-	-	-
Faroe Isl.	-	-	-	-	+	-	-	-	-	-
France	110	-	-	33	6	1	-	-	-	-
German Dem. Rep.	764	5 041	5 625	4 926	3 232	3 723	988	2 409	1 703	894
Germany, Fed.Rep.	1 344	436	537	1 681	1	-	-	-	-	-
Norway	24	40	51	150	100	14	2	2	173 ²⁾	3 ²⁾
Poland	400	3 698	3 873	128	480	-	9	-	-	-
Portugal	-	-	136	176	18	-	12	-	-	...
Spain	-	221	1 015	-	-	250	465	310
U.K.	198	77	650	580	364	99	45	+	+	-
USSR	39 455	161 062	230 828	37 200	43 734	40 293	26 007	24 302	47 935	12 574
Non-Members					296 ¹⁾	435 ¹⁾	124 ¹⁾			
Total	42 295	170 603	242 715	44 874	48 231	44 815	27 652	27 023	49 811	13 471

x) Provisional data.

1) As reported to Norwegian authorities.

2) National statistics.

Table 5 Nominal catch of Sebastes marinus and Sebastes mentella in Sub-area I and Divisions IIa and IIb combined (in tonnes).

Year	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983 ^{x)}
<u>S. marinus</u>	27 272	39 125	48 584	39 508	31 695	26 475	23 411	20 826	16 341	18 128
<u>S. mentella</u>	69 372	239 070	269 022	146 365	92 477	87 145	79 354	81 546	115 186	99 021
Total	96 644	278 195	317 606	185 873	124 172	113 620	102 765	102 372	131 527	117 149

x) Provisional data

Table 6 Sebastes mentella in Divisions IIa and IIb. Catch per unit effort and calculated total international effort 1965-1983.

Year	USSR Catch/hour trawling (tn)		GERMAN DEM.REP. Catch/Day (tonnes) Freezer trawlers	TOTAL EFFORT (USSR Units)	
	RT ¹⁾	PST ²⁾		RT ¹⁾	PST ²⁾
1965	0.38			41 216	
1966	0.39			26 008	
1967	0.37			16 862	
1968	0.45			12 029	
1969	0.48			14 242	
1970	0.46			49 817	
1971	0.38			118 587	
1972	0.38			75 953	
1973	0.45			85 289	
1974	0.69			100 539	
1975	0.95			251 653	
1976	0.99			271 739	
1977	0.77			190 084	
1978	0.63			147 002	
1979	0.56			155 616	
1980	0.70	0.91		113 363	87 202
1981	0.63	0.95	8.71	129 438	85 338
1982	0.63	1.05	9.58	182 835	109 701
1983	0.80	1.09	17.12	123 776	90 845

1) Side trawlers

2) Stern trawlers

Table 7. Year class strength of REDFISH in Sub-area I and Divisions IIa and IIb.

Year class	Dragesund 1971	International 0-group survey . Abundance indices	USSR Young Fish Surveys ^{x)}
1961	poor		poor
1962	very poor		poor
1963	poor		strong
1964	strong		strong
1965	strong	159	strong
1966	strong	236	strong
1967	average	44	average
1968	average	21	average
1969	very strong	295	very strong
1970	strong	247	strong
1971	average	172	strong
1972	average	177	average
1973	strong	385	poor
1974		468	poor
1975		315	poor
1976		447	poor
1977		472	
1978		460	
1979		980	
1980		651	strong
1981		861	strong
1982		694	strong
1983		851	strong

x) On the basis of the abundance of age groups 0+ to 5 in the cpue data of the surveys (publ. in "Annales Biologiques").

Table 8. VIRTUAL POPULATION ANALYSIS
SEBASTES PARINUS IN FISHING AREAS I AND IIA

CATCH IN NUMBERS	UNIT: THOUSANDS										
	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
3	0	0	0	0	66	0	0	0	0	0	0
4	0	0	0	0	423	0	0	0	0	0	0
5	0	0	0	530	1530	20	0	0	0	0	0
6	0	0	0	2084	1831	13	0	0	0	0	0
7	0	0	0	3719	1621	30	12	11	7	0	0
8	0	0	0	12162	4179	320	73	87	125	0	0
9	0	0	0	10250	4920	641	107	180	225	0	0
10	0	0	0	9515	4501	930	149	352	434	3	0
11	0	0	0	3963	2559	615	145	517	779	36	0
12	590	387	693	5003	2559	2003	723	571	665	178	0
13	570	455	566	1080	2557	2768	914	768	1224	815	81
14	913	1049	1638	2670	4242	5453	3422	2368	952	813	234
15	1527	2079	2984	2991	5354	6404	5276	3677	1704	1958	547
16	3266	5479	7397	6775	6072	5880	5594	5502	2502	2360	1278
17	1441	2757	3565	2707	2372	2569	1720	1073	2465	2632	2058
18	2157	4164	5117	3936	3462	3669	2212	2341	608	1331	782
19	1892	3528	4402	3477	3115	2719	2237	1364	2399	1986	2109
20	342	638	775	614	964	1338	1314	1330	1457	1307	1044
21	1420	2359	2629	2475	2408	1716	959	1829	1592	2113	1697
22	849	1373	1721	1529	1170	582	959	1040	734	925	813
23	1123	1527	1615	1614	1464	491	946	1507	1007	713	605
24	1248	1103	1432	1672	1218	411	959	968	550	353	874
25	834	702	930	1106	923	241	673	519	407	129	617
26	729	530	817	918	772	175	630	283	47	48	870
27	568	369	701	622	666	155	541	341	41	16	311
28+	503	332	569	624	677	141	239	39	36	0	0
TOTAL	20027	28631	33269	37789	62266	39312	27542	24790	21770	16895	15165

Table 9. Sebastes mentella in Divisions IIa and IIb.
Mean weight at age.

Age	1965-78 \bar{w} (kg)	1979-80 \bar{w} (kg)	1981-82 \bar{w} (kg)	1983 \bar{w} (kg)
6	.168	.107	.102	.102
7	.183	.155	.138	.138
8	.225	.200	.188	.188
9	.311	.252	.252	.252
10	.367	.310	.310	.310
11	.432	.374	.364	.320
12	.508	.472	.440	.400
13	.611	.568	.560	.466
14	.679	.715	.680	.563
15	.753	.898	.828	.730
16	.821	.934	.906	.992
17	.872	1.024	.970	1.126
18	.910	1.050	1.050	1.149
19	.923	1.076	1.076	1.209
20	.985	1.129	1.129	1.217
21	1.056	1.150	1.150	1.360
22	1.124	1.175	1.175	1.390
23	1.193	1.200	1.200	1.400
24	1.215	1.220	1.220	1.450

Table 10. Sebastes mentella in Divisions IIa and IIb. The calculated catch (SOPs) using the age compositions (Table 11) and the mean weights (Table 9) compared with the nominal catch (Table 5).

Year	Nominal catch	Sum of products	Weight correction factor
1965	15 662	15 107	1.037
1966	10 143	9 221	1.100
1967	6 239	6 215	1.004
1968	5 413	5 775	0.937
1969	6 836	7 205	0.949
1970	22 916	24 491	0.936
1971	45 063	45 756	0.985
1972	28 862	28 455	1.014
1973	38 380	32 568	1.178
1974	69 372	70 156	0.989
1975	239 070	261 392	0.915
1976	269 022	273 195	0.985
1977	146 365	153 822	0.952
1978	92 611	91 421	1.013
1979	87 145	87 444	0.997
1980	81 525	79 354	1.027
1981	81 546	85 813	0.950
1982	115 186	114 929	1.002
1983	99 021	100 116	0.989

Table 11.

VIRTUAL POPULATION ANALYSIS

SEBASTES MENTELLA IN FISHING AREAS IIA AND IIB

CATCH IN NUMBERS

UNIT: THOUSANDS

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
6	606	5834	18891	0	2915	3633	1005	932	5	19
7	4647	19417	29615	2416	50158	29497	7412	5800	653	61
8	15451	42425	59295	17175	65162	45553	26296	8620	4767	1669
9	28781	82469	78247	53454	55591	46996	44751	26716	12553	4504
10	50144	108462	110712	52102	55669	37469	40441	44290	47268	15704
11	19343	119075	112524	49617	19907	26258	27169	39206	57057	29452
12	19603	57231	93144	53936	17242	20717	19750	33394	46450	46066
13	8634	29651	49550	55287	9270	16341	11172	21176	37667	45440
14	3634	20894	26134	19095	7410	6759	6400	11653	15480	26194
15	6514	16499	13661	12605	5455	5539	5607	6038	9476	16115
16	5908	13465	9839	5796	4134	3465	6607	2697	5770	7352
17	5532	13666	6500	4674	2154	2465	3441	2172	3662	4927
18	2673	12207	7233	5499	1545	1964	3007	1344	2156	1933
19	1666	6757	3466	5155	666	1779	1406	632	1621	475
20	2121	7112	3163	3947	1067	1906	796	602	1169	64
21	757	5113	1316	2955	423	1962	145	359	699	74
22	454	2242	1775	2531	507	560	145	117	343	0
23	151	735	1041	1602	507	324	27	6	256	0
24+	151	407	211	322	158	108	27	0	76	0
TOTAL	151475	563674	627076	595766	255202	259625	205552	207350	247001	204589

Table 12. VIRTUAL POPULATION ANALYSIS

SEBASTES PENICELLA IN FISHING AREAS IIA AND IID

	FISHING MORTALITY COEFFICIENT										NATURAL MORTALITY COEFFICIENT = 0.10	
	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984-88	
6	0.001	0.010	0.020	0.000	0.007	0.019	0.103	0.002	0.000	0.000046	0.009	
7	0.012	0.044	0.056	0.004	0.132	0.050	0.044	0.000	0.002	0.000215	0.023	
8	0.035	0.119	0.164	0.037	0.119	0.090	0.080	0.000	0.014	0.00553	0.023	
9	0.070	0.238	0.298	0.113	0.139	0.100	0.111	0.100	0.104	0.0143	0.154	
10	0.067	0.361	0.500	0.295	0.149	0.123	0.112	0.153	0.240	0.105	0.234	
11	0.107	0.503	0.639	0.396	0.157	0.150	0.111	0.130	0.242	0.213	0.302	
12	0.099	0.444	0.626	0.745	0.205	0.217	0.140	0.174	0.212	0.295	0.384	
13	0.132	0.383	0.701	0.715	0.227	0.270	0.156	0.203	0.269	0.295	0.381	
14	0.174	0.471	0.610	0.600	0.277	0.215	0.149	0.221	0.201	0.295	0.370	
15	0.165	0.510	0.581	0.608	0.336	0.205	0.231	0.184	0.246	0.295	0.387	
16	0.162	0.520	0.570	0.453	0.302	0.300	0.042	0.189	0.240	0.295	0.440	
17	0.127	0.596	0.444	0.557	0.260	0.339	0.033	0.383	0.338	0.295	0.423	
18	0.149	0.730	0.640	0.771	0.303	0.371	0.701	0.461	0.716	0.295	0.544	
19	0.102	0.537	0.477	0.570	0.170	0.570	0.433	0.323	1.069	0.295	0.410	
20	0.174	0.705	0.460	1.415	0.343	0.374	0.300	0.420	1.343	0.295	0.639	
21	0.125	0.703	0.343	0.910	0.400	1.753	0.120	0.391	0.700	0.295	0.633	
22	0.139	0.569	0.470	0.983	0.151	1.902	0.300	0.727	0.700	0.000	0.693	
23	0.200	0.400	0.500	0.500	0.250	0.200	0.400	0.000	0.400	0.000	0.361	
24+	0.200	0.400	0.500	0.500	0.250	0.200	0.400	0.000	0.400	0.000	0.361	
(8-1980)	0.117	0.457	0.549	0.495	0.250	0.252	0.304	0.210	0.376	0.230		

Table 13.

VIRTUAL POPULATION ANALYSIS

SEBASIES TENIELLA IN FISHING AREAS IIA AND IIB

STOCK SIZE IN NUMBERS UNIT: THOUSANDS

BIOMASS TOTALS UNIT: TONNES

ALL VALUES ARE GIVEN FOR 1 JANUARY

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
6	526461	644842	767255	887009	457893	202871	436615	436938	437583	434050	*****
7	442972	475785	577951	677187	627632	393460	180112	394234	394471	395937	392726
8	466903	396209	412052	494597	610445	533812	330537	155927	353865	350122	358182
9	444201	407784	318206	316442	431204	490456	441632	279525	132696	315658	320455
10	380196	374580	290708	213714	254549	339461	399137	357683	227545	106343	261528
11	205665	315373	236112	158216	143958	193446	271566	322737	277767	161039	85121
12	117876	167260	172607	107258	96157	111352	154557	219990	254768	197228	117760
13	73447	96535	97124	66214	46078	70622	61093	120930	167349	186453	132669
14	56330	53257	59291	41061	30257	32897	43400	62767	89319	115688	125610
15	44883	43224	32923	26926	19097	20349	24015	37716	45545	66124	77937
16	41397	34427	23469	16655	14249	12107	15005	16411	26394	32219	44547
17	29338	31347	16403	11943	9579	8974	7670	7145	12269	20217	21705
18	21120	23342	15865	10683	6193	6642	3753	3635	4406	7932	13620
19	17973	17010	9625	7532	4471	4139	4149	2587	2062	1949	5343
20	13919	14684	8595	5407	3650	3412	2116	2422	1570	345	1313
21	6766	10531	6564	5135	1108	2466	1269	1165	1432	504	232
22	3357	5495	4740	4215	1600	674	386	1029	712	0	205
23	674	2335	2757	2665	1427	1391	86	0	620	0	0
24+	674	1293	561	655	749	404	36	0	241	0	0
TOTAL (N)	2895477	3120665	3056759	2657720	2734796	2435952	2410466	2422696	2433074	2399607	
SFS (N)	407150	462261	379701	276196	235362	274331	317997	375640	432466	444621	
GTI. BIO. I	940655	1030249	931044	602122	785642	666604	690691	699040	725054	676737	
SFS BIO. I	261364	294109	254733	169700	130957	148425	170471	200471	245762	246700	

Table 14. Sebastes mentella in Divisions IIa and IIb.
Input variables for the ICES prediction program.

Age	1984 stock size	F-pattern	M	Maturity ogive	Weight in the catch	Weight in the stock
6	437000.00	0.0002	0.100	0.0000	0.1020	0.1020
7	392726.00	0.0009	0.100	0.0000	0.1380	0.1380
8	358182.00	0.0239	0.100	0.0300	0.1880	0.1880
9	320455.00	0.0626	0.100	0.0600	0.2520	0.2520
10	281528.00	0.7043	0.100	0.8000	0.3100	0.3100
11	83121.00	0.9261	0.100	0.2200	0.3200	0.3200
12	117760.00	1.2830	0.100	0.3600	0.4000	0.4000
13	132869.00	1.2830	0.100	0.5500	0.4660	0.4660
14	125610.00	1.2830	0.100	0.7200	0.5630	0.5630
15	77937.00	1.2830	0.100	0.8500	0.7300	0.7300
16	44547.00	1.2830	0.100	0.8800	0.9920	0.9920
17	21705.00	1.2830	0.100	0.9500	1.1260	1.1260
18	13620.00	1.2830	0.100	0.9700	1.1490	1.1490
19	5343.00	1.2830	0.100	1.0000	1.2090	1.2090
20	1313.00	1.2830	0.100	1.0000	1.2170	1.2170
21	232.00	1.2830	0.100	1.0000	1.3600	1.3600
22	205.00	1.2830	0.100	1.0000	1.3900	1.3900
23	1.00	1.2830	0.100	1.0000	1.4000	1.4000
24+	1.00	1.2830	0.100	1.0000	1.4500	1.4500

Recruitment at age 6 = 437 million fish for 1984-87.

Table 15 Nominal catch of REDFTSH (in tonnes) by countries in
Division Va (Iceland). (As reported officially to ICES).

Country	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983*
Belgium	2 114	1 945	1 522	1 395	1 549	1 385	1 381	924	283	389
Faroe Islands	254	82	211	292	242	629	1 055	1 212	1 046	1 552
German Dem.Rep.	11	-	-	-	-	-	-	-	-	-
Germany Fed.Rep.	36 398	33 602	32 948	31 632	-	-	-	-	-	-
Iceland	27 799	32 659	34 028	28 119	33 318	62 253	69 780	93 349	115 051	122 668
Norway	15	22	31	87	93	43	33	32	11*	38
Poland	18	-	-	-	-	-	-	-	-	-
U.K.	2 519	2 424	1 124	+	-	-	-	-	-	-
USSR	-	-	-	-	-	-	-	-	-	-
Total	69 129	70 734	69 864	61 525	35 202	64 310	72 249	95 517	116 391	124 647

*) Provisional data

Table 16 Nominal catches of REDFISH (in tonnes) by countries in Division Vb (Faroe Islands). (As reported officially to ICES).

Country	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983 ^{*)}
Faroe Islands	28	9	33	54	1 525	5 693	5 509	3 232	3 999	4 642
France	300	800	-	1 368	448	862	627	59	204	200 ²⁾
German Dem.Rep.	1	1	-	-	-	-	-	-	-	-
Germany Fed.Rep.	7 328	7 628	5 255	5 854	7 767	6 108	3 891	3 841	5 230 ¹⁾	4 389
Iceland	-	-	-	-	-	-	-	-	1	-
Netherlands	-	105	-	-	+	-	-	-	-	-
Norway	10	7	17	10	9	11	12	13	7	-
U.K.	98	41	59	116	57	+	-	-	-	-
Total	7 765	8 591	5 364	7 402	9 806	12 674	10 039	7 145	9 441	9 231

*) Provisional data

1) Including 570 tonnes from Sub-area VI

2) Estimated

Table 17 Nominal catch of REDFISH (in tonnes) by countries in Sub-area XIV (East Greenland). (As reported officially to ICES).

Country	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983*
Canada	-	-	420	-	-	-	-	-	-	-
Greenland	-	-	129	1	3	-	-	1	+	+
Faroe Isl.	43	1	3	19	-	-	-	18	-	-
France	-	-	-	-	-	490	-	-	-	-
German Dem. Rep.	1 275	4 490	-	-	-	-	-	-	-	155 ²⁾
Germany Fed. Rep.	2 632	4 979	4 403	13 347	20 711 ¹⁾	20 428 ¹⁾	32 520 ¹⁾	42 980 ¹⁾	42 815 ¹⁾	30 815 ¹⁾
Iceland	9 777	5 632	7 410	81	151	-	89	-	17 ²⁾	-
Norway	-	63	5	112	2	-	-	-	-	-
Poland	6	276	-	-	-	-	-	-	581 ²⁾	-
U.K.	127	56	286	622	13	-	-	-	1 ²⁾	1 ²⁾
USSR	118	9 830	101 000	251	-	-	-	-	59 914	60 032
Total	13 978	25 329	113 656	14 433	20 880	20 918	32 609	42 999	103 323	91 002
Total used in the Assessments									42 815	30 815

*) Provisional data

1) Catches updated for Sub-area XII included

2) Catches from the Oceanic Stock not included in the assessments

Table 18 Nominal catch (in tonnes) of REDFISH in Sub-area XIV, Divisions Va and Vb, by species for Sub-area XIV and Sub-area V combined. (As reported officially to ICES).

Year	Division Va	Division Vb	Sub-area XIV	Total	<u>S. marinus</u>	<u>S. mentella</u>
1974	69 129	7 765	13 978	90 872	49 845	41 027
1975	70 734	8 591	25 329	104 654	60 980	43 674
1976	69 864	5 364	113 656	188 884	93 605	95 279
1977	61 525	7 402	14 433	83 360	52 752	30 608
1978	35 202	9 806	20 880 ¹⁾	65 888	47 791	18 097
1979	64 310	12 674	20 918 ¹⁾	97 902	75 056	22 846
1980	72 249	10 039	32 609 ¹⁾	114 897	88 085	26 812
1981	95 517	7 145	42 999 ¹⁾	145 661	101 285	44 376
1982	116 391	9 441 ²⁾	103 323 ¹⁾³⁾	229 155 ³⁾	123 165	105 990 ³⁾
1983 ^{*)}	124 647	9 231	91 002 ¹⁾⁴⁾	224 880 ⁴⁾	106 317	118 563 ⁴⁾

1) Catches updated for Sub-area XII included

2) Catches updated for Sub-area VI included

3) Including 60 508 tonnes from the Oceanic Stock not included in the assessments

4) Including 60 187 tonnes from the Oceanic Stock not included in the assessments

*) Provisional data

Table 19 Nominal catch of REDFISH (1 000 tonnes) in Division Va by countries.
Separation into the species components according to the method used
by the Redfish Working Group.

Div. Va Year		Belgium	Faroe Islands	German Dem. Rep.	Germany Fed. Rep.	Iceland	Norway	Poland	United Kingdom	USSR	TOTAL
1974	Total	2.1	0.3	+	36.4	27.8	+	+	2.5	-	69.1
	S. mar.	2.1	0.3		4.3	27.0			2.5		36.2
	S. ment.	-	-		32.1	0.8			-		32.9
1975	Total	1.9	0.1	-	33.6	32.7	+	-	2.4	-	70.7
	S. mar.	1.9	0.1		4.3	31.3			2.4		40.0
	S. ment.	-	-		29.3	1.4			-		30.7
1976	Total	1.5	0.2	-	32.9	34.0	+	-	1.1	-	69.7
	S. mar.	1.5	0.2		4.3	33.3			1.1		40.4
	S. ment.	-	-		28.6	0.7			-		29.3
1977	Total	1.4	0.3	-	31.6	28.1	0.1	-	-	-	61.5
	S. mar.	1.4	0.3		9.2	27.5	0.1				38.5
	S. ment.	-	-		22.4	0.6	-				23.0
1978	Total	1.5	0.2	-	-	33.3	0.1	-	-	-	35.1
	S. mar.	1.5	0.2			29.4	0.1				31.2
	S. ment.	-	-			3.9	-				3.9
1979	Total	1.4	0.6	-	-	62.3	0.1	-	-	-	64.4
	S. mar.	1.4	0.6			54.6	0.1				56.7
	S. ment.	-	-			7.7	-				7.7
1980	Total	1.4	1.1	-	-	69.8	+	-	-	-	72.3
	S. mar.	1.4	1.1			59.6					62.1
	S. ment.	-	-			10.2					10.2
1981	Total	0.9	1.2	-	-	93.4	+	-	-	-	95.5
	S. mar.	0.9	1.2			73.7					75.8
	S. ment.	-	-			19.7					19.7
1982	Total	0.3	1.0	-	-	115.1	+	-	-	-	116.4
	S. mar.	0.3	1.0			96.6	+				97.9
	S. ment.	-	-			18.5					18.5
1983	Total*	0.4	1.6	-	-	122.7	+	-	-	-	124.7
	S. mar.	0.4	1.6			85.6	+				87.6
	S. ment.	-	-			37.1					37.1

*Provisional data

Table 20 Nominal catch (1 000 tonnes) of REDFISH in Division Vb by countries.
Separation into the species components according to the method used by the Redfish Working Group.

Div. Vb Year	Faroe Islands	France	German Dem. Rep.	Germany, Fed. Rep.	Netherlands	Norway	United Kingdom	TOTAL
Total	+	0.3	+	7.3	-	-	0.1	7.7
1974 <u>S. mar.</u>		0.3		-			0.1	0.4
<u>S. ment.</u>		-		7.3			-	7.3
Total	+	0.8	+	7.6	0.1	+	+	8.5
1975 <u>S. mar.</u>		0.8		-	0.1			0.9
<u>S. ment.</u>		-		7.6	-			7.6
Total	+	-	-	5.3	-	+	0.1	5.4
1976 <u>S. mar.</u>				-			0.1	0.1
<u>S. ment.</u>				5.3			-	5.3
Total	0.1	1.4	-	5.9	-	+	0.1	7.5
1977 <u>S. mar.</u>	0.1	0.6		-			0.1	0.8
<u>S. ment.</u>	-	0.8		5.9			-	6.7
Total	1.5	0.4	-	7.8	-	+	0.1	9.8
1978 <u>S. mar.</u>	1.5	0.4		-			0.1	2.0
<u>S. ment.</u>	-	-		7.8			-	6.7
Total	5.7	0.9	-	6.1	-	+	-	12.7
1979 <u>S. mar.</u>	4.8	-		-				4.8
<u>S. ment.</u>	0.9	0.9		6.1				7.9
Total	5.5	0.6	-	3.9	-	+	-	10.0
1980 <u>S. mar.</u>	4.9	-		-		+		4.9
<u>S. ment.</u>	0.6	0.6		3.9		-		5.1
Total	3.2	+	-	3.9	-	+	-	7.1
1981 <u>S. mar.</u>	2.5	-		-		+		2.5
<u>S. ment.</u>	0.7	+		3.9		-		4.6
Total	4.0	0.2	-	5.2	-	+	-	9.4
1982 <u>S. mar.</u>	1.7	0.1		-		+		1.8
<u>S. ment.</u>	2.3	+		5.2		-		7.5
Total*	4.7	0.2	-	4.4	-	-	-	9.2
1983 <u>S. mar.</u>	3.1	0.1	-	-	-	-	-	3.2
<u>S. ment.</u>	1.6	+	-	4.4	-	-	-	6.0

*Provisional data

Table 21 Nominal catch (1 000 tonnes) of REDFISH in Sub-area XIV by countries.
Separation into the species components according to the method used
by the Redfish Working Group.

Sub-area XIV	Canada	Denmark (G)	Faroe Islands	German Dem. Rep.	Germany, Fed. Rep.	Iceland	Norway	Poland	United Kingdom	USSR	TOTAL
Year											
1974											
Total	-	-	+	1.3	2.6	9.8	-	+	0.1	0.1	13.9
<u>S. mar.</u>				1.3	2.6	9.8			0.1	0.1	13.9
<u>S. ment.</u>				-	-	-			-	-	-
1975											
Total	-	-	+	4.5	5.0	5.6	0.1	0.3	0.1	9.8	25.4
<u>S. mar.</u>				4.5	5.0	5.6	0.1	0.3	0.1	5.4	21.0
<u>S. ment.</u>				-	-	-	-	-	-	4.4	4.4
1976											
Total	0.4	0.1	+	-	4.4	7.4	+	-	0.3	101.0	113.6
<u>S. mar.</u>	0.4	0.1			4.4	7.4			0.3	41.3	53.9
<u>S. ment.</u>	-	-			-	-			-	59.7	59.7
1977											
Total	-	+	+	-	13.3	0.1	0.1	-	0.6	0.3	14.4
<u>S. mar.</u>					13.3	0.1	0.1		0.6	0.3	14.4
<u>S. ment.</u>					-	-	-		-	-	-
1978											
Total	-	+	-	-	20.7	0.2	+	-	+	-	20.9
<u>S. mar.</u>					15.3	0.2					15.5
<u>S. ment.</u>					5.4	-					5.4
1979											
Total	-	-	+	-	21.1	-	-	-	-	-	21.1
<u>S. mar.</u>					15.8						15.8
<u>S. ment.</u>					5.3						5.3
1980											
Total	-	-	-	-	32.5	0.1	-	-	-	-	32.6
<u>S. mar.</u>					22.1	0.1					22.2
<u>S. ment.</u>					10.4	-					10.4
1981											
Total	-	-	+	-	43.0	-	-	-	-	-	43.0
<u>S. mar.</u>					23.6						23.6
<u>S. ment.</u>					19.4						19.4
1982											
Total	-	-	-		42.8	+	-	0.6 ¹⁾	-	59.9 ¹⁾	103.3 ¹⁾
<u>S. mar.</u>					23.5			-		-	23.5
<u>S. ment.</u>					19.3			0.6		59.9 ¹⁾	79.8 ¹⁾
1983 [#]											
Total	-	-	-	0.1 ¹⁾	30.8	-	-	-	-	60.0 ¹⁾	90.9 ¹⁾
<u>S. mar.</u>				-	15.6					-	15.7
<u>S. ment.</u>				0.1	15.2					60.0 ¹⁾	75.2 ¹⁾

¹⁾ Catches from the oceanic stock not included in the assessments.

[#] Provisional data.

Table 22. VIRTUAL POPULATION ANALYSIS
 SEBASITES MARINUS IN FISHING AREAS V AND XIV
 CATCH IN NUMBERS UNIT: THOUSANDS

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1985
7	0	0	0	0	0	0	7	13	N	1	16
8	0	0	0	0	0	0	0	30	101	13	223
9	21	48	273	2023	50	89	04	297	1250	57	407
10	28	68	574	2715	71	170	311	637	1508	510	1200
11	402	533	678	6829	556	1039	1049	1723	2204	2136	2449
12	2624	3292	3009	19819	5539	5757	2607	7306	9562	6299	7038
13	4017	4987	3320	19604	5328	5667	2839	9238	8422	9968	11251
14	5652	7437	4262	15770	7320	8023	6192	14052	10513	14054	11603
15	4106	5261	3620	8689	5327	6451	6260	18617	15916	17380	14267
16	4873	6152	5556	9193	5698	5702	10174	13521	10299	14531	13033
17	2074	2518	2704	3780	2392	2188	9134	4620	11042	11159	11782
18	4267	5159	6545	6440	5108	3175	10300	9566	9019	15254	15250
19	2333	3322	4744	5396	3512	2959	5635	5563	7307	10336	12076
20	934	1026	1570	1644	1213	3186	4777	2123	5145	13947	9533
21	2786	3096	4799	5352	3733	3401	3672	5516	9010	9751	5709
22	1798	1956	2973	3339	2434	1511	3210	2297	4113	5090	3235
23	3724	3724	4348	3323	1746	3912	3912	1943	2625	4796	4016
24	2536	2549	3763	3617	2637	1474	2366	2393	3762	2751	2143
25	1239	1229	1740	1751	1170	827	2212	1433	1929	992	1394
26	763	345	1160	1283	793	611	2125	750	1079	449	341
27	360	407	558	587	364	376	1272	461	518	209	287
28	255	306	425	429	271	136	747	249	136	17	28
29	84	113	197	173	112	99	452	33	41	1	1
30+	11	12	111	75	69	37	203	68	7	78	61
TOTAL	44102	52860	56304	125310	50660	54844	41596	102668	116196	142279	127913

Table 23.

VIRTUAL POPULATION ANALYSIS

SEBASTES MARINUS IN FISHING AREAS V AND XIV

FISHING MORTALITY COEFFICIENT

CWI: Year-1

NATURAL MORTALITY COEFFICIENT = 0.10

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
7	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000048
8	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.00074
9	0.000	0.000	0.001	0.007	0.000	0.000	0.001	0.001	0.004	0.000	0.0015
10	0.000	0.000	0.001	0.011	0.000	0.001	0.001	0.003	0.006	0.002	0.0049
11	0.002	0.003	0.004	0.025	0.003	0.004	0.004	0.007	0.008	0.010	0.010
12	0.021	0.020	0.017	0.097	0.016	0.031	0.012	0.030	0.042	0.033	0.036
13	0.038	0.046	0.023	0.132	0.031	0.029	0.017	0.049	0.040	0.051	0.051
14	0.067	0.082	0.046	0.132	0.064	0.054	0.036	0.095	0.064	0.078	0.070
15	0.060	0.074	0.047	0.114	0.054	0.063	0.049	0.129	0.034	0.136	0.095
16	0.096	0.108	0.093	0.145	0.092	0.066	0.119	0.126	0.088	0.156	0.125
17	0.050	0.059	0.057	0.076	0.046	0.041	0.133	0.066	0.130	0.117	0.164
18	0.134	0.151	0.192	0.226	0.126	0.071	0.242	0.181	0.158	0.237	0.211
19	0.107	0.131	0.162	0.223	0.124	0.090	0.157	0.173	0.197	0.245	0.267
20	0.039	0.045	0.076	0.090	0.062	0.142	0.134	0.073	0.222	0.558	0.333
21	0.147	0.157	0.273	0.369	0.236	0.220	0.357	0.298	0.440	0.733	0.413
22	0.129	0.131	0.199	0.282	0.250	0.126	0.297	0.214	0.337	0.424	0.506
23	0.220	0.242	0.350	0.439	0.434	0.249	0.485	0.262	0.390	0.722	0.615
24	0.390	0.349	0.595	0.640	0.595	0.310	0.530	0.549	1.017	0.718	0.740
25	0.298	0.295	0.378	0.541	0.363	0.239	0.915	0.671	1.045	0.724	0.885
26	0.240	0.304	0.443	0.469	0.450	0.292	1.423	0.824	1.567	0.646	1.020
27	0.145	0.170	0.300	0.374	0.208	0.353	1.479	1.407	3.253	1.667	1.020
28	0.214	0.158	0.240	0.352	0.264	0.116	2.414	1.323	4.462	2.374	1.020
29	0.130	0.130	0.130	0.130	0.130	0.130	0.500	0.700	0.700	1.235	1.020
30+	0.130	0.130	0.130	0.130	0.130	0.130	0.500	0.700	0.700	1.235	1.020
(14-23)U	0.105	0.118	0.151	0.210	0.149	0.112	0.206	0.162	0.216	0.341	0.280

Table 24. VIRTUAL POPULATION ANALYSIS

SEBASTES LARINUS IN FISHING AREAS V AND XIV

STOCK SIZE IN NUMBERS UNIT: THOUSANDS

BIOMASS TOTALS UNIT: TONNES

ALL VALUES ARE GIVEN FOR 1 JANUARY

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
7	347423	376484	423321	401665	452310	553152	365155	348493	348534	350103	350280	316937
8	361614	314362	347657	387561	363622	409267	317545	351210	315317	315359	316785	316937
9	304261	327202	264446	308239	350680	329019	370320	289129	317700	285158	265336	286427
10	228749	275286	296019	257115	276983	317261	297624	335019	261352	286351	257967	257796
11	188948	206954	249025	267493	230069	250557	268906	269006	302342	234972	256616	232276
12	131337	170585	166753	224492	236116	207646	225725	253697	241768	271399	210581	231677
13	113978	116344	151222	166120	164299	210262	182225	201766	227053	209672	237683	183804
14	91949	99314	100533	133675	131697	161630	134364	162183	173785	197440	180246	204371
15	75948	77828	52796	66696	105970	111726	136623	161404	133399	147446	165297	152067
16	56049	63009	65422	71476	70182	90823	94965	119482	128362	105588	116433	136012
17	44747	46085	51766	53937	55944	57960	70762	76263	93269	106361	81741	92974
18	35795	38518	39307	43729	45212	48366	50310	60781	64616	75715	85639	62775
19	29911	28317	29953	29553	31558	36055	401731	35749	45696	49902	54034	62749
20	25678	24326	22467	22599	21248	25219	29815	31504	27065	34118	35345	37436
21	21347	22347	21034	13637	16096	18075	19725	22443	26468	19606	17071	22924
22	15548	16670	17280	14479	11782	13355	13126	12532	15075	15432	6525	10579
23	12465	12361	13226	12613	9667	8304	10649	3626	9160	9741	9140	4651
24	8223	9067	8777	8436	7475	5758	5357	5931	6142	5616	4281	4471
25	5038	5037	5768	4381	4023	4082	5346	3100	3100	2071	2476	1648
26	3848	3383	3392	3588	2307	2531	2909	1394	1415	986	882	925
27	2805	2739	2260	1970	2051	1332	1711	634	655	267	468	288
28	1390	2196	2092	1515	1226	1492	646	353	141	19	46	153
29	723	1016	1696	1490	964	852	1292	65	65	1	2	15
30+	95	103	947	629	594	319	699	141	15	114	132	44
TOTAL NO	2105890	2239531	2404560	2522692	2614672	2665026	2747231	2755976	2744671	2723573	2679613	
SPS NO	311845	327129	343072	359394	364048	399930	449022	475325	505762	523386	517364	
TOT. BIOM	851621	912171	978235	1031566	1049702	1110104	1183380	1289050	1234671	1153748	1134505	
SPS BIOM	316831	332607	347661	351280	345521	371973	416466	429206	459504	424141	416247	

Table 25. Sebastes marinus in Sub-areas V and XIV.
Parameters used in catch prediction.

LIST OF INPUT VARIABLES BY AGE GROUP:

AGE	STOCK SIZE	F-PATTERN	N	MATURITY OGIVE	WEIGHT IN THE CATCH	WEIGHT IN THE STOCK
7	350000.00	0.0002	0.100	0.0000	0.1130	0.1130
8	316937.00	0.0026	0.100	0.0000	0.1400	0.1400
9	286427.00	0.0054	0.100	0.0000	0.2460	0.2460
10	257796.00	0.0175	0.100	0.0000	0.3160	0.3160
11	232278.00	0.0364	0.100	0.0000	0.3870	0.3870
12	231677.00	0.1275	0.100	0.0000	0.4240	0.4240
13	183804.00	0.1821	0.100	0.1500	0.5330	0.5330
14	204371.00	0.2513	0.100	0.2600	0.6010	0.6010
15	152007.00	0.3367	0.100	0.4400	0.6540	0.6540
16	136012.00	0.4479	0.100	0.6900	0.7140	0.7140
17	92974.00	0.5803	0.100	0.8400	0.7600	0.7600
18	62775.00	0.7538	0.100	0.9000	0.8570	0.8570
19	62749.00	0.9541	0.100	0.9300	0.9330	0.9330
20	37436.00	1.1903	0.100	0.9700	1.0250	1.0250
21	22924.00	1.4749	0.100	1.0000	1.1470	1.1470
22	10579.00	1.8063	0.100	1.0000	1.2960	1.2960
23	4651.00	2.1959	0.100	1.0000	1.4730	1.4730
24	4471.00	2.6438	0.100	1.0000	1.6470	1.6470
25	1848.00	3.1010	0.100	1.0000	1.9030	1.9030
26	925.00	3.6417	0.100	1.0000	2.3130	2.3130
27	238.00	3.6417	0.100	1.0000	2.8100	2.8100
28	153.00	3.6417	0.100	1.0000	3.6290	3.6290
29	15.00	3.6417	0.100	1.0000	4.0000	4.0000
30+	44.00	3.6417	0.100	1.0000	5.6310	5.6310

Recruitment at age 7 = 350 million fish for 1984-87.

Table 26.

SEBASTES MENTELLA IN FISHING AREAS V AND XIV
CATEGORY: TOTAL

CATCH IN NUMBERS	UNIT: THOUSANDS											
-----	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
7	0	0	0	0	0	0	0	0	0	0	0	105
3	0	0	0	0	0	0	0	216	22	1548	0	795
9	0	0	0	0	3202	2	321	186	74	3202	64	539
10	0	1	0	0	2948	2	656	485	594	5226	181	1197
11	0	2	0	1	6533	3	906	647	1359	5651	582	1223
12	15	122	71	87	22608	142	1521	1517	7256	10626	3718	5217
13	46	269	196	262	21121	362	664	1373	5969	5031	5132	7216
14	320	549	802	1331	14107	1436	816	2622	3311	3045	3579	5516
15	414	408	677	1161	5547	1334	1206	2726	3665	6513	4796	9353
16	1567	1068	1591	2384	4431	3471	1577	1980	2422	4612	5833	5181
17	1685	1107	1445	1797	2619	2697	682	1035	1344	1673	5131	2628
18	2743	1874	2242	2285	2841	3722	1581	1565	1405	2856	3652	5427
19	3500	2586	2790	2202	2229	3454	1371	2022	1256	2445	4425	3278
20	993	779	795	605	541	802	1029	915	1232	1539	4671	4637
21	6865	5741	5467	4474	3625	4664	1666	3135	3378	3003	6140	6193
22	2463	2379	2029	1785	1192	1314	1264	1937	2070	2215	3447	3920
23	6162	9044	7398	6357	4050	3956	2070	1741	2024	2162	4321	4175
24	4703	5862	4602	4093	2473	2172	1388	1449	1419	2151	2415	2546
25	2265	3063	2306	2147	1252	1069	623	642	590	1238	975	2095
25	1844	2551	1935	1862	1061	928	506	297	225	472	97	1255
27	824	1156	900	913	544	480	104	54	121	110	132	289
28+	492	565	439	581	331	377	0	0	0	272	0	45
TOTAL	36961	39126	35735	34327	103165	32771	20435	26742	40116	65990	54691	73030

Table 27c

VIRTUAL POPULATION ANALYSIS

SEBASTES MENTELLA IN FISHING AREAS V AND XIV

FISHING MORTALITY COEFFICIENT

UNIT: Year⁻¹

NATURAL MORTALITY COEFFICIENT = 0.10

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
7	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00037
8	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.010	0.000	0.00308
9	0.000	0.000	0.000	0.000	0.022	0.000	0.002	0.000	0.000	0.031	0.000	0.000
10	0.000	0.000	0.000	0.000	0.036	0.000	0.003	0.003	0.001	0.020	0.002	0.010
11	0.000	0.000	0.000	0.000	0.051	0.000	0.008	0.003	0.009	0.022	0.002	0.015
12	0.000	0.002	0.001	0.001	0.326	0.002	0.023	0.015	0.036	0.035	0.013	0.025
13	0.001	0.004	0.003	0.003	0.200	0.007	0.008	0.024	0.007	0.029	0.029	0.035
14	0.006	0.011	0.015	0.021	0.181	0.023	0.017	0.035	0.016	0.040	0.023	0.060
15	0.011	0.009	0.015	0.024	0.195	0.021	0.022	0.067	0.057	0.162	0.073	0.070
16	0.052	0.033	0.040	0.060	0.106	0.078	0.028	0.041	0.170	0.088	0.191	0.095
17	0.068	0.042	0.051	0.052	0.078	0.085	0.024	0.021	0.052	0.064	0.066	0.120
18	0.110	0.090	0.102	0.097	0.093	0.137	0.055	0.048	0.032	0.080	0.154	0.145
19	0.145	0.129	0.168	0.124	0.116	0.150	0.062	0.083	0.045	0.065	0.153	0.180
20	0.041	0.039	0.048	0.045	0.037	0.050	0.058	0.048	0.061	0.064	0.153	0.213
21	0.265	0.307	0.370	0.363	0.362	0.462	0.127	0.210	0.225	0.182	0.341	0.276
22	0.105	0.134	0.152	0.176	0.138	0.192	0.134	0.189	0.137	0.201	0.291	0.338
23	0.453	0.587	0.671	0.630	0.650	0.777	0.459	0.367	0.275	0.271	0.649	0.601
24	0.403	0.605	0.597	0.876	0.778	0.800	0.609	0.598	0.509	0.463	0.484	0.902
25	0.316	0.441	0.449	0.546	0.629	0.891	0.722	0.624	0.460	1.016	0.350	0.902
26	0.389	0.612	0.490	0.702	0.506	1.293	1.328	0.549	0.476	0.725	0.167	0.902
27	0.400	0.400	0.400	0.400	0.400	0.400	0.400	0.400	0.400	0.400	0.400	0.902
28+	0.400	0.400	0.400	0.400	0.400	0.400	0.400	0.400	0.400	0.400	0.400	0.902
(14-23)U	0.127	0.138	0.165	0.179	0.188	0.197	0.194	0.111	0.106	0.127	0.210	0.210

Table 28.

VIRTUAL POPULATION ANALYSIS

SEBASTES MENEILLA IN FISHING AREAS V AND XIV

STOCK SIZE IN NUMBERS UNIT: THOUSANDS

BIOMASS TOTALS UNIT: TONNES

ALL VALUES ARE GIVEN FOR 1 JANUARY

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
7	174056	119137	184917	355074	227959	416653	374876	133152	172503	230941	296284	275898
8	126945	157492	107800	167520	321284	206266	377005	339021	120451	156091	208964	269899
9	141462	114865	142505	97541	151397	290710	136657	341127	306554	108995	139765	189078
10	135667	128000	103934	128944	88259	133946	265045	166571	308457	277511	95579	126604
11	89302	121128	115819	94043	116673	77051	121196	237388	152068	278756	245953	86311
12	71792	80805	109599	104797	65093	99361	69722	103881	214162	136505	246857	221994
13	59389	64946	72998	99102	94741	55557	89771	61641	97005	186993	113237	220401
14	52856	53693	53510	65665	89422	65667	49926	80597	54470	82682	164334	99484
15	38625	47522	48062	52179	58532	67519	58069	44399	70435	45665	71577	145293
16	32572	34555	42612	42644	46110	47511	59626	51397	37583	60230	35135	60027
17	27044	27983	30252	37045	36502	37513	39749	52633	44624	31705	49926	26254
18	27705	22869	24266	26000	31611	30559	31196	35127	46641	39100	26908	42199
19	27202	22463	18912	19829	21354	26075	24076	26719	30297	40867	32665	20879
20	26170	21290	17669	14465	15650	17205	20522	20502	22255	26220	34654	25554
21	29299	22736	18523	15413	12517	13828	14605	17354	17681	18948	22262	26921
22	26139	19930	15127	11573	9705	7865	7865	11795	12728	12774	14294	14322
23	23472	21293	15819	11761	8762	7549	5867	5935	8652	9552	9455	9664
24	14859	13506	10709	7516	4639	4116	5162	5366	3720	6071	6592	4469
25	8835	8988	6675	5336	2758	1927	1676	1566	1675	2022	3456	3677
26	5997	5827	5231	3855	2796	1350	716	736	622	566	662	2203
27	2618	3679	2659	2600	1728	1525	330	172	584	349	419	507
28+	1563	1795	1553	1646	1052	1196	0	0	0	664	0	79
TOTAL NO	1141769	1114551	1154553	1365853	1423758	1611067	1799705	1741996	1723232	1752707	1820700	1871320
SPS NO	174440	152658	130200	115642	106104	105832	103666	114779	125716	136682	141709	140515
TOT. BIOM	511739	494135	483681	516779	527020	556221	604804	623735	645163	674248	701145	721059
SPS BIOM	190768	169269	139788	119303	111497	97913	91219	101524	112651	125944	131470	129406

Table 29. GREENLAND HALIBUT. Nominal catch (tonnes) in Sub-area I.
(As officially reported to ICES)

Country	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983 ^{x)}
Germany, Fed.Rep.	22	6	2	1	-	-	-	19	-	-
Norway	2 167	2 160	1 203	1 371	1 148	727	490	641	511	649
U.K. (Engl. and Wales)	732	550	665	541	232	36	12	5	8	-
USSR	2 329	3 774	600	360	211	182	100	564	200	196
Others	1	5	9	-	-	-	-	1	-	-
Total	5 251	6 495	2 479	2 273	1 591	945	602	1 230	719	845

x) Provisional data

Table 30. GREENLAND HALIBUT. Nominal catch (tonnes) in Division IIa.
(As reported officially to ICES)

Country	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983 ^{x)}
Faroe Isl.	-	-	2	21	-	3	-	8	-	-
German Dem.Rep.	656	172	354	1 641	1 398	787	570	18	73	14
Germany, Fed.Rep.	49	41	17	22	321	481	303	109	18	129
Norway	6 593	2 265	3 490	1 446	2 084	2 051	2 529	3 077	2 427	4 121
Poland	499	66	31	95	197	4	-	-	-	-
U.K. (Engl. and Wales)	55	107	48	211	82	11	9	4	2	-
USSR	-	515	43	6 960	8 809	6 929	2 014	2 031	2 459	5 257
Others	-	-	-	-	1	21	48	37	8	-
Total	7 852	3 166	3 985	10 396	12 892	10 287	5 473	5 284	4 987	9 521

x) Provisional data.

Table 31. GREENLAND HALIBUT. Nominal catch (tonnes) in Division IIb.
(As officially reported to ICES)

Country	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983 ^{x)}
German Dem. Rep.	5 258	8 295	8 601	6 535	3 213	2 701	1 510	1 340	1 080	1 899
Germany, Fed.Rep.	17	47	12	125	-	-	-	-	-	-
Norway	31	433	1 312	1 400	850	65	138	483	213	152
Poland	4 646	3 579	3 526	129	347	102	-	-	-	-
U.K. (England and Wales)	79	74	222	307	93	12	5	-	+	-
USSR	14 629	16 083	15 937	7 725	5 631	3 200	5 556	6 681	9 735	9 925
Total	24 660	28 511	29 610	16 221	10 134	6 080	7 209	8 504	11 028	11 976

x) Provisional data.

Table 32. GREENLAND HALIBUT.
Nominal catch (tonnes) in Sub-areas I and II, 1974-1983 (data for 1974-1982 from Bulletin Statistique).

Country	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983 ^{*)}
Faroe Isl.	-	-	2	21	-	24	-	8	-	-
German Dem.Rep.	5 914	8 472	8 955	8 176	4 611	3 488	2 080	1 358	1 153	1 913
Germany, Fed.Rep.	88	94	31	148	321	481	303	128	18	129
Norway: trawl catch ¹⁾	4 656	1 686	4 030	2 564	2 302	921	1 559	2 949	1 746	1 814
long-line catch and gill net ²⁾	4 135	3 172	1 975	1 653	1 780	1 992	1 598	1 252	1 404	3 108
Poland	5 146	3 645	3 566	224	544	106	-	-	-	-
U.K. (Eng. + Wales)	866	731	935	1 059	407	59	26	9	10	-
USSR	16 958	20 372	16 580	15 045	14 651	10 311	7 670	9 276	12 394	15 378
Others	-	-	-	-	1	5	48	38	8	-
Total	37 763	39 172	36 074	28 890	24 617	17 312	13 284	15 018	16 733	22 342

*) Provisional data

1) From national statistics (incl. shrimp trawl)

2) From national statistics.

Table 33. GREENLAND HALIBUT in Sub-areas I and II.
Catch per unit effort and total effort.

Year	USSR Catch/hour		Norway Catch/hour trawling (tonnes)	Average Cpue ³⁾	Total effort (in '000 hrs trawling)	Cpue 7+
	RT ¹⁾	FST ²⁾				
1965	.80			.80		
1966	.77			.77		
1967	.70			.70		
1968	.65			.65		
1969	.53			.53		
1970	.53			.53	169	.50
1971	.46			.46	172	.43
1972	.37			.37	116	.33
1973	.37		.41	.39	77	.38
1974	.40		.34	.36	105	.33
1975	.39		.40	.40	95	.38
1976	.40		.34	.37	97	.34
1977	.27		.34	.31	93	.26
1978	.21		.22	.22	112	.18
1979	.23		.27	.25	69	.18
1980	.24	.33	.33	.29	46	.25
1981	.30	.36	.35	.33	45	.24
1982	.26	.45	.40	.33	51	.29
1983*	.26	.40	.36	.31	72	.26

*) Provisional

1) Side trawlers

2) Stern trawlers

3) Arithmetic average of cpue from USSR RT-trawlers and Norwegian fresh-fish trawlers.

Table 34. The six sets of mean weight at age data, one used for the period 1970-78 and five for each of the years 1979-83. The set for 1983 is also used in the predictions.

Age	\bar{w} (kg) 1970-78	\bar{w} (kg) 1979	\bar{w} (kg) 1980	\bar{w} (kg) 1981	\bar{w} (kg) 1982	\bar{w} (kg) 1983
3	0.200	0.3	0.200	.20	.27	.31
4	0.441	0.6	0.482	.50	.62	.45
5	0.567	0.9	0.702	.66	.69	.75
6	0.737	1.2	0.872	.84	.84	1.04
7	1.079	1.5	1.141	1.15	1.03	1.34
8	1.421	1.8	1.468	1.56	1.31	1.57
9	1.848	2.2	1.778	2.04	1.74	1.97
10	2.281	2.6	2.302	2.57	2.24	2.73
11	2.887	3.0	2.664	2.98	2.77	3.29
12	3.247	3.5	3.046	3.43	3.37	4.22
13	4.303	4.1	3.368	4.13	4.32	4.71
14	4.931	4.8	4.285	4.68	5.35	6.08
15	5.765	5.6	5.025	5.81	5.78	6.00
16	6.308	7.0	6.589	6.59	6.60	6.60

Table 35. The estimated catch (sum of products) compared with the nominal catch using the age compositions (Table 37.) and the mean weights in Table 34.

Year	Nominal catch	Sum of products	Weight correction factor
1974	37 763	38 557	0.979
1975	38 172	43 505	0.877
1976	36 074	39 022	0.924
1977	28 827	28 902	0.997
1978	24 617	23 728	1.037
1979	17 312	17 263	1.003
1980	13 284	12 339	1.077
1981	14 956	14 709	1.017
1982	16 733	17 027	.983
1983	22 342	23 481	.952

Table 36. VIRTUAL POPULATION ANALYSIS

GREENLAND HALIBUT IN FISHING AREAS I AND II

CATCH IN NUMBERS

UNIT: THOUSANDS

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
3	1	1	1	22	1	62	73	88	64	664	48	317
4	401	19	276	334	98	755	532	637	275	1146	549	1223
5	1109	212	917	340	330	2037	1897	2213	731	1696	1300	1557
6	3521	1117	2519	2337	2932	3255	3589	3155	1138	1917	1490	1880
7	9605	3923	6204	6328	5824	4200	4116	2727	1665	1919	1272	1667
8	6438	3515	3838	4118	5102	2524	2305	1234	1341	933	1204	2307
9	2775	2551	1834	2265	3000	1610	1509	495	944	484	1488	1504
10	1734	1919	1942	1654	1350	1104	946	319	473	448	1254	1239
11	1368	1536	1622	1857	915	1062	934	296	511	482	835	719
12	1234	1127	1338	1536	1212	858	438	243	275	360	500	492
13	675	716	734	1122	698	595	349	103	247	384	323	249
14	200	251	531	600	526	364	147	45	145	150	108	203
15	46	70	137	276	254	93	63	30	67	47	43	51
16+	40	56	79	96	104	87	27	21	16	15	3	13
TOTAL	29201	17013	21972	23573	22796	18626	17014	11861	7662	10865	10417	13621

Table 37.

VIRTUAL POPULATION ANALYSIS

GREENLAND HALIBUT IN FISHING AREAS I AND II

FISHING MORTALITY COEFFICIENT

UNIT: Year⁻¹

NATURAL MORTALITY COEFFICIENT = 0.15

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
3	0.000	0.000	0.000	0.001	0.000	0.002	0.003	0.004	0.002	0.022	0.002	0.0105
4	0.014	0.001	0.012	0.014	0.004	0.027	0.022	0.040	0.016	0.038	0.022	0.048
5	0.038	0.008	0.040	0.042	0.040	0.096	0.035	0.115	0.040	0.135	0.053	0.075
6	0.162	0.047	0.111	0.127	0.197	0.207	0.230	0.183	0.076	0.133	0.142	0.095
7	0.524	0.257	0.367	0.431	0.494	0.437	0.411	0.259	0.131	0.167	0.116	0.250
8	0.415	0.347	0.405	0.418	0.653	0.389	0.445	0.195	0.185	0.096	0.142	0.300
9	0.264	0.271	0.290	0.419	0.575	0.424	0.401	0.147	0.213	0.089	0.206	0.250
10	0.236	0.277	0.321	0.434	0.446	0.406	0.447	0.130	0.193	0.140	0.329	0.250
11	0.306	0.319	0.376	0.544	0.429	0.718	0.676	0.230	0.297	0.290	0.593	0.300
12	0.443	0.419	0.478	0.695	0.790	0.869	0.701	0.347	0.326	0.355	0.519	0.400
13	0.769	0.472	0.501	0.901	0.754	1.152	1.059	0.327	0.649	0.969	0.545	0.500
14	0.938	0.693	0.729	0.951	1.564	1.256	0.975	0.335	0.985	1.064	0.768	0.750
15	1.000	1.000	1.000	1.000	1.500	1.500	1.000	0.500	1.000	1.000	1.000	1.000
16+	1.000	1.000	1.000	1.000	1.500	1.500	1.000	0.500	1.000	1.000	1.000	1.000
(7-11) U	0.349	0.294	0.352	0.449	0.520	0.475	0.476	0.192	0.204	0.156	0.237	0.270

Table 38. VIRTUAL POPULATION ANALYSIS

GREENLAND HALIBUT IN FISHING AREAS I AND II

STOCK SIZE IN NUMBERS UNIT: THOUSANDS

BIOMASS TOTALS UNIT: TONNES

ALL VALUES ARE GIVEN FOR 1 JANUARY

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
3	34417	29720	30965	32537	35517	30323	28196	22212	38384	32695	32682	32078
4	35677	29622	25585	26649	27984	30569	26042	24196	19037	32978	27526	28085
5	31831	30281	25478	21765	22628	23296	25011	21921	20004	16130	27323	23183
6	25351	26370	25666	21080	17955	18707	18767	20267	16815	16541	12129	22313
7	25209	18563	21062	19932	15981	12697	13692	12836	14544	13419	12463	9061
8	20316	12852	12352	12921	11144	8390	7757	7471	8529	10977	9775	9550
9	12853	11549	7810	7092	7324	4953	4393	3894	5269	6101	6585	7299
10	8864	8499	7584	5035	4016	3543	2813	2820	2893	3680	4803	6013
11	5502	6027	5542	4735	2609	2712	2031	1549	2137	2053	2753	2976
12	3690	3524	3770	3274	2366	1574	923	890	1000	1363	1322	1599
13	1343	2036	1994	2012	1406	924	566	396	541	658	822	677
14	350	536	1093	1040	703	570	251	169	246	244	215	410
15	67	116	231	454	346	127	143	82	104	79	72	86
16+	67	94	133	165	142	118	47	57	27	25	5	22
TOTAL NO	205597	179799	170073	156691	150520	136740	130456	116781	129605	136943	140473	143952
SPS NO	32796	32386	23166	23807	19711	14760	11875	9857	12293	14203	18577	19083
TOT. BIOM	193742	176163	168045	152340	129477	109624	93762	124911	103225	117504	123502	144175
SPS BIOM	80325	82259	76133	66336	50690	37065	29132	26954	28552	37180	42929	53680

Table 39. GREENLAND HALIBUT in Sub-areas I and II.
List of input variables for the ICES
prediction program.

AGE	1984 STOCK SIZE	F-PATTERN		MATURITY GIVE	WEIGHT IN THE CATCH	WEIGHT IN THE STOCK
3	32800.00	0.0400	0.150	0.0000	0.5100	0.5100
4	27832.00	0.1800	0.150	0.0000	0.4500	0.4500
5	25040.00	0.2600	0.150	0.0000	0.7500	0.7500
6	10512.00	0.3500	0.150	0.0000	1.0400	1.0400
7	17464.00	0.9500	0.150	0.0000	1.5400	1.5400
8	6074.00	1.1100	0.150	0.0000	1.5700	1.5700
9	6062.00	0.9500	0.150	1.0000	1.9700	1.9700
11	4092.00	0.9200	0.150	1.0000	2.7500	2.7500
11	4051.00	1.1100	0.150	1.0000	3.2900	3.2900
12	1892.00	1.4300	0.150	1.0000	4.2200	4.2200
13	223.00	1.8500	0.150	1.0000	4.7100	4.7100
14	354.00	2.7300	0.150	1.0000	6.0300	6.0300
15	107.00	3.7000	0.150	1.0000	6.0000	6.0000
15+	54.00	3.7000	0.150	1.0000	6.6000	6.6000

Recruitment at age 3 = 32.8 million for 1984-87.

Table 40. GREENLAND HALIBUT. Nominal catch (tonnes) in Division Va.
(As reported officially to ICES)

Country	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983*
Faroe Isl.	41	2	373	947	256	42	91	325	669	-
German Dem.Rep.	388	-	-	-	-	-	-	-	-	-
Germany, Fed.Rep.	1 786	887	1 719	4 642	-	-	-	-	-	-
Iceland	2 842	1 212	1 687	10 090	11 319	16 934	27 836	15 455	28 300	28 336
Norway	-	-	-	+	13	+	-	+	-	-
Poland	485	-	-	-	-	-	-	-	-	-
U.K.(Engl. & Wales)	2 314	1 207	1 669	-	-	-	-	-	-	-
USSR	10	-	-	-	-	-	-	-	-	-
Total	7 866	3 308	5 448	15 679	11 588	16 976	27 927	15 780	28 969	28 336

*Provisional data

Table 41. GREENLAND HALIBUT. Nominal catch (tonnes) in Division Vb
(As reported officially to ICES)

Country	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983*
Faroe Isl.	7	6	2	304	2	108	951	442	863	1 112
France	-	-	-	-	12	66	51	8	27	-
German Dem.Rep.	147	91	-	-	-	-	-	-	-	-
Germany, Fed.Rep.	163	437	309	341	570	234	172	114	142	78
Norway	-	7	7	5 ¹⁾	3	1	3	2	+	-
Poland	-	18	-	-	-	-	-	-	-	-
U.K.(Engl. & Wales)	8	+	6	8	8	-	-	-	-	-
USSR	-	-	-	-	-	-	-	-	-	-
Total	325	559	324	658	595	409	1 177	566	1 032	1 190

*) Provisional data

1) From national statistics

Table 42. GREENLAND HALIBUT. Nominal catch (tonnes) in Sub-area XIV.
(As reported officially to ICES)

Country	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983*
France	-	-	-	-	-	4	-	-	-	-
German Dem.Rep.	25 266	16 872	-	-	-	-	-	-	-	-
Germany, Fed.Rep.	+	64	191	224	2 156	6 227	2 146	2 893	2 439	1 034
Greenland	2	1	1	1	6	-	-	+	1	+
Iceland	1	+	2	-	-	-	2	-	-	-
Norway	-	-	-	2 ¹⁾	3	-	-	-	-	-
Poland	1 057	1 054	-	-	-	-	-	-	-	-
U.K.(Engl. & Wales)	1	2	5	11	1	-	-	-	-	-
USSR	1 762	1 634	74	-	-	-	-	-	-	-
Total	28 089	19 627	273	241	2 166	6 231	2 148	2 893	2 440	1 034

*) Provisional data

1) From national statistics

Table 43. GREENLAND HALIBUT. Nominal catch (tonnes) in Sub-areas V and XIV, 1974 - 1983.
(Data for 1974 to 1982 from Bulletin Statistique)

Country	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983*
Faroe Isl.	48	8	375	1 251	258	150	1 042	767	1 532	1 112
France	-	-	-	-	12	70	51	8	27	-
German Dem.Rep.	25 801	16 963	-	-	-	-	-	-	-	-
Germany, Fed.Rep.	1 949	1 388	2 219	5 207	2 726	6 461	2 318	3 007	2 581	1 112
Greenland	2	1	1	4	6	-	-	+	1	+
Iceland	2 843	1 212	1 689	10 090	11 319	16 934	27 838	15 455	28 300	28 336
Norway	-	7	7	7	19	1	3	2	+	-
Poland	1 542	1 072	-	-	-	-	-	-	-	-
U.K. (Engl. & Wales)	2 323	1 209	1 680	19	9	-	-	-	-	-
USSR	1 772	1 634	74	-	-	-	-	-	-	-
Total	36 280	23 494	6 045	16 578	14 349	23 616	31 252	19 239	32 441	30 560

*)Provisional data

1)From national statistics

Table 44 Greenland HALIBUT in Sub-area V and XIV
Catch (in tonnes) per unit effort (hours trawling)
in the Icelandic fishery and the total international
effort (in hours trawling).

Year	cpue	Total catch	Total effort
1978	1.733	14 349	8 280
1979	2.348	23 616	10 058
1980	3.062	31 252	10 206
1981	2.140	19 239	8 990
1982	3.696	32 441	8 777
1983	3.648	30 560	8 377

Table 45.

VIRTUAL POPULATION ANALYSIS

GREENLAND HALIBUT IN FISHING AREAS V AND XIV

MEAN WEIGHT AT AGE OF THE STOCK

UNIT: KILOGRAM

	1975	1976	1977	1978	1979	1980	1981	1982	1983
4	0.742	0.680	0.680	0.680	0.742	0.742	0.662	0.662	0.933
5	0.963	1.157	1.157	0.963	0.911	1.125	1.071	1.010	0.984
6	1.199	1.585	1.040	1.199	0.942	1.263	1.257	1.366	1.358
7	1.423	1.768	1.429	1.423	1.276	1.487	1.440	1.618	1.577
8	1.854	2.180	1.794	1.654	1.676	1.756	1.660	1.905	1.648
9	2.256	2.570	2.228	2.256	2.072	2.053	1.967	2.187	2.159
10	2.607	3.018	2.687	2.607	2.333	2.279	2.256	2.516	2.454
11	3.081	3.730	3.017	3.081	2.723	2.496	2.515	2.761	2.603
12	3.591	4.052	3.914	3.591	3.297	3.059	2.950	3.129	3.034
13	4.604	4.815	4.040	4.604	3.985	3.783	3.450	3.785	3.784
14	4.695	5.346	4.714	4.695	4.668	4.507	4.033	4.475	4.446
15	5.151	5.752	5.401	5.151	4.792	5.139	4.652	4.985	4.751
16	5.693	6.227	5.054	5.693	5.229	5.633	4.714	5.610	6.209
17	6.511	8.484	6.258	6.511	5.739	6.655	6.245	6.632	6.400
18+	7.814	9.000	7.000	8.538	6.574	7.814	7.261	7.726	6.571

Table 47.

VIRTUAL POPULATION ANALYSIS

GREENLAND HALIBUT IN FISHING AREAS V AND XIV

CATCH IN NUMBERS

UNIT: THOUSANDS

	1975	1976	1977	1978	1979	1980	1981	1982	1983
4	1	1	0	1	0	0	0	0	2
5	120	43	0	23	29	47	20	8	10
6	800	290	34	91	197	502	153	300	240
7	1775	584	071	347	1605	1536	530	1140	1611
8	1762	621	1727	1037	2253	2630	1100	2451	2651
9	1259	431	2289	1214	3090	3126	1430	2646	3060
10	926	240	334	646	1093	2324	1704	2450	2443
11	404	121	420	567	380	1739	1299	1803	1693
12	459	80	423	512	394	349	604	963	978
13	279	37	174	232	246	578	435	609	424
14	193	32	120	218	189	306	252	351	174
15	137	14	28	114	147	143	176	195	37
16	39	0	86	112	101	82	114	82	17
17	2	1	41	64	15	29	179	39	15
18+	44	2	14	26	9	5	26	11	15
TOTAL	3280	2515	6861	5208	10848	13902	8271	13034	13370

Table 48.

VIRTUAL POPULATION ANALYSIS

GREENLAND HALIBUT IN FISHING AREAS V AND XIV

FISHING MORTALITY COEFFICIENT

UNIT: Year⁻¹

NATURAL MORTALITY COEFFICIENT = 0.15

	1975	1976	1977	1978	1979	1980	1981	1982	1983
4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00006
5	0.005	0.002	0.000	0.001	0.001	0.002	0.001	0.000	0.00036
6	0.045	0.014	0.001	0.003	0.003	0.023	0.007	0.012	0.010
7	0.149	0.040	0.038	0.017	0.067	0.072	0.031	0.059	0.081
8	0.265	0.068	0.149	0.072	0.136	0.141	0.066	0.169	0.160
9	0.323	0.090	0.354	0.140	0.297	0.267	0.100	0.205	0.310
10	0.314	0.086	0.236	0.202	0.260	0.359	0.224	0.236	0.280
11	0.123	0.058	0.208	0.236	0.315	0.484	0.330	0.353	0.240
12	0.464	0.029	0.276	0.222	0.242	0.534	0.324	0.409	0.310
13	0.579	0.057	0.071	0.227	0.259	0.624	0.544	0.523	0.300
14	0.248	0.111	0.250	0.113	0.275	0.553	0.576	1.010	0.260
15	0.363	0.024	0.127	0.376	0.098	0.326	0.679	1.197	0.260
16	1.422	0.025	0.190	0.975	0.652	0.069	0.442	0.745	0.270
17	0.300	0.100	0.200	0.200	0.300	0.350	0.200	0.250	0.270
18+	0.300	0.100	0.200	0.200	0.300	0.350	0.200	0.250	0.270
(8-13)0	0.345	0.065	0.216	0.183	0.255	0.401	0.265	0.316	0.270

Table 49.

VIRTUAL POPULATION ANALYSIS

GREENLAND HALIBUT IN FISHING AREAS V AND XIV

STOCK SIZE IN NUMBERS UNIT: THOUSANDS

 BIOMASS TOTALS UNIT: TONNES

ALL VALUES ARE GIVEN FOR 1 JANUARY

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
4	35458	42079	37001	32010	35719	35400	35074	34760	35097	+++++++
5	20742	30518	36217	32364	28072	29022	30471	30183	29918	30395
6	19717	22900	26227	31172	27335	24135	24930	26202	25971	25742
7	15795	16230	19441	22542	26746	23775	20308	21510	22274	22131
8	6203	10231	13428	16111	19081	21534	19041	16942	17291	17680
9	4897	5415	8231	9960	12907	14338	16101	15314	12315	12431
10	5664	3053	4261	4972	7449	8255	9453	12535	10735	7774
11	4311	2315	2405	2097	3495	4846	4961	6506	8519	6983
12	1323	3261	1651	1682	1969	2196	2570	3071	3936	5766
13	679	716	2744	1223	1159	1331	1108	1599	1755	2435
14	944	326	582	2201	643	770	614	554	816	1119
15	402	634	252	390	1692	551	361	297	173	541
16	54	289	533	191	250	1321	342	167	77	115
17	8	11	243	379	67	105	1061	109	68	31
18+	162	23	65	100	37	16	100	53	63	89
TOTAL NO	120460	138027	154130	153671	165297	167608	166387	169688	169674	
SFS NO	20133	20587	26582	30405	36766	40744	42120	38633	36596	
TCT. BIOM	161199	207229	211170	226235	221575	249752	233644	261317	262971	
SFS BIOM	55594	64198	71750	82502	67153	96874	97365	95065	87096	

Table 50. GREENLAND HALIBUT in Sub-areas V and XIV.
List of input variables for the ICES Prediction Program.

Age	1984 Stock Size	F-Pattern	M	Maturity Ogive	Weight in the Catch	Weight in the Stock
4	35 900.00	0.0002	0.150	0.0000	0.9030	0.9030
5	30 895.00	0.0010	0.150	0.0371	0.9840	0.9840
6	25 742.00	0.0400	0.150	0.0747	1.3380	1.3380
7	22 131.00	0.3000	0.150	0.1530	1.5770	1.5770
8	17 680.00	0.6700	0.150	0.2804	1.8480	1.8480
9	12 431.00	1.1500	0.150	0.3606	2.1590	2.1590
10	7 774.00	1.0400	0.150	0.6051	2.4340	2.4340
11	6 983.00	0.8900	0.150	0.8543	2.6030	2.6030
12	5 768.00	1.1500	0.150	0.9847	3.0340	3.0340
13	2 485.00	1.1100	0.150	1.0000	3.7840	3.7840
14	1 119.00	0.9600	0.150	1.0000	4.4460	4.4460
15	541.00	0.9600	0.150	1.0000	4.7510	4.7510
16	115.00	1.0000	0.150	1.0000	6.2090	6.2090
17	51.00	1.0000	0.150	1.0000	6.4000	6.4000
18+	89.00	1.0000	0.150	1.0000	6.5710	6.5710

Recruitment at age 3 = 35.9 million for 1984-87.

Figure 1. Sebastea mentella, in Divisions IIA and IIB. Relation of mean fishing mortality (age 8-19) to total effort (hours' trawling x 10⁻³ in USSR BT-units).

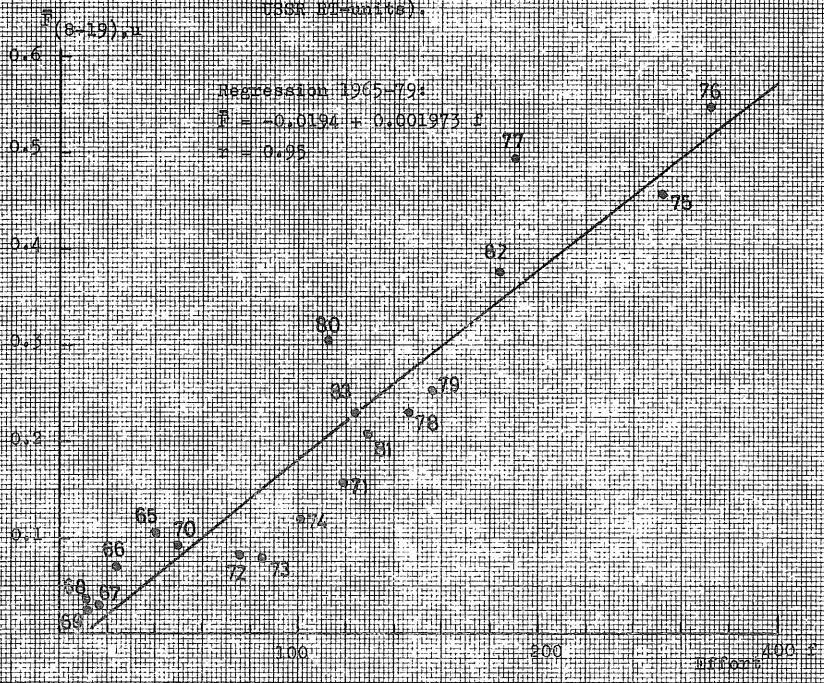


Figure 2. *Sebastes mawalei* in Divisions 17a and 17b. The fishing mortality, catch and development of the stock from 1967-85.

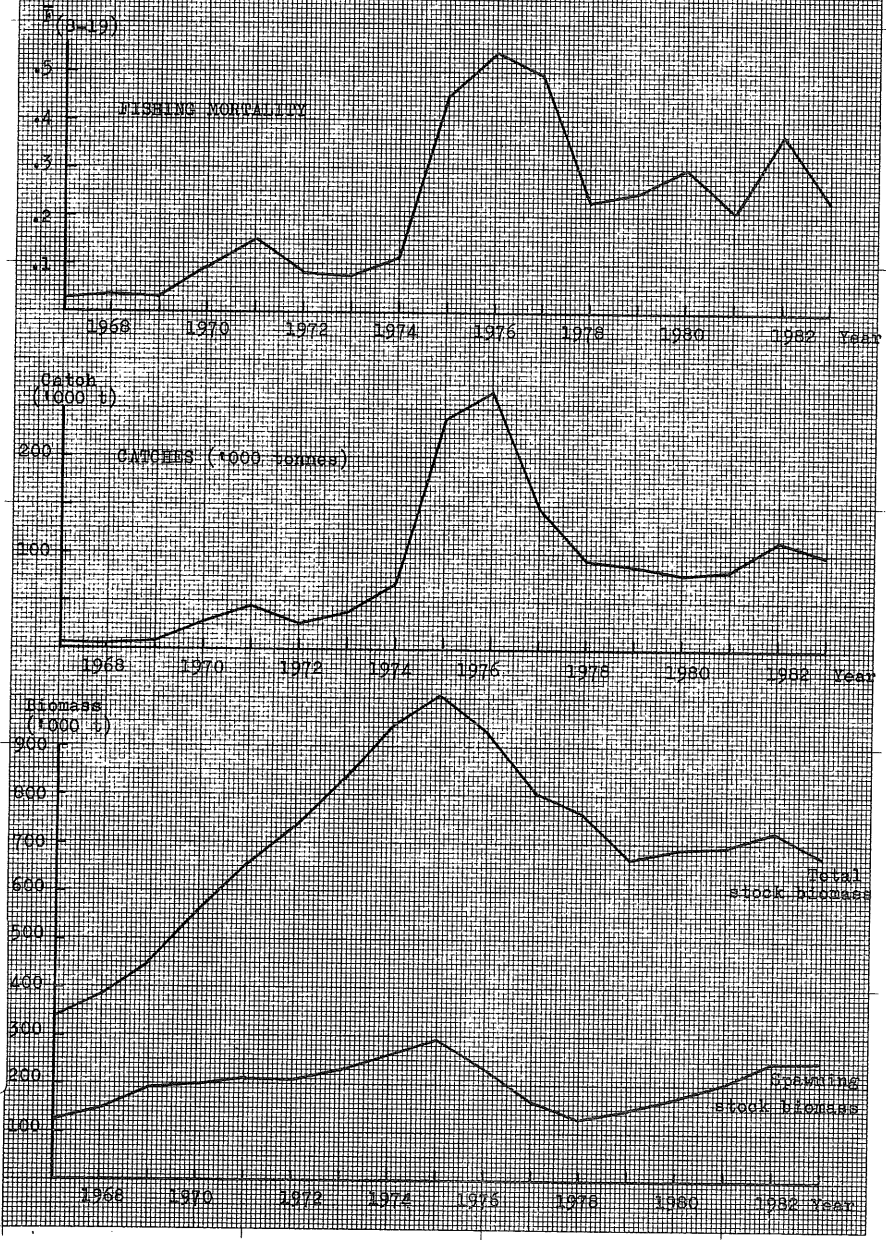


Figure 3: *Sebastes mentella* in Divisions 11a and 11b. Yield per recruit for the present exploitation between $F = 0.2$.

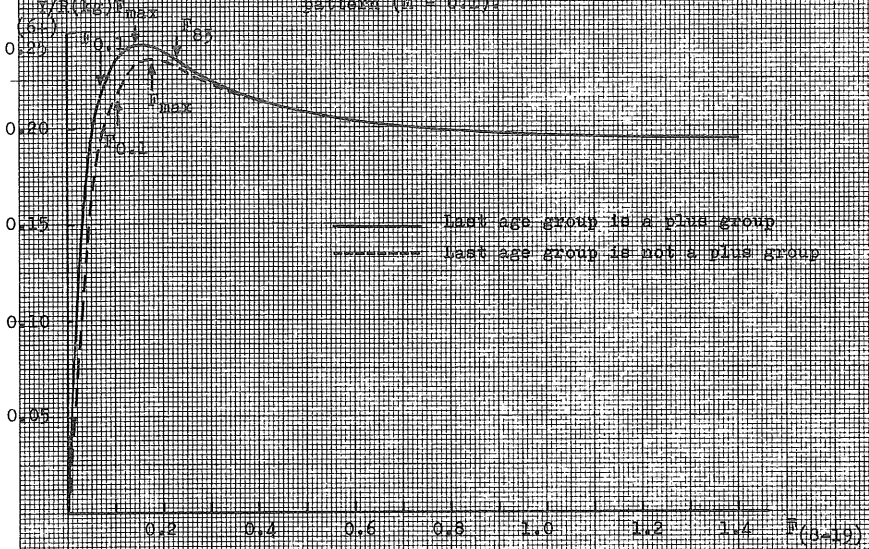


Figure 4: *Sebastes mentella* in Divisions 11a and 11b. Projection for catch in 1985, total biomass (TSB) and spawning stock biomass (SSB) at the beginning of 1985 at different levels of fishing mortality in 1985.

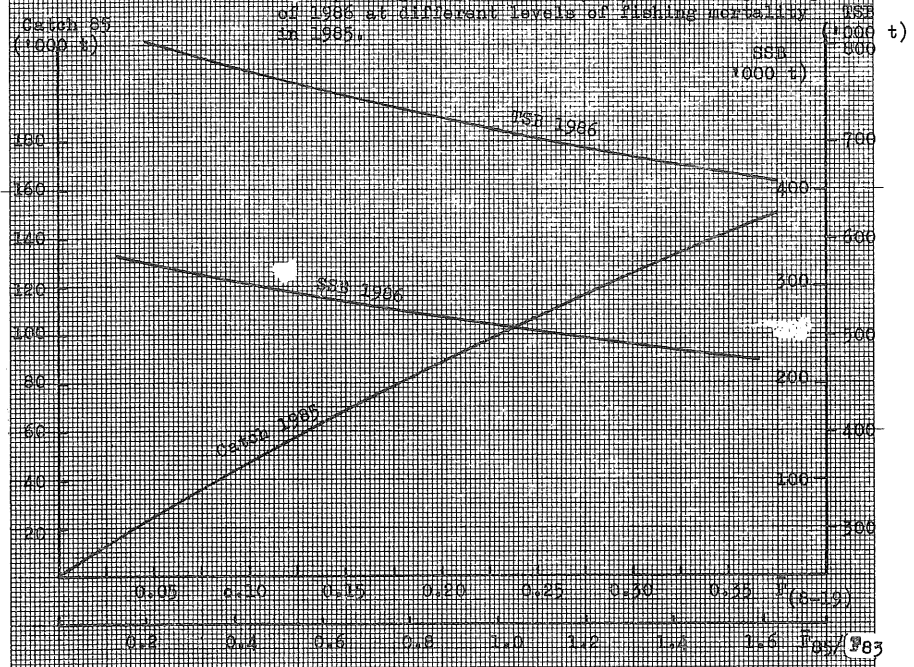
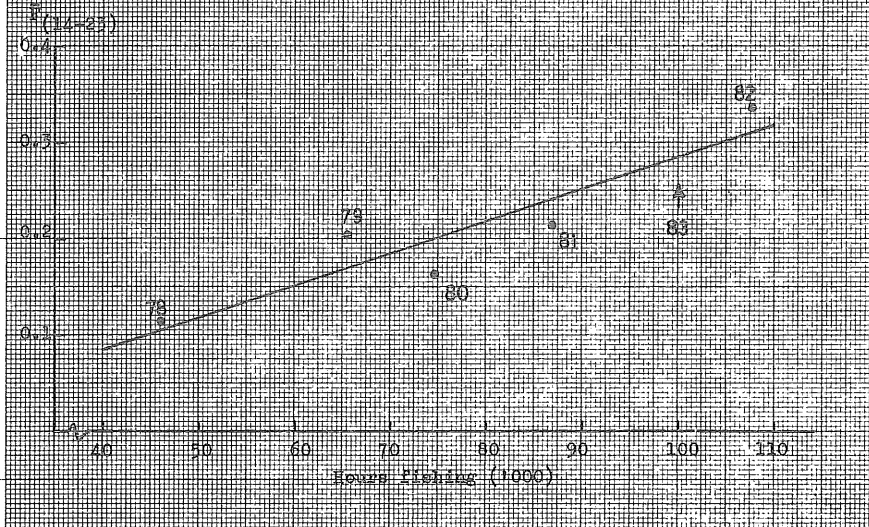


Figure 5. Sebastes maximus in GSA areas V and XIV.
Relation of mean fishing mortality (age 14-23)
to total effort.



Hours fishing ('000)	<u>1978</u>	<u>1979</u>	<u>1980</u>	<u>1981</u>	<u>1982</u>	<u>1983</u>
	46.2	65.4	74.7	86.7	107.5	100.1

$\bar{F}(14-23)$ from VPA with	0.112	0.205	0.161	0.214	0.337	0.275
--------------------------------	-------	-------	-------	-------	-------	-------

$\bar{F}(14-23)=0.275^1)$
in 1983

$$y = -0.050 + 0.003x \quad r = 0.92$$



0.286

1) Corresponding to a catch of 106 300 tonnes in 1983.

Figure 6. Changes in fishing mortality, catch and development of the stock from 1967 to 1983.

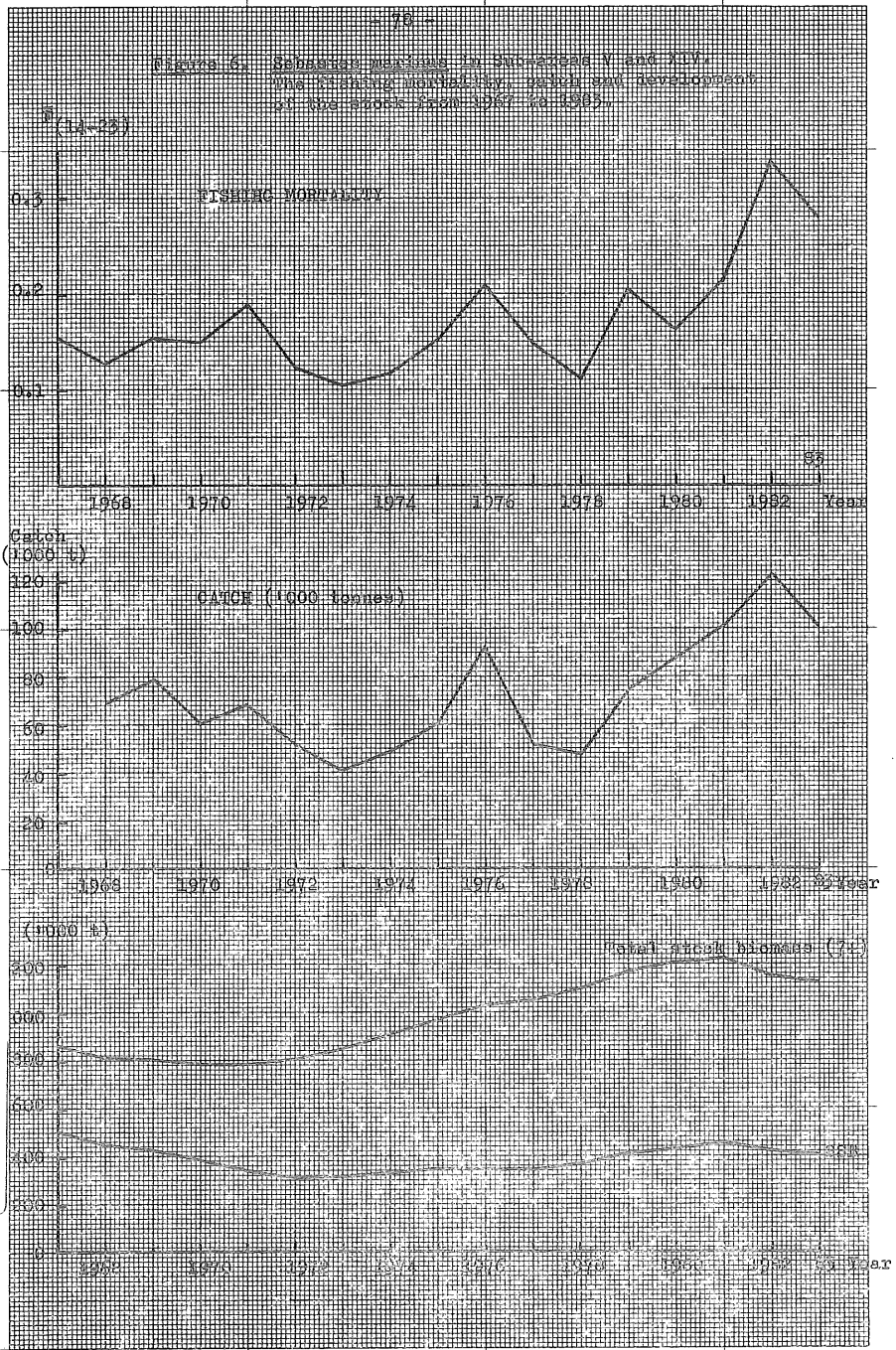


Figure 7. Sebastes marinus in Sub-areas V and XIV. Yield per recruit.

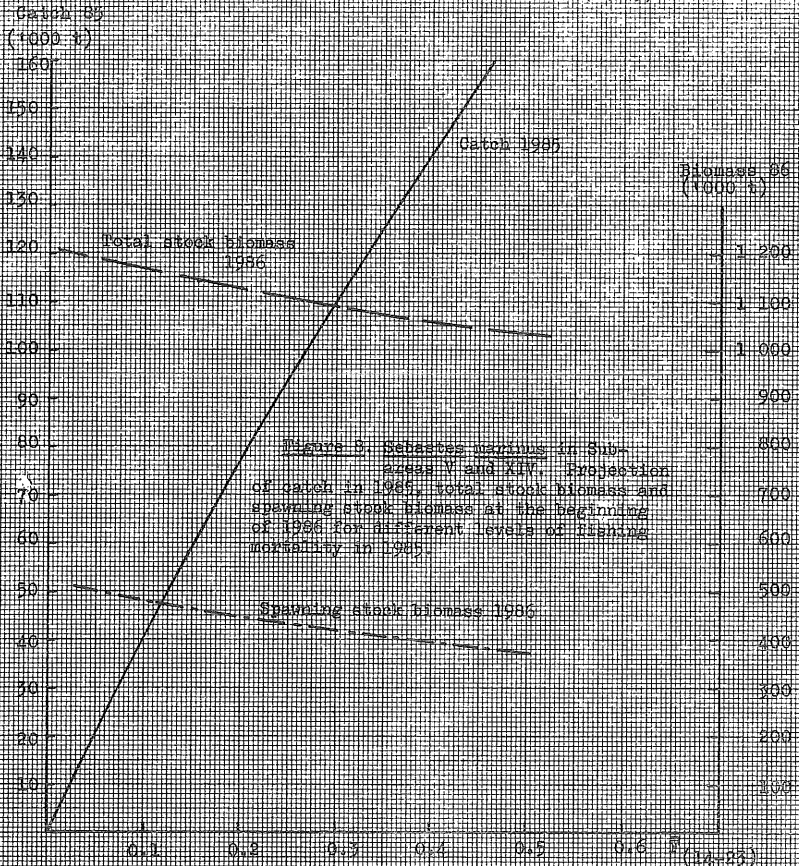
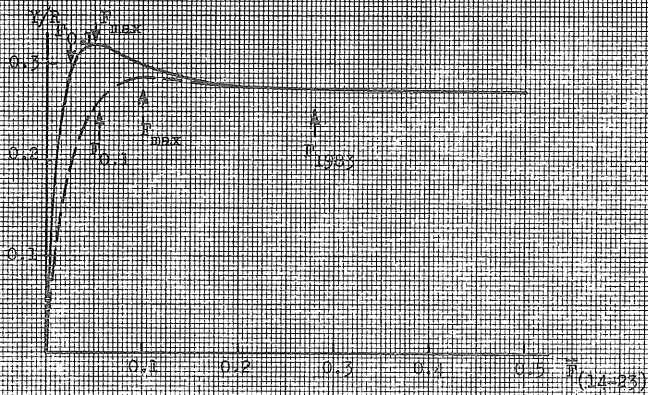


Figure 9. *Sebastes mentella* in Subareas V and XIV.
Relation of mesh fishing mortality (ages 12-25) to total effort.

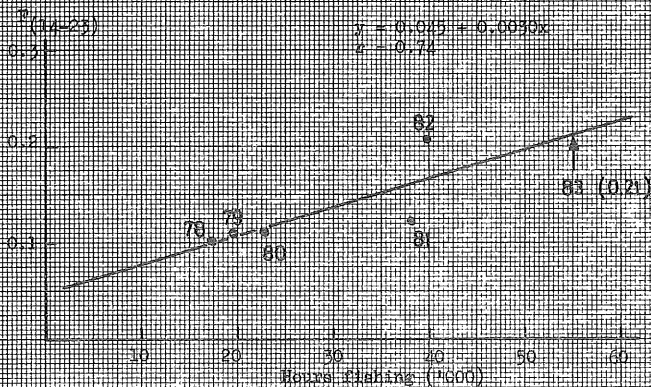
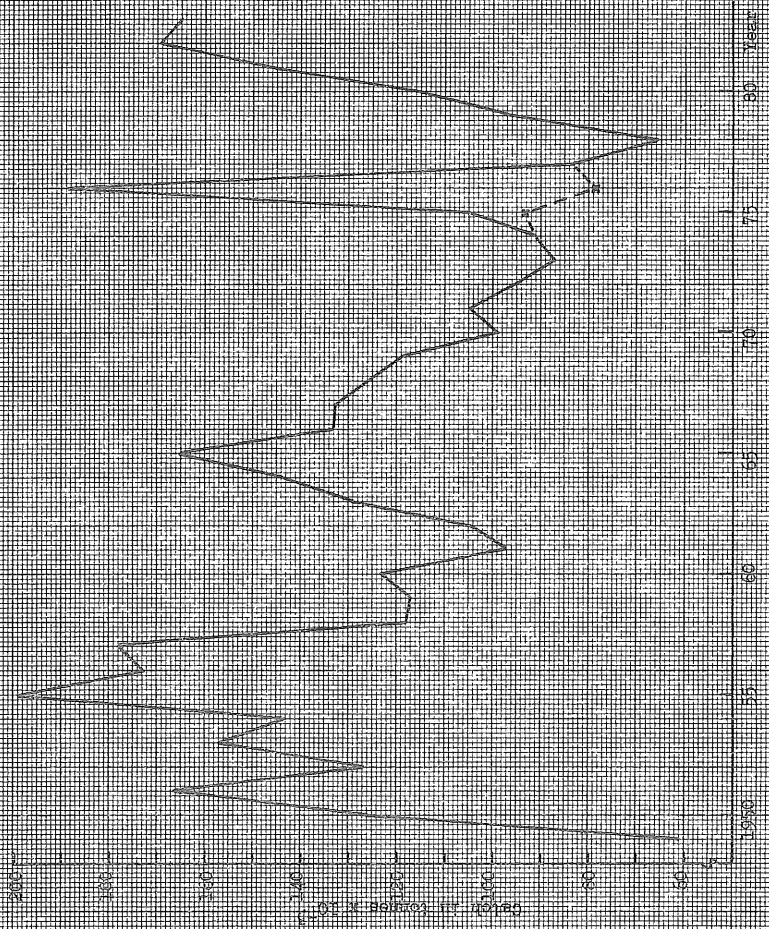


Figure 10: Dutch annual growth of rainfall for Sub-ensembles and their
 The seasonal statistics using 1000 samples



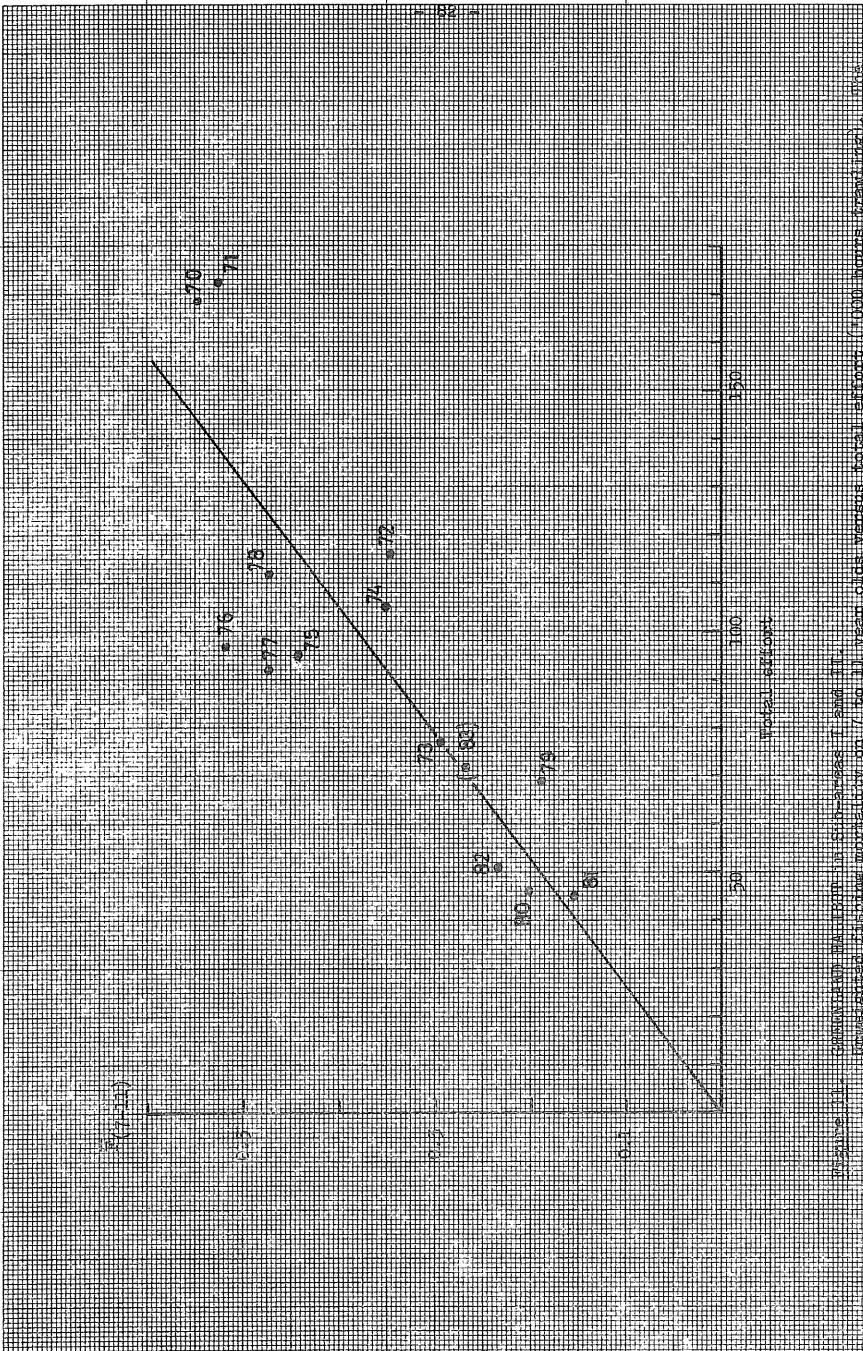


Figure 1. Comparison of 1970-82 production in 500-acre plots with 1970-82 average effort. The regression line is forced through the origin and the average for 1970-82.

Production is defined as the number of fish caught per 1000 hours of effort.

Figure 12. QUANTILY-NATURAL in Sub-areas I and II. Averages of 4 years and older fish in the mid-season versus catch (in tonnes) per unit effort (hour trawling). The line is forced through the origin and the average for 1970-82.

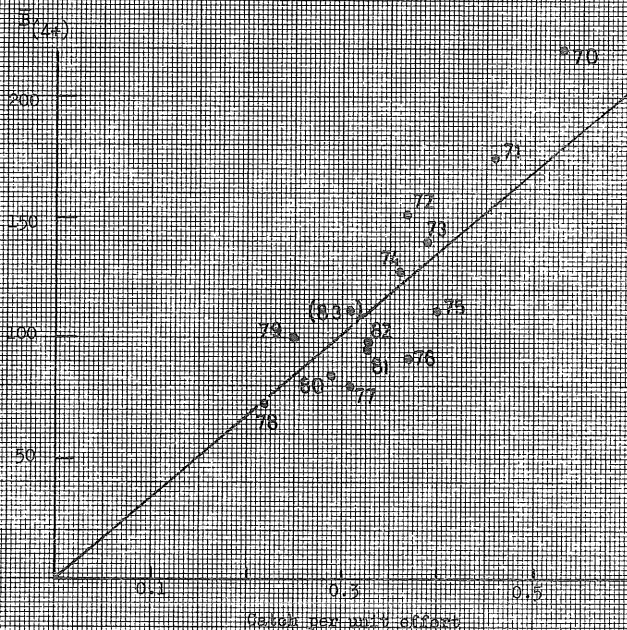


Figure 13. SCORING ANALYSIS in Sub-area I and II. Groups of 7 years and older in the mid-season veena catch (in tonnes) of 7 years and older fish per hour trawling. The line is forced through the origin and the average for 1970-82.

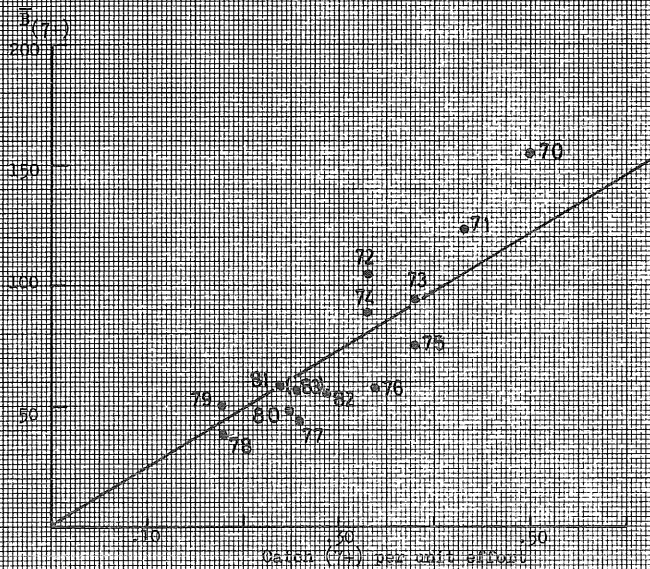


Figure 14. GROWTH RATIO in Sub-area I and II. The fishing mortality, catch and development of the stock from 1970-83.

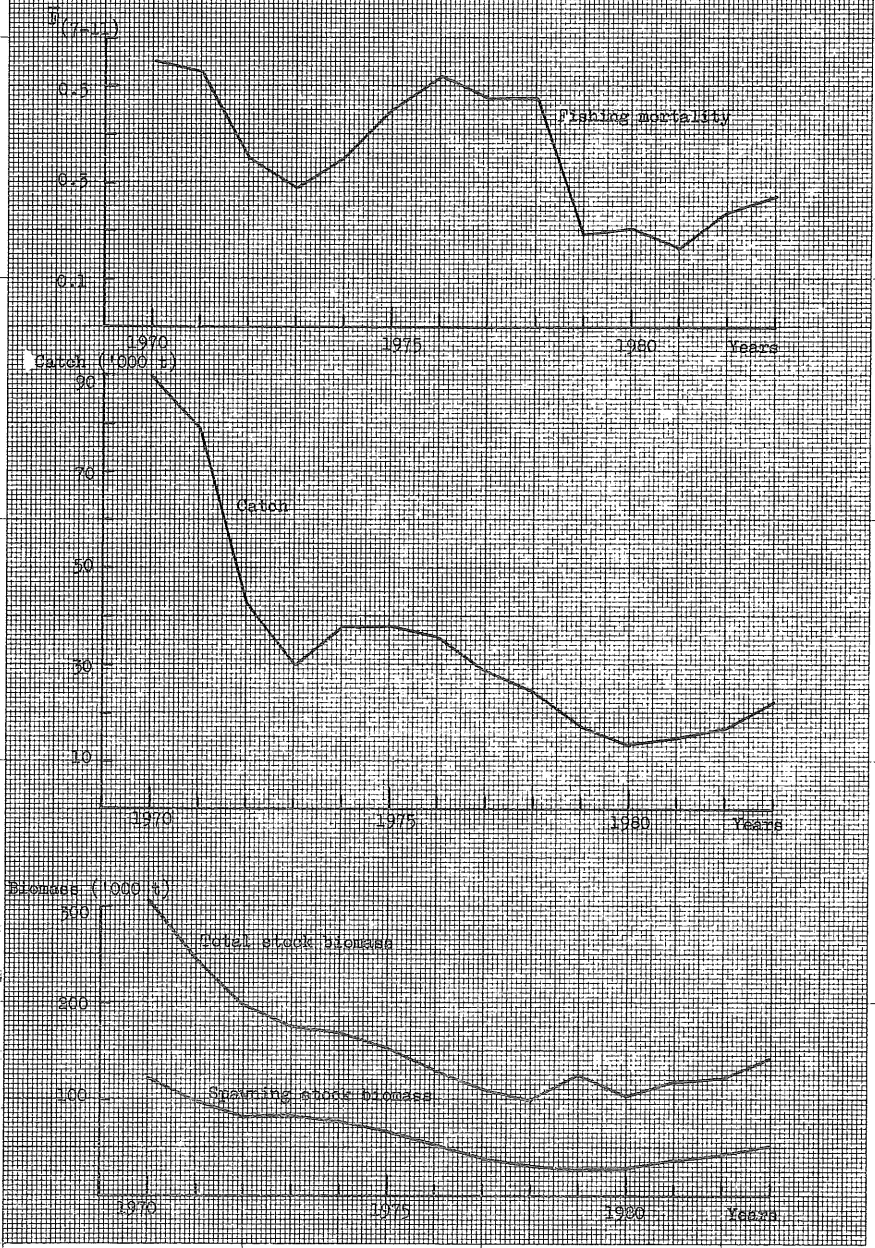


Figure 5. Calculated monthly biomass (mg dry wt) of *S. purpuraceus* and *L. clava* for monthly and quarterly stock biomass observations.

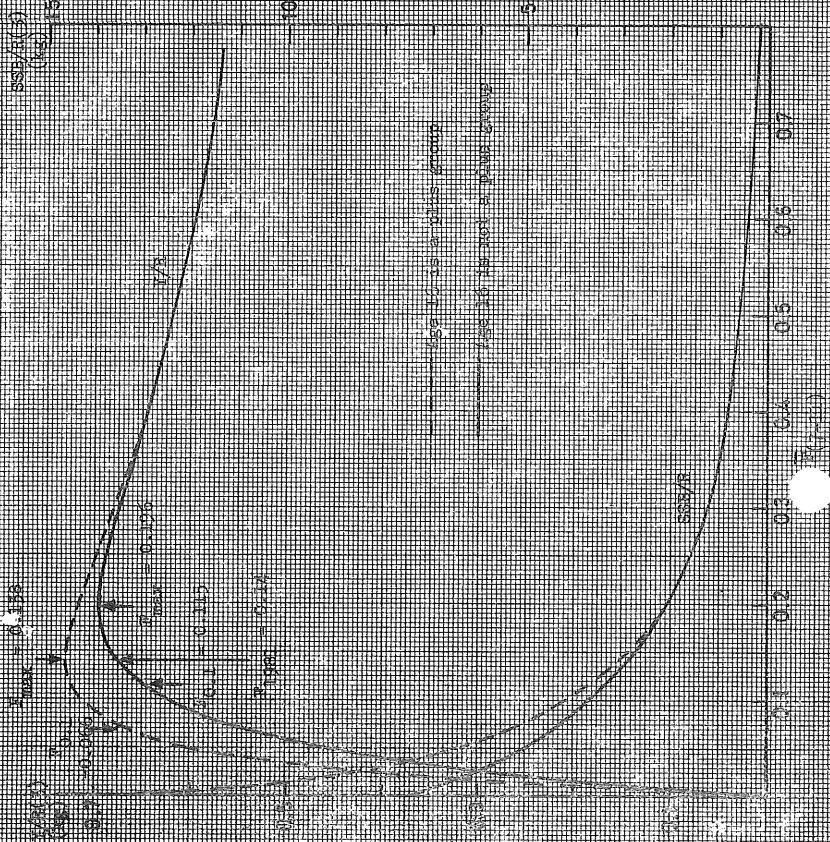


Figure 10. Calculated monthly biomass (mg dry wt) of *S. purpuraceus* and *L. clava*.

Projection of stock in 1985, and biomass of the spawning stock and the biomass of the total stock at the beginning of 1986 for a constant level of fishing mortality in 1985.

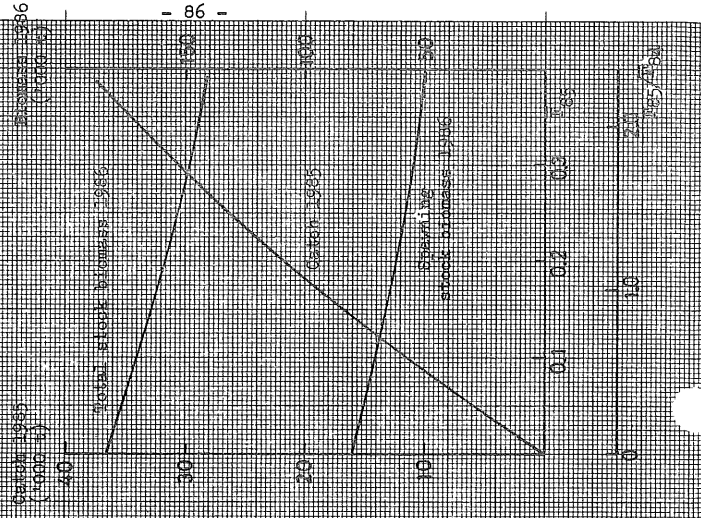


Figure 17. GROWING WATER in Subareas V and XV. Relation of mean fishing mortality (ages 0-13) to total effort (hours trawling x 10⁻³). The line is formed through the origin and the average values for 1975-82.

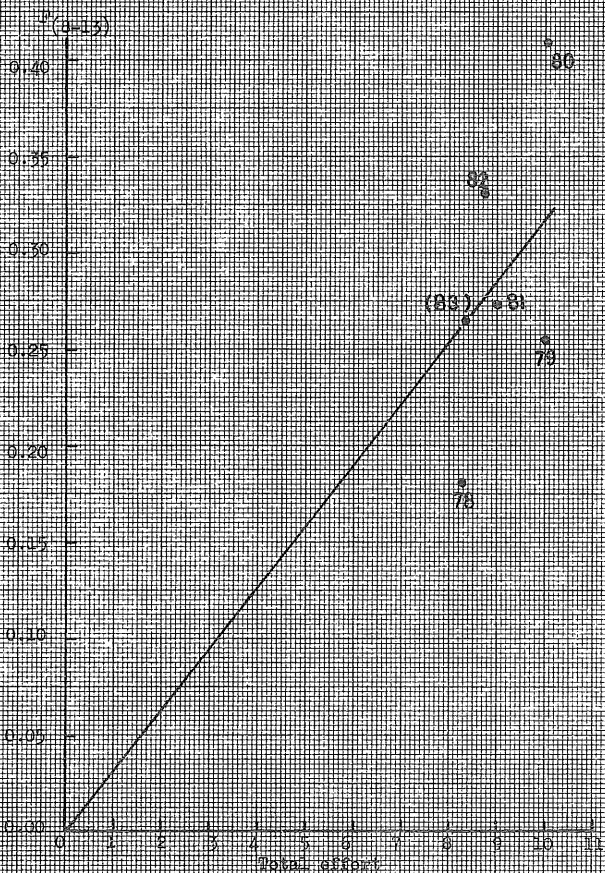


Figure 18. CATCHING BALANCE in Sub-areas V and XIV. The fishing mortality, catch and development of the stock from 1975 to 1983.

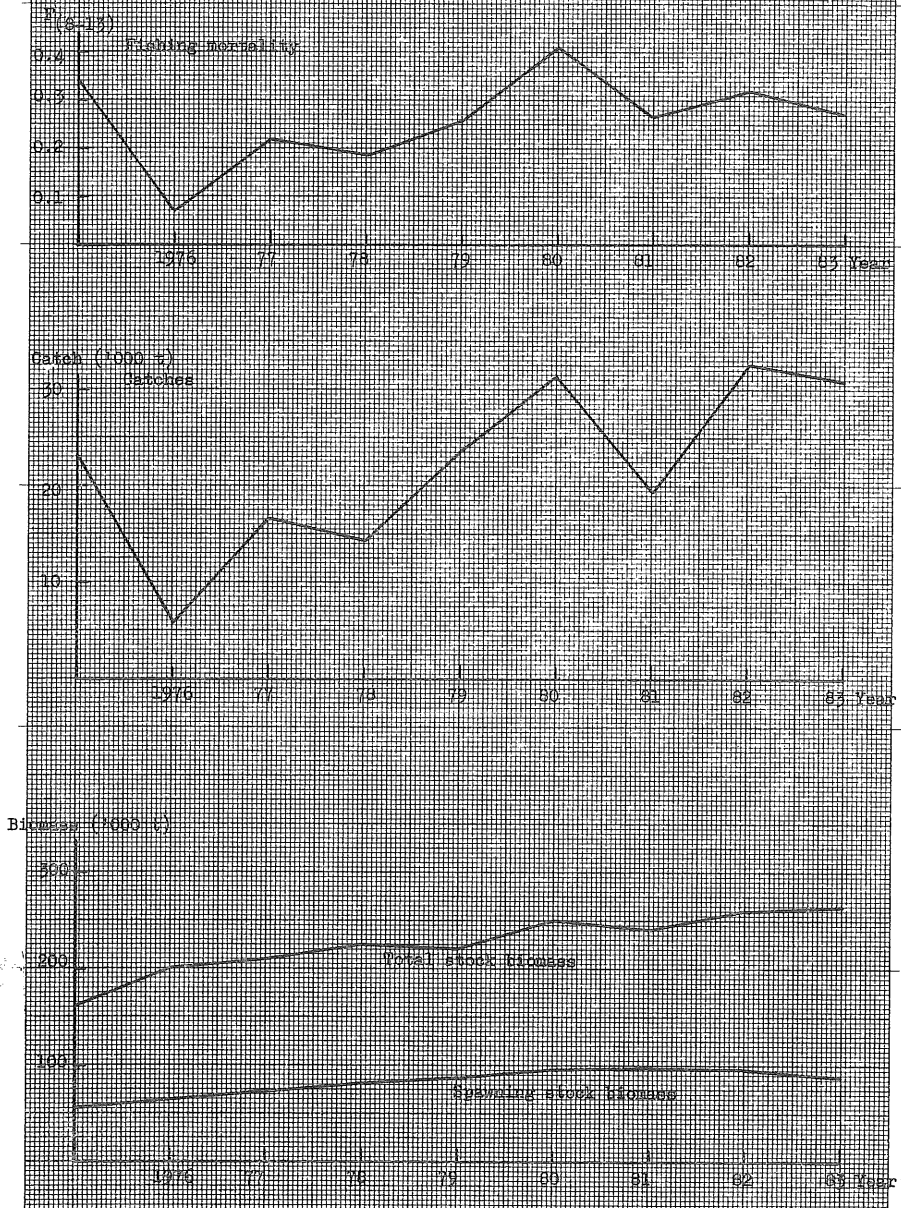


Figure 19. GREENLAND HALIBUT in Sub-areas V and XIV. Yield and spawning stock biomass per recruit.

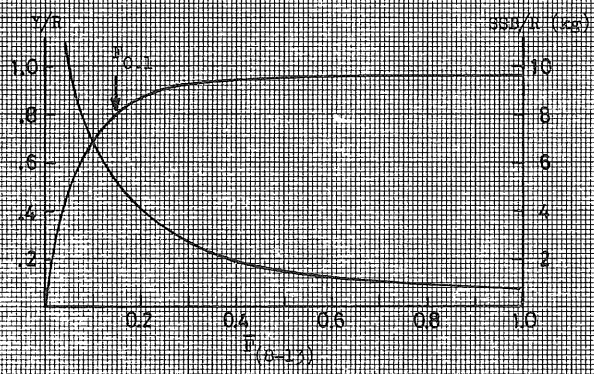
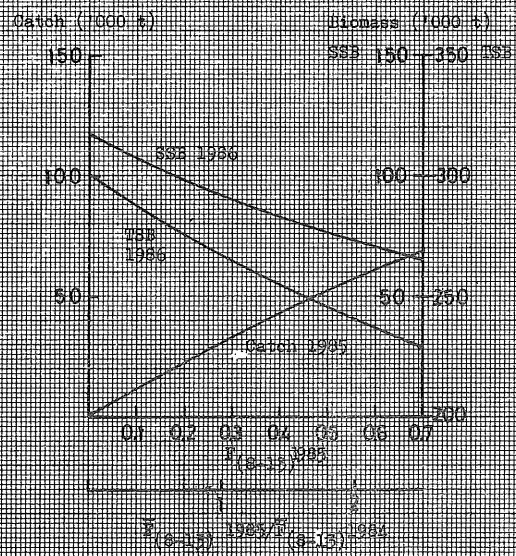


Figure 20. GREENLAND HALIBUT in Sub-areas V and XIV. Predictions for catch in 1985, the biomass of the spawning stock (SSB) and the biomass of the total stock (TSB) at the beginning of 1986.



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