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and Greenland Halibut in Region 1  
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- page 82 - Figure 2: substitute in the heading "5" for "12".
- page 103 - Figure 23: an arrow indicating  $F_{0.1}$  on the curve  
should correspond to  $F_{0.1} = 0.12$  on the  
 $\bar{F}_{82}$  scale.

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International Council for the  
Exploration of the Sea

C.M.1981/G:7  
Demersal Fish Committee

REPORT OF THE WORKING GROUP ON REDFISH AND GREENLAND

HALIBUT IN REGION 1

Copenhagen, 11 - 19 March 1981

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REPORT OF THE WORKING GROUP ON REDFISH AND GREENLAND

HALIBUT IN REGION 1

1. PARTICIPANTS AND TERMS OF REFERENCE

1.1 Participants

W R Bowering	Canada
K Kosswig	Germany, Fed.Rep.of
E Loukmanov	USSR
J Magnússon	Iceland
W D McKone	Canada
J Møller Jensen	Denmark
W Ryjov	USSR
C J Rørvik	Norway
H Schulz	Germany, Fed.Rep.of
A Schumacher	Germany, Fed.Rep.of
A Sigurdsson	Iceland
O M Smedstad	Norway
B Vaske (Chairman)	German Democratic Rep.

V Nikolaev 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.1980/2:6/2):

"It was decided, that the Working Group on Redfish and Greenland Halibut in Region 1 (Chairman: Mr B Vaske) should meet at ICES headquarters from 11-19 March 1981 to:

- (i) assess TACs for 1982 for redfish and Greenland halibut,
- (ii) estimate effective mesh sizes in use for redfish,
- (iii) estimate the short-term losses and long-term gains resulting from an increase in mesh size in Sub-area XIV (to 140 mm) for all species of significant importance in that area,
- (iv) advise on the effectiveness of closed areas for the protection of spawning and nursery grounds of redfish in Sub-area XIV,
- (v) evaluate biological relationships between Greenland halibut and redfish stocks at East and West Greenland.
- (vi) NAFO scientists should be invited to take part in the evaluation mentioned above".

2. GENERAL COMMENTS TO ASSESSMENTS

2.1 Selection of a Suitable Measure of Fishing Mortality

The Working Group studied the problem of selecting a suitable measure of fishing mortality which could be expressed as a single figure for each year following the suggestions made by the ACFM Study Group on Standard ICES Assessment Computer Programs.

The value of F on the age groups subject to maximum exploitation has been used by the Working Group as reference F on the Y/R curve. For all parts of the assessments, however, this concept is not suitable since in most of the stocks the relevant age groups are fairly old and thereby affected by sampling errors due to reduced availability to the fishery as well as incorrect input Fs on the oldest age groups in the VPA.

The use of average F weighted by stock size would result in considerable computational difficulties in the assessment work. Besides, the generally lower Fs could be misleading, in particular for readers who are not familiar with assessment techniques. The purpose of this method, to reduce error due to variability of individual F estimates, could be achieved by using the unweighted mean over a certain range of age groups, provided that this range is properly selected.

The Working Group, therefore, considered the possibility of relying on the F values for the age groups which are contributing most to the catches. Examination of accumulated catches, in percentage of the total catch, for different combinations of age groups for the two redfish species in Sub-areas V and XIV showed that in general more than 70% of the total catch is covered by at least 10 age groups beginning with age 12.

Since, however, the 50% retention length for the present mesh size corresponds to an age of about 13 years, the Group felt that the range should start at an older age but should contain a sufficient number of age groups in order to be representative for an F value which would be related to effort. Older ages should be avoided in the selected range for the reasons given above.

Following these considerations, the Working Group adopted the age ranges for the calculation of unweighted average fishing mortalities given below:

<u>Stock</u>		<u>Range of Age groups</u>
<u>S. marinus</u>	Sub-areas I+II	13-24
<u>S. mentella</u>	" I+II	8-19
<u>S. marinus</u>	" V+XIV	14-23
<u>S. mentella</u>	" V+XIV	14-23
Greenland halibut	" I+II	7-11
Greenland halibut	" V+XIV	8-13

Where used, this index of F is indicated as  $\bar{F}_{(x-y)}$ , where "x" stands for the youngest age group in the selected range, and "y" for the oldest one.

## 2.2 The Standard ICES Assessment Computer Program

The Group utilised the newly developed VPA program. The program had many options and was easy to use. It definitely lightened the work of the members of the Working Group. One additional option that probably could easily be included in the VPA program would be to have the fishing pattern computed for each year (relative to the fishing mortality on one age group or a specified range of age groups). As for the table with fishing mortalities, one should be able to

specify one (or two) range(s) of years for which the average (unweighted) fishing pattern is calculated. Such an additional table would have been of considerable help for this Working Group.

It also seems somewhat unnecessary to have a print-out of the catch at age and year, the natural mortality values, the mean weight at age, and the maturity proportions in each VPA run. These input data are usually constant throughout the assessment. Unless print-outs of these values are specifically requested, they should be suppressed by default.

Both the yield per recruit program and the catch prediction program should use MORPROP file as default to avoid discrepancies with the spawning stock (biomass) estimates from VPA.

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

#### 3.1 Status of the Fisheries

A further reduction in total redfish catches in the North-East Arctic region was recorded in 1980 (Table 1). The preliminary catch figures in 1980 were 100 972 tonnes compared to 113 620 tonnes in 1979. This was 1 000 tonnes higher than the 1980 TAC of 100 000 tonnes.

The total catch in Sub-area I decreased from 2 482 tonnes in 1979 to 1 713 tonnes in 1980 (Table 2).

In contrast to the previous two years, an increase in catch was observed in Division IIA from 66 323 tonnes in 1979 to 72 629 tonnes in 1980 (Table 3).

In Division IIB, the total catch in 1980 was 26 630 tonnes in comparison with 44 815 tonnes in 1979 (Table 4). Redfish catches were split into Sebastes mentella and Sebastes marinus on the same area basis as used in last year's report. All redfish landings from Division IIB, together with the USSR, German Democratic Republic and Polish catches from the northern part of Division IIA (Kopytov area), are recorded as S. mentella. The total landings in Sub-area I, with the exception of 64% of the USSR catches, together with the rest of the German Democratic Republic, USSR and Polish catches from Division IIA and all catches by other countries are assumed to be S. marinus (Table 5).

Compared to 1979, the total landings in 1980 of S. mentella decreased from 87 145 tonnes to 78 352 tonnes, and those of S. marinus decreased from 26 475 tonnes to 22 620 tonnes. Thus, the catches of S. mentella were 3 000 tonnes below the TAC of 81 000 tonnes, while the TAC of S. marinus was exceeded by about 4 000 tonnes.

#### 3.2 Catch Per Unit Effort and Effort

Catch per hour trawling data were available for the USSR S. mentella fishery for the period 1965-80 (Table 7). These data represent cpue values of the RT type side trawlers (500-1000 BRT). In 1980 some increase in catch per hour trawling was observed for this vessel type in comparison with 1978 and 1979. Using these catch per unit effort values as a standard, the total effort in 1980 was 28% lower than in 1979. In the USSR fishery the number of stern trawlers of the BMRT type ( $\geq 2000$  BRT) and the PST type (1500 BRT) was increased in 1980 compared to 1979. On the other hand, the number of RT-trawlers was reduced in 1980. The cpue data for the BMRT vessel type increased from 1979 to 1980 by 1%.

In addition, catch per unit effort data were available from the German Democratic Republic S. mentella fishery for 1976-80. These data were presented for the Z-stern trawler (995 BRT) both for bottom trawl (OTB) and midwater trawl (OTM) fishery for Divisions IIA (Kopytov) and IIB combined. The data were only available as the monthly catch of S. mentella related to the total effort exerted on all species caught during the month. Therefore, only those months were used for the cpue calculations, when at least 80% of the total catch was S. mentella.

More detailed information on the total S. mentella catch as well as the catch and effort figures used for calculating cpue data of the Z-trawler are given in Table 6. The corresponding cpue data and the derived total international effort in German Democratic Republic units are included in Table 7.

### 3.3 Recruitment (Table 8)

In the International O-Group Survey which began in the Barents Sea in 1965 only two year classes, i.e. the 1967 and 1968 ones, have been estimated as very poor. The 1965, 1971 and 1972 year classes were somewhat below average, while the 1966, 1969 and 1970 year classes were of average abundance. The 1973-78 year classes were estimated as more than average in abundance, and the majority of them were strong. The 1979 and 1980 year classes are the most abundant year classes observed in the O-group survey.

It should be noted that the results of the International O-Group Survey as a whole are in good agreement with the subsequent Soviet judgment based on the findings of the annual young fish surveys.

It is hoped that quantitative indices of abundance derived from the young fish surveys could be submitted to the 1982 meeting of the Working Group.

### 3.4 Age and Length Compositions

For 1980, age and length composition data and age/length keys were available from the Federal Republic of Germany for S. marinus in Division IIA. In addition, Soviet length compositions were available from Sub-area I and Division IIA. Total age composition was calculated by applying the Federal Republic of Germany age composition for Division IIA to the total catch of all countries except USSR. The 1980 USSR length distributions were converted by means of the 1980 Federal Republic of Germany age/length key, which did not contain fish between 20 and 30 cm, and therefore an age/length key from 1975 was used for this age range.

For 1978 and 1979, S. marinus age distributions were adjusted to the revised catches, and for years prior to 1978, the age distributions from last year's assessment were used. Input age composition data for S. marinus are given in Table 9.

For 1978 and 1979 the S. mentella total age distributions were adjusted according to the revised catch figures. For years prior to 1978 the total age distributions were left unchanged. The 1980 S. mentella age compositions comprising 97% of the total catch (number landed) were available from the German Democratic Republic and the USSR. Both age compositions were summed and then raised to the total landings of S. mentella in 1980 (Table 14).

### 3.5 Mean Weight at Age

No new data for weight at age were available for S. marinus. The mean weights used are given in Table 13.



### 3.6 Assessment (*S. marinus*)

#### 3.6.1 Parameters used

Since there were no data on the basis of which the terminal F values could be estimated, a preliminary VPA run was carried out using the same F at age array as in the previous assessment. The result of this came out very close to the assessment of last year. Since the calculated Fs reflected the decrease in catches during previous years and the change in effort from 1979 to 1980 was estimated to be rather small, the Group found no reason for changing terminal Fs.

Natural mortality of 0.1 was used as in the previous assessment.

#### 3.6.2 Stock size

Estimates of stock size in numbers for *S. marinus* are given in Table 11. Total stock biomass (age groups 12 and older) and the spawning stock biomass (age groups 15 and older) (Table 12, Figure 1) were estimated by using the average weight at age data given in Table 13. This assessment shows that both the total stock and the spawning stock decreased steadily since 1974, whereas in the preceding period the stock biomass seems to have been relatively stable.

#### 3.6.3 Fishing mortality

Estimates of fishing mortalities from VPA are given in Table 10. Average fishing mortality at age 13 to 24 in the period 1965-73 fluctuated around the average value of 0.065 following the trend in catches. Since 1974, when catches increased considerably over the previous level, mean F increased to a level around 0.16 for the 1974-79 period.

#### 3.6.4 Yield per recruit

Due to the changes made in the reference F value (see Section 2.1) new yield per recruit and spawning stock biomass per recruit curves were calculated using the data for catch predictions given in Table 13.  $F_{max}$  derived from the curve is 0.24 and  $F_{0.1} = 0.09$  (Figure 2).

#### 3.6.5 Catch predictions

Catches for 1982 and both total stock and spawning stock biomasses for 1983 have been calculated for different levels of F in 1982 (Figure 3). These calculations are based on the assumption that the 1981 TAC for *S. marinus* of 19 000 tonnes will be taken. This catch level is generating a fishing mortality of 0.119 in 1981.

Parameters used for the catch predictions are given in Table 13. Recruitment at age 12 from the VPA was averaged over the years 1965-77 and this average value was used in predictions for the years 1981, 1982 and 1983. The results of the calculations are given in Figure 2 and in the following text table for the management options suggested by ACFM:

1981				Management option for 1982	1982				1983	
Stock biom.	Spawning stock biom.	$\bar{F}$ (13-24)	Catch		Stock biom.	Spawning stock biomass	$\bar{F}$ (13-24)	Catch	Stock biom.	Spawning stock biomass
188	149	.119	19.0	$F_{0.1}$	194	133	.09	14.4	207	124
				$F_{max}$			.24	35.8	185	106
				$F_{82} = F_{80}$			.138	21.5	200	118
				$F_{82} = F_{81}$			.119	19	203	120

Weights in thousand tonnes.

Stock biomass = fish at age 12 and older.

Spawning stock biomass = fish at age 15 and older.

Under Option 1 (fishing at the  $F_{0.1}$  level) the total biomass will increase above the 1981 level by about 10% while the spawning stock decreases by 17%.

Fishing at  $F_{max}$  (Option 2) would reduce the total stock biomass by 2% and the spawning stock biomass by about 29%.

Under Option 3 (the same  $\bar{F}$  as in 1980) the total stock biomass increases by 6% while the spawning stock biomass decreases by about 21%.

Option 4 (the same  $\bar{F}$  as in 1981) provides a catch of 19 000 tonnes in 1982, which is the same as the TAC for 1981. Under this option, the total stock biomass increases from the 1981 level by about 8%, while the spawning stock biomass is reduced by 19%.

### 3.7 Assessments (Sebastes mentella)

#### 3.7.1 Parameters used

In a preliminary VPA run the terminal fishing mortality for 1980 was set equal to the value estimated in last year's assessment for 1979 and the same exploitation pattern was applied. From the preliminary VPA, the average fishing mortality for each year was calculated as the unweighted mean of  $F$ s over age groups 8 to 19. This  $F_{(8-19)}$  was considered to be a suitable measure of fishing

mortality by the Working Group, because these age groups contribute most to the catches of S. mentella in Divisions IIa and IIb.  $\bar{F}_{(8-19)}$  for 1980 in the preliminary run was 0.204. This value corresponds to  $F = 0.23$  on age groups subject to maximum exploitation.

A linear regression between the estimated mean  $F$  values and the USSR total trawl effort for the period 1965-77 was calculated and the mean terminal  $F$  in 1980 was estimated from the regression (Figure 4). The predicted value for 1980 of  $F = 0.20$  corresponds to the mean  $F$  in the preliminary run.

Furthermore, regression lines were calculated between total effort in German Democratic Republic units (both OTM and OTB) and the estimated mean fishing mortality (Figure 5). High correlation between  $\bar{F}_{(8-19)}$  and total effort for the period 1976-79 was found and the predicted  $\bar{F}_{(8-19)}$  for 1980 was close to  $F = 0.20$ , i.e. the same value as resulted from the regression of mean  $F$  against the USSR effort and the one used in the preliminary run. It was therefore decided by the Working Group to accept 0.20 as the final input fishing mortality.

The exploitation pattern was left unchanged except for age groups 6 to 8 where slight modifications were made in order to better comply with the average recruitment level at age 6 in 1978-80.

Natural mortality of 0.1 was used as in the previous assessment.

### 3.7.2 Stock size

Estimates of stock size in numbers from VPA are given in Table 16. In addition, the total stock biomass (age 6 and older) and the spawning stock biomass (age 15 and older) were calculated using mean weights at age given in Table 18 (Table 17, Figure 6).

According to the VPA estimates the total stock biomass steadily increased from a level of 279 000 tonnes in 1965 to 1 004 000 tonnes in 1975 - the highest level on record. After 1975, a decline in total biomass to 651 000 tonnes in 1978 was observed, obviously as a result of the high catches taken in 1975-77. Since then biomass increased slightly to a level of 668 000 tonnes in 1980. A similar, but less pronounced, trend was observed in the size of the spawning stock biomass over the same period 1965-80. The 1980 spawning stock biomass was estimated at 91 000 tonnes.

### 3.7.3 Fishing mortality

Estimates of fishing mortalities from VPA are given in Table 15. Calculated mean fishing mortality on age groups 8 to 19 in the period 1965-74 fluctuated around 0.08, but increased to about 0.46 in the 1975-77 period. Following the trend in the total effort the estimated mean fishing mortality for the years 1978-80 decreased to a level of around 0.20.

### 3.7.4 Yield per recruit

In Figure 7 yield per recruit and spawning stock biomass per recruit curves are plotted against mean  $F$  values calculated over age groups 8 to 19 (the new reference  $F$  value) using the 1980 exploitation pattern. The curves were calculated using mean weights at age as given in Table 18, the  $F_{0.1}$  and  $F_{max}$  values are 0.10 and 0.21, respectively. The effect of the slight adjustments in the 1980 exploitation pattern is almost negligible. The major difference from last year's assessment results from the use of a new reference

F value. Therefore, the fishing mortality in 1980 of 0.20 was close to the  $F_{max}$  level.

For  $F_{0.1}$  and  $F_{max}$ , the corresponding sustainable yield and equilibrium spawning stock biomass were calculated using the average recruitment level  $R_6 = 410 \times 10^6$  at age 6 for the period 1965-77. The results are given in the text table below.

F	Y/R (kg)	Sustainable yield (t x 10 <sup>-3</sup> )	S/R (kg)	Spawning stock biomass (t x 10 <sup>-3</sup> )
$F_{0.1} = 0.10$	0.224	92	1.042	428
$F_{max} = 0.21$	0.244	100	0.320	131

For comparison the TAC for 1981 was set at 70 000 tonnes and the spawning stock biomass at the beginning of 1981 was estimated to be 87 000 tonnes.

### 3.7.5 Catch predictions

Catch predictions were calculated for 1982 using the exploitation pattern and the mean weight at age data given in Table 18. The stock size at the beginning of 1981 is estimated from the stock size and fishing mortalities in 1980.

For catch predictions it was assumed that the recommended TAC of 70 000 tonnes will be taken in 1981. The 1981 TAC would be achieved by a fishing mortality of  $\bar{F}_{(8-19)} = 0.16$ , which corresponds to that estimated in last year's report (Doc. C.M.1980/G:4).

The average recruitment for 1965-77 of  $410 \times 10^6$  fish at age 6 was used in the predictions for the years 1981-83. The results of the catch predictions are shown in Figure 8. The possible catch in 1982, spawning stock biomass and total stock biomass at the beginning of 1983 are plotted against the mean F in 1982 and also against the fishing mortality rate expressed as proportion of that estimated for the year 1980.

Furthermore, the following options of fishing mortality in 1982 were selected as reference points:

- Option 1: fishing at  $F_{0.1}$
- Option 2: fishing at  $F_{max}$
- Option 3: fishing at the 1980  $\bar{F}$  level
- Option 4: fishing at the 1981  $\bar{F}$  level, which also corresponds to the F recommended by the ACFM for 1981
- Option 5: fishing at an  $\bar{F}$  level which corresponds to a TAC of 70 000 tonnes in 1982.

The results are summarised in the text table on page 9.

1981				Management option for 1982	1982				1983	
Stock biom.	Spawning stock biom.	$\bar{F}$ (8-19)	Catch		Stock biom.	Spawning stock biomass	$\bar{F}$ (8-19)	Catch	Stock biom.	Spawning stock biomass
690	87	.16	70	$F_{0.1}$	726	93	.10	50	785	113
				$F_{max}$			.21	100	730	99
				$\bar{F}_{82} = \bar{F}_{80}$			.20	97	733	100
				$\bar{F}_{82} = \bar{F}_{81}$			.16	76	757	106
				TAC 70 000 t			.14	70	765	107

Weight in thousand tonnes.

Stock biomass = fish at age 6 to 24.

Spawning stock biomass = fish at age 15 to 24.

Under all options the spawning stock biomass as well as the total stock biomass are expected to increase over the 1978-81 level.

In considering the management options in the table above, it should be noted that a continuation of a TAC level of 70 000 tonnes in 1982 would also be in accordance with ACFM's general management strategy to reduce fishing mortality stepwise towards  $F_{0.1}$ . Reducing the fishing mortality to the  $F_{0.1}$  level in 1982 would imply a considerable reduction in the catch, and the additional benefit to the stock and spawning stock biomass would be small compared to the option producing a stable TAC-level of 70 000 tonnes.

The other three options require continuation of or increase in fishing mortality in 1982 compared to 1981.

#### 4. REDFISH IN SUB-AREAS V AND XIV

##### 4.1 Status of the Fisheries (Tables 19-25)

The total catch from the Irminger Sea redfish stock complex increased from 97 902 tonnes in 1979 to about 114 000 tonnes in 1980, i.e. by about 16.5%.

The catch increased in Division Va and Sub-area XIV but decreased in Division Vb. In Division Va (Iceland) the Icelandic fleet increased fishing effort in 1980 and their catch increased from 62 253 tonnes to about 68 500 tonnes. About 2 600 tonnes were taken by other nations in Division Va.

The fishing pattern of the Icelandic trawler fleet was similar to that in 1979. The increased effort (due to greater restrictions in the cod fishery) was directed more to the area SW of Iceland than to other areas.

In Division Vb (Faroe Islands) catches decreased from 12 674 tonnes in 1979 to about 10 000 tonnes in 1980, which is about the 1978 level. Catches of the Federal Republic of Germany fleets declined from 6 108 tonnes to about 3 800 tonnes due to quota allocations.

No catch figures have been reported by France. Since, however, it is known that French vessels have been fishing in Division Vb, an estimated amount of the same order as the catch reported for 1979 was assumed to be taken.

In Sub-area XIV (East Greenland) the increase in total catch was the greatest, from 20 918 tonnes in 1979 to about 33 000 tonnes in 1980, i.e. by about 58%. The catches in Sub-area XIV were almost completely taken by the Federal Republic of Germany fleets, as in 1979.

Over the last few years there has been a trend in the fishing pattern in Sub-area XIV towards catching the younger age groups of both species, particularly of S. mentella. Before 1976, S. mentella at age 12 years and younger were scarcely found in the landings, whereas in 1980 about 23% of the total number landed of this species belonged to those age groups. This could partly be explained by reduced discarding of small redfish; however, the main reason seems to be the increased effort in areas where relatively small redfish are abundant.

#### 4.2 Recruitment of Redfish in the Irminger Sea Area

In 1980 most of the 0-group redfish were observed on the banks off East Greenland and in the Dohrn Bank region. In contrast to most previous years there were practically no 0-group redfish in the Central Irminger Sea. The 1980 0-group survey was carried out during the same period of time as usual, and earlier than the 1979 survey, which was delayed by, approximately, a fortnight compared to previous years.

In general, 0-group redfish were unusually abundant in the Icelandic area, especially off the north coast. Nevertheless, the total abundance index of 0-group redfish was only  $3.0 \times 10^6$  fish per nautical square mile and thus the second lowest index figure on record.

The year to year fluctuations in the abundance of 0-group redfish are presented in the following text table as index figure of individuals per nautical square mile.

Number of 0-group redfish  $\times 10^6$  per nautical square mile

Year class	No. of fish
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

Although the year 1979 was rather exceptional because of the timing of the survey, there appears to be a strong decline in the recruitment of redfish in the Irminger Sea area in recent years.

The analysis of redfish fry by species indicated that S. marinus fry amounted to 47.2% of the total compared to 38.7% in 1979. In general, S. marinus were mainly found on the banks off East Greenland, while S. mentella dominated in the Dohrn Bank region and west of Iceland.

#### 4.3 Splitting of Catches into S. marinus and S. mentella Components

In Division Vb all the Federal Republic of Germany catches were S. mentella according to observations on landings. Of Faroese catch 89.76% were reported as S. marinus and 10.24% as S. mentella in accordance with samples taken from landings. Due to the nature of the fishery, estimated French catches have been allocated to S. mentella.

In Division Va the Icelandic catches were allocated into S. marinus and S. mentella components in proportion 85.4% to 14.6%. These figures were derived from observations on landings and conform to the figures derived by that method used in the last two years' reports (i.e., an area and depth stratification). The catches of Faroe Islands and Belgium are in accordance with their fisheries allocated to S. marinus.

In Sub-area XIV the total catches are allocated in the same proportions as observed in the landings of the Federal Republic of Germany, i.e., 32.19% and 67.81% for S. mentella and S. marinus respectively.

#### 4.4 Length and Age Compositions

Division Va: Length frequencies from the Icelandic catches in 1980 were available for both species and have been used to calculate the length distribution of total catches of each species in Division Va.

Division Vb: Data on length compositions of the 1980 catches from the Faroe Islands were available for both species in 5 cm groups. They were split in 1 cm groups on the basis of length composition data obtained from Faroese landings in the Federal Republic of Germany. The length composition of the total catch for S. marinus was calculated by using these data, and that for S. mentella by using the Federal Republic of Germany data.

Sub-area XIV: Data on length compositions of the 1980 catches by the Federal Republic of Germany were available for both species and were used to calculate the length distributions of the total catch.

Age/length keys: Age/length keys were available for both S. marinus and S. mentella in Sub-area XIV from samples of the fishery of the Federal Republic of Germany. Since there were no age/length keys available for the fishery in Division Va, the age/length keys for both species from Sub-area XIV were used to calculate the numbers at age. As the 1980 age/length keys for S. mentella did not cover all length frequencies in the Division Va material, an age/length key for 1979 and 1980 combined was used for fish longer than 39 cm. In Division Vb an age/length key of the Federal Republic of Germany for S. mentella was applied, whereas for S. marinus the age/length key presented to the Group in 1979 was used to calculate the numbers at age, because of very limited sampling in 1980.

The summed age compositions of the total catches in Sub-areas V and XIV are given in Table 26 for S. marinus and in Table 31 for S. mentella.

#### 4.5 Assessments

As in previous years, no data were available on effort, catch per unit of effort and survey results, which could give fishing mortality estimates for 1980. Therefore, only qualitative information on changes in fishing effort and area distribution could be considered and evaluated against earlier situations.

##### 4.5.1 S. marinus

###### 4.5.1.1 VPA

For the selection of terminal 1980 Fs in the VPA the Working Group considered the ratio of the catch in 1978 and 1977 to the 1980 catch assuming that the total recruited biomass was almost stable. In a preliminary VPA run with  $F_{(14-23)} = 0.25$  for 1980, the ratio of the corresponding values for 1977 and 1978 was approximately the same as the ratio of the catches. This value is about 37% higher than that used as terminal F for the 1980 assessment on the 1979 catches.

No changes have been made in the weight at age data since there was no trend in the ratio of actual catches to the calculated catches using weight at age data. For 1980 the SOP was only 2% higher than the nominal catch. The exploitation pattern has been revised during the 1980 meeting of the Working Group and there was no reason for a further revision.

The input data for the VPA are given in Table 26, the detailed results are given in Tables 27 and 28 and are summarised in Figure 9 and Table 29.

Fishing mortalities increased in 1979 and 1980 over the previous level as a result of the high catches in these years. The corresponding figures from the 1980 report, which are weighted means for ages 16-30, are not directly comparable to those given in the present report as unweighted average over the ages 14 to 23 (see Section 2.1). The level of the total recruited biomass in the present assessment is somewhat higher compared to the 1980 report due to good recruitment and shows an increasing trend since 1973. However, these figures should be considered with caution since they may be influenced by the terminal F values in the VPA. The estimated spawning stock biomass, however, is lower compared to the previous assessment, indicating that fishing mortality might have been underestimated for 1979 in that assessment.

###### 4.5.1.2 Yield per recruit (Figure 10)

Due to the changes made in the reference F new curves for yield per recruit and spawning stock biomass per recruit had to be calculated, using the exploitation pattern and mean weight at age given in Table 30.

As previously, the Y/R curve has no maximum within the normal range of fishing mortalities on this stock. The curve approaches the top level at  $F_{(14-23)} = 0.25$ , i.e. the value estimated for 1980, and  $F_{0.1} = 0.1$ .



4.5.1.3 Catch predictions

The basic data used in the catch predictions are given in Table 30. Average recruitment of 9 year old fish over the years 1967 to 1975 was used for the years 1981-83.

The total catch in 1981 of S. marinus from the Irminger Sea stock complex was assumed to be in the same order of magnitude as in 1980, possibly slightly higher. In the absence of effective management measures for 1981 limiting the catches in Sub-areas V and XIV, it is to be expected that the increasing trend in effort observed in 1979 will continue. On this basis a catch figure of 90 000 tonnes in 1981, associated with an  $\bar{F}_{(14-23)}$  of 0.244, was applied to the catch predictions.

The results of the calculations are given in Figure 11, and in the following text table with reference to the management options suggested by ACFM and those which the Working Group felt worthwhile to discuss.

1981				Management option for 1982	1982				1983	
Stock biom.	Spawning stock biom.	$\bar{F}_{(14-23)}$	Catch		Stock biom.	Spawning stock biomass	$\bar{F}_{(14-23)}$	Catch	Stock biom.	Spawning stock biomass
1 017	291	.244	90	$F_{0.1}$	996	293	.10	40	1 025	332
				$\bar{F}_{82} = 0.8 \times \bar{F}_{80}$			.20	78	985	305
				$\bar{F}_{82} = \bar{F}_{80}$			.25	94	970	292
				$\bar{F}_{82} = \bar{F}_{81}$			.244	93	970	293
				TAC 90 000 t			.236	90	974	295
				TAC 82 = TAC 81 <sup>1)</sup>			.15	60	1 005	315

Weights in thousand tonnes      1) ACFM recommendation.

Stock biomass = fish at age 9+.

Spawning stock biomass = fish at age 16+.

Under no option is the spawning stock biomass expected to decrease below the level estimated for the beginning of 1981, which is about 15% above the 1980 level. But only the options associated with  $F_{0.1}$  and with a TAC level as recommended by ACFM for 1981 would result in a noticeable increase in the spawning stock biomass.

For the consideration of management measures it should be kept in mind that long-term maintenance of the high catch level associated with high and probably increasing fishing mortalities would result in a decline in the spawning stock biomass as can be seen from the SSB/R curve. Under these conditions, and assuming the average recruitment of 187 million fish, as used in the catch prediction, the long-term equilibrium SSB would be about 230 000 tonnes, i.e. about 20% below the 1981 level and about 10% below the lowest level on record (1977 and 1980). Long-term management at  $F_{0.1}$  would increase the SSB to the level of 1967 and earlier years, i.e. 460 000 tonnes. Total recruited biomass in 1983 resulting from the 1982 fishery has to be considered in the light of the comments made on the VPA results in Section 4.5.1.1.

Long-term catch levels associated with the reference points on the yield curve are about 60 000 tonnes to 65 000 tonnes for  $F_{0.1}$  and  $F_{(13-24)}$  in 1980, respectively, assuming the average recruitment over the years 1967-75. This could be interpreted as an indication that the high catches in the late 1960s have been taken from accumulated stocks and that future expectations on catch levels have to be reduced if a viable fishery is to be maintained.

#### 4.5.2 S. mentella

##### 4.5.2.1 VPA

The increase in effort reported from Division Va for 1979 was mainly directed to S. marinus and the increase in catch of S. mentella was considered as by-catch. In 1980 the situation was similar in the fishery at Iceland. However, catches of S. mentella decreased in Division Vb by about 35%, whereas in Sub-area XIV there was an increase in 1980 by 100% from 5 300 tonnes to 10 600 tonnes, while an increase in the catch of S. marinus was only by about 40%. This indicates that the increased effort in Sub-area XIV was partly directed towards S. mentella and, as shown by the size composition of the catches, mainly towards smaller fish.

For the estimation of terminal F for 1980 in the VPA the Working Group followed the same approach as in the case of S. marinus (see Section 4.5.1.1). The resulting  $\bar{F}_{(14-23)} = 0.26$  is of the same order as that in 1979 and somewhat below the highest values in 1976 and 1977. The input data for the VPA are given in Table 31, the results are given in Tables 32 and 33, and are summarised in Figure 12 and Table 34. The downward trend in SSB, which has been shown in the previous assessments, has continued in 1980. The estimated total recruited biomass from the VPA seems to have been biased due to high F values on age groups 9 and 10 since they resulted in unrealistically low recruitment figures for 1979 and 1980. Recruitment at age 9 was, therefore, taken as the average over the years 1967-75, i.e. 60 million fish and the estimates of the stock numbers, biomass estimates and Fs were adjusted accordingly. The adjustments are given in the relevant tables.

The exploitation pattern has been examined and, as was the case last year, there was no indication of a need to change the relative F values. However, considering the catch composition in 1980 compared to previous years, there might in future be a need for a close examination of this parameter if this trend is going to continue.

Comparison of the sum of products (catch numbers x average weight) with nominal catches did not show a particular trend before 1975 although almost all calculated catches have been slightly higher than the nominal catches. However, since 1978 there might be a trend towards SOP being smaller than the nominal catches. This trend could be associated with changes in the size composition of the catches as indicated by the extreme discrepancy of 64% in 1976 where more than 70% of the catch in numbers were prespawning fish. The Group felt that it would be premature to adjust the weight figures derived from average weights per age group before the trend is really established.

4.5.2.2 Yield per recruit (Figure 13)

Due to the changes made in the reference F value (see Section 2.1) new curves for yield per recruit and spawning stock biomass per recruit had to be calculated, using the exploitation pattern and mean weight at age data given in Table 35. The Y/R curve has a maximum at  $F_{max} = 0.18$ ,  $F_{0.1} = 0.09$  and the  $\bar{F}(14-23)$  for 1980 is beyond  $F_{max}$ .

4.5.2.3 Catch predictions

The basic data used in the catch predictions are given in Table 35. Average recruitment at age 9 over the years 1967-75 of 60 million fish derived from the VPA run was applied. The estimated catch level of 25 000 tonnes of S. mentella in Sub-areas V and XIV is at the same level as that of 1980 and corresponds to the TAC recommended by ACFM. The results of the calculations are given in Figure 14 and the predictions of catch in 1982 and stock biomass in 1983 for several options are given in the text table below.

1981				Management option for 1982	1982				1983	
Stock biom.	Spawning stock biom.	$\bar{F}$ (14-23)	Catch		Stock biom.	Spawning stock biomass	$\bar{F}$ (14-23)	Catch	Stock biom.	Spawning stock biomass
181	55	.282	25	$F_{0.1}$	173	58	.09	8.4	182	77
				$F_{max}$			.18	16.0	174	72
				$\bar{F}_{82} = \bar{F}_{80}$			.26	22.4	167	67
				$\bar{F}_{82} = \bar{F}_{81}$			.28	24.0	165	66
				TAC 82 = TAC 81 <sup>1)</sup>			.295	25.0	164	65

Weights in thousands t. 1) Recommended by ACFM.  
 Stock biomass = fish at age 9+.  
 Spawning stock biomass = fish at age 16+.

Under all options the spawning stock biomass at the beginning of 1983 is expected to be higher compared to the 1980-82 level due to relatively good recruitment to the spawning stock. However, it should be noted that the SSB is on very low levels compared to previous years.

Total recruited biomass is expected to decrease by the beginning of 1983 below the level estimated for 1981 under all options except that of  $F_{0.1}$ . In considering these values, the adjustments referred to in Section 4.5.2.1 should be kept in mind.

Long-term yield estimated from average recruitment as used in the catch predictions is about 15 000 tonnes and 17 000 tonnes for  $F_{0.1}$  and  $F_{max}$  respectively. The corresponding figures for the spawning stock biomass are 114 000 tonnes and 66 000 tonnes. As in the case of S. marinus this can be taken as an indication that the high yields of S. mentella in the late 1960s were taken from accumulated stocks, and that expectations on future yields have to be reduced.

## 5. GREENLAND HALIBUT IN SUB-AREAS I AND II

### 5.1 Status of the Fisheries

The total nominal catch for the main fishing areas for the North-east Atlantic are included in Table 36 for 1970-80. The nominal catches by country for Sub-area I and Divisions IIa and IIb are given in Tables 37-39. In Table 40 the catches are summarised for Sub-areas I and II.

The catch from this stock reached a maximum of 89 484 tonnes in 1970. TACs were introduced in 1978, when the TAC was set at 40 000 tonnes. TAC had to be reduced to 25 000 tonnes in 1979. The total catch in 1980 was 13 214 tonnes, i.e. 6% below the TAC of 14 000 tonnes.

### 5.2 Catch Per Unit Effort and Effort

Catch per hour trawling data were available from the USSR RT and SRTM-1000 vessels for the period from 1965 to 1980 (Table 41).

Catch per unit effort from Norwegian wet fish trawlers were calculated for the statistical areas 12, 20 and 39 in the national statistics. These areas are near the Bear Island in Division IIa (12 and 39) and IIb (20).

The catch and the corresponding effort directed towards Greenland halibut were calculated by pooling the data for those days in the three-months period from September to November when at least 80% of daily catches (by weight) consisted of Greenland halibut. The statistical areas 12, 20 and 39 were selected because they are adjacent to each other, and the main directed catch (according to the definition above) is taken from these areas. The period September-November was chosen because this is the main fishing season for Greenland halibut, and cpue does not show a definite trend throughout these months. The cpue data for Norwegian trawlers for 1973-79 are given in Table 41.

Data on catch per day trawling in October in Division IIb by German Democratic Republic freezer trawlers were given in last year's report (Doc. C.M.1980/G:4, Table 37). For the current meeting, the German Democratic Republic data were available on a monthly basis. The cpue data from German Democratic Republic freezer trawlers were recalculated by taking the pooled catch and

effort data for those months during the September-November season when Greenland halibut made up at least 80% of the total monthly catch (by weight). These revised cpue data from Division IIB are given in Table 41.

Figure 15 shows the available cpue data from 1973 onwards. Both the original and the revised cpue data from the German Democratic Republic freezer trawlers are given. The revision of the German Democratic Republic cpue data particularly affected the values for 1973, 1974 and 1980. The revised cpue was reduced in 1973 and 1974 compared to the previously given German Democratic Republic cpue figures, and increased in 1980 (Figure 15). In Figure 16 the ratios between the available cpue series are shown. For the period from 1973-79, for which data from all the above countries are available, the trend in the revised German Democratic Republic data seem to be in a better agreement to the USSR and the Norwegian cpue data than the previously given German Democratic Republic cpue data. It was felt that the revised German Democratic Republic cpue data were more representative, and it was decided to use these cpue data (Table 41) instead of the previously used German Democratic Republic cpue data (Figure 15 and Doc. C.M.1980/G:4, Table 37).

Figures 15 and 16 indicate that the three accepted cpue data series are of the same quality. A new cpue was, therefore, derived using the following method. Firstly, the three cpue series were re-calculated relative to the respective averages for the period 1973-79. Based on the assumption of the same quality of these national cpue data, a new calibrated cpue series (Table 41) was derived as the unweighted average of the revised cpue's. This new cpue series was used in the assessment. The total international effort index was calculated by the formula (total catch/cpue) x 10<sup>-3</sup>. These effort data (Table 41) are the only ones referred to in the assessment.

In addition, the catch per unit effort of 7 years and older fish by trawlers was calculated by the formula:

$$\text{Cpue}_{7+}^j = \left( \sum_{i=7}^{16+} C_{i,j,\text{trawlers}} \cdot W_{i,j} \right) \cdot (\text{TNC/SOP})_j \cdot (\text{Cpue/TNCT})_j$$

where:  $C_{i,j,\text{trawlers}}$  = the catch in numbers of age  $i$  in year  $j$  by trawlers

$W_{i,j}$  = mean weight

TNC = total nominal catch of all age groups

TNCT = total nominal catch by trawlers

SOP = sum of products.

The results are given in Table 41.

### 5.3 VPA

#### 5.3.1 Age compositions

The age composition for 1979 was adjusted according to the revised catch statistics. For 1980, age compositions were available for the trawl catches of the German Democratic Republic, Norway and the USSR. The sum of these were raised to the total landings of the trawl fisheries.

The catches from the Norwegian gillnet fishery were pooled with the longline catches and the age composition of the longline fishery was raised correspondingly. In the estimation of the total number caught by the German Democratic Republic and Norway in 1980, the mean weights for 1979 from last year's report (Doc. C.M.1980/G:4, Table 40) were used (Table 42).

All age compositions available for 1979 represent 88% of the total landings in Sub-areas I and II. The total age compositions for 1970-80 are given in Table 44.

### 5.3.2 Mean weight at age

The two sets of mean weights used in last year's assessment for the period up to 1978 and for 1979 were left unchanged for this year's assessment. The USSR provided mean weights for 1980 which were used for this year. Table 42 gives the mean weights used. Table 43 gives the ratio between the nominal catch and the sum of products.

The mean weights for 1980 seem to be closer to those applied to the period 1970-78 than those used for 1979.

### 5.3.3 Estimation of the input fishing mortalities for 1980

As in previous reports, a constant natural mortality of 0.15 was used. Because of the consistently increasing trend of fishing mortalities after the age of 11, the Group considered it appropriate to have this trend reflected in the input fishing pattern for 1980. Therefore, it was decided to let the average fishing pattern in 1970-78 from a preliminary run on the 7 to 16+ year olds be the basis for the input fishing mortalities on the same age groups in 1980. As in previous years, the unweighted average fishing mortality on the 7 to 11 year olds was selected as the standard.

The  $\bar{F}(7-11)$  for 1980 was chosen by comparing  $\bar{F}(7-11)$  for 1970-78 with the total effort (calculated from the new average cpue index), and taking the linear regression between cpue7+ (Table 41) and the biomass of 7 year old and older fish in the mid-fishing season. The stock compositions in the mid-fishing season were estimated by applying half of the fishing mortality and natural mortality to the stock as estimated at the first of January, for the respective years and age groups.

An  $\bar{F}(7-11) = 0.16$  was the best estimate as determined from Figures 17 and 18. In Figure 18 a linear regression was found appropriate since the 1980 value was based on an interpolation. In Figure 17 a linear regression would imply an extrapolation in the estimate of  $\bar{F}(7-11)$  from the estimated total effort in 1980 outside the observed values. The linear regression line has a high intercept and since no fishing by definition would imply no fishing mortality, it was considered more appropriate to estimate the  $\bar{F}(7-11)$  in 1980 from a straight line through the origin and the mean for the years 1970 to 1978 in this particular case. With this procedure  $\bar{F}(7-11) = 0.16$  for 1980 fitted well with resulting relations both in Figures 17 and 18.

For the input fishing mortalities on the 4 to 7 year olds, it was decided to apply the average fishing pattern of 1977 and 1978. The fishing mortalities on the 3 year olds were chosen so that the recruitment in 1980 was kept at the same level as in the previous years.

In accordance with the new fishing pattern for the 7-16+ year olds, the fishing mortality on the oldest true age group was iteratively

set equal to 2.5 times the resulting  $\bar{F}(7-11)$  for the years 1970-79.

The resulting fishing mortalities and stock in numbers for 1980 and the previous years are given in Tables 45 and 46.

The resulting relation between cpue and biomass of 4 years and older in the mid-fishing season (1970-78) confirms the validity of the chosen input parameters (Figure 19). The resulting fishing mortality patterns are shown in Figure 20.

The 1979 season was excluded from this comparison (Figures 17-19), since the fishing pattern in 1979 (Figure 20) seems rather anomalous compared to previous years. It was not possible to get both the 1980 and the 1979 fishing patterns compatible with previous years' fishing pattern. The age composition of the catches in 1979 is more concentrated on younger age groups than in the other years (Table 44). Although there has evidently been a slight increase in the exploitation of 4 to 6 year olds over the years 1970-78 (Figure 20), it was felt that it was not appropriate to adjust the 1980 fishing pattern according to the 1979 situation.

The Working Group could not explain the apparent differences in 1979 and deferred that as a matter for next year's meeting when more data would be available.

Figure 21 shows the catches, mean fishing mortality for age groups 7 to 11 and trends in the total stock (fish at age 3 and older), as well as the spawning stock (fish at age 9 and older) biomasses.

#### 5.4 Yield per Recruit (Figure 22)

The yield and spawning stock per recruit were calculated for the 1980 fishing pattern and mean weights (Table 47). For the present exploitation pattern  $F_{0.1} = 0.12$  and  $F_{max} = 0.24$ . These are somewhat below those estimated in last year's report ( $F_{0.1} = 0.14$  and  $F_{max} = 0.26$ ). The difference is likely to be due to changes resulting from the new mean weights which were applied, and, to some extent, to the new exploitation pattern.

The estimated fishing mortality in 1980 of 0.16 is close to the  $F_{0.1}$  value.

The yield and the spawning stock under equilibrium conditions using an average recruitment at age 3 in 1975-79 of  $30 \times 10^6$  (Table 46) are calculated for three different values of  $F$  in the text table below.

$F$	Y/R (kg)	Sustainable yield (tonnes)	S/R (kg)	Spawning stock biomass (tonnes)
$F_{0.1} = 0.12$	0.571	17 100	2.81	84 000
$F_{80} = 0.16$	0.606	18 200	2.21	66 000
$F_{max} = 0.24$	0.625	18 800	1.43	43 000

For comparison the TAC for 1981 has been set at 12 000 tonnes, and the spawning stock (9 years and older) at the beginning of 1981 is estimated to be 43 000 tonnes.

5.5 Catch Predictions

The stock was projected to the beginning of 1983 assuming that the TAC of 12 000 tonnes in 1981 will be taken. The average recruitment for 1975-79 of  $30 \times 10^6$  fish at age 3 was used both for 1981 and 1982 and the catch prediction parameters are given in Table 47.

The catch in 1982 for four alternative fishing mortalities, and the resulting total stock (3 years and older) and the spawning stock (9 years and older) in 1983 are given in the text table below. Figure 23 shows the same parameters as a function of the fishing mortality in 1982.

1981				Management option for 1982	1982				1983	
Stock biom.	Spawning stock biomass	$\bar{F}(7-11)$	Catch		Stock biom.	Spawning stock biomass	$\bar{F}(7-11)$	Catch	Stock biom.	Spawning stock biomass
125	48	.141	12.0	$F_{0.1}$	134	54	.12	11.6	143	59
				$F_{max}$			.24	21.6	132	51
				$\bar{F}_{82} = \bar{F}_{80}$			.16	15.1	139	56
				$\bar{F}_{82} = \bar{F}_{81}$			.141	13.4	141	58

Weights in thousand tonnes.

Stock biomass = fish at age 4 and older.

Spawning stock biomass = fish at age 9 and older.

A TAC of 12 000 tonnes in 1982 as in 1981 would bring the fishing mortality close to the estimated  $F_{0.1}$  of 0.12, and it would allow the stock to rebuild. A decline in the spawning stock and the total stock has occurred since 1970 (Figure 21). The stock in 1970 was probably also considerably lower than the stock in the mid-1960s as indicated by the cpue in the USSR fishery (Table 41). Thus, the fishing mortality level in 1982 at around  $F_{0.1}$  seems to be advisable.

6. GREENLAND HALIBUT IN SUB-AREAS V AND XIV

6.1 Status of the Fisheries

The total nominal catch figures by country for Divisions Va and Vb, Sub-area XIV and Sub-areas V and XIV combined are presented in



Tables 48-51 for 1970-80. During this period the total catches ranged from 6 045 tonnes (1976) to 36 280 tonnes (1974) with a mean of 26 125 tonnes (Figure 24). Since the drop in 1976 the total catches increased steadily each year to a level of 31 157 tonnes in 1980 in which 90% of the total were taken by Iceland.

6.2 Catch per Unit Effort

Catch per unit effort data were not available.

6.3 VPA

6.3.1 Age compositions

Age compositions of the catches from 1975 to 1978 were left unchanged from the report of 1979 (Doc. C.M.1979/G:8).

In 1979 and 1980 the catches in Sub-areas V and XIV were almost entirely taken by otter trawl with a minor portion of the Icelandic catch taken by longline.

For 1979, age and length samples were available from Icelandic commercial catches both by gear and by sex. Since no other age/length data were available, these Icelandic data were applied to the total landings for 1979.

For 1980, age compositions were available from Division Va (Icelandic data) and from Sub-area XIV (the Federal Republic of Germany data). The Icelandic samples were aged up to 18 years old whereas the Federal Republic of Germany samples were not aged beyond 10 years old with the remainder accumulated in the age class 10+. The Icelandic data were used to break down by age composition all catches in Sub-area V. In Sub-area XIV landings were broken down by the Federal Republic of Germany age composition up to age 10 years and by the Icelandic data beyond age 10 years. Since the landings in Sub-area XIV were small relative to those from Sub-area V, it was felt that a breakdown by this method would not introduce a serious bias into the total landings by age from the stock area as a whole.

The total landings by age are given in Table 52.

6.3.2 Parameters used

Due to the lack of catch per unit effort data a definitive value for the present level of fishing mortality was impossible to obtain. A catch curve (Figure 25) was, however, constructed by combining the 1975-80 data in order to give some indication of the average fishing mortality over the past 10 years. A value of  $F = 0.36$  (assuming  $M = 0.15$  - as used in the past years) was derived with a correlation coefficient on the regression of  $r = 0.99$ . This  $F$  value represents average removals of about 23 000 tonnes annually over the past 10 years. An  $F$  value of 0.35 was considered to be possibly in the neighbourhood of the true value, since  $\bar{F}$  on the fully recruited age groups for 1975 was close to the value derived from the catch curve and the catch in 1975 was almost the same as the long-term average of 23 000 tonnes.

As the catch in 1980 (31 157 tonnes) was considerably higher, the terminal  $F$  might be too low.

From the preliminary VPA, the average fishing mortality for each year was calculated as unweighted mean  $F$ s on age groups 8 to 13 (Table 53). This  $\bar{F}_{(8-13)}$  was considered as a suitable measure of fishing mortality by the Working Group, because these age groups contribute most of the catches. The corresponding  $\bar{F}_{(8-13)}$  for 1980 was 0.325.

### 6.3.3 Yield per recruit

Yield and spawning stock with the knife-edge maturity at age 10 and older per recruit curves (Figure 26) were constructed using the exploitation pattern for 1980 as derived from the VPA. Therefore, the results of the spawning stock per recruit calculations are not directly comparable with the spawning stock biomass estimates from the VPA and catch predictions. The mean weight at age data (Table 55) were taken from samples of commercial landings. The age at entry into the commercial fishery was considered to be 4 years.

For the 1980 exploitation pattern  $F_{0.1}$  equals 0.12, and there is no maximum on the yield per recruit curve within a reasonable range of fishing mortalities.

### 6.3.4 Stock size

Estimates of stock size in number, total stock biomass (age 4 and older), and spawning stock biomass (using the maturity ogive), from VPA are given in Tables 54 and 56. According to VPA estimates the total stock biomass steadily increased from 157 000 tonnes in 1975 to 262 000 tonnes in 1980. The corresponding figures for the spawning stock biomasses are 50 000 tonnes (1975) and 92 000 tonnes (1980).

### 6.3.5 Catch predictions

Catch predictions for 1982 were calculated using the exploitation pattern and the mean weight at age data given in Table 55. The stock size at the beginning of 1981 was estimated from the stock size and fishing mortalities in 1980 (Table 55).

For catch predictions it was assumed that the catch taken in 1981 will be equal to 30 000 tonnes. Possible catches in 1982, the total and spawning stock biomasses at the beginning of 1983 are plotted against the mean  $F$  in 1982 and also against the fishing mortality rate expressed as a proportion of that estimated for the year 1980 (Figure 27).

Furthermore, the following options of fishing mortality were taken as reference points:

- Option I: fishing at  $F_{0.1}$
- Option II: fishing at the 1980  $\bar{F}$  level
- Option III: fishing at the 1981  $\bar{F}$  level.

The results are summarised in the text table on p.23.

Under all options the spawning stock biomass as well as the total stock biomass are expected to increase over the 1978-81 level - provided that terminal  $F$ s chosen had not been underestimated.

1981				Management option for 1982	1982				1983	
Stock biom.	Spawning stock biomass	$\bar{F}$ (8-13)	Catch		Stock biom.	Spawning stock biomass	$\bar{F}$ (8-13)	Catch	Stock biom.	Spawning stock biomass
266	95	0.3	30	$F_{0.1}$	272	106	0.12	14	293	128
				$\bar{F}_{82} = \bar{F}_{80}$			0.325	36	271	111
				$\bar{F}_{82} = \bar{F}_{81}$			0.3	33	273	112

Weights in thousand tonnes.

7. MESH ASSESSMENT ON REDFISH

There were no new data for redfish in Sub-areas I and II at the present time that would significantly change the estimation of the effective mesh sizes as done in last year's report (Doc. C.M.1980/G:4). The same applies to the estimated consequences of an increase in the minimum mesh size for this area.

The Group considered the possibilities of doing a similar assessment for redfish in Sub-areas V and XIV, as done for redfish in Sub-areas I and II last year.

The assessment can be done both on the basis of length and age distributions. On the basis of the data available in national laboratories, the Group considered that five fisheries could be constructed for each of the two stocks.

- 1) Federal Republic of Germany fishery Division Va
- 2) " " " " " Division Vb
- 3) " " " " " Sub-area XIV
- 4) Icelandic fishery Division Va
- 5) " " " " " Sub-area XIV.

Other nations' fisheries for which data are lacking could be included in that of the five above-mentioned fisheries, which is most representative for the purpose. Altogether four data bases are to be constructed.

The average age (or length distribution) should be calculated as the average of the absolute (not relative) distributions for the individual years. The number of years averaged should preferably be of the same magnitude as the number of age groups simulated in order to average out varying recruitment. As a minimum requirement the number of years should be of at least the same number as the number of age groups in the ascending part of the simulated distributions.

The Group considered it appropriate to start the range of the years averaged when 120 mm mesh size was introduced in the 1960s.

The range of years could include 1980. However, it might be necessary to exclude the years from 1977 onwards when a 135 mm mesh size was introduced in the Icelandic redfish fishery. A scrutiny of the data available should be done before deciding on the exact range of years to be included in the simulation.

Other data needed are the von Bertalanffy parameters, selection factor and the steepness of the selection curve. Knowledge about the area and depth distribution of the different age groups are essential, so is information about discarding. Discard curves seem to be essential, and discard percentages (by weight and/or number) would be very helpful. Fishing mortalities and M may be derived from VPA (see also Doc. C.M.1980/G:28).

A trial assessment on the basis of the length distribution of the total S. marinus catches from 1965-76 was made. However, with the data and the time available, one was not able to parameterize the model of the present situation in such a way as to obtain reasonable consistent results. A consistent parameterization is necessary before an assessment of the short- and long-term effects of an increase in the legal mesh size can be done.

The Group proposes that further work on this assessment for Sub-areas V and XIV is done in the following way:

All the relevant data necessary for making the assessment should be prepared by the national laboratories concerned and be sent to Mr C J Rørvik by the end of November 1981.

It is recommended that a small Study Group comprised of representatives from the Bergen, Hamburg and Reykjavik laboratories, and the Greenland Fisheries Research Institute, directly involved in this assessment should meet for two days immediately preceding the Working Group meeting in 1982 in order to finalise the compilation of relevant data, make preliminary assessment runs, and submit the findings to the Working Group meeting.

#### 8. ADVICE ON THE EFFECTIVENESS OF CLOSED AREAS FOR THE PROTECTION OF NURSERY GROUNDS OF REDFISH IN SUB-AREA XIV

The recent changes in the pattern of exploitation towards the smaller redfish as reflected in the length compositions of the catches for both species and, in particular, for S. mentella, will certainly have an adverse effect on the recruitment to the spawning stock. Young redfish stay on the nursery grounds for several years, and if the exploitation of young fish is going to be continued, a year class of redfish will be exposed, for several years, to increasing fishing mortality. Therefore, in 1977 the Working Group recommended to prohibit fishing for redfish in two nursery areas off the east coast of Greenland. In the terms of reference for the Working Group in 1981, the Group was asked to "advise on the effectiveness of closed areas for the protection of spawning and nursery grounds of redfish in Sub-area XIV".

Only very little "spawning" of redfish takes place in Sub-area XIV, and the Working Group, therefore, is not recommending any measures to be taken to protect the "spawning" grounds in this Sub-area. On the other hand, the East Greenland shelf region serves as a very important and extensive nursery ground for redfish of both species.

In 1979 and 1980 special surveys were conducted (by Iceland and the Federal Republic of Germany) in order to obtain a better knowledge

of the extension and magnitude (importance) of the nursery grounds for redfish in the East Greenland shelf region. The results from these cruises were used for the revision of the closed areas proposed in 1977.

0-group surveys have shown in the past that redfish fry from the "spawning" area SW of Iceland drift to the East Greenland shelf area when they have reached the size at which they seek bottom. Some of them, however, might drift further around Cape Farewell.

The criterion for small redfish has been selected as 32 cm, which is the 50% retention length in the catches. Fish of this size are about 11-12 years old. Maturity is not reached until at about 38 cm in length at an age of about 16-18 years. Furthermore, fish of this size (32 cm) and smaller are not accepted by the industry, at least by some of the nations engaged in the fishery of these stocks.

When treating the data from the small redfish surveys in 1979 and 1980, the East Greenland shelf was divided into 3 sampling areas for reviewing purposes (Figure 1 of Appendix 1).

Sampling area I	Dohrn Bank - Kulusuk
Sampling area II	Jónsmid - Møsting
Sampling area III	Skjoldungen - Walløe

The cruises in both years combined covered the greatest part of the East Greenland shelf area in question.

S. mentella dominated in sampling area I and was lacking in sampling area III. The species were mixed in sampling area II, the S. marinus outnumbering the S. mentella in the southern part of that area.

In the text table below the number of small redfish is given for the three sampling areas by species and for each of the two years separately. Those are arithmetic means derived from area swept and echo-sounding categories in 1980, but by unit squares in 1979. In the table no S. mentella was allocated to sampling area III on the basis of the results from the 1979 survey and other observations in this area. Although these figures do not represent the total number of small redfish in the region, they indicate the importance of the East Greenland shelf area as a nursery ground for redfish and the relative importance of different areas for the two species.

Young redfish (5-32 cm) off East Greenland (XIV).  
No. per survey area for 1979 and 1980 (in 1 000 t).

Year	Sub-Area	<u>S. mentella</u>	%	<u>S. marinus</u>	%	Total both species
1979	I	1 561 955	96.4	57 813	3.6	1 619 768
	II	184 635	86.2	29 472	13.8	214 107
	III	-	-	29 400	100.0	29 400
	Total	1 746 590	93.7	116 685	6.3	1 863 275
1980	I	204 862	78.5	56 213	21.5	261 075
	II	23 938	41.1	34 278	58.9	58 216
	III*)	-	-	45 865	100.0	45 865
	Total	228 800	62.7	136 356	37.3	365 156

\*) Echo survey only.

Sampling area I has the heaviest bearing on the quantitative distribution of young redfish, which is mainly S. mentella. So far, no small S. mentella have been observed in sampling area III. The figures generated from the echo-survey in 1980 are therefore allocated to S. marinus.

The station list for the Icelandic and Federal Republic of Germany surveys in 1979 and 1980 is given in Appendix 1, and the stations are plotted in Figure 1 of Appendix 1. The mean length and the percentage of redfish  $\geq 32$  cm in length and smaller are also given in the Appendix. S. mentella were the smallest in sampling area I, but S. marinus in sampling area II. The average length increased towards the slope area. Generally, the average length of each species increased with increasing depth.

When revising the proposed closed areas for redfish fishing, the mean length of redfish and the percentage of small redfish were considered. Only on two stations within the closed areas did the mean length exceed  $\geq 32$  cm. On the other hand, on a number of stations outside the closed areas the mean length was less than  $\geq 32$  cm. This was, e.g., the case in the area lying between the closed areas. Considering this and also the fact that the catches in the closed areas and in between these areas consisted almost exclusively of redfish, the Working Group recommends that all fishing for redfish should be prohibited in an area as defined below.

Since redfish in this area is caught by bottom trawl exclusively, the term "fishing for redfish" has to be defined as "all bottom trawl fishing" for enforcement purposes.

From the coast of Greenland at 67°N to

67°	30°30'W to
65°40'N	30°30'W to
65°40'N	31°50'W to
65°30'N	33°10'W to
65°10'N	34°00'W to
65°00'N	35°05'W to
64°20'N	35°35'W to
64°20'N	36°00'W to
63°50'N	36°50'W to
63°15'N	39°30'W to
63°45'N	39°30'W to the coast of

Greenland at 63°45'N

9. BIOLOGICAL RELATIONSHIPS BETWEEN GREENLAND HALIBUT AND REDFISH STOCKS AT EAST AND WEST GREENLAND

9.1 Stock Relationships of Greenland Halibut

This question was addressed at the last meeting of the Working Group during 1980, and suggestions were made at that time concerning relationships of Greenland halibut in these areas, based upon relevant material in the literature. It was the consensus of the Working Group that based upon the literature review, stock relationships between East and West Greenland were probably insignificant. It was felt that there may be some larval drift from East to West Greenland. However, it should be borne in mind that no spawning grounds of Greenland halibut have been found at East Greenland so far, in spite of two Icelandic research trips in the area at the spawning time. On the other hand, the species is known to spawn at the continental slope west of Iceland from where the larvae will be drifted to East Greenland by a current in the Irminger Sea and might be further drifted around Cape Farewell to the West Greenland coast. However, the reverse appeared to be unlikely.

Results from Icelandic tagging experiments have shown no returns at West Greenland and tagging experiments at West Greenland have produced only one return off the northwest coast of Iceland. This would suggest little migration of adults from one area to the other.

It was recommended in the previous report by the Working Group that further scientific investigations should be carried out before final conclusions on this matter are made.

It was indicated by representatives of the Federal Republic of Germany that three research vessel surveys were carried out in 1980, two trips at both East and West Greenland and one at West Greenland alone. It was also indicated that three further surveys are planned for these areas in 1981 with the possible expansion of these surveys to cover distribution of Greenland halibut.

It was suggested by the Working Group that all survey results should be made available in order to facilitate a more current evaluation of the situation.

9.2 Stock Relationships of Redfish

In last year's report of the Working Group in dealing with the feasibility of assessing these stocks as single units, the biological relationships were outlined so far as known. Very little additional data on the subject were available to the Working Group at this meeting, except for the Icelandic 0-group survey in the Irminger Sea and the young redfish and bottom trawl surveys at East Greenland in 1979 and 1980.

The analysis of the 0-group data and the young redfish surveys shows that S. marinus dominate in the southern part of the East Greenland shelf. This might indicate that S. marinus at West Greenland are of the same origin as S. marinus at East Greenland. For S. mentella the same origin is less likely. There is no further new information available to the Working Group on the migration of redfish between these areas.

The Working Group is of the opinion that there is a relationship between East and West Greenland at least for some of the stocks. But the knowledge on the matter is very limited, and there is a

need for special research on this subject. The Working Group therefore suggests that a special ICES/NAFO Study Group should be set up to:

1. evaluate all available data on the subject;
2. plan and coordinate special research on the relationships of stocks at East and West Greenland;
3. evaluate data from such research.

#### REFERENCES

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- Hoydal, K, Rørvik, J and Sparre, P. 1980. A method for estimating the effective mesh sizes and the effects of changes in gear parameters. ICES, C.M.1980/G:28 (mimeo.).



Table 1. Nominal catch of REDFISH (in tonnes) by countries (Sub-area I, Divisions IIA and IIB combined).

Country	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980 <sup>⊠</sup>
Belgium	-	-	-	-	30	28	2	2	-	-	-
Faroe Isl.	60	-	9	32	6	67	137	8	1	1 142	
France	-	-	-	-	1 116	-	-	660	3 608	-	765
German Dem.Rep.	7 149	14 786	9 972	11 756	28 275	28 020	22 636	17 614	16 165	16 162	8 448
Germany, Fed.Rep.	2 416	3 076	1 697	3 479	6 597	5 182	7 894	7 231	11 483	11 913	8 231
Netherlands	-	-	-	-	-	-	127	-	-	-	-
Norway	3 832	4 644	6 776	7 714	7 055	4 966	7 305	7 381	7 802	9 025	9 034
Poland	4 631	2 532	1 112	215	1 269	4 711	4 137	175	2 957	261	87
Portugal	-	-	-	-	-	331	3 463	1 480	378	1 100	697
Spain	-	-	-	-	-	1 194	3 398	-	-	1 375	76
U.K.	4 554	4 002	4 379	4 791	3 509	2 746	4 961	6 330	3 390	1 756	1 308
USSR	13 091	29 839	22 647	31 829	48 787	230 950	263 546	144 993	78 092	70 451	72 202
Total	35 733	58 879	46 592	59 816	96 644	278 195	317 606	185 874	124 352 <sup>⊠⊠</sup>	113 620 <sup>⊠⊠</sup>	100 972

⊠) Provisional data.

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

Table 2. Nominal catch of REDFISH (in tonnes) by countries in Sub-area I.

Country	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980*
Belgium	-	-	-	-	30	-	2	1	-	-	-
Faroe Isl.	-	-	-	6	6	-	-	-	-	-	-
France	-	-	-	-	26	-	-	-	27	7	-
German Dem.Rep.	4 912	78	36	-	358	201	90	-	-	-	-
Germany Fed.Rep.	133	148	7	76	1 086	483	635	786	-	-	-
Netherlands	-	-	-	-	-	-	-	-	-	-	-
Norway	141	316	1 000	1 917	194	482	739	1 181	1 333	1 374	1 385
Poland	6	1	22	-	-	93	47	-	-	-	-
Portugal	-	-	-	-	-	331	478	55	8	-	-
Spain	-	-	-	-	-	820	301	-	-	-	-
U.K.	1 384	1 406	1 363	1 894	1 320	1 048	1 392	1 686	959	462	295
USSR	2 281	3 743	4 403	4 885	9 318	30 750	12 411	13 154	2 575	639	33
Total	8 857	5 692	6 831	8 778	12 338	34 208	16 095	17 012	4 902	2 482	1 713

\* ) Provisional data.

Table 3. Nominal catch of REDFISH (in tonnes) by countries in Division IIa.

Country	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980 <sup>*)</sup>
Faroe Isl.	60	-	9	22	-	67	137	8	1	-	-
France	-	-	-	-	980	-	-	478	3 575	1 134	765 <sup>###)</sup>
German Dem.Rep.	2 212	12 339	8 963	11 474	27 153	22 778	16 921	12 688	12 933	12 439	7 460
Germany Fed.Rep.	2 165	1 188	1 466	2 207	4 167	4 263	6 722	4 764	11 482	11 913	8 231 <sup>####)</sup>
Netherlands	-	-	-	-	-	-	127	-	-	-	-
Norway	3 679	4 277	5 720	5 564	6 837	4 444	6 515	6 050	6 369	7 637	7 646
Poland	269	1 605	784	156	869	920	217	47	2 477	261	78
Portugal	-	-	-	-	-	-	2 849	1 249	352	1 100	697 <sup>###)</sup>
Spain	-	-	-	-	-	153	2 082	-	-	1 125	47 <sup>###)</sup>
U.K.	2 741	2 463	2 680	2 125	1 991	1 621	2 919	4 064	2 067	1 195	968
USSR	142	209	291	131	14	39 138	20 307	94 639	31 783	29 519	46 737
Total	11 268	22 081	19 913	21 679	42 011	73 384	58 796	123 987	71 039	66 323	72 629

\*) Provisional data.

###) As reported to Norwegian authorities.

####) Jul-Dec catch estimates based on information from fishing vessels.

Table 4. Nominal catch of REDFISH (in tonnes) by countries in Division IIB.

Country	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980 <sup>⊛</sup>
Belgium	-	-	-	-	-	28	-	-	-	-	-
Faroe Isl.	-	-	-	4	-	-	-	-	-	-	-
France	-	-	-	-	110	-	-	33	6	1	-
German Dem.Rep.	25	2 369	973	282	764	5 041	5 625	4 926	3 232	3 723	988
Germany, Fed.Rep.	118	1 740	224	1 196	1 344	436	537	1 681	1	-	-
Norway	12	51	56	233	24	40	51	150	100	14	3
Poland	4 356	926	306	59	400	3 698	3 873	128	480	-	9
Portugal	-	-	-	-	-	-	136	176	18	-	-
Spain	-	-	-	-	-	221	1 015	-	-	250	29 <sup>⊛</sup>
U.K.	429	133	336	772	198	77	650	580	364	99	45
USSR	10 668	25 887	17 953	26 813	39 455	161 062	230 828	37 200	43 734	40 293	25 432
Total	15 608	31 106	19 848	29 359	42 295	170 603	242 715	44 874	47 941	44 815	26 630
Non-members									296 <sup>⊛</sup>	435 <sup>⊛</sup>	124 <sup>⊛</sup>

⊛) Provisional data.

⊛⊛) As reported to Norwegian authorities.

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

Year	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980 <sup>⊛</sup>
<u>S. marinus</u>	12 817	13 816	17 730	21 436	27 272	39 125	48 584	39 509	31 741	26 475	22 620
<u>S. mentella</u>	22 916	45 063	28 862	38 380	69 372	239 070	269 022	146 365	92 611	87 145	78 352
Total	35 753	58 879	46 592	59 816	96 644	278 195	317 606	185 874	124 352	113 620	100 972

⊛) Provisional data.

Table 6. Sebastes mentella in Divisions IIa and IIb.  
Catch and effort data of the German Democratic  
Republic Z-trawler fishery 1976-80.

Year	Total catch (t) of <u>S. mentella</u>		Total catch (t) used in cpue calculations		Total effort (days trawling) used in cpue calculations	
	OTM	OTB	OTM	OTB	OTM	OTB
1976	10 343	6 075	10 230	4 295	534	343
1977	9 135	3 484	9 110	799	610	88
1978	6 870	5 504	6 864	3 314	327	314
1979	11 320	2 829	11 260	2 261	655	218
1980	2 806	270	2 732	270	139	28

Table 7. Sebastes mentella in Divisions IIa and IIb. Catch per unit effort and calculated total international effort 1965-80.

Year	USSR Catch/hour (tonnes)	German Dem.Rep. Catch/day (tonnes), OTM	German Dem.Rep. Catch/day (tonnes), OTB	Total effort (USSR units)	Total effort GDR units, OTM	Total effort GDR units, OTB
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			79 953		
1973	0.45			85 289		
1974	0.69			100 539		
1975	0.95			251 653		
1976	0.99	19.16	12.52	271 739	14 041	21 487
1977	0.77	14.93	9.08	190 084	9 803	16 119
1978	0.63	20.99	10.55	147 002	4 412	8 778
1979	0.56	17.19	10.37	155 616	5 070	8 404
1980	0.70	19.65	9.64	111 931	3 987	8 128

Table 8. Year class strength of Redfish in Sub-area I and Divisions IIa and IIb.

Year class	Dragesund 1971	Surkova, 1960		Baranenkova, 1968		0-group surveys Abundance indices	USSR <sup>x)</sup> young fish surveys
		<u>S. marinus</u>	<u>S. mentella</u>	<u>S. marinus</u>	<u>S. mentella</u>		
1956	strong		strong	strong			
1957	average	average	strong	average	average		
1958	poor	poor	poor	below average	poor		
1959	average		average	strong	strong		
1960	poor			poor	poor		
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						172	strong
1972						177	average
1973						385	
1974						468	
1975						315	
1976						447	
1977						472	
1978						460	
1979						980	
1980						651	

x) On the basis of 0+ to 4 age group surveys, and also on the basis of  $\geq 8$  year olds' percentage (representation) in the fishery.



Table 9. Sebastes marinus in fish as I and IIa.  
Input catch data for VFA .

	1965	1966	1967	1968	1969	1970	1971	1972	1973
3	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0
12	256	41	44	43	51	62	46	261	590
13	322	118	94	32	35	122	41	332	570
14	805	370	199	74	97	229	107	633	913
15	1531	863	406	165	209	444	239	1137	1527
16	3505	2952	1363	550	666	1232	886	2563	3266
17	1529	1737	919	364	556	723	594	1261	1441
18	2321	2753	1550	611	954	1138	955	2014	2157
19	2251	2718	1695	684	1223	997	990	2046	1892
20	445	503	310	131	223	185	185	385	342
21	2223	2471	1459	753	1456	1003	858	1732	1420
22	1624	1687	951	555	1084	750	595	1112	849
23	1758	2158	1167	898	1518	921	749	1251	1123
24	1741	1924	1241	1266	2259	966	1123	1121	1248
25	958	960	896	993	1845	716	776	746	884
26	637	615	723	887	1667	623	636	585	729
27	460	406	504	644	1362	526	426	429	568
28+	328	405	432	614	1038	347	431	377	508
TOTAL	22674	22681	13939	9264	16243	10984	9647	17985	20027
	1974	1975	1976	1977	1978	1979	1980		
3	0	0	0	86	0	0	0		
4	0	0	0	428	0	0	0		
5	0	0	0	1839	20	0	10		
6	0	0	2884	1831	13	0	11		
7	0	0	5719	1621	50	12	13		
8	0	0	12162	4179	328	75	84		
9	0	0	10250	4620	661	101	174		
10	0	0	9515	4501	950	149	340		
11	0	0	5963	2359	615	145	500		
12	387	693	5008	3306	2003	723	742		
13	455	868	1680	2557	2788	914	552		
14	1049	1638	2670	4242	5453	3422	2288		
15	2079	2984	2991	5334	6404	3276	3553		
16	5479	7397	6775	6072	5880	3554	3584		
17	2757	3563	2707	2372	2569	1726	1037		
18	4164	5117	3938	3462	3669	2212	2262		
19	3528	4402	3417	3115	2719	2237	1318		
20	638	775	614	964	1538	1614	1285		
21	2359	2829	2475	2408	1716	2237	1767		
22	1373	1721	1529	1170	382	959	1005		
23	1527	1813	1814	1464	491	946	1456		
24	1103	1432	1672	1318	411	959	935		
25	702	930	1106	923	241	673	501		
26	530	817	918	772	175	630	370		
27	369	701	822	666	155	541	329		
28+	332	589	624	677	141	239	38		
TOTAL	28831	38269	87789	62286	39312	27542	23954		

Table 10. Sebastes marinus in fishing areas I and IIa.  
Fishing mortalities from VPA (M = 0.1).

	1965	1966	1967	1968	1969	1970	1971	1972	1973
12	0.006	0.001	0.001	0.001	0.001	0.001	0.001	0.005	0.014
13	0.007	0.003	0.002	0.001	0.001	0.002	0.001	0.006	0.012
14	0.027	0.010	0.006	0.002	0.003	0.005	0.002	0.013	0.017
15	0.040	0.033	0.012	0.005	0.007	0.014	0.006	0.023	0.036
16	0.096	0.091	0.060	0.018	0.023	0.045	0.031	0.071	0.077
17	0.051	0.057	0.033	0.018	0.020	0.029	0.025	0.051	0.047
18	0.114	0.110	0.059	0.025	0.056	0.048	0.043	0.099	0.104
19	0.113	0.170	0.082	0.030	0.058	0.068	0.048	0.111	0.114
20	0.026	0.030	0.024	0.007	0.011	0.010	0.015	0.021	0.022
21	0.144	0.175	0.104	0.066	0.095	0.057	0.053	0.165	0.092
22	0.110	0.139	0.085	0.047	0.116	0.058	0.039	0.082	0.102
23	0.089	0.187	0.121	0.097	0.158	0.122	0.071	0.098	0.100
24	0.193	0.119	0.140	0.168	0.332	0.128	0.192	0.125	0.121
25	0.172	0.139	0.067	0.143	0.348	0.149	0.129	0.169	0.123
26	0.180	0.143	0.132	0.079	0.336	0.169	0.171	0.122	0.222
27	0.150	0.150	0.150	0.150	0.150	0.150	0.150	0.150	0.150
28+	0.150	0.150	0.150	0.150	0.150	0.150	0.150	0.150	0.150
F(13-24),W	0.069	0.074	0.044	0.024	0.039	0.030	0.024	0.049	0.054
F(13-24),U	0.084	0.094	0.061	0.040	0.073	0.049	0.044	0.072	0.070

	1974	1975	1976	1977	1978	1979	1980	1965-1977
12	0.007	0.021	0.095	0.064	0.064	0.087	0.060	0.017
13	0.012	0.018	0.058	0.058	0.064	0.034	0.080	0.014
14	0.025	0.048	0.065	0.180	0.152	0.094	0.100	0.031
15	0.044	0.084	0.105	0.161	0.399	0.115	0.120	0.044
16	0.158	0.194	0.250	0.286	0.239	0.359	0.150	0.108
17	0.077	0.131	0.091	0.116	0.168	0.092	0.150	0.057
18	0.165	0.180	0.187	0.144	0.237	0.192	0.150	0.102
19	0.220	0.235	0.157	0.199	0.144	0.198	0.150	0.124
20	0.046	0.062	0.042	0.055	0.128	0.122	0.150	0.029
21	0.185	0.263	0.254	0.204	0.117	0.247	0.150	0.143
22	0.109	0.179	0.198	0.164	0.041	0.080	0.150	0.110
23	0.240	0.183	0.259	0.263	0.086	0.120	0.150	0.153
24	0.121	0.330	0.230	0.271	0.098	0.216	0.150	0.190
25	0.083	0.127	0.405	0.171	0.065	0.206	0.150	0.171
26	0.091	0.118	0.160	0.486	0.040	0.216	0.150	0.185
27	0.150	0.150	0.150	0.150	0.150	0.150	0.150	0.150
28+	0.150	0.150	0.150	0.150	0.150	0.150	0.150	0.150
F(13-24),W	0.093	0.128	0.135	0.153	0.162	0.129	0.134	
F(13-24),U	0.117	9	0.158	0.175	0.156	0.156	38	

Table 11. Sebastes marinus in fishing areas I and IIa.  
Stock size in numbers ('000) from -

	1965	1966	1967	1968	1969	1970	1971	1972	1973
12	46124	44445	46261	59602	71219	61891	70170	54502	45656
13	45344	41492	40176	41817	53890	64393	55943	63449	49067
14	31798	40723	37431	36264	37807	48728	58150	50580	57095
15	40991	28007	36496	33680	32742	34117	43873	52514	45165
16	40174	35635	24521	32637	30318	29428	30448	39471	46436
17	32392	33021	29439	20892	29008	26799	25456	26709	33279
18	22609	27856	28228	25764	18558	25719	23562	22469	22968
19	21878	18253	22590	24082	22731	15885	22190	20431	18418
20	18321	17677	13935	18830	21140	19406	13426	19137	16543
21	17390	16155	15517	12314	16913	18916	17383	11973	16950
22	16346	13624	12271	12654	10427	13920	16163	14914	9189
23	21794	13247	10726	10200	10922	8405	11883	14059	12438
24	10417	18050	9938	8596	8376	8441	6730	10012	11533
25	6357	7773	14505	7814	6576	5437	6721	5024	7994
26	4049	4842	6122	12273	6127	4201	4240	5344	3837
27	3466	3059	3797	4852	10262	3963	3210	3232	4280
28+	2471	3052	3255	4626	7821	2615	3247	2841	3828
TOTAL	381924	366911	355208	366898	394839	392266	412795	416660	404676
SPAWN. ST.	258657	240251	231340	229214	231923	217254	228533	248129	252857

	1974	1975	1976	1977	1978	1979	1980	1981	1965-1977
12	55639	35613	57897	55622	35998	9092	13382	*****	54203
13	40751	49976	31565	47629	47187	28859	7540	11404	48115
14	43856	36440	44395	26959	40667	25244	40047	25244	42325
15	50794	38685	31416	37633	20366	31618	32985	20668	38932
16	39415	43984	32169	25585	28987	12359	25497	26471	34632
17	38913	30462	32776	22679	17390	20648	7813	19857	29371
18	28743	32590	24179	27085	18267	13296	17043	6085	25410
19	18733	22053	24631	18139	21220	13047	9931	13273	20770
20	14868	13602	15777	19042	13456	16618	9682	7734	17054
21	14644	12846	11571	13692	16314	10715	13314	7540	15097
22	13988	11010	8940	8122	10104	13131	7572	10369	12428
23	7508	11353	8329	6638	6238	8779	10971	5897	11346
24	10187	5344	8551	5815	4617	5178	7045	8544	9384
25	9250	8170	3478	6150	4011	3787	3775	5487	7327
26	6394	7703	6509	2099	4689	3400	2788	2940	5672
27	2780	5282	6194	5018	1168	4076	2479	2171	4569
28+	2502	4438	4702	5101	1062	1801	286	2154	3884
TOTAL	398963	369552	353677	333007	289740	236452	197347		
SPAWN. ST.	258718	247523	219220	202797	167888	158454	151181		

Table 12. Sebastes marinus in Sub-area I and Division IIA. Total stock biomass (age 12+) and spawning stock biomass (age 15+) (in '000 tonnes).

Year	Total stock	Spawning stock
1965	313	250
1966	306	240
1967	298	234
1968	306	235
1969	328	244
1970	301	210
1971	315	219
1972	321	233
1973	321	241
1974	315	242
1975	304	240
1976	285	216
1977	263	200
1978	(246)	(174)
1979	(218)	(169)
1980	(186)	(157)

Table 13. Sebastes marinus in Sub-area I and Division IIa. Parameters used in catch predictions (for age groups 12 and older) and yield per recruit (for age groups 5 and older) calculations.

Age	Stock size beginning of 1981 x 10 <sup>-3</sup>	Relative fishing mortality $\bar{F}(13-24) = 1.0$	Mean weight used 1965 to 1977	Mean weight for 1978 and later
5		0.007	.059	.059
6		0.007	.086	.086
7		0.072	.147	.147
8		0.145	.194	.194
9		0.217	.254	.254
10		0.290	.334	.334
11		0.290	.421	.421
12	54 200	0.435	.477	.520
13	11 404	0.58	.512	.564
14	6 298	0.725	.577	.703
15	20 668	0.87	.611	.750
16	26 471	1.087	.710	.846
17	19 857	↓	.761	.860
18	6 085		.826	.931
19	13 237		.895	.991
20	7 734		.947	1.028
21	7 540		1.093	1.148
22	10 369		1.145	1.207
23	5 897		1.293	1.410
24	8 544		1.580	1.521
25	5 487		1.793	1.702
26	2 940		1.885	1.693
27	2 171		2.393	2.393
28+	2 154		2.454	2.454

Table 14. *Sebastes mentella* in fishing areas IIa and IIb.  
Input catch data for VPA ('000).

	1965	1966	1967	1968	1969	1970	1971	1972	1973
6	48	0	0	7	31	0	0	466	172
7	285	0	0	0	94	0	0	792	1660
8	1592	27	7	15	409	33	114	5728	4865
9	2163	279	15	89	524	131	284	3586	9729
10	1141	532	182	192	838	620	681	2049	4636
11	1545	465	285	355	933	2122	1590	1770	2633
12	1972	731	343	436	954	3428	4429	3865	5148
13	2471	1223	394	554	849	3983	4884	4564	5208
14	2804	1927	489	864	618	3526	5451	4704	5666
15	1996	2007	496	768	482	2808	4940	4098	4578
16	2067	1741	628	931	807	3983	7496	4704	5380
17	1592	1422	613	694	451	2743	4486	3632	5777
18	1473	944	540	665	849	3559	7382	3167	2747
19	1069	837	949	702	786	2318	4770	1816	1316
20	689	532	649	369	555	1567	3918	885	973
21	404	346	693	347	440	784	2585	373	630
22	261	186	598	251	514	653	1874	279	114
23	71	66	248	89	199	327	1590	47	10
24+	95	13	117	44	42	65	397	47	10
TOTAL	25738	13278	7246	7372	10375	32650	56671	46572	57252
	1974	1975	1976	1977	1978	1979	1980		
6	606	5834	18891	0	2905	3633	1052		
7	4847	19417	29815	2418	30158	20497	7318		
8	15451	42425	59395	17175	65162	43553	25964		
9	28781	82480	78241	53454	55391	46996	43574		
10	30144	108462	110712	52102	33569	37469	39930		
11	19843	119075	112524	49617	19909	26298	26747		
12	10603	57231	93144	53938	17242	20717	19698		
13	8634	29651	49550	33287	9270	16341	11051		
14	8634	20894	26134	19095	7410	6059	6519		
15	6514	16499	13881	12605	5456	3589	5536		
16	5908	13465	9839	5796	4134	3465	6715		
17	3352	13668	6300	4874	2134	2465	3398		
18	2878	12207	7233	5499	1545	1964	2963		
19	1666	6757	3486	3155	666	1719	1388		
20	2121	7112	3168	3941	1061	1906	786		
21	757	5113	1818	2955	423	1962	143		
22	454	2242	1715	2531	308	560	143		
23	151	735	1041	1002	301	324	27		
24+	151	407	211	322	158	108	27		
TOTAL	151475	563674	627098	503766	255202	239625	202759		

Table 15. Sebastes mentella in fishing area I Ia and I Ib.  
Fishing mortalities from VPA (M<sub>1</sub>).

	1965	1966	1967	1968	1969	1970	1971	1972	1973
6	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000
7	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.004
8	0.015	0.000	0.000	0.000	0.003	0.000	0.000	0.012	0.010
9	0.025	0.003	0.000	0.001	0.005	0.001	0.002	0.013	0.022
10	0.015	0.007	0.002	0.002	0.009	0.006	0.006	0.013	0.020
11	0.026	0.007	0.004	0.004	0.010	0.026	0.018	0.018	0.018
12	0.044	0.014	0.006	0.007	0.013	0.044	0.063	0.050	0.037
13	0.080	0.031	0.008	0.010	0.015	0.064	0.073	0.077	0.079
14	0.137	0.075	0.014	0.020	0.012	0.072	0.106	0.084	0.116
15	0.147	0.123	0.022	0.025	0.013	0.065	0.123	0.097	0.098
16	0.194	0.165	0.046	0.048	0.030	0.123	0.220	0.148	0.160
17	0.097	0.177	0.073	0.060	0.027	0.121	0.178	0.141	0.152
18	0.222	0.069	0.085	0.095	0.087	0.269	0.482	0.165	0.136
19	0.273	0.170	0.083	0.136	0.139	0.320	0.608	0.185	0.086
20	0.323	0.189	0.173	0.038	0.136	0.396	1.200	0.189	0.128
21	0.195	0.243	0.356	0.118	0.052	0.259	1.654	0.282	0.179
22	0.499	0.116	0.741	0.188	0.229	0.092	1.481	0.799	0.117
23	0.200	0.200	0.200	0.200	0.200	0.200	0.300	0.100	0.050
24+	0.200	0.200	0.200	0.200	0.200	0.200	0.300	0.100	0.050
F(8-19) <sub>0</sub>	0.106	0.070	0.029	0.034	0.030	0.093	0.156	0.083	0.078
	1974	1975	1976	1977	1978	1979	1980		
6	0.001	0.014	0.035	0.000	0.007	0.009	0.003		
7	0.013	0.054	0.081	0.005	0.068	0.060	0.021		
8	0.038	0.134	0.208	0.055	0.165	0.119	0.090		
9	0.069	0.257	0.345	0.156	0.216	0.154	0.150		
10	0.079	0.353	0.570	0.361	0.207	0.207	0.170		
11	0.098	0.444	0.663	0.479	0.203	0.222	0.200		
12	0.086	0.396	0.660	0.691	0.270	0.299	0.230		
13	0.122	0.325	0.623	0.461	0.210	0.392	0.250		
14	0.163	0.426	0.467	0.460	0.156	0.185	0.230		
15	0.169	0.466	0.493	0.382	0.205	0.095	0.250		
16	0.160	0.546	0.496	0.349	0.185	0.174	0.230		
17	0.126	0.581	0.471	0.433	0.186	0.144	0.230		
18	0.149	0.793	0.618	0.864	0.211	0.234	0.230		
19	0.102	0.537	0.471	0.531	0.204	0.341	0.230		
20	0.174	0.705	0.460	1.375	0.303	1.241	0.230		
21	0.125	0.703	0.343	0.916	0.436	1.261	0.230		
22	0.169	0.569	0.476	0.983	0.191	1.572	0.230		
23	0.200	0.400	0.500	0.500	0.250	0.280	0.230		
24+	0.200	0.400	0.500	0.500	0.250	0.280	0.230		
F(8-19) <sub>0</sub>	0.114	0.437	0.507	0.435	0.202	0.214	0.204		

Table 16. *Sebastes mentella* in fishing areas IIA and IIB.  
Stock size in numbers ('000) from VPA.

	1965	1966	1967	1968	1969	1970	1971	1972	1973
6	144379	157127	169618	254337	380984	641219	617317	536553	439701
7	141421	130593	142174	153477	230127	344699	580199	558571	485050
8	115188	127692	118166	128644	138872	208138	311897	524985	504663
9	93192	102713	115515	106914	116388	125267	188300	282107	469581
10	81436	82267	92673	104508	96655	104814	115222	170111	251852
11	64433	72601	73933	83681	94380	86661	94250	101800	151974
12	48055	56833	65250	66626	75380	84512	76397	83769	90430
13	33595	41608	50729	58715	59871	67300	73211	64917	72124
14	23029	28050	36486	45527	52601	53367	57111	61603	54403
15	15353	18174	23550	32549	40373	47007	44937	46497	51271
16	12319	11996	14539	20837	28721	36073	39865	35969	38179
17	18045	9185	9201	12558	17969	25221	28857	28957	28078
18	7764	14815	6961	7743	10703	15831	20215	21852	22752
19	4698	5627	12508	5785	6374	8878	10948	11300	16765
20	2581	3237	4297	10416	4568	5021	5835	5393	8501
21	2393	1682	2424	3272	9074	3606	3058	1591	4040
22	695	1782	1194	1536	2631	7792	2519	529	1085
23	411	382	1433	515	1152	1892	6430	519	215
24+	550	75	677	255	243	376	1606	519	215
TOTAL SPAWN. ST.	809536	866440	941330	1097896	1367068	1867675	2276174	2537543	2690880
	64808	66955	76785	95466	121809	151699	164272	153125	171103
	1974	1975	1976	1977	1978	1979	1980	1981	1965-1977
6	427898	452220	572585	554030	413740	412713	410000	*****	409843
7	397694	386602	403639	500139	483210	371605	369984	369870	342645
8	437313	355240	331358	356897	450246	408567	316763	327818	279927
9	452013	381010	281140	243448	288514	345526	328316	261950	227507
10	415645	381647	266494	180203	188512	210383	268017	255693	180118
11	223478	347448	242501	136359	113662	138709	154797	204598	136423
12	135009	183358	201578	113016	76392	83947	100550	114676	98478
13	78832	112087	111669	94312	51266	52764	56309	72288	70690
14	60312	65129	73303	54170	53808	37588	32256	40482	51007
15	43844	46374	37324	41574	30928	41651	28259	23190	37602
16	42043	35486	26334	20627	25670	22806	34277	20316	27768
17	29438	32432	17554	14511	13169	19303	17345	24643	20924
18	21820	23472	16412	9917	8512	9890	15125	12470	15404
19	17978	17010	9706	8008	3782	6235	7085	10874	10430
20	13919	14684	8995	5481	4259	2790	4012	5094	7148
21	6768	10581	6564	5138	1253	2847	730	2884	4630
22	3057	5405	4740	4215	1860	733	130	525	2860
23	874	2335	2769	2665	1427	1391	138	525	1661
24+	874	1293	561	856	749	464	138	198	623
TOTAL SPAWN. ST.	88060613	2849812	2615225	2305567	2210959	2169911	4483207840		
		187072	130959	112993	91610	10811			



Table 17. Sebastes mentella in Divisions IIa and IIb.  
 Biomass of the total stock  $B(N_{6+})$ , the spawning stock  $B(N_{15+})$  and the year class strength (estimates from VPA).

Year	$B(N_{6+})$ (tonnes $\times 10^{-3}$ )	$B(N_{15+})$ (tonnes $\times 10^{-3}$ )	Year class	Year class strength at age 6 (millions)
1965	279	56	1965	617
1966	304	58	1966	537
1967	338	66	1967	440
1968	389	81	1968	428
1969	464	104	1969	452
1970	583	130	1970	573
1971	685	142	1971	534
1972	758	129	1972	414
1973	852	145	1973	413
1974	946	156		
1975	1 004	164		
1976	869	114		
1977	707	97		
1978	651	77		
1979	665	90		
1980	668	91		

Table 18. Sebastes mentella in Divisions IIa and IIb.  
Parameters used in catch predictions.

Age	Stock size at the beginning of 1981 ( $N \times 10^{-3}$ )	Proportional fishing mortality (1980-1982) in relation to $\bar{F}_{(8-19)}$	Mean weight at age (kg)
6	410 000	.015	.168
7	369 870	.103	.183
8	327 818	.441	.225
9	261 950	.735	.311
10	255 693	.833	.367
11	204 598	.980	.432
12	114 676	1.127	.508
13	72 288	↓	.611
14	40 482		.679
15	23 190		.753
16	20 316		.821
17	24 643		.872
18	12 470		.910
19	10 874		.923
20	5 094		.985
21	2 884		1.056
22	525		1.124
23	525		1.193
24	198		1.215

Table 19. Nominal catches of REDFISH (in tonnes) by countries in Division Va (Iceland).

Country	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980 <sup>x)</sup>
Belgium	2 204	2 798	2 484	1 622	2 114	1 945	1 522	1 395	1 549	1 385	1 381
Faroe Isl.	-	35	9	243	254	82	211	292	242	629	1 145
German Dem.Rep.	827	238	135	-	11	-	-	-	-	-	-
Germany, Fed.Rep.	48 907	46 580	43 963	38 358	36 398	33 602	32 948	31 632	-	-	-
Iceland	23 807	29 118	26 973	26 470	27 799	32 659	34 028	28 119	33 318	62 253	68 482
Netherlands	-	-	-	-	-	-	-	-	-	-	-
Norway	-	1	1	4	15	22	31	87	93	43	44
Poland	259	17	35	-	18	-	-	-	-	-	-
U.K.	2 948	3 552	3 697	2 951	2 519	2 424	1 124	+	-	-	-
USSR	10	31	28	2	-	-	-	-	-	-	-
Total	78 962	82 370	77 325	69 650	69 129	70 734	69 864	61 525	35 202	64 310	71 052

x) Provisional data.

Table 20. Nominal catches of REDFISH (in tonnes) by countries in Division Vb (Faroe Islands).

Country	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980 <sup>x)</sup>
Faroe Isls.	-	-	-	121	28	9	33	54	1 525	5 693	5 315
France	-	-	-	-	300	800	-	1 368	448	862	800 <sup>1)</sup>
German Dem.Rep.	-	-	-	-	1	1	-	-	-	-	-
Germany, Fed.Rep.	1 914	2 328	4 034	9 490	7 328	7 628	5 255	5 854	7 767	6 108	3 783
Netherlands	-	-	-	-	-	105	-	-	-	-	-
Norway	-	-	-	-	10	7	17	10	9	11	13
U.K.	33	24	53	85	98	41	59	116	57	-	-
Total	1 947	2 352	4 087	9 696	7 765	8 591	5 364	7 402	9 806	12 674	9 911

x) Provisional data.

1) Estimated from 1979 catch.

Table 21. Nominal catch of REDFISH (in tonnes) by countries in Sub-area XIV (East Greenland).

Country	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980 <sup>x)</sup>
Canada	-	-	-	-	-	-	420	-	-	-	-
Greenland	-	-	-	-	-	-	129	1	3	-	-
Faroe Isl.	-	-	-	13	43	1	3	19	-	-	-
France	-	-	-	-	-	-	-	-	-	490	-
German Dem.Rep.	409	611	703	841	1 275	4 490	-	-	-	-	-
Germany, Fed.Rep.	16 316	17 062	7 287	4 491	2 632	4 979	4 403	13 347	20 711 <sup>1)</sup>	20 428 <sup>1)</sup>	32 959 <sup>1)</sup>
Iceland	1 001	2 380	5 490	2 144	9 777	5 632	7 410	81	151	-	91
Norway	-	-	-	-	-	63	5	112	2	-	-
Poland	436	312	464	281	6	276	-	-	-	-	-
U.K.	+	+	5	65	127	56	286	622	13	-	-
USSR	-	71	21	64	118	9 830	101 000	251	-	-	-
Total	18 162	20 436	13 970	7 899	13 978	25 329	113 656	14 433	20 880	20 918	33 050

x) Provisional data.

1) Catches updated for Sub-area XII included.

Table 22. 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.

Year	Division Va	Division Vb	Sub-area XIV	Total	<u>S. marinus</u>	<u>S. mentella</u>
1965	114 100	5 862	36 513	156 475	97 006	59 469
1966	107 068	3 297	23 290	133 655	80 347	53 308
1967	95 083	5 013	33 198	133 294	85 249	48 045
1968	96 475	6 637	23 074	126 186	68 709	57 477
1969	87 736	1 326	30 367	119 429	79 467	39 962
1970	78 962	1 947	18 162	99 071	60 805	38 266
1971	82 370	2 352	20 436	105 158	68 374	36 784
1972	77 325	4 087	13 970	95 382	50 961	44 421
1973	69 650	9 696	7 899	87 245	41 856	45 389
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 <sup>1)</sup>	65 888	47 791	18 097
1979	65 310	12 674	20 918 <sup>1)</sup>	97 902	75 056	22 846
1980 <sup>x)</sup>	71 052	9 911	33 050 <sup>1)</sup>	114 013	88 236	25 777

x) Provisional data.

1) Catches updated for Sub-area XII included.

Table 23. Nominal catch of REDFISH (1 000 t) 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. Republic	Germany, Fed. Republic	Iceland	Norway	Poland	United Kingdom	USSR	Total
Total	2,2	-	0,8	48,9	23,8	-	0,3	2,9	+	78,9
S.mar.	2,2	-	0,8	13,1	23,3	-	0,3	2,9	-	42,6
S.ment.	-	-	-	35,8	0,5	-	-	-	-	36,3
Total	2,8	+	0,2	46,6	29,1	+	+	3,6	+	82,3
S.mar.	2,8	-	0,2	12,2	28,6	-	-	3,6	-	47,4
S.ment.	-	-	-	34,4	0,5	-	-	-	-	34,9
Total	2,5	+	0,1	44,0	27,0	+	+	3,7	+	77,3
S.mar.	2,5	-	0,1	4,1	26,4	-	-	3,7	-	36,8
S.ment.	-	-	-	39,9	0,6	-	-	-	-	40,5
Total	1,6	0,2	-	38,4	26,5	+	-	3,0	+	69,7
S.mar.	1,6	0,2	-	3,1	25,7	-	-	3,0	-	33,6
S.ment.	-	-	-	35,3	0,8	-	-	-	-	36,1
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
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
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
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
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
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
Total	1,4	1,1	-	-	68,5	0,1	-	-	-	71,1
S.mar.	1,4	1,1	-	-	58,5	0,1	-	-	-	61,1
S.ment.	-	-	-	-	10,0	-	-	-	-	10,0

\*Preliminary

Table 24. Nominal catch (1 000 t) 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. Republic	Germany, Fed. Republic	Netherlands	Norway	United Kingdom	Total
1970 Total <u>S.mar.</u> <u>S.ment.</u>	- - -	- - -	- - -	1.9 - 1.9	- - -	- - -	+ - -	1.9 - 1.9
1971 Total <u>S.mar.</u> <u>S.ment.</u>	- - -	- - -	- - -	2.3 - 2.3	- - -	- - -	+ - -	2.3 - 2.3
1972 Total <u>S.mar.</u> <u>S.ment.</u>	- - -	- - -	- - -	4.0 - -	- - -	- - -	0.1 0.1 -	4.1 0.1 4.0
1973 Total <u>S.mar.</u> <u>S.ment.</u>	0.1 0.1 -	- - -	- - -	9.5 - 9.5	- - -	- - -	0.1 0.1 -	9.7 0.2 9.5
1974 Total <u>S.mar.</u> <u>S.ment.</u>	+ - -	0.3 0.3 -	+ - -	7.3 - 7.3	- - -	- - -	0.1 0.1 -	7.7 0.4 7.3
1975 Total <u>S.mar.</u> <u>S.ment.</u>	+ - -	0.8 0.8 -	+ - -	7.6 - 7.6	0.1 0.1 -	+ - -	+ - -	8.5 0.9 7.6
1976 Total <u>S.mar.</u> <u>S.ment.</u>	+ - -	- - -	- - -	5.3 - 5.3	- - -	+ - -	0.1 0.1 -	5.4 0.1 5.3
1977 Total <u>S.mar.</u> <u>S.ment.</u>	0.1 0.1 -	1.4 0.6 0.8	- - -	5.9 - 5.9	- - -	+ - -	0.1 0.1 -	7.5 0.8 6.7
1978 Total <u>S.mar.</u> <u>S.ment.</u>	1.5 1.5 -	0.4 0.4 -	- - -	7.8 - 7.8	- - -	+ - -	0.1 0.1 -	9.8 2.0 6.7
1979 Total <u>S.mar.</u> <u>S.ment.</u>	5.7 4.8 0.9	0.9 - 0.9	- - -	6.1 - 6.1	- - -	+ - -	- - -	12.7 4.8 7.9
* 1980 Total <u>S.mar.</u> <u>S.ment.</u>	5.3 4.8 0.5	0.8 - 0.8	- - -	3.8 - 3.8	- - -	+ - -	- - -	9.9 4.8 5.1

\*) Preliminary



Table 25. Nominal catch (1 000 t) 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 Year	Canada	Denmark (G)	Faroe Islands	German Dem. Republic	Germany Fed. Republic	Iceland	Norway	Poland	United Kingdom	USSR	Total	
1970	Total	-	-	0.4	16.3	1.0	-	0.4	+	-	18.1	
	<u>S.mar.</u> <u>S.ment.</u>	-	-	0.4	16.3	1.0	-	0.4	-	-	18.1	
1971	Total	-	-	0.6	17.1	2.4	-	0.3	+	0.1	20.5	
	<u>S.mar.</u> <u>S.ment.</u>	-	-	0.6	17.1	2.4	-	0.3	+	0.1	20.5	
1972	Total	-	-	0.7	7.3	5.5	-	0.5	+	+	14.0	
	<u>S.mar.</u> <u>S.ment.</u>	-	-	0.7	7.3	5.5	-	0.5	+	+	14.0	
1973	Total	-	-	+	0.8	4.5	2.1	-	0.3	0.1	0.1	7.9
	<u>S.mar.</u> <u>S.ment.</u>	-	-	+	0.8	4.5	2.1	-	0.3	0.1	0.1	7.9
1974	Total	-	-	+	1.3	2.6	9.8	-	+	0.1	0.1	13.9
	<u>S.mar.</u> <u>S.ment.</u>	-	-	+	1.3	2.6	9.8	-	+	0.1	0.1	13.9
1975	Total	-	-	+	4.5	5.0	5.6	0.1	0.3	0.1	9.8	25.4
	<u>S.mar.</u> <u>S.ment.</u>	-	-	+	4.5	5.0	5.6	0.1	0.3	0.1	5.4	21.0
1976	Total	0.4	0.1	+	-	4.4	7.4	+	-	0.3	101.0	113.6
	<u>S.mar.</u> <u>S.ment.</u>	0.4	0.1	+	-	4.4	7.4	+	-	0.3	41.3	53.9
1977	Total	-	+	+	-	13.3	0.1	0.1	-	0.6	0.3	14.4
	<u>S.mar.</u> <u>S.ment.</u>	-	+	+	-	13.3	0.1	0.1	-	0.6	0.3	14.4
1978	Total	-	+	-	-	20.7	0.2	+	-	+	-	20.9
	<u>S.mar.</u> <u>S.ment.</u>	-	+	-	-	15.3	0.2	+	-	-	-	15.5
1979	Total	-	-	+	-	21.1	-	-	-	-	-	21.1
	<u>S.mar.</u> <u>S.ment.</u>	-	-	+	-	15.8	-	-	-	-	-	15.8
*1980	Total	-	-	-	-	33.0	0.1	-	-	-	-	33.1
	<u>S.mar.</u> <u>S.ment.</u>	-	-	-	-	22.4	0.1	-	-	-	-	22.5
												10.6

\* Preliminary

Table 26. Sebastes marinus in fishing areas V and XIV.  
Input catch data for VPA ('000).

	1967	1968	1969	1970	1971	1972	1973	1974	1975
7	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0
9	0	0	0	8	4	59	21	48	-273
10	0	0	0	15	5	65	28	68	374
11	154	138	137	179	102	503	402	533	878
12	1166	1101	1108	1126	803	3066	2624	3292	3009
13	2075	1996	2141	1790	1565	4539	4017	4987	3320
14	4546	3971	4891	3529	3713	5998	5652	7437	4282
15	4159	3519	4354	3072	3323	4044	4106	5261	3620
16	6810	5373	6617	4614	5081	4469	4873	6152	5536
17	3563	2718	3200	2306	2424	1928	2074	2518	2704
18	9205	6618	7746	5700	5798	4269	4287	5159	6545
19	7317	5272	6047	4750	4712	3003	2883	3322	4744
20	2682	1964	2245	1871	1841	1020	934	1028	1570
21	8153	6025	6567	5730	6152	3217	2786	3096	4799
22	5535	4252	4608	4502	4939	2304	1798	1956	2973
23	7410	5892	6240	6467	7342	3269	2349	2537	3724
24	6970	5619	6204	6722	7233	3066	2536	2549	3763
25	2966	2502	2868	3016	3189	1268	1259	1229	1740
26	1882	1630	1894	1918	2205	726	783	845	1160
27	829	774	910	898	981	303	360	407	558
28	650	577	717	670	762	211	255	306	425
29	582	210	324	270	259	59	84	118	197
30+	143	117	284	180	121	29	11	12	110
A) TOTAL	76595	60218	69102	59313	62554	47415	44102	52860	56304
	1976	1977	1978	1979	1980				
7	0	0	0	7	13				
8	0	0	0	8	30				
9	2023	50	89	64	298				
10	2715	71	170	311	838				
11	6229	56	1039	1049	1726				
12	19819	3539	5957	2607	6519				
13	19604	5398	5667	2839	9254				
14	15776	7820	8023	6192	14076				
15	8889	5327	6451	6260	18649				
16	9193	5898	5702	10174	13544				
17	3780	2592	2188	9134	4628				
18	8440	5108	3173	10300	9602				
19	5596	3512	2959	5635	5573				
20	1844	1213	3186	4777	2127				
21	5552	3753	3401	5672	5525				
22	3389	2484	1511	3216	2301				
23	4348	3323	1746	3912	1946				
24	3817	2832	1474	2368	2399				
25	1751	1170	827	2212	1432				
26	1283	798	611	2125	751				
27	587	364	378	1272	462				
28	429	271	156	747	249				
29	173	112	99	452	33				
30+	73	69	37	263	68				
A) TOTAL	125310	56060	54844	81596	102843				

Table 27. Sebastes marinus in fishing areas V and XIV.  
Fishing mortalities from VPA = 0.1<sup>1</sup>

	1961	1968	1969	1970	1971	1972	1973	1974	1975
9	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001
10	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001
11	0.002	0.001	0.001	0.001	0.001	0.001	0.004	0.003	0.004
12	0.014	0.013	0.013	0.012	0.007	0.042	0.025	0.024	0.030
13	0.026	0.026	0.028	0.024	0.019	0.048	0.064	0.055	0.027
14	0.059	0.057	0.075	0.053	0.057	0.084	0.069	0.146	0.055
15	0.063	0.054	0.074	0.055	0.059	0.073	0.069	0.077	0.088
16	0.119	0.098	0.122	0.094	0.110	0.094	0.107	0.125	0.097
17	0.066	0.057	0.070	0.051	0.059	0.050	0.052	0.067	0.067
18	0.193	0.152	0.206	0.153	0.157	0.126	0.135	0.158	0.220
19	0.164	0.144	0.181	0.167	0.164	0.103	0.105	0.132	0.192
20	0.064	0.054	0.076	0.070	0.082	0.044	0.038	0.045	0.076
21	0.226	0.180	0.231	0.252	0.307	0.179	0.145	0.152	0.269
22	0.205	0.158	0.182	0.220	0.318	0.161	0.129	0.129	0.192
23	0.394	0.311	0.325	0.369	0.583	0.320	0.220	0.242	0.341
24	0.613	0.518	0.552	0.608	0.799	0.455	0.390	0.349	0.595
25	0.553	0.410	0.482	0.504	0.578	0.272	0.298	0.295	0.378
26	0.335	0.298	0.551	0.611	0.753	0.220	0.240	0.304	0.443
27	0.196	0.200	0.241	0.487	0.647	0.188	0.145	0.170	0.300
28	0.293	0.165	0.257	0.251	0.882	0.244	0.214	0.158	0.240
29	0.130	0.130	0.130	0.130	0.130	0.130	0.130	0.130	0.130
30+	0.130	0.130	0.130	0.130	0.130	0.130	0.130	0.130	0.130
F(14-25),U	0.155	0.127	0.154	0.149	0.190	0.123	0.107	0.127	0.160

	1976	1977	1978	1979	1980	1977-1979
9	0.009	0.000	0.000	0.000	0.001	0.000
10	0.014	0.000	0.001	0.001	0.004	0.001
11	0.026	0.003	0.006	0.003	0.007	0.004
12	0.118	0.017	0.039	0.017	0.027	0.024
13	0.247	0.039	0.030	0.021	0.068	0.030
14	0.155	0.132	0.067	0.038	0.123	0.079
15	0.139	0.065	0.138	0.061	0.136	0.088
16	0.299	0.116	0.082	0.297	0.164	0.165
17	0.080	0.106	0.052	0.165	0.191	0.107
18	0.273	0.133	0.179	0.323	0.233	0.212
19	0.265	0.156	0.096	0.483	0.259	0.245
20	0.095	0.075	0.185	0.198	0.300	0.153
21	0.370	0.254	0.278	0.510	0.327	0.347
22	0.275	0.251	0.138	0.407	0.555	0.265
23	0.418	0.420	0.250	0.548	0.409	0.406
24	0.614	0.467	0.296	0.554	0.682	0.439
25	0.541	0.339	0.214	0.840	0.682	0.464
26	0.469	0.449	0.266	1.115	0.682	0.610
27	0.374	0.208	0.353	1.187	0.682	0.582
28	0.352	0.264	0.116	2.398	0.682	0.926
29	0.130	0.130	0.130	0.500	0.682	0.253
30+	0.130	0.130	0.130	0.500	0.682	0.253
F(14-25),U	0.237	0.171	0.146	0.303	0.250	

Table 28. Sebastes marinus in fishing areas V and XIV.  
Stock size in numbers ('000) from VFA.

	1967	1968	1969	1970	1971	1972	1973	1974	1975
9	132929	154488	105644	150362	200522	145215	252869	513604	227547
10	108934	120279	139786	95950	136046	181436	131340	228785	283715
11	100500	98567	108833	126484	86479	123094	164108	118814	206949
12	90577	90790	89056	98346	114277	78153	110902	148109	107001
13	85319	80849	81105	79528	87916	102639	87801	97854	130885
14	82955	75227	71258	71350	70258	78062	88557	57532	83802
15	71473	70741	64294	59829	61206	60044	64934	74759	44994
16	63717	60719	60664	54038	51216	52224	50487	54853	62645
17	58176	51184	49836	48606	44512	41515	43008	41053	43790
18	55118	49254	45730	42053	41789	37972	35732	36944	34753
19	50671	41134	38282	32216	32638	32306	30304	28260	28529
20	45324	38901	32213	28898	24659	25058	26379	24681	22415
21	42300	38462	33333	27014	24370	20563	21704	22981	21355
22	31310	30537	29081	23928	19006	16216	15551	16992	17854
23	23845	25078	23593	21959	17378	12514	12485	12364	15518
24	15896	14553	15294	15430	13721	8777	8223	9067	8780
25	10437	7789	7848	7966	7602	5583	5038	5037	5788
26	6926	6632	4677	4385	4352	3861	3848	3383	3392
27	4889	4483	4455	2439	2153	1855	2805	2739	2260
28	2680	3636	3321	5167	1356	1021	1390	2196	2092
29	3289	1808	2790	2325	2230	508	723	1016	1696
30+	1231	1007	2445	1550	1042	250	95	103	947
TOTAL	1088495	1064118	1011537	997444	1044730	1028864	1138284	1301127	1354707
SPAWN. ST.	415808	375177	351562	319555	288075	260222	257772	261670	269814

	1976	1977	1978	1979	1980	1977-1979
9	227790	391235	318017	245849	313302	317700
10	205634	204189	353957	287669	220583	281938
11	256360	183484	184691	320112	254998	229429
12	186420	226043	165494	166127	288652	185888
13	93958	149854	201167	144083	147840	165035
14	115274	66415	130462	176637	127673	124505
15	71758	89323	52667	110423	153942	84138
16	37273	56487	75760	41529	93966	57925
17	51424	25006	45509	63133	27927	44549
18	37053	42939	20354	39098	48452	34131
19	25234	25520	34001	15405	25610	24975
20	21311	17524	19756	27954	8602	21745
21	18790	17531	14703	14851	20759	15695
22	14770	11739	12302	10078	8068	11373
23	13333	10150	8265	9696	6071	9570
24	8700	7944	6035	5822	5070	6600
25	4384	4261	4506	4063	3027	4277
26	3588	2309	2747	3292	1587	2782
27	1970	2031	1333	1905	976	1757
28	1515	1226	1492	848	526	1189
29	1490	964	852	1202	70	1006
30+	629	594	319	699	144	537
TOTAL	398656	1536768	1654390	1688475	1762844	
SPAWN. ST.	241463	226225	247935	239576	250856	

Table 29. Sebastes marinus in Sub-areas V and XIV. Total stock biomass (age 9+) and spawning stock biomass (age 16+) (in '000 tonnes).

Year	Total stock biomass	Spawning stock biomass
1967	849	494
1968	802	444
1969	768	423
1970	729	376
1971	722	337
1972	686	292
1973	733	290
1974	808	296
1975	844	306
1976	864	275
1977	904	252
1978	967	265
1979	1 010	262
1980	1 038	254

Table 30. Sebastes marinus in Sub-areas V and XIV. Parameters used in catch predictions.

Age	Stock size at the beginning of 1981   1982 (in '000)		Relative fishing mortality	Mean weight at age (kg)	Recruitment: (average over 1967-1975) $187\ 000 \times 10^{-3}$  M = 0.1
9	187 000	187 000	.002	0.399	
10	283 204	168 979	.006	0.440	
11	198 795	255 231	.010	0.486	
12	233 615	178 683	.04	0.536	
13	254 225	205 824	.10	0.591	
14	124 977	215 205	.18	0.652	
15	102 153	100 303	.20	0.720	
16	121 580	80 900	.24	0.794	
17	72 163	93 753	.28	0.876	
18	20 876	54 183	.34	0.966	
19	34 729	15 060	.38	1.066	
20	17 886	24 395	.44	1.176	
21	5 766	12 071	.48	1.297	
22	13 545	3 789	.52	1.431	
23	5 119	8 667	.60	1.579	
24	3 649	3 105	1.00	1.742	
25	2 320	1 696	1.00	1.922	
26	1 385	1 078	1.00	2.120	
27+	1 512	1 346	1.00	2.700	

Table 31. Sebastes mentella in fishing areas V and XIV.  
Input catch data for VPA ('000).

	1967	1968	1969	1970	1971	1972	1973	1974	1975
8	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	1	0	0
11	0	0	0	0	0	0	2	0	1
12	32	12	46	77	19	15	122	71	87
13	84	40	137	225	66	46	269	196	262
14	437	250	649	1007	372	320	549	802	1331
15	479	292	606	920	385	414	408	677	1161
16	1452	1024	1576	2212	1066	1567	1068	1591	2384
17	1519	1221	1492	1932	1059	1685	1107	1445	1797
18	2515	2260	2362	2736	1691	2743	1874	2242	2285
19	3349	3433	3000	3019	2284	3500	2586	2790	2202
20	1060	1136	844	847	699	993	779	795	605
21	8121	9195	6578	6013	5609	6885	5741	5467	4474
22	3203	3945	2610	2110	2528	2483	2379	2029	1785
23	10430	12819	9126	6850	8854	8162	9044	7398	6357
24	5339	6473	5960	3793	4758	4703	5862	4602	4093
25	2490	2908	2390	1851	2186	2285	3063	2306	2147
26	1851	2149	2079	1488	1647	1844	2551	1935	1862
27	785	914	717	727	666	824	1158	900	913
28+	369	441	899	533	385	492	565	489	581
TOTAL	43515	48512	41071	56340	34274	38961	39128	35735	34327
	1976	1977	1978	1979	1980				
8	0	0	0	216	19				
9	3202	2	321	186	63				
10	2948	2	656	485	336				
11	6533	3	908	647	1158				
12	22608	142	1521	1517	6183				
13	21121	362	664	1373	5103				
14	14107	1438	816	2622	3247				
15	5547	1334	1206	2726	3140				
16	4431	3411	1577	1980	2064				
17	2619	2897	882	1035	1145				
18	2841	3722	1581	1565	1197				
19	2229	3454	1371	2022	1070				
20	541	802	1089	915	1067				
21	3625	4884	1688	3133	2895				
22	1192	1314	1264	1937	1764				
23	4050	3958	2070	1741	1725				
24	2403	2172	1388	1449	1209				
25	1232	1089	823	842	503				
26	1061	928	506	297	192				
27	544	480	104	54	103				
28+	331	377	0	0	0				
TOTAL	1031	32771	20435	26742	34183				

Table 32. Sebastes mentella in fishi. as V and XIV.  
Fishing mortalities from VPA (= 0.1).

	1967	1968	1969	1970	1971	1972	1973	1974	1975
9	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
11	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
12	0.001	0.000	0.001	0.002	0.000	0.001	0.004	0.002	0.002
13	0.002	0.001	0.003	0.006	0.002	0.001	0.010	0.008	0.009
14	0.009	0.006	0.018	0.029	0.012	0.009	0.015	0.034	0.060
15	0.009	0.007	0.016	0.030	0.012	0.015	0.013	0.021	0.057
16	0.026	0.022	0.040	0.065	0.039	0.058	0.044	0.059	0.087
17	0.026	0.025	0.037	0.057	0.036	0.072	0.048	0.069	0.079
18	0.046	0.045	0.055	0.080	0.058	0.112	0.097	0.115	0.134
19	0.067	0.073	0.070	0.083	0.080	0.148	0.132	0.182	0.142
20	0.024	0.026	0.021	0.023	0.022	0.041	0.040	0.049	0.049
21	0.218	0.266	0.186	0.182	0.185	0.283	0.307	0.379	0.375
22	0.100	0.140	0.100	0.075	0.097	0.105	0.134	0.152	0.182
23	0.525	0.623	0.485	0.365	0.448	0.453	0.587	0.671	0.830
24	0.477	0.642	0.588	0.339	0.412	0.403	0.605	0.597	0.876
25	0.402	0.459	0.458	0.322	0.297	0.316	0.441	0.449	0.546
26	0.472	0.638	0.616	0.510	0.467	0.389	0.612	0.490	0.702
27	0.400	0.400	0.400	0.400	0.400	0.400	0.400	0.400	0.400
28+	0.400	0.400	0.400	0.400	0.400	0.400	0.400	0.400	0.400
F(14-23),U	0.105	0.123	0.103	0.099	0.099	0.130	0.142	0.173	0.200
							Adjusted <sup>x</sup>		
	1976	1977	1978	1979	1980	1979	1980		
9	0.031	0.000	0.017	0.038	0.081	0.003	0.001		
10	0.044	0.000	0.007	0.029	0.081		0.006		
11	0.117	0.000	0.011	0.007	0.081				
12	0.585	0.003	0.029	0.021	0.081				
13	0.802	0.014	0.016	0.029	0.081				
14	0.731	0.098	0.036	0.071	0.081				
15	0.537	0.120	0.100	0.147	0.102				
16	0.282	0.318	0.182	0.211	0.142				
17	0.117	0.269	0.114	0.157	0.163				
18	0.155	0.217	0.206	0.269	0.244				
19	0.168	0.255	0.104	0.389	0.265				
20	0.042	0.075	0.107	0.084	0.325				
21	0.404	0.563	0.201	0.444	0.366				
22	0.144	0.223	0.245	0.331	0.427				
23	0.690	0.836	0.569	0.546	0.488				
24	0.778	0.887	0.708	0.896	0.813				
25	0.629	0.891	0.910	1.164	0.813				
26	0.506	1.293	1.328	0.896	0.813				
27	0.400	0.400	0.400	0.400	0.813				
28+	0.400	0.400	0.400	0.400	0.813				
F(14-23),U	0.307	0.298	0.186	0.265	0.260				

x) See Section 4.5.2.1

Table 33. Sebastes mentelle in fishing areas V and XIV.  
Stock size in numbers ('000) from VPA.

	1967	1968	1969	1970	1971	1972	1973	1974	1975
9	60119	62762	42112	39773	47369	59776	72064	76108	79988
10	49374	54398	56790	38105	35988	42862	54087	65206	68865
11	50572	44675	49221	51386	34479	32563	38783	48939	59001
12	45770	45759	40424	44537	46496	31198	29464	35090	44282
13	50651	41384	41393	36533	40226	42053	28214	26544	31683
14	52343	45751	37408	37324	32843	36335	38007	25274	23832
15	54211	46946	41160	33231	32815	29364	32573	33868	22106
16	59654	48596	42201	36667	29194	29326	26176	29086	30002
17	61145	52597	42998	36687	31075	25402	25046	22670	24806
18	58884	53883	46431	37488	31360	27111	21384	21610	19139
19	54584	50890	46607	39768	31321	26768	21926	17568	17424
20	46803	46207	42785	39321	33115	26170	20897	17383	13248
21	43432	41341	40730	37911	34774	29299	22736	18168	14973
22	35293	31591	28683	30609	28595	26139	19980	15127	11257
23	26705	28891	24838	23474	25691	23472	21293	15819	11761
24	14725	14289	14016	13832	14747	14859	13506	10709	7318
25	7873	8267	6807	7043	8919	8935	8988	6675	5336
26	5147	4764	4726	3895	4617	5997	5827	5231	3855
27	2494	2904	2278	2310	2116	2618	3679	2859	2900
28+	1172	1401	2856	1693	1223	1563	1795	1553	1846
TOTAL	780950	727298	654464	591586	546961	521709	506425	495489	493623
SPAWN. ST.	417911	395621	345956	310697	276746	247560	213232	184459	163865

	1976	1977	1978	1979	1980	1981	Adjusted <sup>x)</sup>		
							1979	1980	1981
9	109430	114240	19990	5207	850	*****	60000	60000	60000
10	72376	95973	103366	17782	4535	710		54127	54235
11	62312	62687	86838	92906	15629	3784			48663
12	53385	50176	56718	77711	83450	13041			
13	39985	26912	45266	49875	68873	69633			
14	28419	16230	24007	40327	43824	57470			
15	20299	12382	13319	20947	33998	36568			
16	18899	13108	9937	10906	16365	27780			
17	24882	12897	8626	7494	7989	12847			
18	20738	20026	8922	6967	5798	6141			
19	15148	16066	14588	6572	4819	4110			
20	13675	11590	11260	11897	4030	3346			
21	11412	11859	9725	9154	9895	2635			
22	9308	6891	6108	7197	5315	6209			
23	8491	7290	4988	4328	4675	3138			
24	4639	3854	2859	2554	2268	2597			
25	2738	1927	1437	1274	944	910			
26	2796	1330	716	523	360	379			
27	1728	1525	330	172	193	145			
28+	1052	1198	0	0	0	78			
TOTAL	521731	488160	428999	373794	313810	62651	428587	422552	396904
SPAWN. ST.	135523	109560	79494	69038	62651	70315	69038	62651	70315

x) See Section 4.5.2.1



Table 34. Sebastes mentella in Sub-areas V and XIV.  
Total stock biomass (age 9+) and spawning stock biomass  
(age 16+) in '000 tonnes.

Year	Total stock biomass	Spawning stock biomass
1967	510	374
1968	477	352
1969	433	319
1970	395	291
1971	367	267
1972	343	244
1973	317	213
1974	286	178
1975	264	153
1976	251	122
1977	222	100
1978	193	72
1979	192	63
1980	188	54

Table 35. Sebastes mentella in Sub-areas V and XIV.  
Parameters used in catch predictions.

Age	Stock size in numbers at the beginning of 1981   1982 (in '000)		Relative fishing mortality	Mean weight at age (kg)	Recruitment: (average over 1967-1975) 60 000 x 10 <sup>-5</sup>  M = 0.1
9	60 000	60 000	0.10	0.260	
10	54 235	49 717	0.10	0.292	
11	48 683	44 940	0.10	0.327	
12	13 041	40 339	0.10	0.367	
13	69 633	10 806	0.10	0.410	
14	57 470	57 699	0.10	0.461	
15	36 568	47 620	0.13	0.516	
16	27 780	29 641	0.18	0.578	
17	12 847	21 549	0.20	0.648	
18	6 141	9 748	0.30	0.726	
19	4 110	4 267	0.33	0.813	
20	3 346	2 994	0.40	0.912	
21	2 635	2 129	0.45	1.022	
22	6 209	1 605	0.53	1.145	
23	3 138	3 524	0.60	1.284	
24	2 597	1 675	1.00	1.438	
25	910	975	1.00	1.614	
26	379	342	1.00	1.809	
27+	223	197	1.00	2.028	

Table 36. GREENLAND HALIBUT. Total nominal catches (in tonnes) by main fishing areas.

Year	Sub-area I	Div. IIb	Div. IIa	Div. Va	Div. Vb	Sub-area XIV	Total
1970	4 011	70 523	14 950	30 001	-	3 822	123 307
1971	5 413	62 764	10 857	15 049	11	13 913	108 007
1972	8 549	18 873	15 633	10 666	417	15 389	69 527
1973	5 667	16 081	8 190	7 386	358	12 719	50 401
1974	5 251	24 600	7 852	7 866	325	28 089	74 043
1975	6 495	28 511	3 166	3 308	560	19 627	61 667
1976	2 479	29 610	3 985	5 448	324	273	42 119
1977	2 222	16 221	10 384	15 679	658	241	45 465
1978	1 591	10 134	12 892	11 588	592	2 166	38 963
1979	945	6 080	10 287	16 976	409	6 231	40 928
1980 <sup>x)</sup>	654	7 414	5 146	27 900	1 086	2 171	44 371

x) Provisional data.

Table 37. GREENLAND HALIBUT. Nominal catch (tonnes) in Sub-area I.

Country	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980 <sup>x)</sup>
German Dem.Rep.	-	14 <sup>1)</sup>	1 <sup>1)</sup>	-	-	5	-	-	-	-	-
Germany, Fed.Rep.	-	-	-	25	22	6	2	1	-	-	-
Norway	1 675	1 951	3 116	2 947	2 167	2 160	1 203	1 320	1 148	727	602 <sup>1)</sup>
Poland	-	7	117	-	1	-	9	-	-	-	-
UK (Engl. & Wales)	-	-	949	995	732	550	665	541	232	36	12
USSR	2 336	3 441	4 366	1 700	2 329	3 774	600	360	211	182	40
Total	4 011	5 413	8 549	5 667	5 251	6 495	2 479	2 222	1 591	945	654

x) Provisional data.

1) From national statistics.

Table 38. GREENLAND HALIBUT. Nominal catch (tonnes) in Division IIa.

Country	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980 <sup>x)</sup>
Faroe Isl.	44	-	-	-	-	-	2	21	-	3	-
German Dem.Rep.	2 131 <sup>1)</sup>	353 <sup>1)</sup>	1 069 <sup>1)</sup>	52	656	172	354	1 641	1 398	787	570
Germany, Fed.Rep.	-	3	3	+	49	41	17	22	321	481	288
Norway	6 408	4 974	11 715	7 861	6 593	2 265	3 490	1 434	2 084	2 051	2 329 <sup>1)</sup>
Poland	6 291	5 036	2 643	137	499	66	31	95	197	4	-
UK (Engl. & Wales)	-	-	182	118	55	107	48	211	82	11	9
USSR	76	491	21	22	-	515	43	6 960	8 809	6 929	1 950
Others	-	-	-	-	-	-	-	-	1	21	-
Total	14 950	10 857	15 633	8 190	7 852	3 166	3 985	10 384	12 892	10 287	5 146

x) Provisional data.

1) From national statistics.

Table 39. GREENLAND HALIBUT. Nominal catch (tonnes) in Division IIb.

Country	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980 <sup>x)</sup>
German Dem.Rep.	16 598 <sup>1)</sup>	2 582 <sup>1)</sup>	563 <sup>1)</sup>	3 902	5 258	8 295	8 601	6 535	3 213	2 701	1 510
Germany, Fed.Rep.	-	-	-	34	17	47	12	125	-	-	-
Norway	7 788	2 541	1 152	3 181	31	433	1 312	1 400	850	65	192 <sup>1)</sup>
Poland	12 971	7 234	5 221	2 003	4 646	3 579	3 526	129	347	102	-
UK (Engl. & Wales)	-	-	131	122	79	74	222	307	93	12	5
USSR	33 166	50 407	11 806	6 839	14 629	16 083	15 937	7 725	5 631	3 200	5 707
Total	70 523	62 764	18 873	16 081	24 660	28 511	29 610	16 221	10 134	6 080	7 414

x) Provisional data.

1) From national statistics.

Table 40. GREENLAND HALIBUT. Nominal catch (tonnes) in Sub-areas I and II. 1970-80.  
(Data for 1970-79 from Bulletin Statistique)

Country	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980 <sup>x)</sup>
Faroe Isl.	44	-	-	-	-	-	2	21	-	24	-
German Dem.Rep.	18 729 <sup>1)</sup>	2 949 <sup>1)</sup>	1 633 <sup>1)</sup>	3 954	5 914	8 472	8 955	8 176	4 611	3 488	2 080
Germany, Fed.Rep.	-	3	3	59	88	94	31	148	321	481	288
Norway: trawl catch <sup>1)</sup>	1 638	2 309	9 656	10 217	4 656	1 686	4 030	2 526	2 302	921	1 528
long-line catch and gill net <sup>1)</sup>	14 233	7 157	6 327	3 772	4 135	3 172	1 975	1 628	1 780	1 992	1 595
Poland	19 262	12 277	7 981	2 140	5 146	3 645	3 566	224	544	106	-
UK (Engl. & Wales)	-	-	1 262	1 235	866	731	935	1 059	407	59	26
USSR	35 578	54 339	16 193	8 561	16 958	20 372	16 580	15 045	14 651	10 311	7 697
Others	-	-	-	-	-	-	-	-	1 <sup>1)</sup>	5	-
Total	89 484	79 034	43 055	29 938	37 763	38 172	36 074	28 827	24 617	17 312	13 214

x) Provisional data.

1) From national statistics.

Table 41. GREENLAND HALIBUT in Sub-areas I and II.  
Catch per unit effort and total effort.

Year	USSR Catch/hour trawling (tonnes)	German Dem.Rep. Catch/day trawling (tonnes)	Norway Catch/hour trawling (tonnes)	Calibrated catch per unit effort CPUE	Total effort $\times 10^{-3}$ (CPUE units)	CPUE 7+
1965	.80			2.47	14.1	
1966	.77			2.38	11.0	
1967	.70			2.16	11.2	
1968	.65			2.01	13.0	
1969	.53			1.64	26.7	
1970	.53			1.64	54.6	1.54
1971	.46			1.42	55.7	1.33
1972	.37			1.14	37.8	1.01
1973	.37	8.6	.506	1.24	24.1	1.20
1974	.40	8.4	.432	1.19	31.7	1.11
1975	.39	8.9	.479	1.24	30.8	1.18
1976	.40	7.1	.452	1.14	31.6	1.06
1977	.27	5.0	.361	.83	34.7	.71
1978	.21	4.6	.223	.63	39.1	.51
1979	.23	4.8	.298	.73	23.7	.52
1980	.24	6.6		.86	15.4	.74

Table 42. The three sets of mean weight at age data, one used for the period 1970-78, the other used for 1979, and another for 1980 and in the predictions.

Age	$\bar{w}$ (kg) 1970-78	$\bar{w}$ (kg) 1979	$\bar{w}$ (kg) 1980
3	0.200	0.3	0.200
4	0.441	0.6	0.482
5	0.567	0.9	0.702
6	0.737	1.2	0.872
7	1.079	1.5	1.141
8	1.421	1.8	1.468
9	1.848	2.2	1.778
10	2.281	2.6	2.302
11	2.887	3.0	2.664
12	3.247	3.5	3.046
13	4.303	4.1	3.368
14	4.931	4.8	4.285
15	5.765	5.6	5.025
16	6.308	7.0	6.589

Table 43. The estimated catch (sum of products) compared with the observed catch using the age compositions (Table 44) and the mean weights in Table 42.

Year	Observed catch	Sum of products	Weight correction factor
1970	89 484	94 846	0.943
1971	79 034	75 749	1.043
1972	43 055	44 353	0.971
1973	29 938	32 440	0.923
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	13 214	12 317	1.073



Table 44. GREENLAND HALIBUT in fishing areas I and II.  
Input catch data for VPA ('000)

	1970	1971	1972	1973	1974	1975	1976	1977	1978
3	1	1	1	1	1	22	1	62	78
4	34	1	461	19	276	334	98	755	532
5	526	80	1109	212	917	840	830	2037	1897
6	2792	4486	3521	1117	2519	2337	2982	3255	3589
7	10464	12712	9605	3923	6204	6520	5824	4200	4118
8	18562	12283	6438	3515	3838	4118	5002	2524	2365
9	10034	6130	2775	2551	1834	2265	3000	1610	1509
10	6671	4339	1734	1919	1942	1654	1350	1104	946
11	2517	2703	1368	1536	1622	1857	915	1062	934
12	1250	1660	1234	1127	1338	1536	1212	858	438
13	616	1044	675	716	734	1122	698	595	349
14	1104	300	200	251	531	600	526	384	147
15	266	123	40	70	137	270	254	93	83
16+	15	20	40	56	79	98	104	87	29
TOTAL	54852	45882	29201	17013	21972	23573	22796	18626	17014
	1979	1980							
3	88	64							
4	887	273							
5	2218	729							
6	3155	1135							
7	2727	1660							
8	1234	1336							
9	495	943							
10	319	472							
11	296	498							
12	243	274							
13	103	261							
14	45	124							
15	30	63							
16+	21	25							
TOTAL	11861	7857							

Table 45. GREENLAND HALIBUT in fishing areas I and II.  
Fishing mortalities from VPA (M = 0.15).

	1970	1971	1972	1973	1974	1975	1976	1977	1978
3	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.002	0.003
4	0.001	0.000	0.013	0.001	0.011	0.011	0.004	0.051	0.025
5	0.014	0.003	0.036	0.007	0.035	0.039	0.034	0.093	0.096
6	0.067	0.151	0.158	0.044	0.105	0.113	0.179	0.171	0.223
7	0.296	0.454	0.515	0.250	0.337	0.404	0.421	0.385	0.319
8	0.697	0.630	0.413	0.338	0.390	0.370	0.585	0.307	0.367
9	0.599	0.490	0.263	0.269	0.280	0.396	0.475	0.354	0.287
10	0.620	0.532	0.234	0.276	0.319	0.412	0.409	0.302	0.342
11	0.523	0.518	0.299	0.316	0.374	0.538	0.396	0.618	0.425
12	0.555	0.746	0.447	0.405	0.470	0.689	0.774	0.750	0.529
13	0.876	1.254	0.741	0.478	0.473	0.871	0.741	1.092	0.751
14	1.891	1.546	0.821	0.645	0.747	0.850	1.393	1.195	0.844
15	1.370	1.320	0.860	0.730	0.850	1.060	1.070	0.980	0.870
16+	1.370	1.320	0.860	0.730	0.850	1.060	1.070	0.980	0.870
F(7-11),U	0.547	0.525	0.345	0.290	0.340	0.424	0.457	0.393	0.348
	1979	1980							
3	0.003	0.002							
4	0.041	0.011							
5	0.130	0.041							
6	0.216	0.086							
7	0.249	0.160							
8	0.141	0.176							
9	0.114	0.144							
10	0.085	0.144							
11	0.161	0.176							
12	0.175	0.208							
13	0.212	0.272							
14	0.185	0.400							
15	0.380	0.400							
16+	0.380	0.400							
F(7-11),U	0.150	0.160							

Table 46. GREENLAND HALIBUT in fishing areas I and II.  
Stock size in numbers ('000) from VPA.

	1970	1971	1972	1973	1974	1975	1976	1977	1978
3	45851	43431	38371	32281	36558	33314	30999	27188	27559
4	35072	39464	37381	33025	27784	31465	28653	26681	23343
5	40659	30155	33966	31747	28408	23658	26772	24571	22265
6	46323	34508	25881	28207	27128	23601	19584	22274	19263
7	43868	37285	25551	19019	25243	21018	18150	14099	16161
8	39501	28094	20375	13146	12745	14279	12077	10252	8260
9	23790	16942	12885	11601	8071	7429	8491	5792	6494
10	15437	11245	8935	8526	7628	5253	4305	4544	3499
11	6608	7151	5683	6088	5566	4773	2996	2461	2892
12	3137	3370	3666	3628	3822	3294	2398	1734	1141
13	1124	1550	1376	2018	2083	2056	1424	952	705
14	1369	403	381	564	1077	1117	741	584	275
15	378	178	74	144	255	439	411	158	152
16+	21	29	74	115	147	159	168	148	53
TOTAL SPAWN. ST.	503140	253804	214597	190109	184513	171855	157171	141438	132062
	51865	40867	33072	32684	28649	24521	20934	16374	15211
	1979	1980	1981						
3	31313	34494	*****						
4	23648	26870	29630						
5	19599	19533	22874						
6	17407	14816	16136						
7	13262	12066	11702						
8	10108	8895	8850						
9	4928	7558	6421						
10	4196	3783	5633						
11	2139	3316	2820						
12	1628	1567	2393						
13	579	1176	1096						
14	286	403	771						
15	102	205	233						
16+	71	81	165						
TOTAL SPAWN. ST.	129265	134763							
	13928	18090							

Table 47. GREENLAND HALIBUT in Sub-areas I and II.  
Input parameters used in the catch  
predictions.

Age	Exploitation pattern	Mean weights (kg)	Stock size in 1981 ( $\times 10^{-3}$ )
3	.013	.200	30 000
4	.070	.482	29 630
5	.255	.702	22 874
6	.540	.872	16 136
7	1.00	1.141	11 702
8	1.10	1.468	8 850
9	.90	1.778	6 421
10	.90	2.302	5 633
11	1.10	2.664	2 820
12	1.30	3.046	2 393
13	1.70	3.368	1 096
14	2.10	4.285	771
15	2.50	5.025	233
16+	2.50	6.589	165

Catch 1981 = 12 000 tonnes  
M = 0.15  
Recruitment at age 3 in 1981 and 1982:  $30\ 000 \times 10^3$

Table 48. GREENLAND HALIBUT. Nominal catch (tonnes) in Division Va.

Country	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980 <sup>x)</sup>
Faroe Isl.	4 122	1 316	1 180	188	41	2	373	947	256	42	91
German Dem.Rep.	14 958 <sup>1)</sup>	3 317 <sup>1)</sup>	159 <sup>1)</sup>	320	388	-	-	-	-	-	-
Germany, Fed.Rep.	-	882	1 119	826	1 786	887	1 719	4 642	-	-	-
Iceland	7 343	5 020	4 640	2 115	2 842	1 212	1 687	10 090	11 319	16 934	27 809
Norway	338	369	186	-	-	-	-	+	13	-	-
Poland	1 127	899	31	-	485	-	-	-	-	-	-
UK(Engl. & Wales)	-	-	2 223	3 648	2 314	1 207	1 669	-	-	-	-
USSR	2 113	3 246	1 128	289	10	-	-	-	-	-	-
Total	30 001	15 049	10 666	7 386	7 866	3 308	5 448	15 679	11 588	16 976	27 900

x) Provisional data.

1) From national statistics.

Table 49. GREENLAND HALIBUT. Nominal catch (tonnes) in Division Vb).

Country	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980 <sup>x)</sup>
Faroe Isl.	-	-	-	-	7	6	2	304	2	108	931
France	-	-	-	-	-	-	-	-	12	66	-
German Dem.Rep.	-	-	-	-	147	91	-	-	-	-	-
Germany, Fed.Rep.	-	11	405	287	163	437	309	341	570	234	155
Norway	-	-	-	-	-	7	7	5 <sup>1)</sup>	3	1	-
Poland	-	-	-	9	-	18	-	-	-	-	-
UK (Engl. & Wales)	-	-	12	61	8	+	6	8	8	-	-
USSR	-	-	-	1	-	-	-	-	-	-	-
Total	-	11	417	358	325	559	324	658	595	409	1 086

x) Provisional data.

1) From national statistics.

Table 50. GREENLAND HALIBUT. Nominal catch (tonnes) in Sub-area XIV.

Country	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980 <sup>x)</sup>
France	-	-	-	-	-	-	-	-	-	4	-
German Dem.Rep.	2 981 <sup>1)</sup>	3 491 <sup>1)</sup>	7 328 <sup>1)</sup>	8 806	25 266	16 872	-	-	-	-	-
Germany, Fed.Rep.	-	270	5	7	+	64	191	224	2 156	6 227	2 170
Greenland	-	2	3	4	2	1	1	4	6	-	1
Iceland	2	+	-	3	1	+	2	-	-	-	-
Norway	-	-	-	-	-	-	-	2 <sup>1)</sup>	3	-	-
Poland	732	7 910	7 847	3 122	1 057	1 054	-	-	-	-	-
UK (Engl. & Wales)	-	-	1	1	1	2	5	11	1	-	-
USSR	107	2 240	205	776	1 762	1 634	74	-	-	-	-
Total	3 822	13 913	15 389	12 719	28 089	19 627	273	241	2 166	6 231	2 171

x) Provisional data.

1) From national statistics.

Table 51. GREENLAND HALIBUT. Nominal catch (tonnes) in Sub-areas V and XIV, 1970-80.  
(Data for 1970-79 from Bulletin Statistique)

Country	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980 <sup>x)</sup>
Faroe Isl.	4 122	1 316	1 180	188	48	8	375	1 251	258	150	1 022
France	-	-	-	-	-	-	-	-	12	70	-
German Dem.Rep.	17 939 <sup>1)</sup>	6 808 <sup>1)</sup>	7 487 <sup>1)</sup>	9 126	25 801	16 963	-	-	-	-	-
Germany, Fed.Rep.	-	1 163	1 529	1 120	1 949	1 388	2 219	5 207	2 726	6 461	2 325
Greenland	-	2	3	4	2	1	1	4	6	6	1
Iceland	7 345	5 020	4 640	2 118	2 843	1 212	1 689	10 090	11 319	16 934	27 809
Norway	338	369	186	-	-	7	7	7	19	1	-
Poland	1 859	8 809	7 878	3 131	1 542	1 072	-	-	-	-	-
UK (Engl. & Wales)	-	-	2 236	3 710	2 323	1 209	1 680	19	9	-	-
USSR	2 220	5 486	1 333	1 066	1 772	1 634	74	-	-	-	-
Total	33 823	28 973	26 473	20 463	36 280	23 494	6 045	16 578	14 349	23 622	31 157

x) Provisional data.

1) From national statistics.



Table 50. GREENLAND HALIBUT. Nominal catch (tonnes) in Sub-area XIV.

Country	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980 <sup>x)</sup>
France	-	-	-	-	-	-	-	-	-	4	-
German Dem.Rep.	2 981 <sup>1)</sup>	3 491 <sup>1)</sup>	7 328 <sup>1)</sup>	8 806	25 266	16 872	-	-	-	-	-
Germany, Fed.Rep.	-	270	5	7	+	64	191	224	2 156	6 227	2 170
Greenland	-	2	3	4	2	1	1	4	6	-	1
Iceland	2	+	-	3	1	+	2	-	-	-	-
Norway	-	-	-	-	-	-	-	2 <sup>1)</sup>	3	-	-
Poland	732	7 910	7 847	3 122	1 057	1 054	-	-	-	-	-
UK (Engl. & Wales)	-	-	1	1	1	2	5	11	1	-	-
USSR	107	2 240	205	776	1 762	1 634	74	-	-	-	-
Total	3 822	13 913	15 389	12 719	28 089	19 627	273	241	2 166	6 231	2 171

x) Provisional data.

1) From national statistics.

Table 51. GREENLAND HALIBUT. Nominal catch (tonnes) in Sub-areas V and XIV, 1970-80.  
(Data for 1970-79 from Bulletin Statistique)

Country	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980 <sup>x)</sup>
Faroe Isl.	4 122	1 316	1 180	188	48	8	375	1 251	258	150	1 022
France	-	-	-	-	-	-	-	-	12	70	-
German Dem.Rep.	17 939 <sup>1)</sup>	6 808 <sup>1)</sup>	7 487 <sup>1)</sup>	9 126	25 801	16 963	-	-	-	-	-
Germany, Fed.Rep.	-	1 163	1 529	1 120	1 949	1 388	2 219	5 207	2 726	6 461	2 325
Greenland	-	2	3	4	2	1	1	4	6	6	1
Iceland	7 345	5 020	4 640	2 118	2 843	1 212	1 689	10 090	11 319	16 934	27 809
Norway	338	369	186	-	-	7	7	7	19	1	-
Poland	1 859	8 809	7 878	3 131	1 542	1 072	-	-	-	-	-
UK (Engl. & Wales)	-	-	2 236	3 710	2 323	1 209	1 680	19	9	-	-
USSR	2 220	5 486	1 333	1 066	1 772	1 634	74	-	-	-	-
Total	33 823	28 973	26 473	20 463	36 280	23 494	6 045	16 578	14 349	23 622	31 157

x) Provisional data.

1) From national statistics.

Table 52. GREENLAND HALIBUT in fishing areas V and XIV.  
Input catch data for VPA ('000).

	1975	1976	1977	1978	1979	1980
4	1	1	0	1	0	6
5	120	43	0	23	29	45
6	800	296	34	91	197	481
7	1775	584	671	347	1605	1471
8	1782	621	1727	1037	2253	2519
9	1259	431	2289	1214	3090	2994
10	926	240	834	848	1693	2226
11	464	121	420	567	880	1666
12	459	86	423	312	394	813
13	279	37	174	232	246	554
14	193	32	120	218	189	293
15	137	14	28	114	147	137
16	39	6	86	112	101	79
17	2	1	41	64	15	28
18+	44	2	14	28	9	5
TOTAL	8280	2515	6861	5208	10848	13317

Table 53. GREENLAND HALIBUT in fishing areas V and XIV.  
Fishing mortalities from VPA (M = 0.15).

	1975	1976	1977	1978	1979	1980	1976-1980
4	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5	0.005	0.002	0.000	0.001	0.001	0.002	0.001
6	0.039	0.014	0.002	0.004	0.006	0.015	0.008
7	0.132	0.035	0.038	0.021	0.095	0.050	0.048
8	0.221	0.059	0.129	0.073	0.175	0.200	0.127
9	0.281	0.072	0.302	0.120	0.302	0.350	0.229
10	0.326	0.075	0.184	0.165	0.230	0.350	0.201
11	0.268	0.060	0.171	0.174	0.243	0.350	0.200
12	0.468	0.069	0.291	0.176	0.167	0.350	0.210
13	0.557	0.058	0.182	0.243	0.194	0.350	0.205
14	0.285	0.105	0.253	0.344	0.301	0.350	0.271
15	0.426	0.028	0.120	0.382	0.387	0.350	0.253
16	2.112	0.028	0.228	0.880	0.649	0.350	0.427
17	0.250	0.250	0.250	0.250	0.250	0.350	0.270
18+	0.250	0.250	0.250	0.250	0.250	0.350	0.270
F( 8-13),U	0.353	0.066	0.210	0.158	0.219	0.325	

Table 54. GREENLAND HALIBUT in fishing areas V and XIV.  
Stock size in numbers ('000) from VPA.

	1975	1976	1977	1978	1979	1980	1981	1976-1980
4	28114	30040	51223	46992	37562	32309*****		39625
5	26374	24197	25855	44088	40445	32330	27803	33383
6	22263	22589	20787	22254	37925	34785	27785	27668
7	15399	18421	19168	17860	19070	32460	29494	21396
8	9647	11612	15314	15877	15050	14927	26576	14556
9	5520	6656	9419	11582	12705	10870	10519	10247
10	3570	5588	5330	5993	8846	8082	6593	6368
11	2119	2218	2866	3816	4374	6049	4902	3865
12	1315	1395	1797	2078	2760	2952	3669	2196
13	699	709	1121	1156	1500	2011	1790	1300
14	836	345	576	804	781	1064	1220	714
15	423	542	267	385	491	497	645	436
16	47	238	453	204	226	287	302	282
17	10	5	199	311	73	102	174	138
18+	214	10	68	136	44	18	73	55
TOTAL	116549	122563	154442	173535	181852	178744		
SPAWN. ST.	18924	20614	27617	31572	36836	38623		

Table 55. GREENLAND HALIBUT in Sub-areas V and XIV.  
Parameters used in catch predictions.

Age	Stock size in numbers at beginning of 1981 ( $\times 10^{-3}$ )	Relative fishing mortality ( $\bar{F}_{(8-13)} = 1.0$ )	Mean weight (kg)
4	39 600	0.0000	0.742
5	27 803	0.005	1.125
6	27 785	0.043	1.283
7	29 494	0.14	1.487
8	26 576	0.57	1.756
9	10 519	1.00	2.052
10	6 593	1.00	2.278
11	4 902	1.00	2.497
12	3 669	1.00	3.057
13	1 790	1.00	3.781
14	1 220	1.00	4.506
15	645	1.00	5.140
16	302	1.00	5.634
17	174	1.00	6.655
18+	73	1.00	7.814

$R_4$  in 1982 =  $39.6 \times 10^{-6}$

Table 56. GREENLAND HALIBUT in Sub-areas V and XIV. Stock biomass estimates (in tonnes).

Year	Stock biomass	
	Total	Spawning
1975	157 221	50 354
1976	193 949	60 664
1977	205 037	71 292
1978	232 603	83 449
1979	231 872	87 292
1980	261 688	91 707

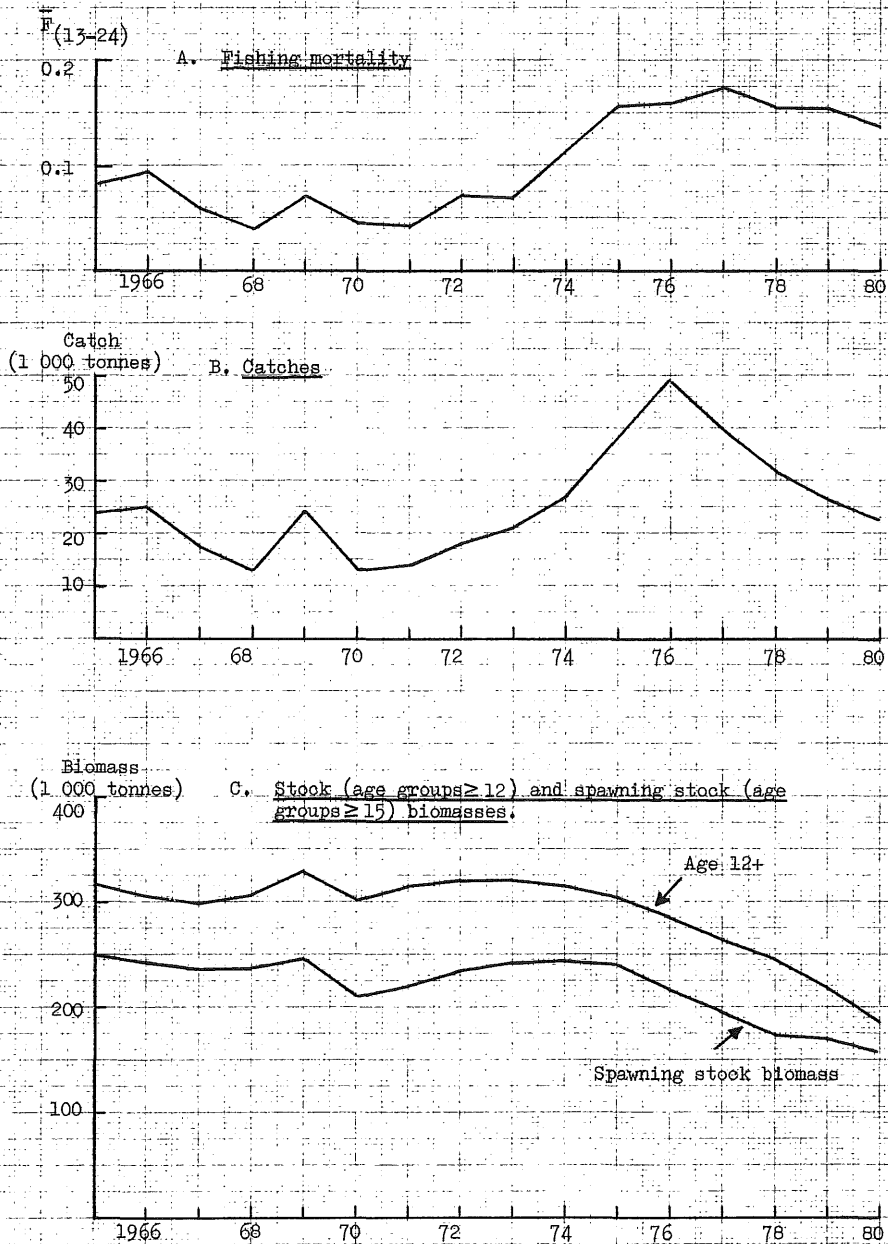


Figure 1. Sebastes marinus in Sub-area I and Division IIa.

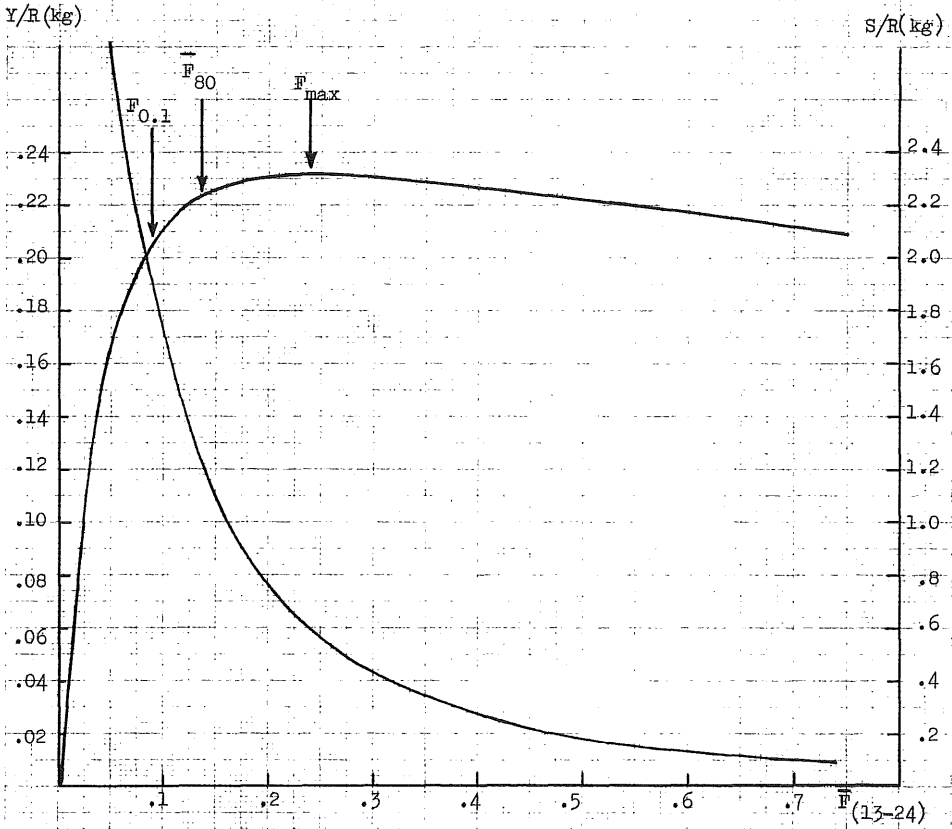


Figure 2. *Sebastes marinus* in Sub-area I and Division IIa.  
Yield and spawning stock biomass per 12 year old recruits.



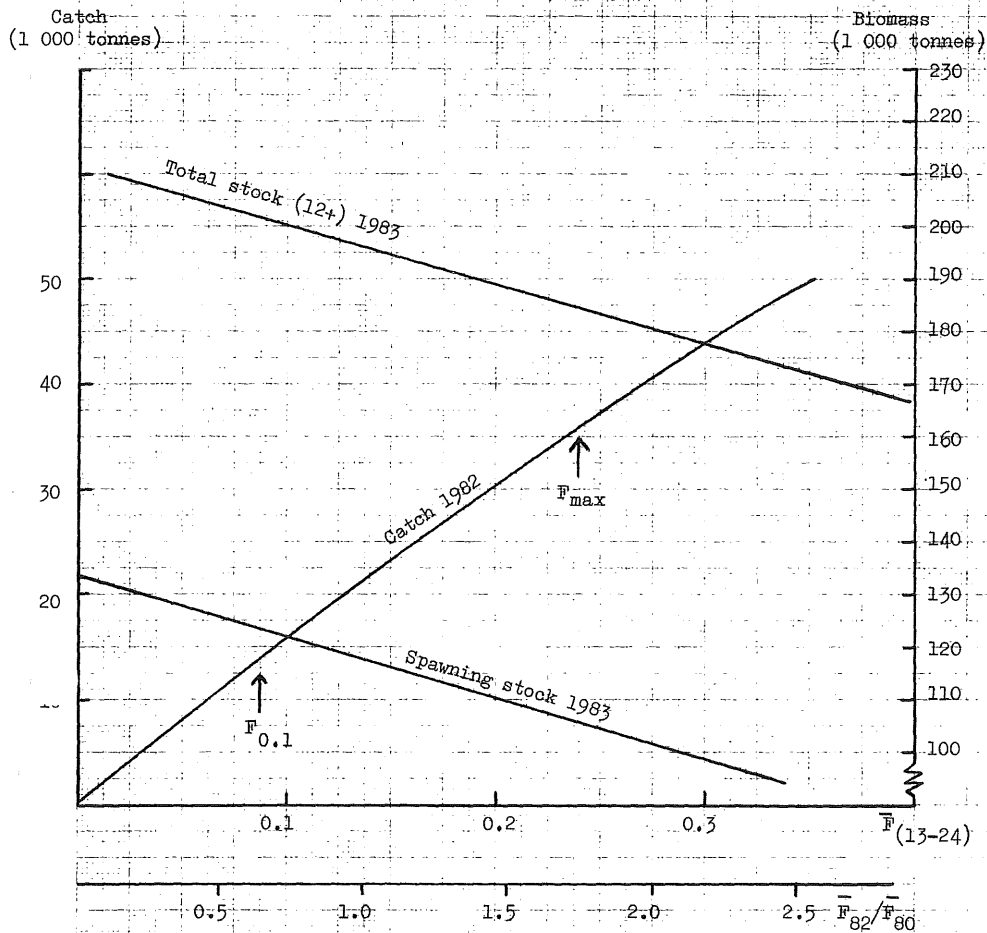


Figure 3. Sebastes marinus in Sub-area I and Division IIa.  
Predictions for catch in 1982 and stock biomasses in 1983.

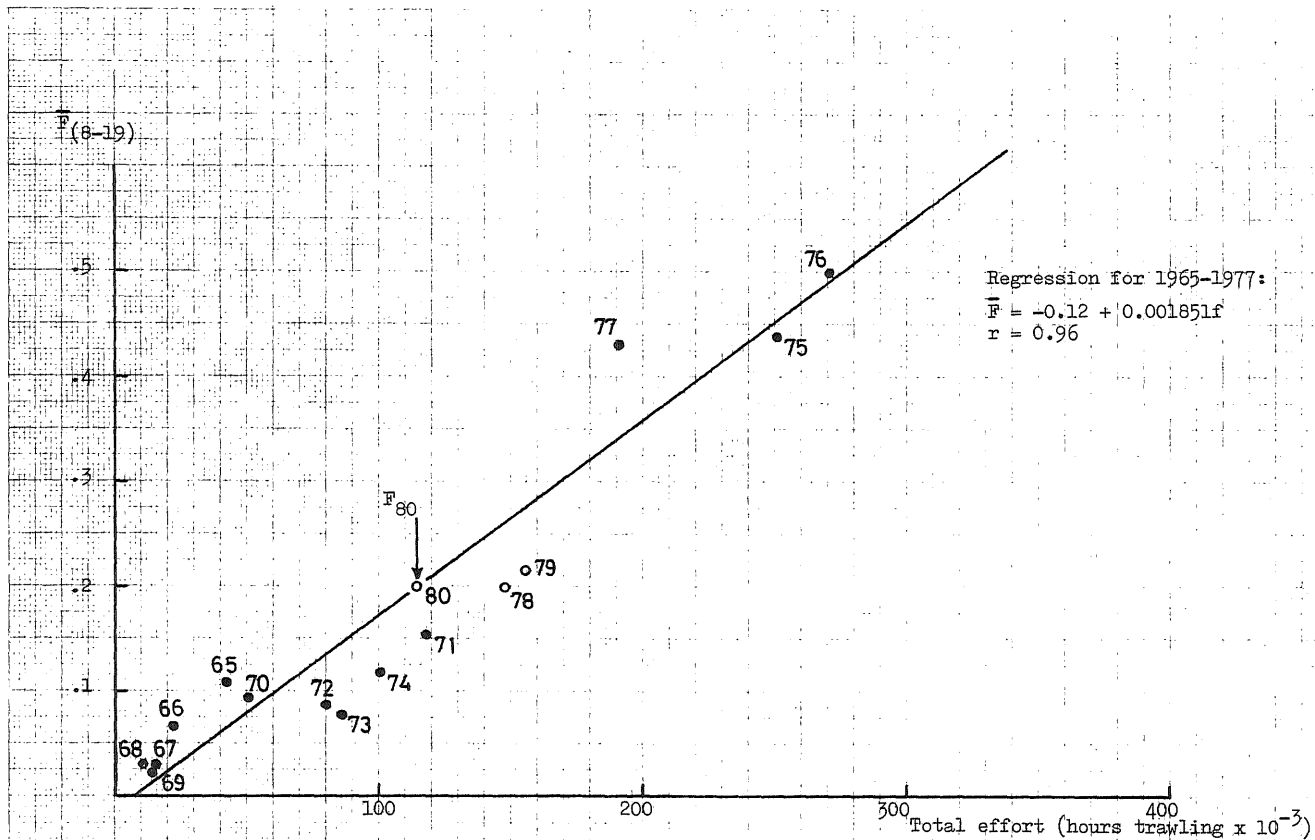


Figure 4. *Sebastes mentella* in Divisions IIa and IIb.  
 Relation of mean fishing mortality (ages 8-19) to total effort derived from USSR-cpue data.

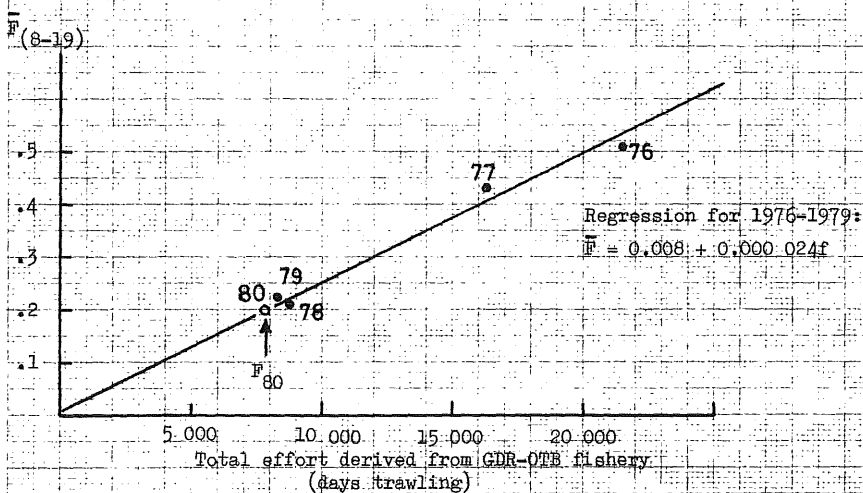
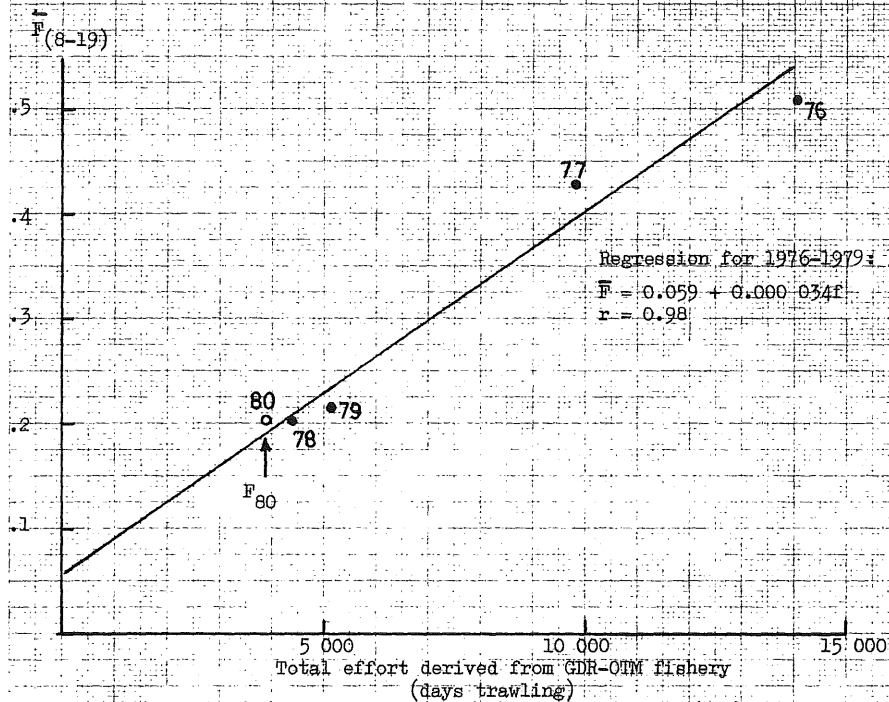
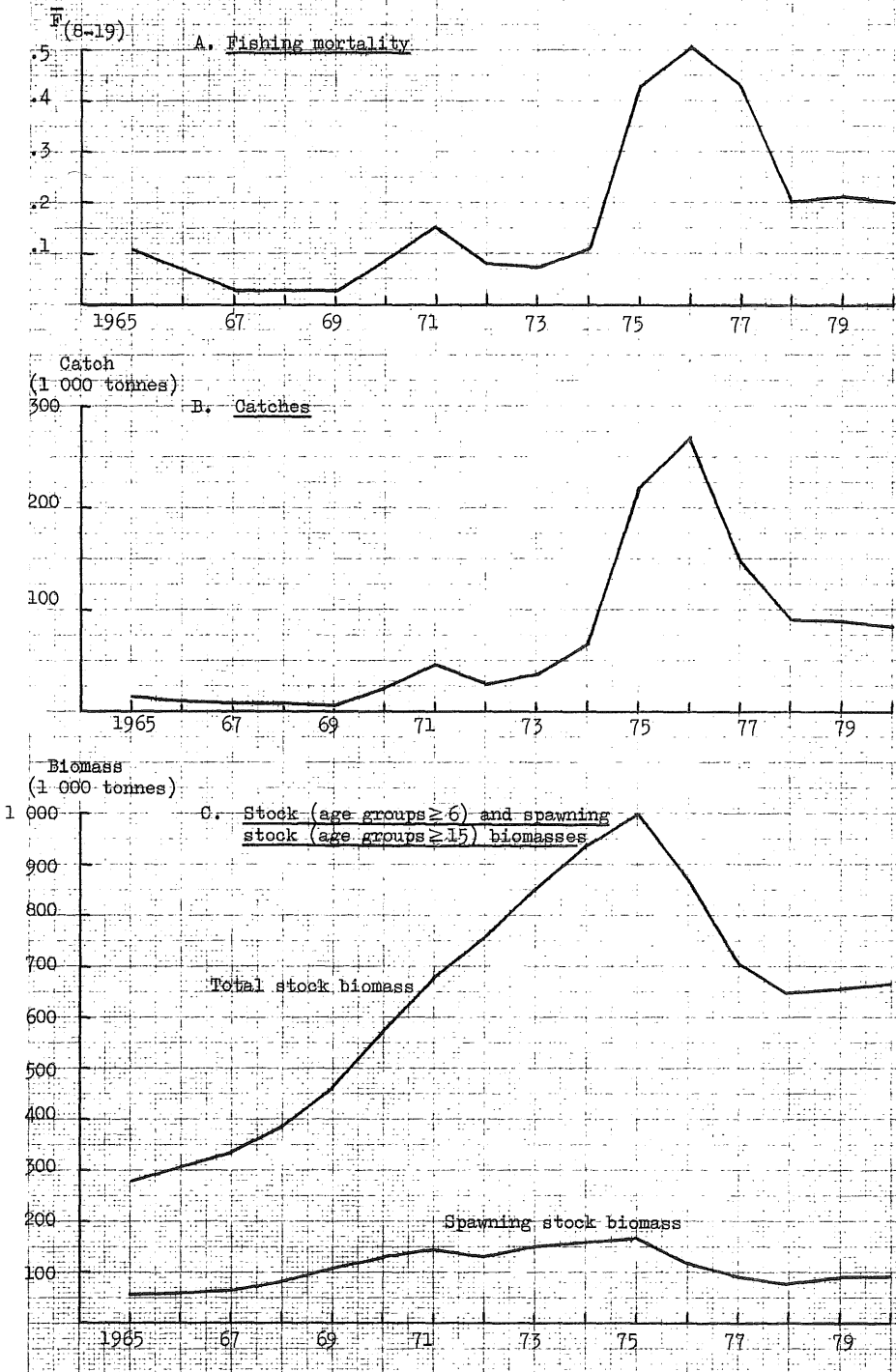


Figure 5. *Sebastes mentella* in Divisions IIa and IIb. Relation of mean fishing mortality (ages 8-19) to total effort derived from GDR-cpue data.

Figure 6. Sebastes mentella in Divisions IIa and IIb.



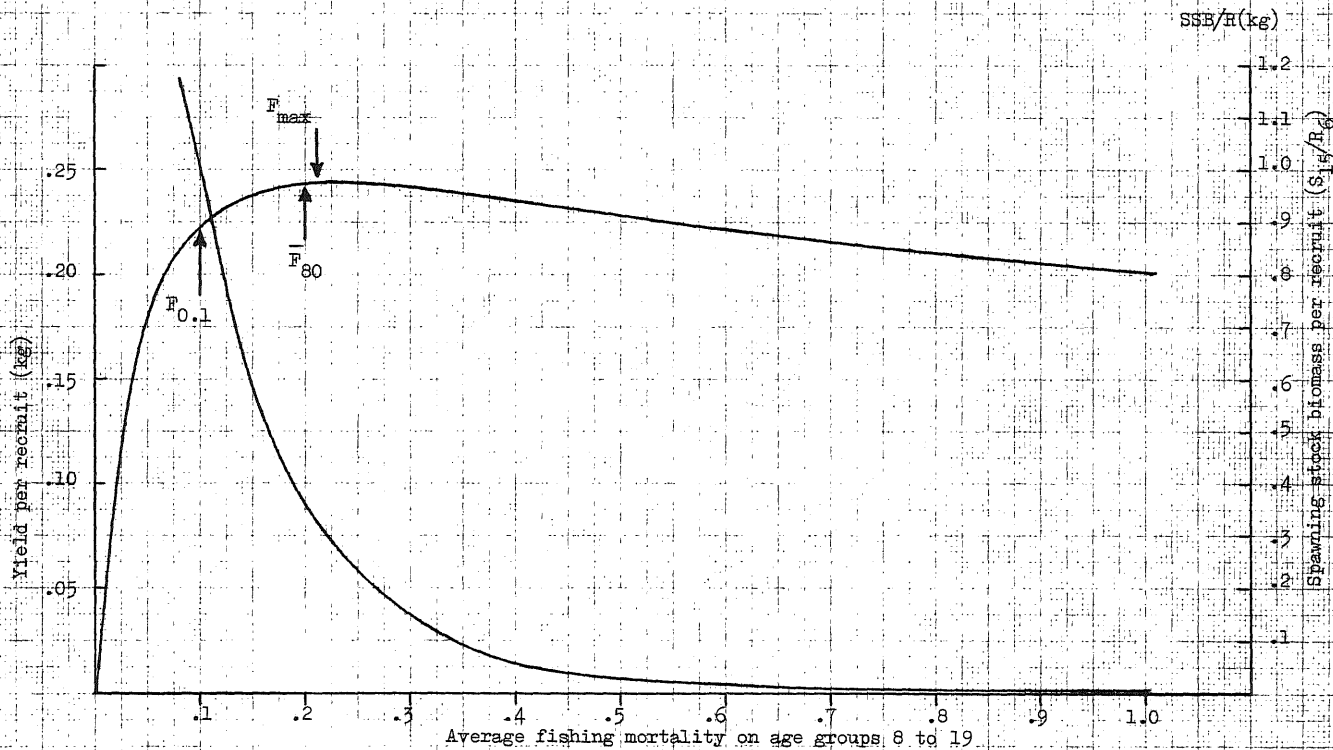


Figure 7. Sebastes mentella in Divisions IIa and IIb. Yield and spawning stock biomass per 6-year-old recruit curves for the present exploitation pattern ( $M = 0.1$ ).

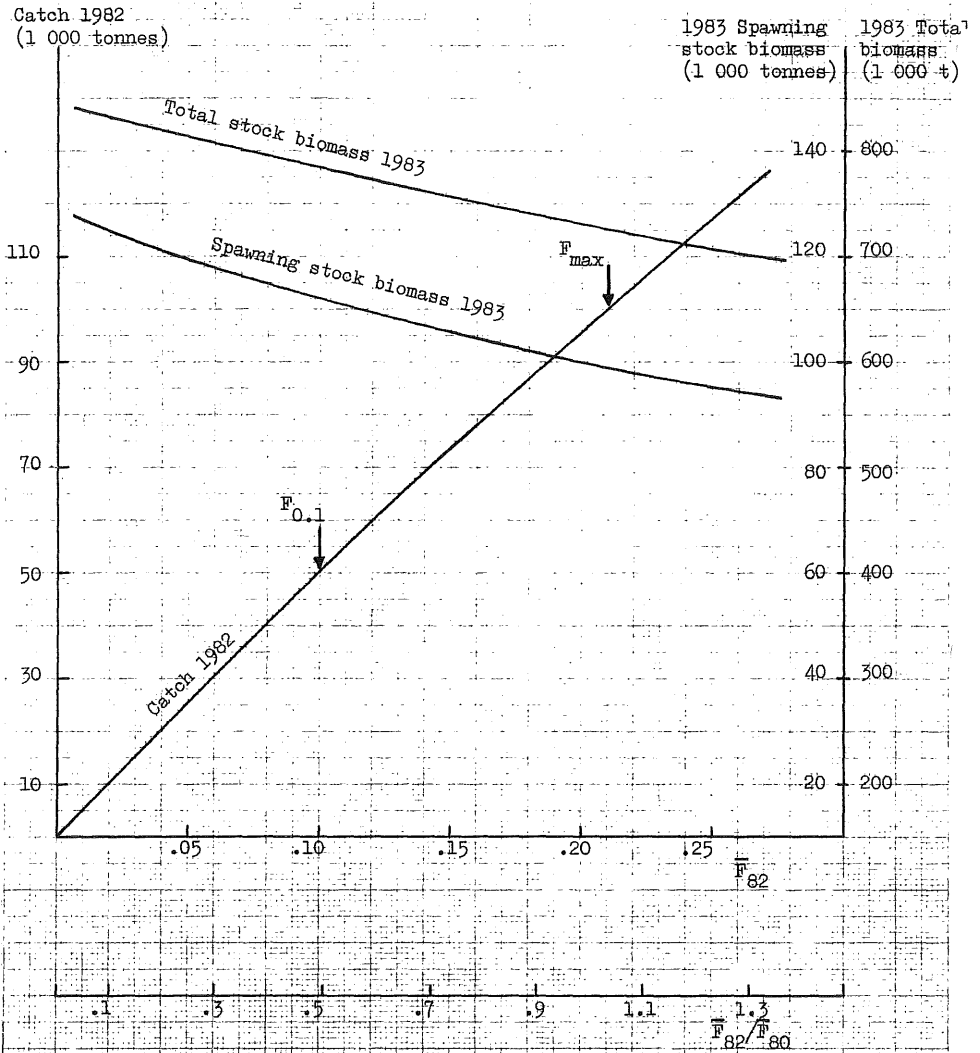


Figure 8. Sebastes mentella in Divisions ILa and IIb. Catch in 1982; total biomass (age 0+) and spawning stock biomass (age 15+) at the beginning of 1983 at different levels of  $F(8-19)$  in 1982.

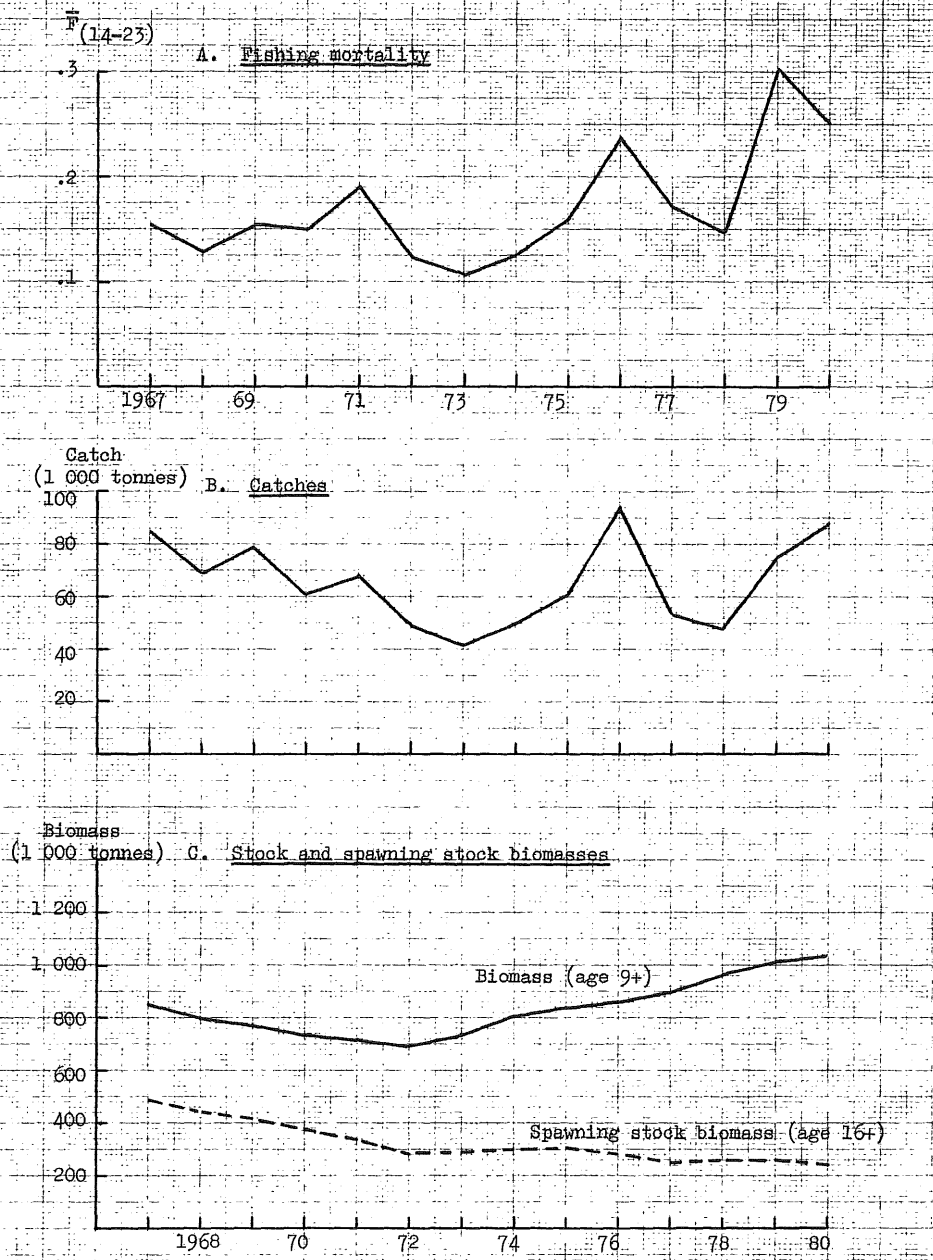


Figure 9. Sebastes marinus in Sub-areas V and XIV.

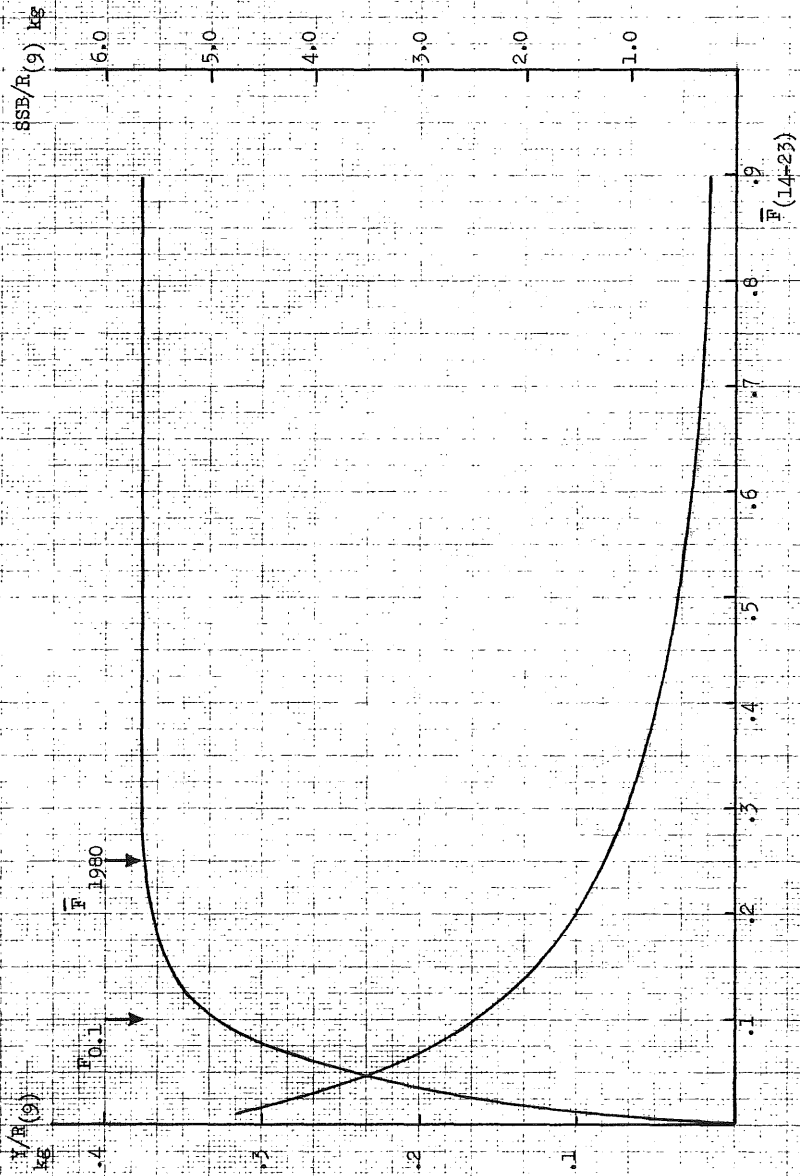


Figure 10. *Sebastes marinus* in Sub-areas V + XIV. Yield per recruit and spawning stock biomass per recruit.



Figure 11. *Sebastes marinus* in Sub-areas V + XIV. Predictions for catch in 1982, total biomass and spawning stock biomass at the beginning of 1983 at different levels of fishing mortality in 1982.

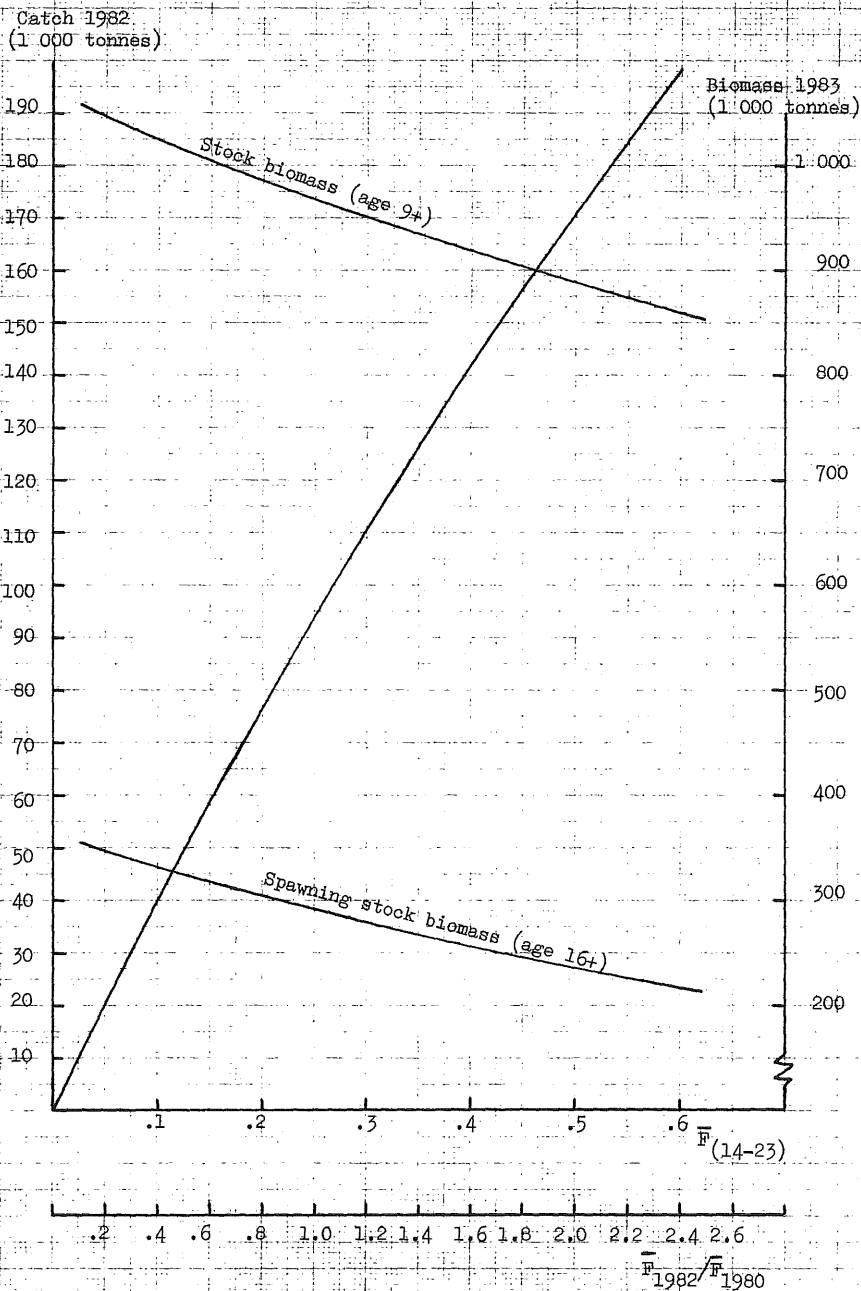


Figure 12. Sebastes mentella in Sub-areas V + XIV.

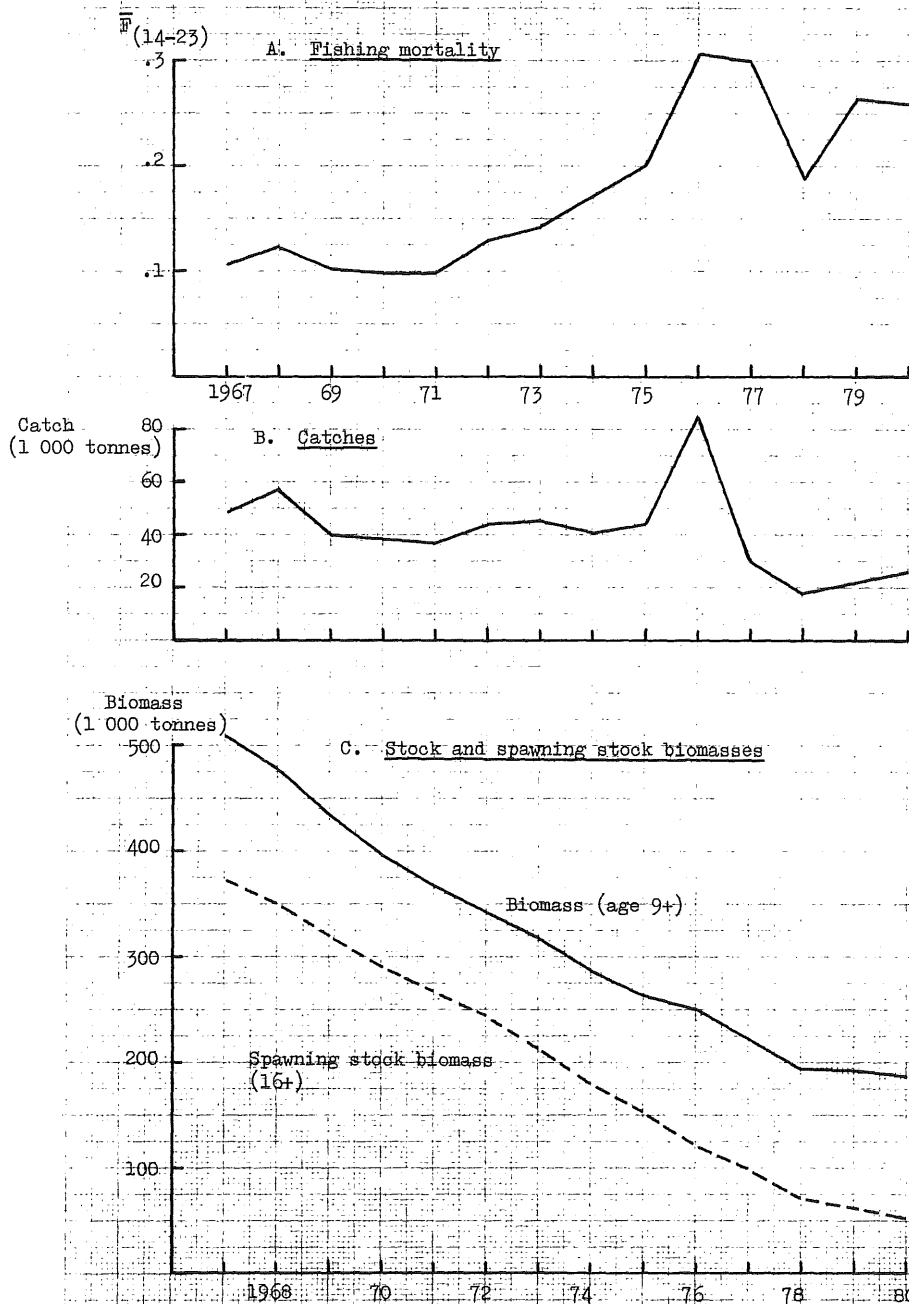


Figure 13. Sebastes mentella in Sub-areas V + XIV, yield per recruit and spawning stock biomass per recruit.

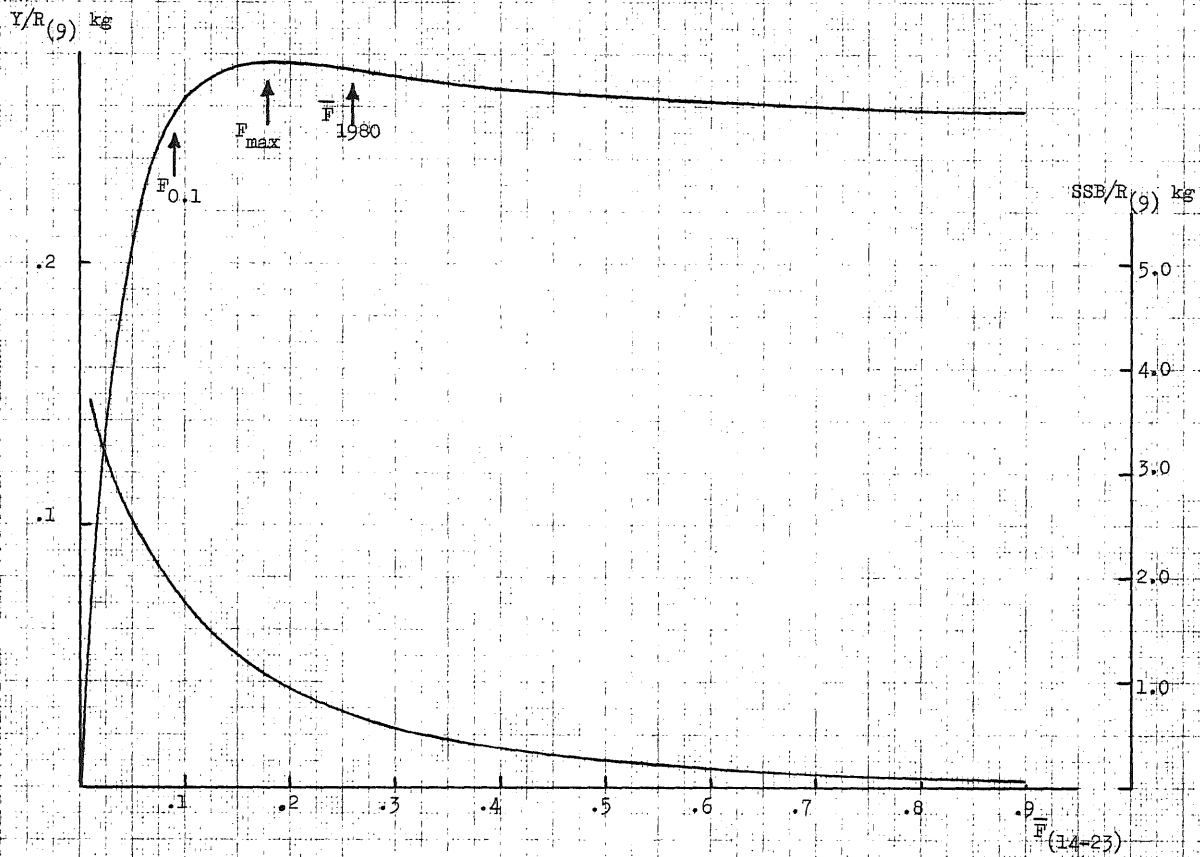


Figure 14. *Sebastes mentella* in Sub-areas V + XIV. Predictions for catch 1982, total biomass and spawning stock biomass at the beginning of 1983 at different levels of  $F$  in 1982.

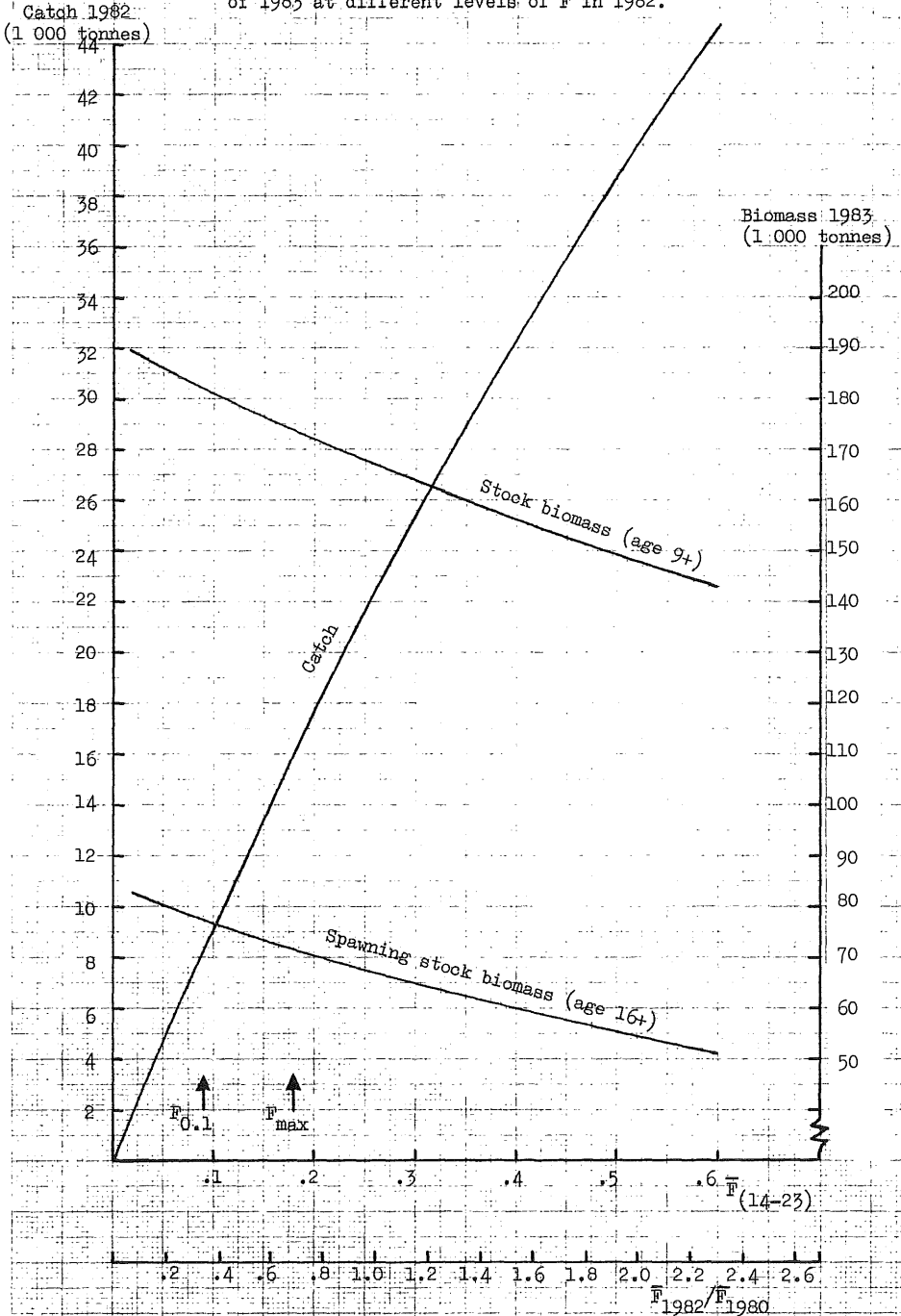


Figure 15. GREENLAND HALIBUT in Sub-areas T and II. The available opue data for the years 1973-80.

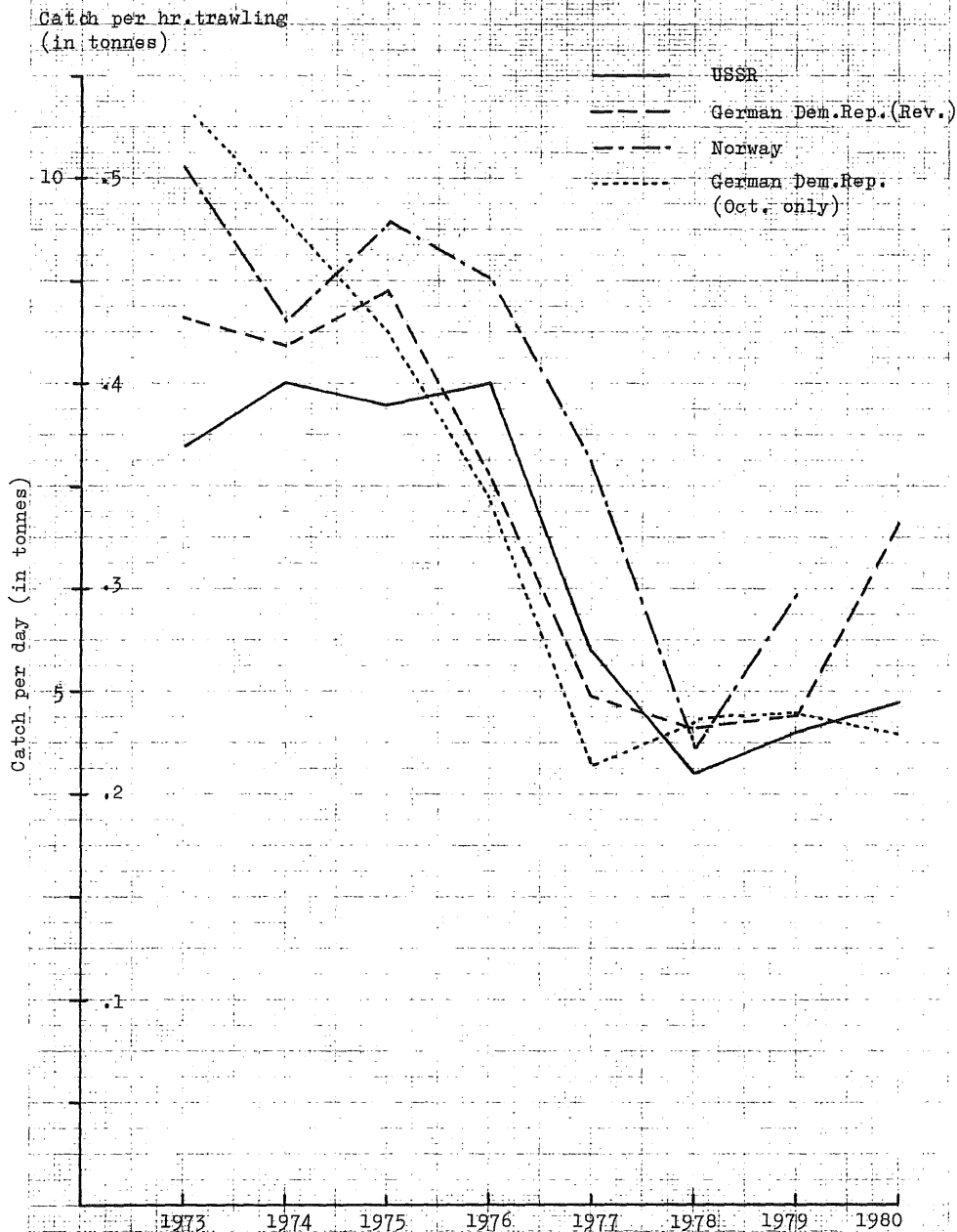


Figure 16. GREENLAND HALIBUT in Sub-areas I+IIb. Ratio between the cpue data from three different trawl fisheries.

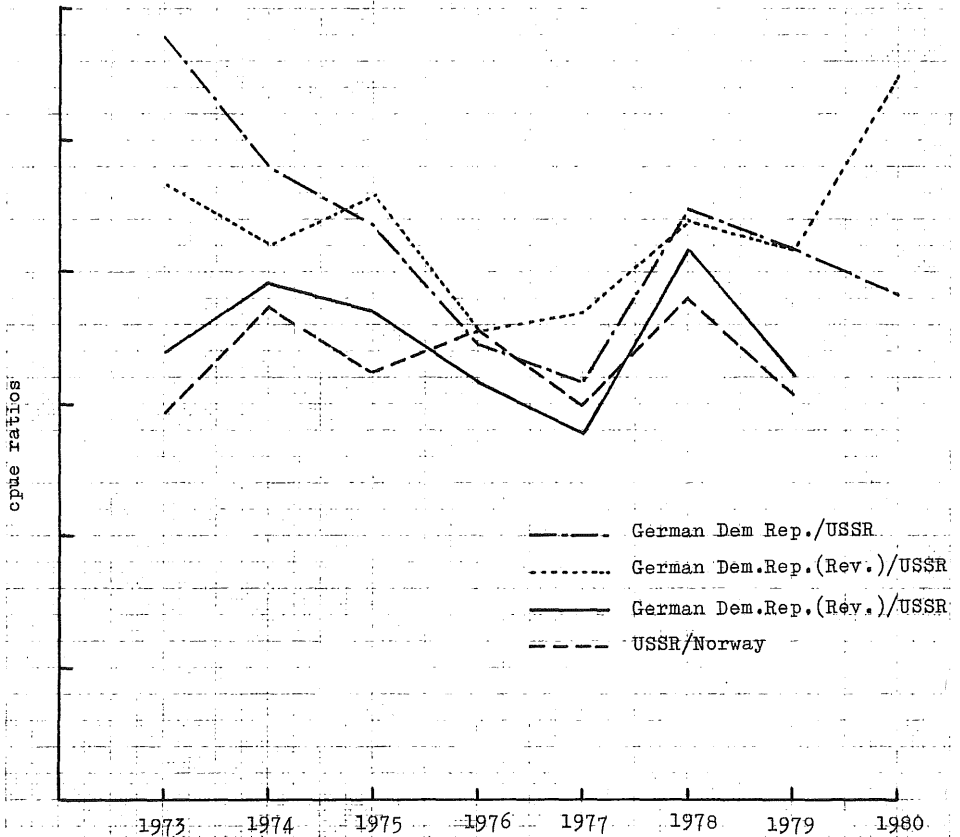
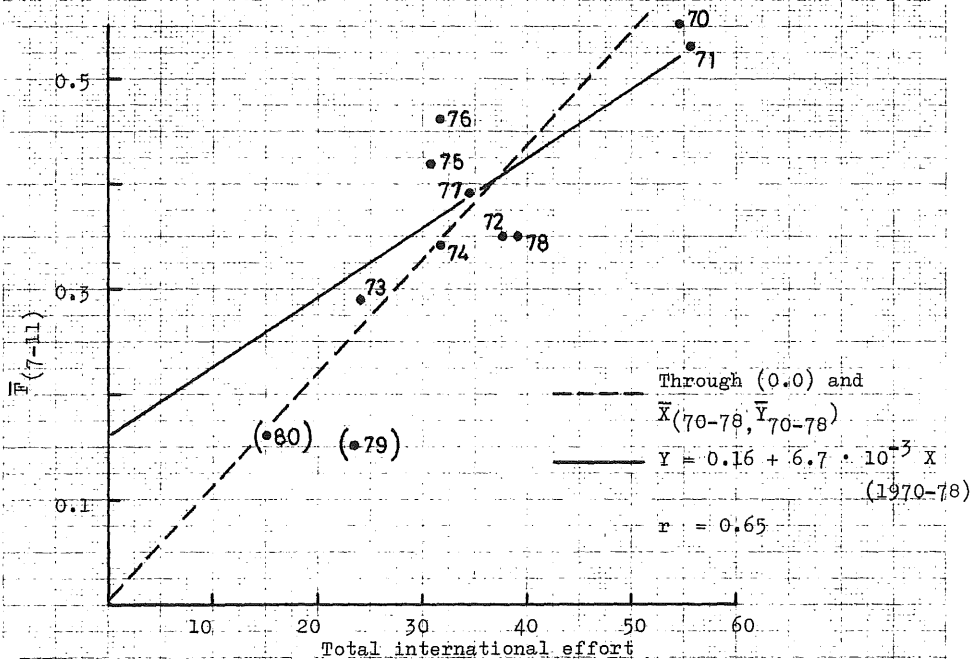


Figure 17. GREENLAND HALIBUT in Sub-areas I and II. Total effort versus unweighted fishing mortalities on 7 to 11 year olds (Final run).



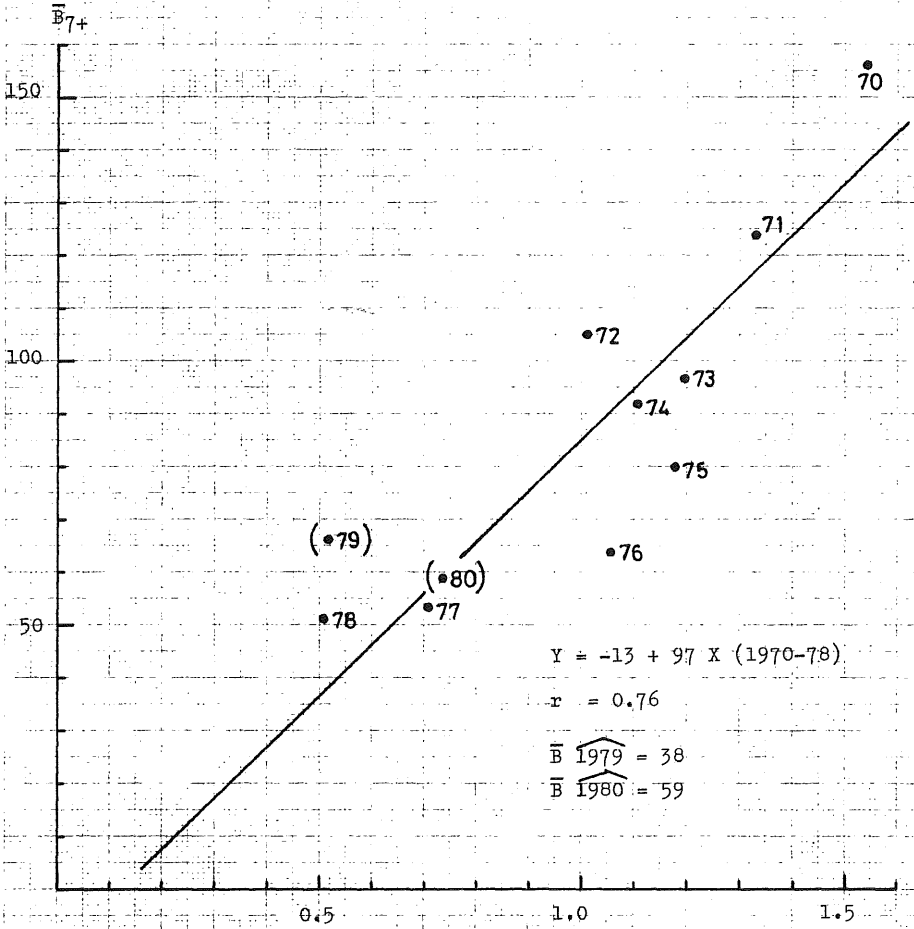


Figure 18. GREENLAND HALIBUT in Sub-areas I and II. Catch per unit effort of 7 years and older fish versus biomass (in mid-fishing season) of 7 years and older fish.



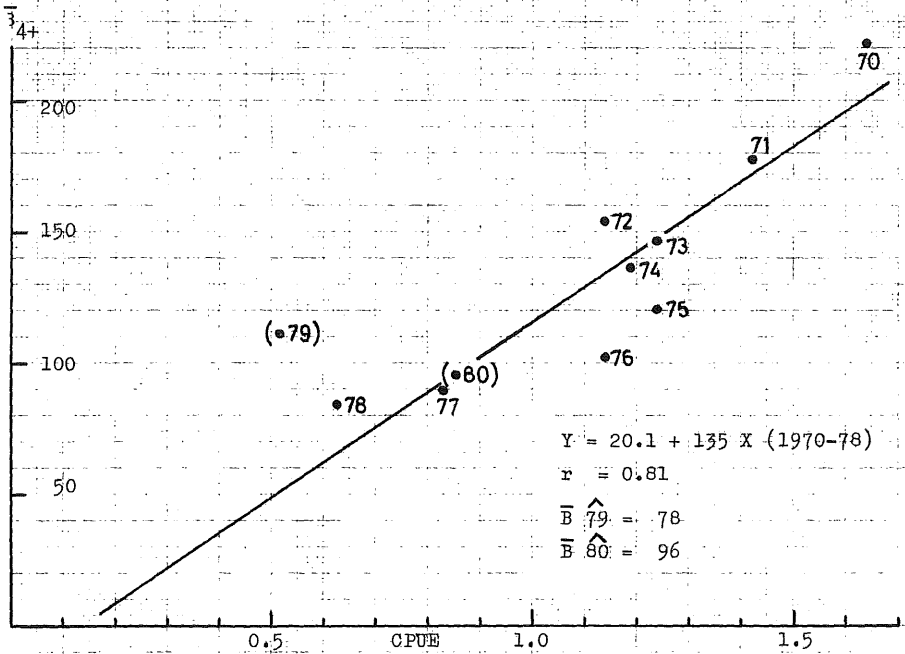


Figure 19. GREENLAND HALIBUT in Sub-areas I and II. Catch per unit effort versus the biomass of 4 year olds and older fish in mid-fishing season.

Figure 20. GREENLAND HALIBUT in Sub-areas I and II. Fishing patterns during the catch history from 1970. Average fishing pattern on 7 to 11 year old fish is set at 1.0.

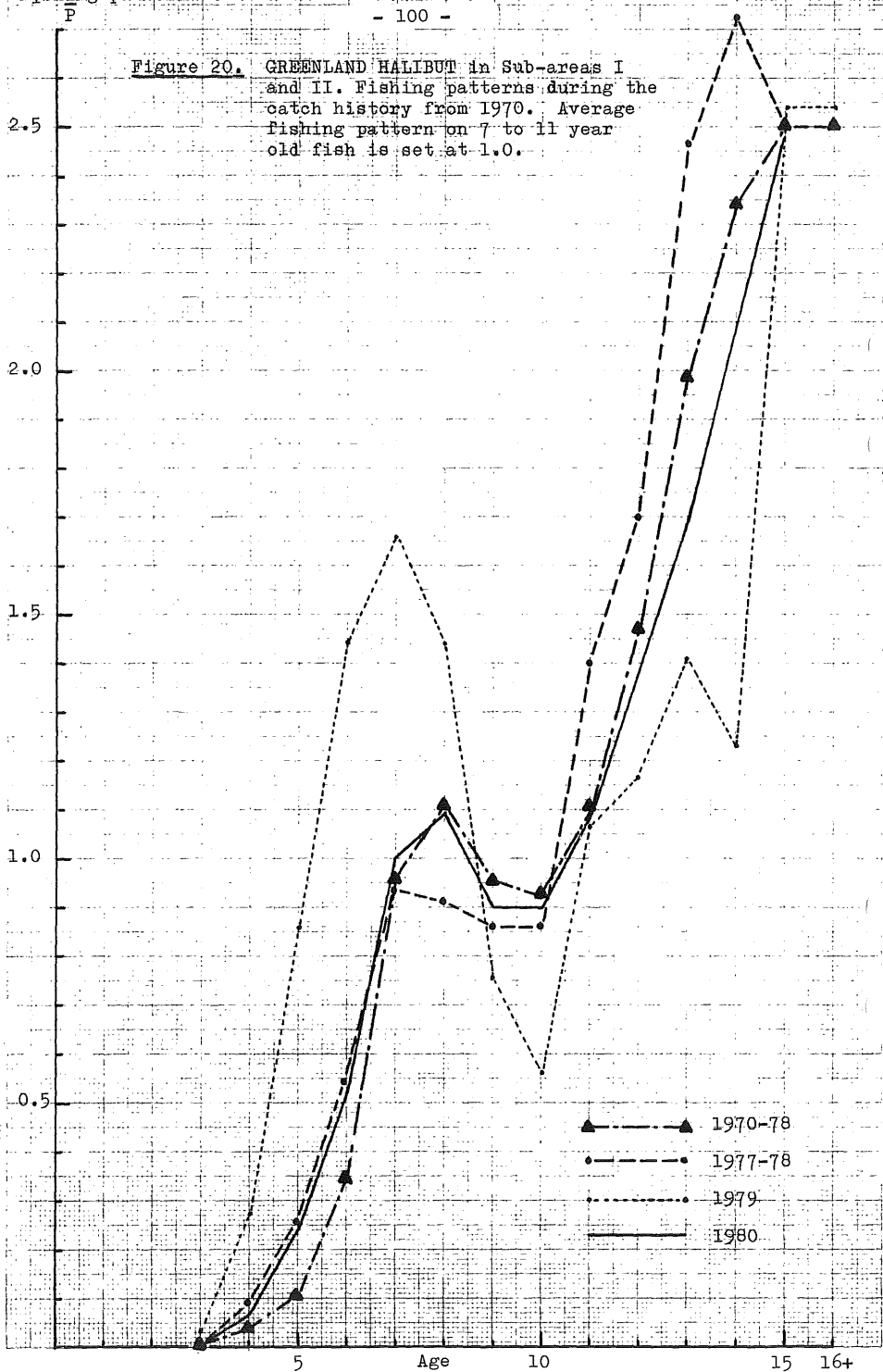


Figure 21. GREENLAND HALIBUT in Sub-areas I and II. The fishing mortality, catch and development of the stock from 1970 to 1980.

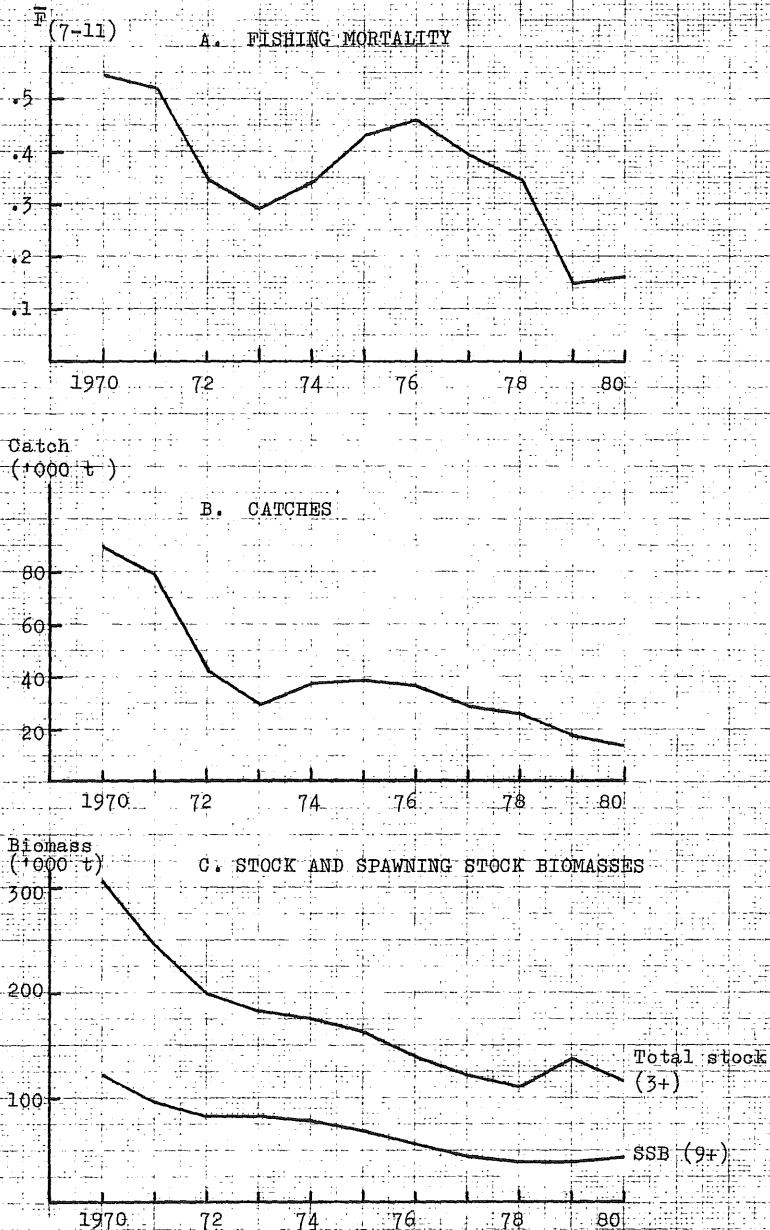


Figure 22. GREENLAND HALIBUT in Sub-areas I and II. Yield and spawning stock biomass per 3 year old recruits.

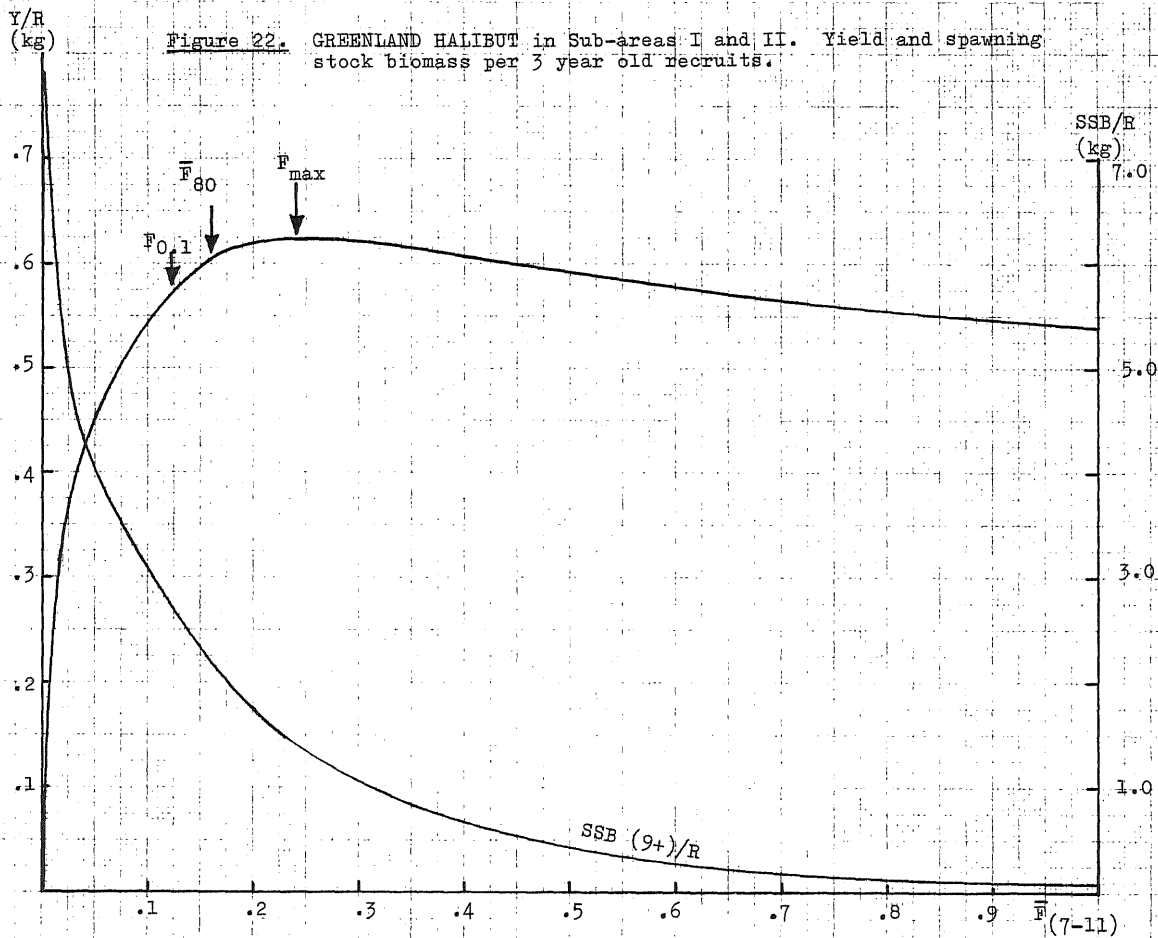


Figure 23. GREENLAND HALIBUT in Sub-areas I and II. Predictions for catch in 1982, and the spawning stock (9+) and the total stock (3+) at the beginning of 1983.

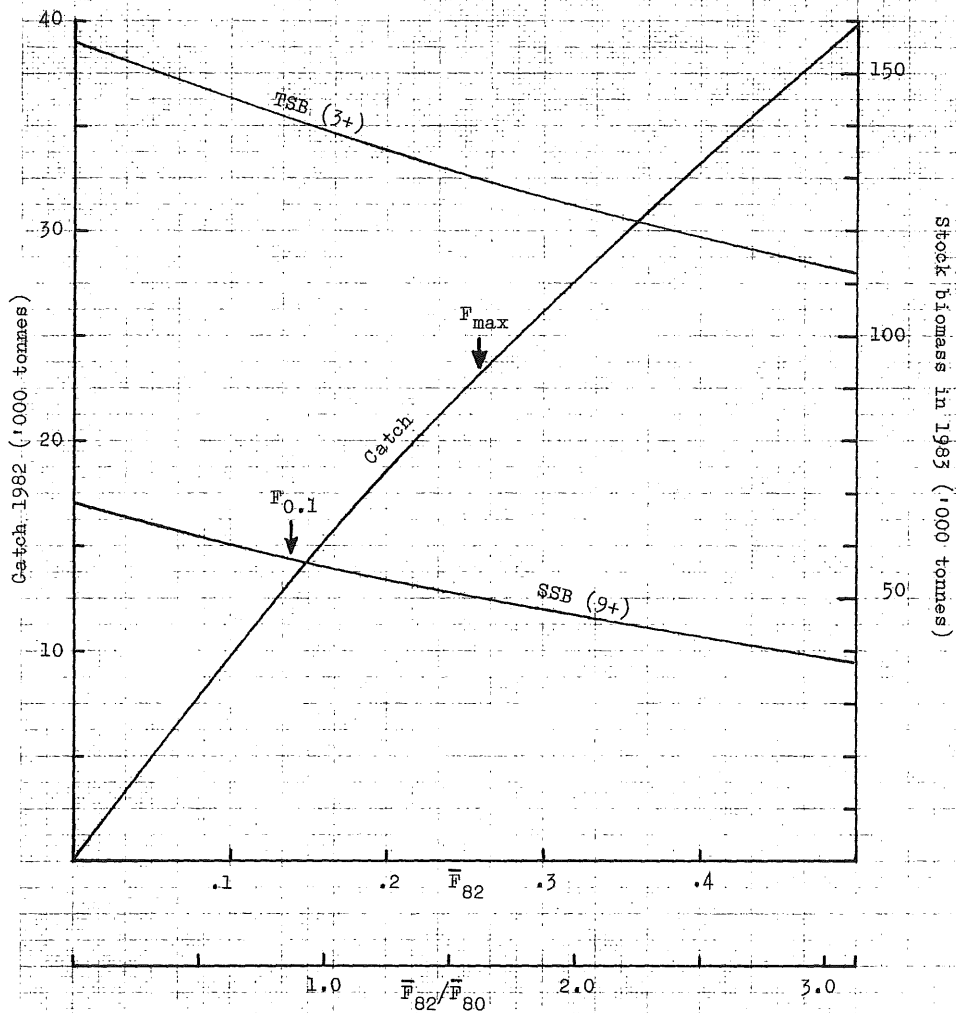


Figure 24. GREENLAND HALIBUT in Sub-areas V and XIV.

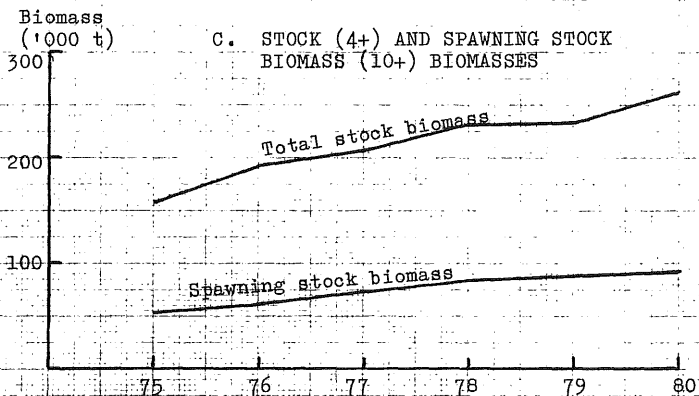
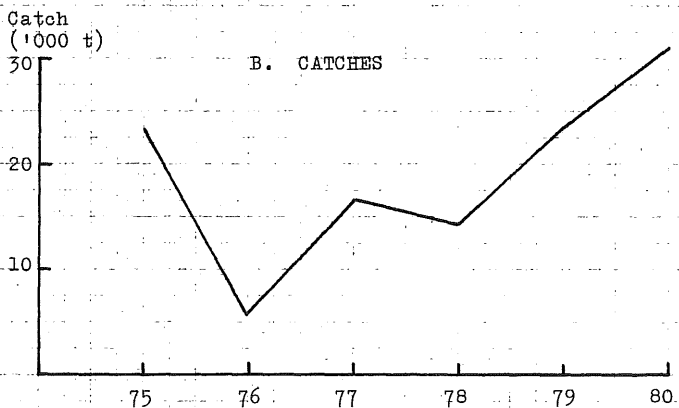
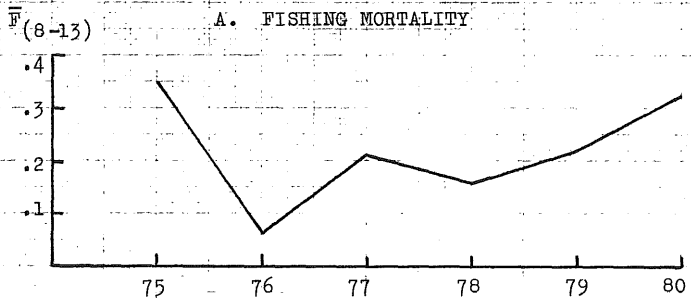


Figure 25. GREENLAND HALIBUT in Sub-areas V and XIV.  
Estimation of total long-term mortality  
from the catch curve.

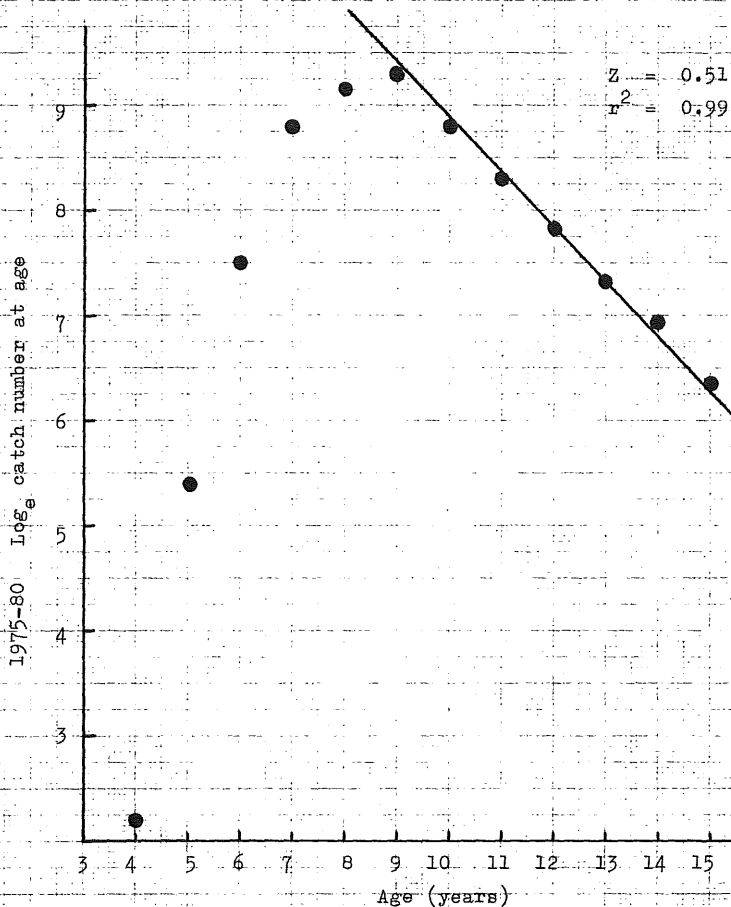
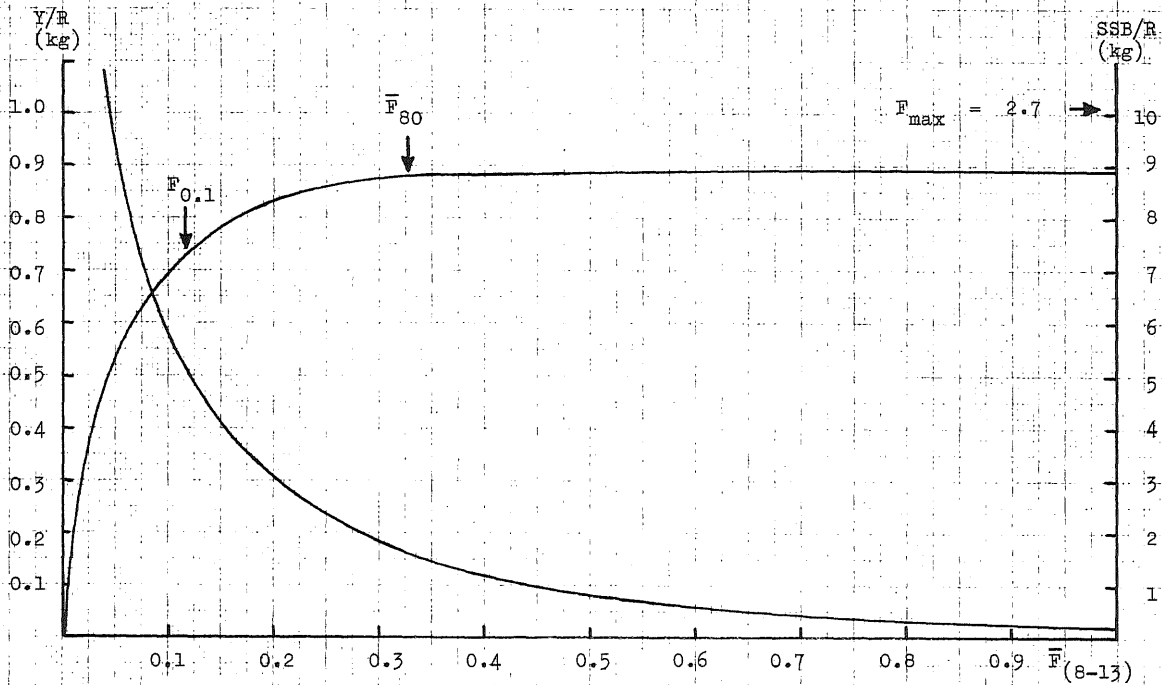


Figure 26. GREENLAND HALIBUT in Sub-areas V and XIV. Yield and spawning stock biomass per 4 year old recruit.





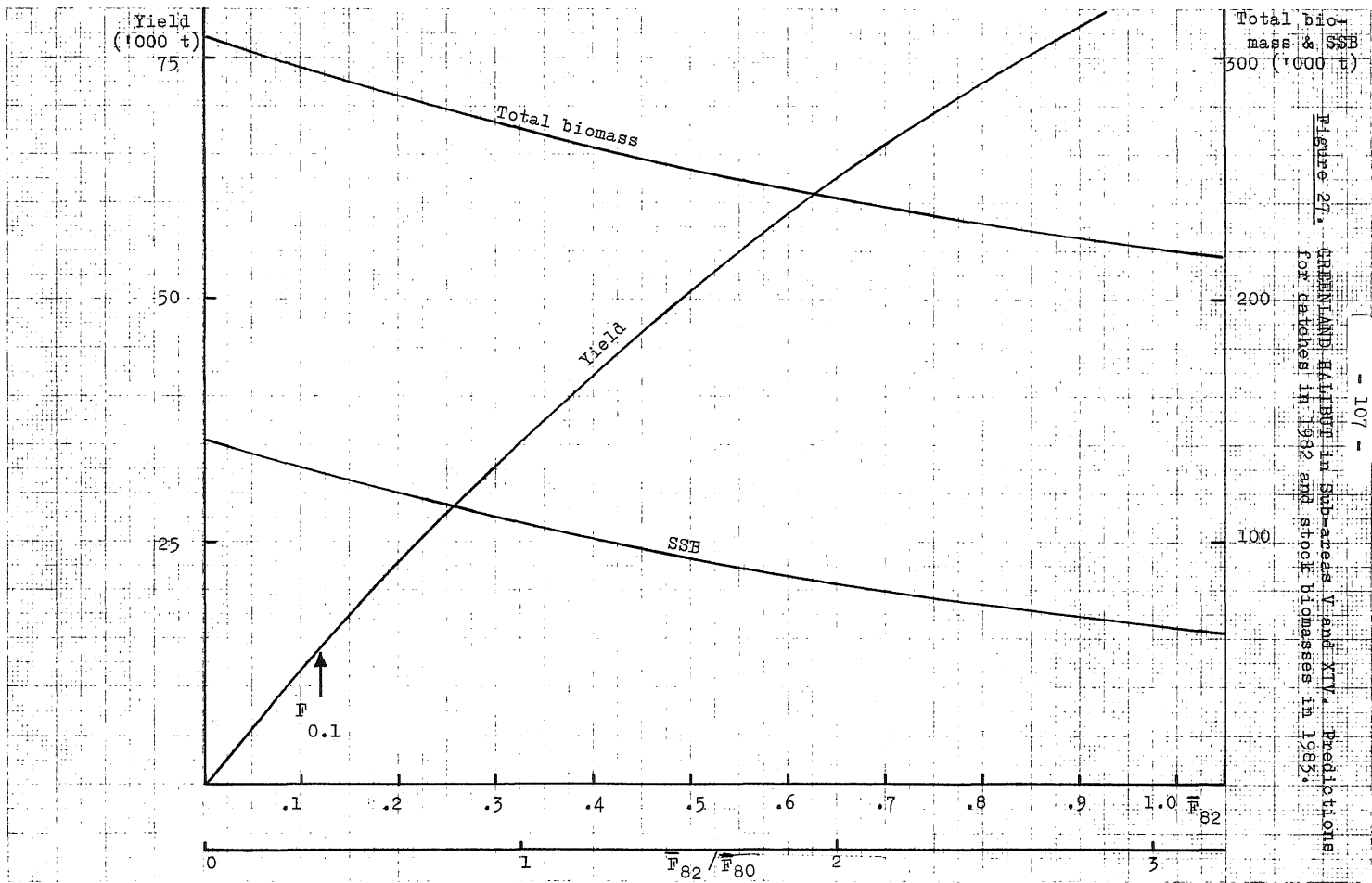


Figure 27. GREENLAND HALIBUT in Sub-areas V and XIV. Predictions for catches in 1982 and stock biomasses in 1985.

APPENDIX 1

App.1/Table 1 Mean length and percentages of small redfish in the catches from the Federal Republic of Germany and Icelandic surveys, at East Greenland waters in 1979 and 1980. Station numbers refer to App.1, Figure 1.

Station	Total mean length (cm)	% of small redfish (32cm and smaller in the catches)
1	36.67	30.81
2	34.45	45.42
3	35.10	49.06
4	32.39	84.22
5	27.24	100.00
6	19.87	100.00
7	18.92	99.19
8	35.25	21.88
9	38.76	2.86
10	19.70	96.70
11	18.20	95.00
12	18.25	100.00
13	14.84	98.54
14	16.67	100.00
15	15.77	98.70
16	16.69	99.21
17	22.97	100.00
18	23.57	100.00
19	22.23	100.00
20	29.68	79.75
21	24.82	100.00
22	29.78	84.18
23	39.55	23.42
24	21.41	100.00
25	24.45	100.00
26	23.52	98.47
27	29.74	58.33
28	27.96	94.89
29	25.49	92.58
30	30.79	89.00
31	32.36	85.87
32	25.87	98.07
33	23.59	98.97
34	26.21	100.00
35	21.51	100.00
36	26.86	94.82
37	25.48	100.00
38	27.14	94.93
39	27.19	96.31
40	46.52	4.55
41	29.59	91.94
42	31.15	84.25
43	28.90	95.14
44	42.35	87.50
45	30.00	100.00
46	28.69	93.62

ctd.

Appendix 1, Table 1 (ctd)

Station	Total mean length (cm)	% of small redfish (32cm and smaller in the catches)
47	31.10	82.91
48	32.00	71.47
49	19.65	99.07
50	23.13	
51	14.30	100.00
52	20.07	92.81
53	19.47	100.00
54	24.61	99.24
55	26.49	90.70
56	27.16	98.98
57	29.61	87.32
58	26.34	99.49
59	36.54	16.42
60	26.20	100.00
61	27.03	90.31
62	28.89	93.09
63	34.67	55.76
64	34.98	25.00
65	24.58	100.00
66	31.12	39.41
67	32.54	66.01
68	33.11	43.92
69	31.41	85.00
70	31.24	67.69
71	22.17	99.48
72	29.29	83.62
73	36.20	28.39
74	34.17	13.27
75	28.55	76.19
76	35.27	37.03
77	38.70	25.00
78	36.02	34.13
79	49.62	0.00
80	32.46	54.24
81	34.27	25.64
82	37.65	11.85
83	33.26	11.76
84	37.15	19.16
85	23.73	100.00
86	23.47	99.37
87	21.35	90.42
88	14.77	97.33
89	35.38	17.65
90	16.25	100.00
91	15.18	100.00
92	19.36	100.00
93	14.47	100.00
94	16.07	100.00
95	15.73	98.86

