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Exploration of the Sea

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*Subsidiary Report
Halibut*

REPORT OF THE WORKING GROUP ON REDFISH AND GREENLAND

HALIBUT IN REGION 1

Copenhagen, 10-18 March 1982

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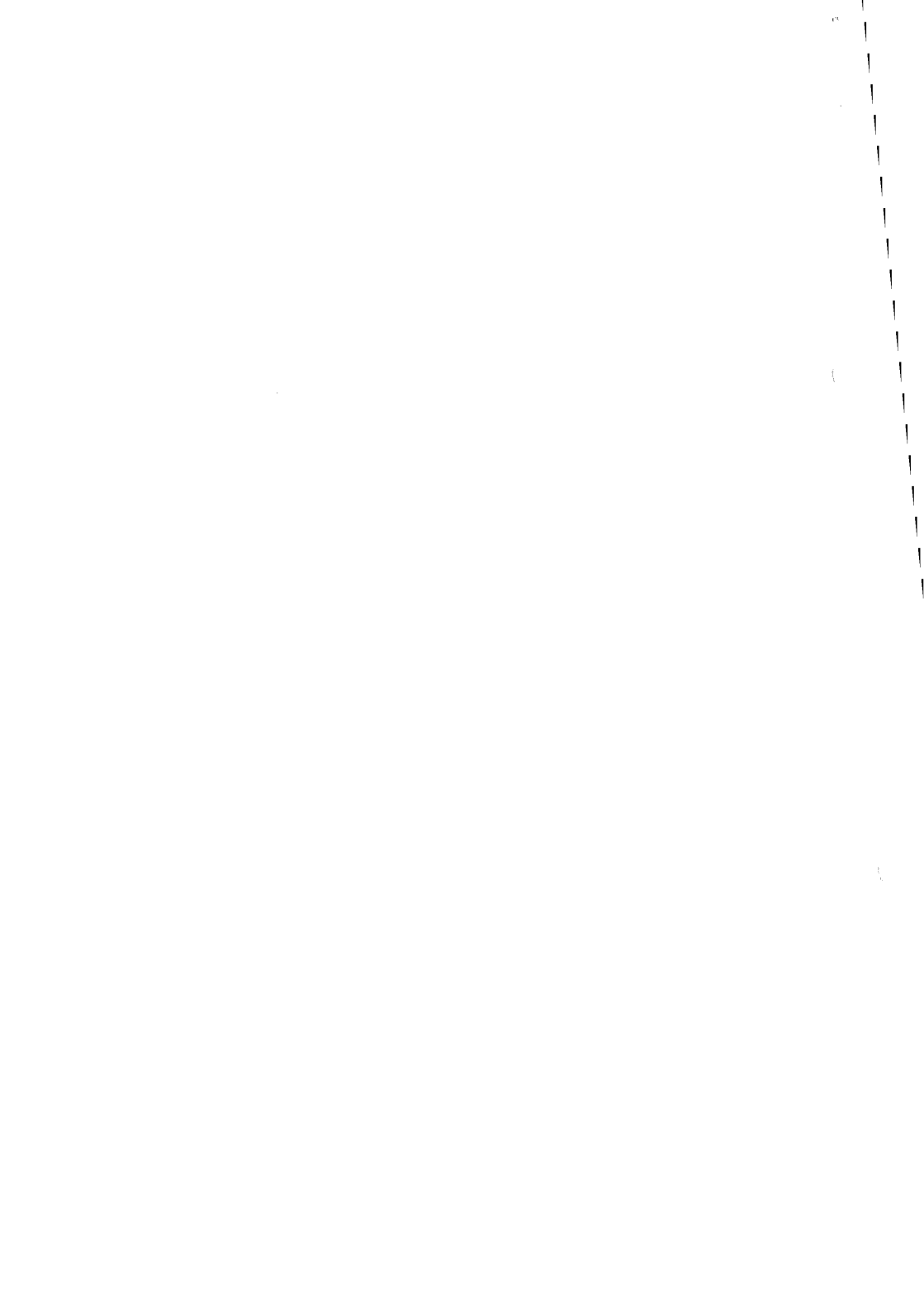


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REPORT OF THE WORKING GROUP ON REDFISH AND GREENLAND

HALIBUT IN REGION 1

1. PARTICIPANTS AND TERMS OF REFERENCE

1.1 Participants

| | |
|--------------------|-----------------------------|
| W R Bowering | Canada |
| K Kosswig | Federal Republic of Germany |
| E Loukmanov | USSR |
| J Magnússon | Iceland |
| J Møller Jensen | Denmark |
| W Ryzov | USSR |
| C J Rørvik | Norway |
| H Schulz | Federal Republic of Germany |
| A Schumacher | Federal Republic of Germany |
| A Sigurdsson | Iceland |
| O M Smedstad | Norway |
| B Vaske (Chairman) | German Democratic Republic |

K Hoydal attended the meeting as ICES Statistician.

1.2 Terms of Reference

At the last Statutory Meeting, the Council adopted the following resolution (C.Res.1981/2:27:4):

"It was decided, that the Working Group on Redfish and Greenland Halibut in Region 1 (Chairman: Mr B Vaske) should meet at ICES headquarters 10-18 March 1982 to:

- (i) assess catch options for 1983 for redfish and Greenland halibut,
- (ii) estimate effective mesh sizes in use for redfish in Sub-areas V and XIV. A small Study Group, set up by the Chairman for this purpose, should meet for two days immediately preceding the main meeting at the ICES headquarters to finalize the compilation of relevant data, make preliminary assessment runs, and submit the findings to the Working Group,
- (iii) specify deficiencies in data required for assessments".

2. GENERAL COMMENTS TO ASSESSMENTS

2.1 Yield per Recruit (Figure 10)

During the present Working Group meeting, the parameters used to calculate the yield per recruit curve for Sebastes marinus in Sub-areas V and XIV have been changed only marginally compared to last year's assessment. However, the resulting $F_{0.1}$ value was considerably

smaller compared to 1981. This is due to the different approaches as to the treatment of the oldest age group in the assessment.

The treatment in the ICES computer program of the oldest age group as a plus group is theoretically required, since this plus group simulates a continuation of the exploitation beyond the oldest age in the assessment. This can be demonstrated by adding a number of age groups with the appropriate average weights to the Y/R calculation and treating the oldest age group in this exercise not as a plus group. The results are almost identical.

The differences between these two approaches are entirely dependent on the contribution, which the last age group makes to the total yield as illustrated in the following text table.

| F ^{3E} | Y/R in weight | Contribution of the oldest age group | |
|-------------------------|------------------------------|--------------------------------------|-------------------------------|
| | | in weight | in % of Y/R |
| Age 30 a plus group | | | |
| .04 | .268 | .071 | 26.5 |
| .08 | .300 | .032 | 10.7 |
| .172 | .306 | .003 | 1.0 |
| Age 30 NOT a plus group | | | |
| .04 | .207 | .011 | 5.3 |
| .08 | .275 | .007 | 2.5 |
| .172 | .304 | .001 | 0.3 |
| Catch Data | | | |
| .172 | Average catch 1976-81 (t) | Average catch age 30 1976-81(t) | % of average catch 1976-81 |
| | 74 335 | 397 | 0.5 |

*) $F_{0.1}$ (if age 30 a plus group) = 0.04

$F_{0.1}$ (if age 30 not a plus group) = 0.08

$\bar{F}_{(14-23)} 1967-81 = 0.172$

It is obvious from the above table as well as from Figure 10 that the relative contribution to the yield per recruit of the oldest age group decreases with increasing fishing mortality. However, there are considerable differences between the two methods within the range of fishing mortalities where $F_{0.1}$ normally lies.

Comparison of the relative contribution to the yield of the oldest age group between the Y/R calculations and the observed weights of this age group in the catches leads to the conclusion that to treat the oldest age group not as a plus group is more close to reality.

This discussion could be considered as a purely theoretical one. However, it will have a practical importance, if management objectives are being defined by reference points on the Y/R curve, e.g., $F_{0.1}$. For Sebastes marinus in Sub-areas V and XIV, which served as an example in the text table above, there is a difference of 100% between the two estimates of $F_{0.1}$. TACs associated with these values are 15 000 tonnes and 27 000 tonnes for $F_{(14-23)}$ values of 0.04 and 0.08, respectively. The difference of 12 000 tonnes represents a considerable market value, which should not be ignored by only theoretical considerations. The Working Group would, therefore, like to see this question considered by ACFM, if management strategies should be based on Y/R considerations.

2.2 The Standard ICES Assessment Computer Program

The Working Group reiterated the comments made last year (Doc. C.M.1981/G:7, p.2-3). In particular, the option concerning the possibilities to have the fishing patterns printed out, and the option of selecting the amount of output from the VPA program.

In addition to the above points, the Group would mention the following:

- 1) possibilities to have an option of selecting whether the oldest age group in a Y/R analysis should be a plus group or not;
- 2) an option of selecting several possibilities of fishing mortalities for the prognosis year without having to re-run the prediction program with the intermediate year (1982 in the present assessment) printed out every time.

Finally, the Working Group expressed its general satisfaction with the programs, since they had made the work of the Working Group much easier. In general, the programs are easy to use.

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

3.1 Status of the Fisheries

A small reduction in total redfish catches in the North-East Arctic region was recorded in 1981 (Table 1). The preliminary catch figures in 1981 were 100 940 tonnes compared to 102 765 tonnes in 1980. This was 11 940 tonnes higher than the redfish TAC for 1981 of 89 000 tonnes. The total catch in Sub-area I increased from 1 235 tonnes in 1980 to 1 904 tonnes in 1981 (Table 2). The total catch in Division IIa decreased slightly from 73 878 tonnes in 1980 to 72 321 tonnes in 1981 (Table 3). In Division IIb, the total catch in 1981 was 26 715 tonnes in comparison with 27 652 tonnes in 1980 (Table 4).

Redfish catches were split into Sebastes mentella and Sebastes marinus on the same area basis as described 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), are recorded as S. mentella. The total landings in Sub-area I, with the exception of 80% of the USSR catches, together with the rest of the German Democratic Republic, USSR and Polish catches from Division IIa and all catches taken by other countries are assumed to be S. marinus (Table 5).

Compared to 1980, the total landings in 1981 of S. marinus decreased from 23 411 tonnes to 19 702 tonnes, and those of S. mentella

increased from 79 354 tonnes to 81 238 tonnes (Table 5). Thus, the catches of S. marinus were close to the TAC of 19 000 tonnes, while the TAC of S. mentella was exceeded by about 11 000 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 1965-81 (Table 6). These data represent cpue values of the RT-type side trawlers (500-1000 BRT). The cpue of this vessel type in 1981 was at a level of 0.63 compared to 0.70 in 1980. Using these cpue values as a standard, the total effort in 1981 was 15% higher than in 1980.

USSR cpue data for the most recent years were also presented for stern trawlers of the BMRT-type (≥ 2000 BRT). The cpue data for the BMRT vessel type decreased from 1980 to 1981 by 6%.

Catch per unit effort data were also available from the German Democratic Republic S. mentella fishery for 1976-81. 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. Further information on the total S. mentella catch as well as the catch and effort figures used for calculating catch per unit effort data of the Z-trawler are given in Table 7. The corresponding cpue data and the derived total international effort in German Democratic Republic units are included in Table 6.

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 year classes, 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 1979-81 year classes are the most abundant observed in the O-group surveys.

It should be noted that the results of the International O-Group Surveys were generally in good agreement with the indices based on the findings of the annual USSR Young Fish Surveys. However, for year classes 1973-75 some disagreement was observed between the results of the International O-Group Surveys and the qualitative indices of the USSR Young Fish Surveys, where these year classes appeared to be poor.

3.4 Age and Length Compositions

For 1981, age and length composition data and age/length keys for S. marinus were available from the Federal Republic of Germany and the USSR for Division IIa. In addition, Soviet length distribution was available from Sub-area I. 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 the USSR. The 1981 USSR length distributions were converted by means of the 1981 USSR age/length key. For fish smaller than 27 cm an age/length key from the Federal Republic of Germany for 1981 was used.

For 1980 S. marinus age distribution was adjusted to the revised catch, and for years prior to 1980 the age distributions from last year's assessment were used. Input age composition data for S. marinus are given in Table 10.

The total age composition of S. mentella for 1980 was adjusted according to the revised catch statistics. For years prior to 1980 the age distributions were left unchanged. For 1981, age compositions were available for the catches of the German Democratic Republic and the USSR. The sum of these were raised to the total landings in 1981 (Table 13).

The age compositions of S. mentella available for 1981 represent 99% of the total landings.

3.5 Mean Weight at Age

For 1981, the mean weights at age for S. marinus were adjusted to that the sum of products fitted with the observed catch. The mean weights used are given in Table 9.

For S. mentella, the mean weight at age used in last year's assessment was applied for the period 1965-78. For 1979 and 1980, the USSR data provided for 1980 were used in order to bring the sum of products close to the observed catch. For 1981 and the catch prediction, mean weights observed in the USSR catches have been taken.

The three sets of mean weight at age data are given in Table 12.

3.6 Proportion of Mature Fish at Age

Data on the proportion of mature fish at age by sex for S. mentella were presented by the USSR. These data were obtained from research vessel samples during 1966-72. For assessment purposes, the data for males and females were combined, assuming a ratio of 1:1. The proportions of mature fish at age used for spawning stock calculations are given in Table 17.

3.7 Assessment (Sebastes marinus)

Since no effort data were available on which to base the terminal F, a preliminary VPA run was carried out using the same F at age array as in the previous assessment, i.e., $\bar{F}_{(13-24)} = 0.138$. If the stock is considered to be in a stable state, the terminal F value can be found by plotting the resulting Fs against the catches. This was done for the values of F computed from the first VPA run. To fit the line from the first run, the terminal $\bar{F}_{(13-24)}$ for 1981 had to be reduced to 0.08 (Figure 1), and after the second VPA run the F was subsequently reduced to 0.07. However, it should be stressed that this method is only valid when the stock is in a stable condition up to the most recent year. According to the assessment, when we are using a predicted terminal F of 0.138 (as last year) the stock has decreased seriously in the last several years (Table 11), and hence the method of estimating the terminal Fs by the catches is not valid. However, if a terminal F value of 0.07 is used, a more or less stable stock is implied (Table 11).

A catch curve was computed from the 1981 data (Figure 2). It was agreed, however, that the F value derived by this method only represents a long-term average of about 10 years and is very sensitive to fluctuations in year class strength. It was, therefore, not considered reliable as an estimate of the present situation.

Having exhausted all possibilities of estimating the terminal fishing mortality, using the data available, the Working Group agreed that an assessment of this stock and its development in recent years was not possible at present with any degree of reliability.

3.8 Assessment (Sebastes mentella)

3.8.1 Parameters used

Using F values derived from a preliminary VPA run, a trial terminal fishing mortality was estimated by regressing these F values on total effort in USSR units as given in last year's report. Using the total effort figure for 1981, the input F was estimated from this relationship as $\bar{F}(8-19) = 0.22$ for the trial run. From this trial VPA, the linear regression between the total effort and the mean fishing mortality was again calculated for the period 1965-78, and the mean terminal F in 1981 was estimated from this regression (Figure 3). The predicted value for 1981 of $F = 0.21$ was very close to the mean F in the preliminary run.

As in last year's report, regression lines were also calculated between total effort in German Democratic Republic units (both OTM and OTB) and the estimated fishing mortality (Figure 4). The predicted values for the F in 1981 from these relationships for OTM data and OTB data are: $\bar{F}(8-19) = 0.31$ and $\bar{F}(8-19) = 0.19$, respectively. The Working Group, however, was of the opinion that for the selection of the final terminal F, the USSR data should be incorporated, since 94% of the catches in 1981 was taken by the USSR. The corresponding cpue values are, therefore, considered representative. Taking into account the observed correspondence between the F in the trial run and the predicted F, it was decided to accept an F of 0.21 as the final input fishing mortality.

For the exploitation pattern of age groups 6-9, slight modifications were made in order to better comply with the average recruitment level at age 6 in 1978-81. For age groups 10 and 11, the exploitation pattern was set equal to the average in 1974-78.

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

3.8.2 Fishing mortality (Figure 5)

Estimates of fishing mortality from VPA are given in Table 14. The calculated mean fishing mortality on age groups 8-19 was low in the period 1965-74, fluctuating around 0.08. Following the trend in effort, an increase to an average level of 0.49 was recorded for the period 1975-77, with a peak of 0.54 in 1976. Since 1978 the fishing mortality has remained fairly stable at a level of 0.24.

3.8.3 Stock size

Estimates of stock size in numbers from VPA, total stock biomass and spawning stock biomass are given in Tables 15 and 16. For the biomass calculations, mean weight at age data and the proportions of mature fish at age as given in Tables 12 and 17 were used.

The results from the VPA (Figure 5) show that the total stock biomass increased steadily from about 300 000 tonnes in 1965 to 1 000 000 tonnes in 1975. By 1978 it decreased to about 600 000 tonnes and has remained fairly stable since. The level of the fully recruited biomass in the present assessment of 631×10^3 tonnes in 1981 is slightly below that estimated in the 1981 report ($690 \text{ tonnes} \times 10^3$).

The values of the spawning stock biomass are not directly comparable to those given in last year's report due to the fact that in the present assessment, a maturity ogive was introduced to calculate the spawning stock biomass. According to the present assessment, the spawning stock biomass shows an increasing trend since 1978.

3.8.4 Yield per recruit

Yield per recruit and spawning stock biomass per recruit curves are plotted against mean F values calculated over age groups 8-19 (Figure 6), using the exploitation pattern and the mean weight at age

data for 1981 (Table 17). The last group was considered as a non-plus group in the calculations. To get the spawning stock biomass per recruit curve, the proportions of mature fish at age were taken into account.

The $F_{0.1}$ and F_{max} values are 0.14 and 0.24, respectively, and are somewhat higher than those estimated in last year's report ($F_{0.1} = 0.10$ and $F_{max} = 0.21$). This difference is due to the change of the last age group into a non-plus group.

The estimated fishing mortality in 1981 of 0.21 was, therefore, between the $F_{0.1}$ and the F_{max} level.

3.8.5 Catch projections

Catch projections were made for 1983, using the parameters given in Table 17. The stock size was projected to the beginning of 1983, assuming that the TAC of 70 000 tonnes in 1982 will be taken. This catch level would be achieved at a fishing mortality level of $\bar{F}(8-19) = 0.16$, which is close to the value of 0.14 estimated in last year's report (Doc. C.M.1981/G:7). The average recruitment for 1965-77 of 421×10^6 at age 6 was used in the projections for 1982-84.

The results of the catch projections are shown in Figure 7. The possible catch in 1983, spawning stock biomass and total stock biomass at the beginning of 1984 are plotted against the mean \bar{F} in 1983 and also against the fishing mortality rate expressed as a proportion of that estimated for the year 1981.

For the following selected options of fishing mortality in 1983, the results are summarized in the text table below.

Sebastes mentella

Sub-areas I and II

| 1982 | | | | Management option for 1983 | 1983 | | | | 1984 | |
|-------------|------------------------|-----------------|-------|-------------------------------|-------------|------------------------|-----------------|-------|-------------|------------------------|
| Stock biom. | Spawning stock biomass | $\bar{F}(8-19)$ | Catch | | Stock biom. | Spawning stock biomass | $\bar{F}(8-19)$ | Catch | Stock biom. | Spawning stock biomass |
| 652 | 194 | .16 | 70 | $F_{0.1}$ | 692 | 227 | .14 | 67 | 738 | 263 |
| | | | | F_{max} | | | .24 | 110 | 690 | 235 |
| | | | | $\bar{F}_{83} = \bar{F}_{81}$ | | | .21 | 98 | 703 | 243 |
| | | | | $\bar{F}_{83} = \bar{F}_{82}$ | | | .16 | 76 | 728 | 257 |
| | | | | TAC 70 000 t | | | .15 | 70 | 735 | 261 |

Weight in thousand tonnes.
 Stock biomass = fish at age 6 to 24.
 Spawning stock biomass from maturity ogive.

Under all options the spawning stock biomass at the beginning of 1984 is estimated to be higher than the 1982-83 level. The same is the case for the total stock biomass in the projections, except for the F_{max} option.

In considering the management options presented, it should be noted that a continuation of a TAC level of 70 000 tonnes in 1983 would bring the fishing mortality very close to the $F_{0.1}$ value, and both the total stock biomass and the spawning stock biomass would increase from 1983 to 1984 by 6% and 15%, respectively.

4. REDFISH IN SUB-AREAS V AND XIV

4.1 Status of the Fisheries (Tables 18-24)

The total catch from the Irminger Sea redfish stock complex increased from 114 897 tonnes in 1980 to about 149 000 tonnes in 1981, i.e., by about 30%. The catch increased in Division Va and Sub-area XIV but decreased in Division Vb.

In Division Va (Iceland), the Icelandic fleet increased their fishing effort in 1981, and their catch increased from 69 780 tonnes to about 93 400 tonnes. About 2 200 tonnes were taken by other nations in Division Va. The fishing pattern of the Icelandic trawler fleet was similar to that of 1980. The increased effort (due to greater restrictions in the cod fishery and slight increases in the fleet) was, as in 1980, directed more to the area southwest of Iceland and towards greater depths, resulting in a greater proportion of S. mentella in the total catch.

In Division Vb (Faroe Islands) catches decreased from 10 039 tonnes in 1980 to about 7 200 tonnes in 1981, which is about the same as the 1977 level. Catches of the Federal Republic of Germany fleet remained stable at about 3 900 tonnes for both years, while the catches of the Faroe Islands fleet decreased from 5 509 tonnes to about 3 200 tonnes. This decrease in the catches is probably due to the fact that the effort of the Faroe Islands fleet was directed more towards the saithe fishery. The catches by French vessels in Division Vb decreased from 627 tonnes to some 40 tonnes.

In Sub-area XIV (East Greenland), the total catch increased from 32 609 tonnes in 1980 to about 47 000 tonnes in 1981, i.e., by about 43%. The catches in Sub-area XIV were almost exclusively taken by the Federal Republic of Germany fleet. This increase in the catches in Sub-area XIV is generated by greater effort by the Federal Republic of Germany fleet.

Over the last few years there has been a trend in the fishing pattern in Sub-area XIV towards catching younger age groups of both species, particularly S. mentella. Before 1976, S. mentella at 12 years of age and younger were scarcely found in the landings. This trend continued in 1981, when about 40% of the total number landed of S. mentella and about 13% of S. marinus belonged to age groups 12 and younger, compared to less than 1% and 8% respectively in 1977. This could be explained by reduced discarding of redfish or/and increased effort in areas, where relatively small redfish are abundant, or/and recruitment of the relatively strong year classes from 1972-74, indicated by the 0-group surveys.

4.2 Recruitment of Redfish in the Irminger Sea Area

In 1981, high densities of 0-group redfish were found on the banks off East Greenland and the Dohrn Bank region. The highest densities were observed in an area between about 61°-63°N and 40°-42°N.

As last year, the concentration of redfish in the centre of the Irminger Sea was lower than usual. In the Icelandic area only few 0-group redfish were observed.

The total abundance index of 0-group redfish was 9.0×10^6 fish per nautical square mile. The 1981 year class is estimated to be of average size, but still much lower than the 1972-74 year classes.

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

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

| <u>Year class</u> | <u>Number of fish</u> |
|-------------------|-----------------------|
| 1970 | 8.6 |
| 1971 | 12.6 |
| 1972 | 31.1 |
| 1973 | 74.0 |
| 1974 | 23.6 |
| 1975 | 12.6 |
| 1976 | 5.8 |
| 1977 | 13.0 |
| 1978 | 6.5 |
| 1979 | 1.3 |
| 1980 | 3.0 |
| 1981 | 9.0 |

Apart from the main extrusion in the Reykjanes Ridge area, there seems to be an influx of redfish fry by drifting from south of 60°N, which varies considerably in strength from one year to another.

The analysis of redfish fry according to species indicated that S. marinus fry amounted to 43.1% of the total compared to 47.2% in 1980. The area distribution of S. marinus and S. mentella does not seem to be as clear as in 1980.

4.3 Splitting of 1981 Catches into S. marinus and S. mentella Components

In Division Va the Icelandic catches were allocated to S. marinus and S. mentella components in the proportion 78.90% to 21.10%. These figures were derived from observations on landings. The catches of Faroe Islands, Belgium and Norway are in accordance with their fisheries allocated to S. marinus.

In Division Vb the Faroese catches were reported as 76.54% S. marinus and 23.46% S. mentella based on samples taken from landings. The Federal Republic of Germany catches were S. mentella according to observations on landings. Due to the nature of the fisheries, the Norwegian catches were allocated to S. marinus.

In Sub-area XIV the total catches were allocated in the same proportions as observed in the landings of the Federal Republic of Germany, i.e., 54.73% and 45.27% for S. marinus and S. mentella, respectively.

4.4 Length and Age Compositions

Division Va: Length frequencies from the Icelandic catches in 1981 were available for both species and were used to calculate the length distribution of each species in Division Va.

Division Vb: Data on length compositions of the 1981 catches from the Faroe Islands were available for both species in 5 cm groups. These were split into 1 cm groups for S. marinus by length composition data obtained from Icelandic landings in Division Va, and for S. mentella by Federal Republic of Germany landings from Division Vb.

Sub-area XIV: Data on length compositions of the 1981 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. For S. marinus in Division Va an Icelandic age/length key was presented. Since it did not cover all length frequencies for the younger and older age groups, it was supplemented by using the 1980 age/length key of the Federal Republic of Germany in Sub-area XIV. For S. mentella in Division Va no age/length data were available. To calculate the numbers at age, the age/length key of the Federal Republic of Germany in Sub-area XIV was used. In Division Vb an age/length key of the Federal Republic of Germany for S. mentella was applied, whereas for S. marinus the 1981 Icelandic age/length key in Division Va was used to calculate the numbers at age.

The combined age compositions of the total catches in Sub-areas V and XIV are given in Table 25 for S. marinus and in Table 30 for S. mentella.

4.5 Assessment of *Sebastes marinus*

4.5.1 Weight at age (Table 29)

New Icelandic data from Division Va were available on weight per age group, originating from an intensive sampling programme from commercial catches as well as from research vessel catches. These data have been converted into weight at age data, based on average length per age.

A comparison between the new data and those used in last year's report shows only discrepancies in age groups 7-13, which could be explained by the difference in selection between trawls used. The cod ends used by the Icelandic research vessels were lined with fine-meshed nets, and, therefore, it was thought that the weight of the younger age groups in the new data represents the weight of the fish in the stock. Thus, the figures from last year's report are used to estimate the weight of the catches. In the estimate of the stock biomass, the Icelandic figures for ages 7-13 are used, and from age group 14 and onwards the figures from last year's report, since the new Icelandic data from age 14 and onwards are almost identical with those used previously.

4.5.2 Proportion of mature fish at age

New Icelandic data on the proportion of mature fish per cm group were available to the Working Group for Division Va. These data were used to plot the curve for percentage mature at length. The proportions of mature fish per length group are different for sexes, but for assessment purposes the values for males and females had to be combined, assuming a sex ratio of 1:1. The mean length per age data were then used to derive the proportions of maturity for each age group.

Although the data originate entirely from Division Va, they have been used for the stock complex in Sub-areas V and XIV, keeping in mind that the application of a maturation ogive in estimating the size of the spawning biomass is an improvement in any case, compared to the knife-edge estimate at age 16 used previously.

4.5.3 VPA

Data on fishing effort for the Icelandic fleet in Division Va are now available for the years 1978-81 showing an increase in effort for 1981 by about 40% compared to 1980. Since, however, the time series is too short to correlate fishing mortality with effort, no estimate of the terminal F for 1981 could be made on this basis.

Icelandic catch per unit effort figures are given in the text table below:

| <u>Year</u> | <u>kg/hour trawling</u> [⊛]) |
|-------------|--|
| 1978 | 1 034 |
| 1979 | 1 148 |
| 1980 | 1 180 |
| 1981 | 1 168 |

⊛ For landings with $\geq 70\%$ of redfish in the catches.

These data indicate, taken as indices of stock abundance, that in Division Va the S. marinus stock has been almost stable in recent years.

The results of the trawl surveys made by the Federal Republic of Germany indicate that there was no considerable change in stock abundance of this species in Sub-area XIV from November 1980 to November 1981 as shown in the text table below:

Survey results from the Federal Republic of Germany surveys

| <u>S. marinus - Sub-areas V and XIV</u> | <u>1980</u> | <u>1981</u> |
|---|-------------|-------------|
| Biomass estimate (1 000 tonnes) | 446 | 513 |
| Stock numbers ($\times 10^{-6}$) | 654 | 669 |
| Mean catch per hour trawling (kg) | 1 436 | 1 526 |
| Mean catch per hour trawling (No.) | 2 033 | 2 010 |

Since the results of the previous assessment indicate that stock abundance has also been relatively stable during the 1970-79 period, the Working Group concluded that in such a situation the fishing mortality is dominantly a function of the catch, and that it would be justifiable to correlate fishing mortality with catches. A linear regression of $\bar{F}_{(14-23)}$ against catches, which were based on the 1981 assessment, indicated a level of fishing mortality for 1981 of 0.39. This value was then used to run a VPA (RUN 1). The resulting $\bar{F}_{(14-23)}$ regressed against catches resulted in an estimate of $\bar{F}_{(14-23)}$ for 1981 of 0.345 (Figure 8). Using this F as the terminal F , a further VPA was made, and the regression of the average fishing mortalities against catches produced an $\bar{F}_{(14-23)}$ of 0.33. Since this value is only slightly different from the one used in the VPA (RUN 2) (i.e., $\bar{F}_{(14-23)} = 0.345$), this was considered as the estimate of

fishing mortality for 1981 on S. marinus in Sub-areas V and XIV. As in previous assessments, a natural mortality of 0.1 was used. The detailed results of the VPA are given in Tables 26, 27 and 28 and are summarized in Figure 9.

The results of the VPA confirmed that the basic requirement for the approach taken to estimate fishing mortality for 1981 is met; this is particularly obvious for the biomass of S. marinus for age groups 14 to 23, to which the average fishing mortality refers (Figure 9).

Spawning stock biomass decreased from the level of 500 000 tonnes in 1967 to about 300 000 tonnes in 1972, a level which was maintained into 1981 with only minor fluctuations. Total biomass was relatively stable in the period 1967-78 at levels between 700 000 tonnes and 800 000 tonnes. The moderate increase in total biomass in 1973 could be explained by the recruitment of the strong year classes 1969 and particularly 1972; however, this estimate must be seen in the light of possible biases in the exploitation pattern used in the VPA.

The fishing mortality followed the trend in catches and reached its highest level in 1981.

4.5.4 Catch projection and management options

The basic data for the projection of catches in 1983 and for stock size at the beginning of 1984 are given in Table 29. Average recruitment of 7 year old fish over the years 1969-78 was used for the years 1982, 1983 and 1984.

The exploitation pattern, which was revised in 1980 to take account of the change in fishing pattern, has been extended for age groups 7 and 8 with relatively small values.

In the absence of any indication of the likely total catch level of S. marinus from the Irminger Sea stock complex in 1982, three levels of catch have been considered in the catch projection, i.e.:

- (i) 60 000 tonnes as recommended by ACFM
- (ii) 90 000 tonnes corresponding to the 1980 level
- (iii) 120 000 tonnes, if the recent trend of increasing effort is maintained

The results of the catch projection are given in Figure 11.

In the following text table, management options for 1983 are given, selected according to advice from ACFM and considering some target levels of spawning stock biomass at the beginning of 1984. The management options in the table refer to a catch of 90 000 tonnes in 1982, but factors have been calculated to allow the figures in the table to be corrected for deviations from the 90 000 tonnes catch level in 1982 (see Note below option table):

Sebastes marinus

| 1982 | | | | Management option for 1983 | 1983 | | | | 1984 | |
|------------------|------------------------|-------------------|------------|------------------------------------|------------------|------------------------|--------------------|------------|------------------|------------------------|
| Stock biom. (7+) | Spawning stock biomass | \bar{F} (14-23) | Catch (7+) | | Stock biom. (7+) | Spawning stock biomass | \bar{F} (14-23) | Catch (7+) | Stock biom. (7+) | Spawning stock biomass |
| 972 | 260 | 0.30 | 90 | $F_{1981} \times 0.8$ | 993 | 258 | 0.28 | 89 | 1 010 | 280 |
| | | | | Maintaining 1982 SSB | | | 0.39 | 118 | 975 | 260 |
| | | | | $F_{0.1}$ | | | 0.08 ¹⁾ | 29 | 1 070 | 325 |
| | | | | F_{max} | | | - | | | |
| | | | | SSB 1984 = 300 | | | 0.185 | 60 | 1 035 | 300 |
| | | | | Maintaining 1981 level of exploit. | | | 0.345 | 106 | 990 | 265 |

Weights in thousand tonnes. 1) If age group 30 is not a plus group. Spawning stock biomass using maturation ogive.

Note on the Option Table

Since the catch level for 1982 is not known at present, the catch projection has been made for three levels of catch in that year, i.e., 60 000 tonnes (as recommended by ACFM), 90 000 tonnes (corresponding to the 1980 catch), and 120 000 tonnes (if the present trend of increasing catches continues in 1982). The options in the text table above are referring to a catch of 90 000 tonnes in 1982. The weights given in the table can be corrected by adding (if the 1982 catch is below 90 000 tonnes) or subtracting (if the 1982 catch is higher than 90 000 tonnes) the following percentages for each 5 000 tonnes deviation:

| | |
|-------------------------|----------|
| Catch: | ± 1.333% |
| Spawning stock biomass: | ± 1.136% |
| Total biomass (7+): | ± 0.367% |

Under no option is the spawning stock biomass expected to decrease below the 1982-83 level. However, if management aims at an increase of spawning stock biomass by the beginning of 1984 to a level of 300 000 tonnes - the stable level of the 1972-80 period - then a catch level of around 60 000 tonnes would be required in 1983, depending on the 1982 catch.

4.6 Assessment of *Sebastes mentella*

In previous assessments the terminal F for the years 1979 and 1980 were found by relating the catches of the two most recent years to fishing mortalities based on more qualitative indications of the development of effort, because no other data were available.

During the last three years, more fishing effort has been directed towards S. mentella, and especially the younger age groups have been more heavily exploited. Besides that, the observed decline in the stock size as well as in the spawning stock, which has taken place in the observed period, indicates an unstable situation in the stock. The Working Group felt it unrealistic to continue the procedure used earlier.

No effort data and no other fishery-independent data were available, which could allow a realistic estimate of the fishing mortality in 1981. The Working Group was, therefore, unable to compute a VPA and the subsequent catch projection in a situation, where none of the important assessment parameters could be estimated with sufficient reliability.

The previous assessment shows a continuous decline in both total biomass and spawning stock biomass, at least up to 1976.

In view of the uncertainty about the more recent development of the stock, and considering the recent increase in catches of that species, the Working Group feels that a continuous approach seems to be advisable in the management of this stock.

5. GREENLAND HALIBUT IN SUB-AREAS I AND II

5.1 Status of the Fisheries

The nominal catches by country for Sub-area I and Divisions IIA and IIB are given in Tables 31, 32 and 33. In Table 34 the catches are summarized for Sub-areas I and II. The total catch in 1980 was 13 284 tonnes, i.e. 5% below the TAC of 14 000 for that year. In 1981 the total catch was 14 956 tonnes, i.e. 25% above the TAC of 12 000 tonnes.

5.2 Catch per Unit Effort and Effort Data

Data on catch per hour trawling were available from USSR trawlers (1965-81) and Norwegian fresh fish trawlers (1973-81), and catch per day trawling data were available from the German Democratic Republic freezer trawlers (1973-80). Due to a change in the fishing strategy of the German Democratic Republic trawlers from 1980 to 1981, the cpue for the German Democratic Republic trawlers in 1981 was not comparable with previous years and was subsequently not used in the present assessment.

The way in which these cpue data were obtained and treated was described in last year's report of the Working Group (Doc. C.M.1981/G:7, pp.16-17). The calibrated cpue series is taken to be the unweighted average of the three national cpue series relative to their 1973-80 averages. In last year's assessment, the recalculation of the cpue series was done on the basis of the 1973-79 data.

The total effort index is obtained by dividing the total catch by the calibrated cpue data (Table 35).

5.2.1 Mean weight at age in 1981

The mean weights of the 4 to 14 year olds were taken from USSR investigations. The mean weights of the 3 and 16+ age groups were taken to be the same as in 1980. The mean weight of the 15 year olds in 1981 was derived from Norwegian data. The mean weights are given in Table 36 with the ratio between the nominal catch and the sum of products shown in Table 37.

5.3 VPA

5.3.1 Age compositions

The age composition for 1980 was adjusted according to the revised catch statistics. For 1981, length compositions, age/length keys and age compositions were available for the trawl catches of USSR and Norway, and these were used to estimate age composition of total trawl landings.

The age compositions for the Norwegian long-line and gill-net fisheries were then added to provide an age composition for the total fishery.

The age compositions available for 1981 account for 90% of the total catch. The total age compositions as estimated for 1970-81 are given in Table 38.

5.3.2 Estimation of the input fishing mortalities for 1981

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

The $\bar{F}(7-11)$ for 1981 was chosen by regressing $\bar{F}(7-11)$ on total effort for the years 1970-77 inclusive and forcing the regression through the origin.

The reason for choosing this type of regression is that the value of 1981 using a normal regression had to be extrapolated from the previous years' data points. This procedure gives an estimate of 0.14 for $\bar{F}(7-11)$ in 1981 (Figure 12), while a normal linear regression on the same data would predict $\bar{F}(7-11) = 0.26$ for 1981, but with a large intercept of 0.17.

In Figure 13.a the biomass of the 4+ age groups at mid-season is plotted against the calibrated cpue. A linear regression forced through the origin was performed for the 1970-77 data points. The biomass of 4+ in 1981, as implied by $\bar{F}(7-11) = 0.14$ in 1981, is close to this line.

The same type of regression (1970-77) is shown in Figure 13.b, where the biomass of 7+ age groups at mid-season is plotted against the cpue of 7+. This line passes through the 1981 value when $\bar{F}(7-11)$ in 1981 = 0.14.

In both Figure 13.a and 13.b a normal linear regression would give similar predictions of the biomass in 1981, as the 1981 cpue values are near the centre of the data points.

For age groups 5 to 16+, the average exploitation pattern for 1977-78 was chosen (Figure 14). As in last year's report, the exploitation pattern for 1979 appears anomalous compared to the other years. The input fishing mortalities on 3 and 4 year olds in 1981 were selected such that the number of 3 and 4 year olds in the stock during 1981 become close to the average for the years 1970-78. The results of the VPA are given in Tables 39, 40 and 41, and shown in Figure 15.

5.4 Yield per Recruit (Figure 16)

Yield and spawning stock per recruit curves were calculated using the 1977-78 exploitation pattern and the 1981 mean weights (Table 42).

$F_{0.1}$ and F_{max} are estimated at 0.115 and 0.196, respectively, when age 16 is not treated as a plus group.

The yield and the spawning stock under equilibrium conditions, using an average recruitment at age 3 in 1970-78 of 36.6×10^6 , are shown for the different values of F in the text table below.

| F | Y/R (kg) | Sustainable yield (tonnes) | SSB/R (kg) | Spawning stock biomass (SSB) (tonnes) |
|-------------------|----------|----------------------------|------------|---------------------------------------|
| $F_{0.1} = 0.115$ | 0.651 | 23 800 | 3.05 | 112 000 |
| $F_{81} = 0.14$ | 0.678 | 24 800 | 2.79 | 102 000 |
| $F_{max} = 0.196$ | 0.694 | 25 400 | 2.05 | 75 000 |

5.5 Catch Projections

The stock was projected to the beginning of 1984, assuming that the TAC of 12 000 tonnes in 1982 will be taken. The average recruitment for the years 1970-78 of 36.6×10^6 at age 3 was used both for 1982 and 1983, and the catch projection parameters are given in Table 42.

The catch in 1982 for four alternative fishing mortalities, the resulting stock biomass (3 years and older), and the spawning stock biomass (9 years and older) in 1984 are given in the text table below. The same parameters as a function of the fishing mortality in 1983 are shown in Figure 17.

Species: Greenland halibut

Area: ICES Sub-areas I and II

| 1982 | | | | Management option for 1983 | 1983 | | | | 1984 | |
|------------------|-------------------------|------------------|-------|----------------------------|------------------|-------------------------|------------------|-------|------------------|-------------------------|
| Stock biom. (3+) | Spawn. stock biom. (9+) | \bar{F} (7-11) | Catch | | Stock biom. (3+) | Spawn. stock biom. (9+) | \bar{F} (7-11) | Catch | Stock biom. (3+) | Spawn. stock biom. (9+) |
| 173 | 51 | .095 | 12 | F_{1981} | 193 | 66 | .140 | 20.8 | 204 | 81 |
| | | | | F_{1982} | | | .095 | 14.5 | 211 | 85 |
| | | | | $F_{0.1}$ | | | .115 | 17.3 | 208 | 83 |
| | | | | F_{max} | | | .196 | 28.1 | 195 | 76 |

Weights in thousand tonnes.

Looking at both the cpue data (Table 35) and the VPA results (Figure 15), the stock appears to have been decreasing from 1965 up to about 1978. Since that time, an increasing trend seems to have occurred.

In all the options for 1983, given in the text table above, the total stock and the spawning stock will continue to increase up to 1984. However, the stock is still below the level in 1965-70, as indicated by the cpue data.

Keeping the fishing mortality near the $F_{0.1}$ level, the TAC could be increased from the 1981-82 level (12 000 tonnes) to about 17 000 tonnes in 1983.

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 43-46 for the years 1971-81. During this period the total catches ranged from 6 045 tonnes (1976) to 36 280 tonnes (1974), with the mean of 22 466 tonnes (Figure 18). Since the drop in 1976, the total catches increased steadily to 31 252 tonnes in 1980 but dropped to 19 599 tonnes in 1981, in which year 79% of the total catch was taken by Icelandic vessels.

In 1981, 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.

6.2 Effort and Catch per Unit Effort

Catch per unit effort data from Icelandic trawlers were available for the years 1978-81 (Table 47). The cpue figures refer to all tonnage classes combined. Since, however, the composition of the fleet has been rather stable over the four years, the cpue data could be taken as being representative for this fishery.

Total effort increased from 1978 by about 65% to a high level in 1979-80, followed by a decrease of about 20% in 1981 (see Table 47).

6.3 VPA

6.3.1 Age compositions

The age compositions of the catches from 1975-79 were left unchanged, and the catch in numbers per age for 1980 were corrected according to the final catch data.

For the year 1981, length compositions and age/length keys were available from Division Va (Icelandic data) and Sub-area XIV (Federal Republic of Germany data). As the age/length/weight relations in both sets of data were almost identical, the Icelandic data were used to break down the total catch from Sub-areas V and XIV.

The total age composition is given in Table 48.

6.3.2 Parameters and results

As in previous years, the natural mortality was assumed to be $M = 0.15$.

Since the effort series was too short to be used for an adequate regression analysis (Table 47), an unweighted mean effort value was calculated for the years 1978-80. The resulting value was plotted against the mean $\bar{F}_{(8-13)}$ for the same three years from the VPA as suggested by ACFM in its July 1981 assessment. A line was drawn from this point to the origin, and a terminal $\bar{F}_{(8-13)}$ of 0.249 was estimated for 1981.

The results of the VPA are given in Tables 49-51 and shown in Figure 18.

Total stock biomass increased from about 170 000 tonnes in 1975 to slightly above 200 000 tonnes in 1976, remained stable around that level until 1980 and then decreased to about 177 000 tonnes in 1981. The spawning stock increased steadily from 57 857 tonnes in 1975 to 97 961 tonnes in 1980 but decreased to 84 770 tonnes in 1981.

6.4 Yield per Recruit (Figure 19)

Yield and spawning stock (with maturity ogive) per recruit curves are based on parameters given in Table 52. The age group 18 was not used as a plus group.

$F_{0.1}$ equals 0.204, and there is no maximum on the yield per recruit curve within a reasonable range of fishing mortality.

6.5 Catch Projections

Catch projections for 1983 were made using the parameters given in Table 52. The estimate of stock size at the beginning of the 1982 fishing season was calculated, using the stock size at the beginning of 1981 adjusted by the 1981 fishing mortalities (Table 52).

For catch projections it was assumed that the total removals in 1982 will be at a level of 25 000 tonnes. Possible catches in 1983 and the total and spawning stock biomass at the beginning of 1984 are plotted against the mean F in 1983, as well as the ratio of mean F in 1983 to mean F in 1981 (Figure 20).

Subsequently, three options of fishing mortality and the respective estimates of catches and biomass are summarized in the text table below.

Greenland Halibut

Sub-areas V and XIV

| 1982 | | | | Management option for 1983 | 1983 | | | | 1984 | |
|------------------|--------------------|--------------------|------------|-------------------------------|------------------|-------------------------|--------------------|------------|------------------|--------------------|
| Stock biom. (4+) | Spawn. stock biom. | $\bar{F}_{(8-13)}$ | Catch (4+) | | Stock biom. (4+) | Spawn. stock biom. (4+) | $\bar{F}_{(8-13)}$ | Catch (4+) | Stock biom. (4+) | Spawn. stock biom. |
| 175 | 82 | 0.135 | 25 | $F_{0.1}$ | 168 | 77 | 0.204 | 15 | 170 | 80 |
| | | | | $\bar{F}_{83} = \bar{F}_{81}$ | | | 0.249 | 20 | 168 | 76 |
| | | | | $\bar{F}_{83} = \bar{F}_{82}$ | | | 0.315 | 24 | 164 | 72 |

Weights in thousand tonnes.

Under all options, however, the spawning stock biomass as well as the total stock biomass are estimated to be somewhat lower than the levels indicated in the VPA for the late 1970s, provided that the estimates of terminal F are not substantially overestimated.

7. MESH ASSESSMENT OF REDFISH IN SUB-AREAS V AND XIV

The method is described in Doc. C.M.1980/G:28.

Sebastes mentella (Tables 53, 55 and 56; Figures 21-23)

Length distributions were available from the Federal Republic of Germany catches in Division Va from 1965-77, and from Division Vb from 1965-80. Since the legal mesh size in both areas from 1965-75 was 120 mm, the length distributions obtained from the catches during this period were used for the analysis. It was considered that the length distributions from the respective areas were representative of the total catch in each area.

The "total F" used in the model was selected at a level such that the simulated F closely approximated that calculated in the VPA from the period 1967-75 (C.M.1981/G:7, Table 32, Figure 23). This total F was subsequently broken down proportionately between the two fishing areas, Divisions Va and Vb, in order to simulate the observed break-down between areas (89.4% in Division Va and 10.6% in Division Vb, 1965-75, by weight).

The von Bertalanffy growth parameters used in the model were generated from age/length keys, while a natural mortality of $M = 0.1$ was used as in the VPA.

In the initial trials it became apparent that estimates of effective mesh sizes could not be derived with any degree of confidence. The main reason for this is that recruitment of fish smaller than 40 cm to the fishing grounds is very low, whereas discarding is not a problem in this fishery. Consequently, the key parameter in this mesh assessment appeared to be recruitment for which very little independent information was available. The Working Group decided, therefore, to fix the effective mesh size equal to the legal mesh size (120 mm) during the period in question, using a selection factor of 2.90 and a selection range of 11.8 cm previously derived from selection experiments. This provided 50% and 75% selection lengths of 34.80 cm and 40.70 cm, respectively.

Since estimates of effective mesh sizes could not be calculated, estimates of recruitment patterns were derived. The results yielded 50% recruitment sizes of 46.2 cm in Division Va and 46.9 cm in Division Vb, with 75% recruitment sizes being 7% and 9% higher in the respective areas. A 25% derecruitment size of 53.0 cm and a 50% derecruitment size of 51.0 cm provided a good fit to the decreasing limb of the length frequency distribution (Figures 21 and 22). Large S. mentella occur only occasionally in the catches, which is circumstantial evidence for having a derecruitment curve.

The resulting predicted length distributions closely approximated the observed ones, when very low discard rates were assumed (Table 56, Figures 21 and 22). The available information on these fisheries during the period seems to give a reasonably consistent picture.

Before experimenting with the model, it was felt that it should be calibrated to correspond to the more recent situation with new legal mesh sizes. However, this would be difficult to perform with the development of a new fishing pattern at East Greenland in recent years. Younger age groups now form a large proportion of the total fishery. Given that a recruitment pattern is not available from such a short series of data, the Working Group could not assess the effects of change in legal mesh sizes etc., as the results for the above-mentioned reasons would be subject to very wide degrees of confidence.

Sebastes marinus (Tables 54, 55 and 57; Figures 24-27)

For the analysis of this stock, the data were organized according to the definition of three fisheries: 1) the total fishery (all countries) in Sub-area XIV, using length frequencies from the Federal Republic of Germany portion of the fishery, 2) the Federal Republic of Germany fishery in Division Va, using Federal Republic of Germany data, and 3) the remaining fishery in Division Va, including incidental catches in Division Vb, using Icelandic data from Division Va (Table 54). As with S. mentella, total F was broken down between the three fisheries in proportion to the observed catch distribution, and the analysis was performed on data from the same time frame (1965-75). The discard parameters required for the third fishery were based upon Icelandic data for the years 1976-81 and a rate of 50% discarded for fish of 28.50 cm and 25% for those of 31.50 cm was estimated. However, qualitative information from the other fisheries indicated a higher discard rate for these fisheries, and, consequently, the discard rates for these were adjusted to 32 cm and 34 cm for 50% and 25%, respectively.

For similar reasons as with S. mentella, effective mesh sizes could not be ascertained from the analysis. The effective mesh size was, therefore, set at the legal limit of 120 mm for the period concerned. This gave selection lengths of 32.9 cm for 50% retention and 37.9 cm for 75% retention, using a selection factor of 2.70 and a ratio between the 75% and 50% value of 1.17.

Attempts were made to calculate recruitment curves for the three respective fisheries. This was, however, not possible for the Sub-area XIV fishery due to the inclusion of one or more strong year classes entering the fishery in the late 1960s when catches were high. Consequently, the observed length distributions were not considered representative of an equilibrium situation required for a valid recruitment curve calculation. A 50% recruitment size of 36 cm was estimated for the Federal Republic of Germany fishery in Division Va. If this could be extrapolated to the Federal Republic of Germany fishery in Sub-area XIV, the estimated length frequencies would be similar to those of Division Va, as shown in Figure 24. For the third fishery (all remaining countries, Division Va), the 50% recruitment size was estimated to be 32 cm, somewhat lower than that of the Federal Republic of Germany fishery (Table 57). The distribution of the observed F values (1967-75) as they relate to the simulated F values are presented in Figure 27.

Due to difficulties encountered in estimating the recruitment curve for Sub-area XIV along with changes in the nature of these fisheries since 1975, it was considered of no value to calibrate the model to the present situation in an attempt to estimate the effects of changes.

8. DEFICIENCIES IN DATA REQUIREMENTS FOR ASSESSMENT PURPOSES

8.1 Catch and Effort Information

Although misreporting has occurred, it is the general impression of the Working Group that the reporting of catch statistics has improved for both redfish and Greenland halibut in recent years. However, a severe problem still exists in unreported discards, particularly redfish. In the S. marinus fisheries in Division IIa and Division Va and the fisheries for both redfish species in Sub-area XIV, discarding is known to occur; however, no quantitative data are available. The Working Group also considered that small redfish and Greenland halibut may be discarded as well in the shrimp fishery of Sub-areas I and II.

Effort data for S. mentella and Greenland halibut in Sub-areas I and II appear reasonable. However, for all other stocks considered by the Group, no effort data are available, except short-time series for Greenland halibut in Sub-areas V and XIV and redfish in Division Va, where some Icelandic data have recently been produced.

As a result of the lack of effort data, assessments of S. marinus in Sub-area I and Division IIa and S. mentella in Sub-areas V and XIV could not be carried out.

Splitting of the redfish catches into species is somewhat of a problem in certain segments of the fishery, particularly with regard to factory trawlers in Sub-area XIV. Because the catches of factory trawlers are processed at sea, it is almost impossible to obtain biological samples from these catches.

The Working Group agreed that these problems can only effectively be overcome by reliable record-keeping and reporting of all fishing activities implemented by a scientific observer programme in the commercial fisheries.

8.2 Fishery-Independent Stock Estimates

In the absence of usable commercial catch and effort data, indices or direct estimates of stock abundance seem desirable by extensive biomass surveys. The Group felt that such surveys should not only be intensified, but the survey design should also be expanded to cover redfish and Greenland halibut depths, including nursery grounds. The results of these surveys also provide important biological information needed, such as distribution patterns and estimates of recruitment. Dealing with the problems of surveying pelagic concentrations of redfish, it was considered that a combination of trawling and hydroacoustic methods might be a useful approach.

8.3 Biological Data

Although the taxonomy of redfish species is not yet completely solved, it is not considered a major problem to identify neither the two species, S. marinus and S. mentella, upon which the fisheries in these regions are based, nor S. viviparus, which frequently occur in the catches. Redfish workers should, however, be aware that there are other stocks of redfish in the region (e.g., the oceanic stock in the Irminger Sea), and fish from such stocks may occasionally occur in the catches. This is, however, not thought to affect the assessment at present.

There is a considerable difference in growth rate of male and female Greenland halibut, and redfish males and females reach maturity at different sizes. Age/length keys should, therefore, be given by sex, as well as combined both for Greenland halibut and redfish.

Redfish age-reading is difficult and time-consuming. There are also some discrepancies in age-reading between different age-readers. The Working Group felt it could be of great value, if a workshop could be arranged for the age-readers.

At the present meeting there were no age/length keys presented for the following species:

S. marinus - Division IIa, the Norwegian catches

S. marinus - Division Vb

S. mentella - Division Va

To improve the data on mean weight at age it would be helpful, if the number of specimens weighted could be increased.

It would be desirable to derive maturation ogives from older material, and present this to the Working Group in order to elucidate trends in the age of maturation during the observed periods. No maturation ogives have so far been presented for Greenland halibut in Sub-areas I, II and XIV, for S. marinus in Sub-areas I, II and XIV, or for S. mentella in Sub-area XIV.

There is still no biological evidence supporting a split of the stock complex of redfish in Sub-areas V and XIV into separate stock units.

9. OTHER MATTERS

The USSR scientists raised some questions concerning mesh sizes and closed areas in the redfish fisheries in Sub-areas I and II.

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

| Country | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 ^{x)} |
|-------------------|--------|--------|--------|--------|---------|---------|---------|------------------------|------------------------|------------------------|--------------------|
| Belgium | - | - | - | 30 | 28 | 2 | 1 | - | - | - | - |
| Faroe Isl. | - | 9 | 32 | 6 | 67 | 137 | 8 | 1 | - | - | - |
| France | - | - | - | 1 116 | - | - | 660 | 3 608 | 1 142 | 1 297 | - |
| German Dem Rep. | 14 786 | 9 972 | 11 756 | 28 275 | 28 020 | 22 636 | 17 614 | 16 165 | 16 162 | 8 448 | 4 614 |
| Germany, Fed.Rep. | 3 076 | 1 697 | 3 479 | 6 597 | 5 182 | 7 894 | 7 231 | 11 483 | 11 913 | 7 992 | 4 578 |
| Netherlands | - | - | - | - | - | 127 | - | - | - | - | - |
| Norway | 4 644 | 6 776 | 7 714 | 7 055 | 4 966 | 7 305 | 7 381 | 7 802 | 9 025 | 8 472 | 9 555 |
| Poland | 2 532 | 1 112 | 215 | 1 269 | 4 711 | 4 137 | 175 | 2 957 | 261 | 87 | 26 |
| Portugal | - | - | - | - | 331 | 3 463 | 1 480 | 378 | 1 100 | 271 | - |
| Spain | - | - | - | - | 1 194 | 3 398 | - | - | 1 375 | 1 965 | 45 |
| U.K. | 4 002 | 4 379 | 4 791 | 3 509 | 2 746 | 4 961 | 6 330 | 3 390 | 1 756 | 1 307 | 470 |
| USSR | 29 839 | 22 647 | 31 829 | 48 787 | 230 950 | 263 546 | 144 993 | 78 092 | 70 451 | 72 802 | 81 652 |
| Total | 58 879 | 46 592 | 59 816 | 96 644 | 278 195 | 317 606 | 185 873 | 124 172 ^{xx)} | 113 620 ^{xx)} | 102 765 ^{xx)} | 100 940 |

x) Provisional data

xx) 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.
(As reported officially to ICES.)

| Country | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 ^{x)} |
|----------------------|-------|-------|-------|--------|--------|--------|--------|-------|-------|-------|--------------------|
| Belgium | - | - | - | 30 | - | 2 | 1 | - | - | - | - |
| Faroe Isl. | - | - | 6 | 6 | - | - | - | - | - | - | - |
| France | - | - | - | 26 | - | - | 149 | 27 | 7 | 1 | - |
| German Dem.Rep. | 78 | 36 | - | 358 | 201 | 90 | - | - | - | - | - |
| Germany, Fed.Rep. | 148 | 7 | 76 | 1 086 | 483 | 635 | 786 | + | - | - | 7 |
| Netherlands | - | - | - | - | - | - | - | - | - | - | - |
| Norway | 316 | 1 000 | 1 917 | 194 | 482 | 739 | 1 181 | 1 333 | 1 374 | 736 | 616 |
| Poland | 1 | 22 | - | - | 93 | 47 | - | - | - | - | - |
| Portugal | - | - | - | - | 331 | 478 | 55 | 8 | - | 170 | - |
| Spain | - | - | - | - | 820 | 301 | - | - | - | - | - |
| U.K. | 1 406 | 1 363 | 1 894 | 1 320 | 1 048 | 1 392 | 1 686 | 959 | 462 | 295 | 61 |
| USSR | 3 743 | 4 403 | 4 885 | 9 318 | 30 750 | 12 411 | 13 154 | 2 575 | 639 | 33 | 1 220 |
| Total | 5 692 | 6 831 | 8 778 | 12 338 | 34 208 | 16 095 | 17 012 | 4 902 | 2 482 | 1 235 | 1 904 |

x) Provisional data

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

| Country | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 ^{x)} |
|----------------------|--------|--------|--------|--------|--------|--------|---------|--------|--------|--------|--------------------|
| Faroe Isl. | - | 9 | 22 | - | 67 | 137 | 8 | 1 | - | - | - |
| France | - | - | - | 980 | - | - | 478 | 3 575 | 1 134 | 1 296 | - |
| German Dem.Rép. | 12 339 | 8 963 | 11 474 | 27 153 | 22 778 | 16 921 | 12 688 | 12 933 | 12 439 | 7 460 | 2 205 |
| Germany, Fed.Rep. | 1 188 | 1 466 | 2 207 | 4 167 | 4 623 | 6 722 | 4 764 | 11 482 | 11 913 | 7 992 | 4 571 |
| Netherlands | - | - | - | - | - | 127 | - | - | - | - | - |
| Norway | 4 277 | 5 720 | 5 564 | 6 837 | 4 444 | 6 515 | 6 050 | 6 369 | 7 637 | 7 734 | 8 935 |
| Poland | 1 605 | 784 | 156 | 869 | 920 | 217 | 47 | 2 477 | 261 | 78 | 26 |
| Portugal | - | - | - | - | - | 2 849 | 1 249 | 352 | 1 100 | 89 | - |
| Spain | - | - | - | - | 153 | 2 082 | - | - | 1 125 | 1 500 | 45 ^{xx)} |
| U.K. | 2 463 | 2 680 | 2 125 | 1 991 | 1 621 | 2 919 | 4 064 | 2 067 | 1 195 | 967 | 409 |
| USSR | 209 | 291 | 131 | 14 | 39 138 | 20 307 | 94 639 | 31 783 | 29 519 | 46 762 | 56 130 |
| Total | 22 081 | 19 913 | 21 679 | 42 011 | 73 384 | 58 796 | 123 987 | 71 039 | 66 323 | 73 878 | 72 321 |

x) Provisional data

xx) As reported to Norwegian authorities.

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

| Country | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 ^{x)} |
|-------------------|--------|--------|--------|--------|---------|---------|--------|--------------------|--------------------|--------------------|--------------------|
| Belgium | - | - | - | - | 28 | - | - | - | - | - | - |
| Faroe Isl. | - | - | 4 | - | - | - | - | + | - | - | - |
| France | - | - | - | 110 | - | - | 33 | 6 | 1 | - | - |
| German Dem.Rep. | 2 369 | 973 | 282 | 764 | 5 041 | 5 625 | 4 926 | 3 232 | 3 723 | 988 | 2 409 |
| Germany, Fed.Rep. | 1 740 | 224 | 1 196 | 1 344 | 436 | 537 | 1 681 | 1 | - | - | - |
| Norway | 51 | 56 | 233 | 24 | 40 | 51 | 150 | 100 | 14 | 2 | 4 |
| Poland | 926 | 306 | 59 | 400 | 3 698 | 3 873 | 128 | 480 | - | 9 | - |
| Portugal | - | - | - | - | - | 136 | 176 | 18 | - | 12 | - |
| Spain | - | - | - | - | 221 | 1 015 | - | - | 250 | 465 | - |
| U.K. | 133 | 336 | 772 | 198 | 77 | 650 | 580 | 364 | 99 | 45 | - |
| USSR | 25 887 | 17 953 | 26 813 | 39 455 | 161 062 | 230 828 | 37 200 | 43 734 | 40 293 | 26 007 | 24 302 |
| Non-members | | | | | | | | 296 ^{xx)} | 435 ^{xx)} | 124 ^{xx)} | |
| Total | 31 106 | 19 848 | 29 359 | 42 295 | 170 603 | 242 715 | 44 874 | 48 231 | 44 815 | 27 652 | 26 715 |

x) Provisional data.

xx) As reported to Norwegian authorities.

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

| Year | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 ^{x)} |
|--------------------|--------|--------|--------|--------|---------|---------|---------|---------|---------|---------|--------------------|
| <u>S. marinus</u> | 13 816 | 17 730 | 21 436 | 27 272 | 39 125 | 48 584 | 39 508 | 31 695 | 26 475 | 23 411 | 19 702 |
| <u>S. mentella</u> | 45 063 | 28 862 | 38 380 | 69 372 | 239 070 | 269 022 | 146 365 | 92 477 | 87 145 | 79 354 | 81 238 |
| Total | 58 879 | 46 592 | 59 816 | 96 644 | 278 195 | 317 606 | 185 873 | 124 172 | 113 620 | 102 765 | 100 940 |

x) Provisional data.

Table 6. Sebastes mentella in Divisions IIa and IIb. Catch per unit effort and calculated total international effort 1965-81.

| 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 |
| 1981 | 0.63 | 12.60 | 12.36 | 128 949 | 6 447 | 6 573 |

Table 7. Sebastes mentella in Divisions IIa and IIb.
Catch and effort data of the German Democratic
Republic Z-trawler fishery 1976-81.

| 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 |
| 1981 | 529 | 978 | 529 | 729 | 42 | 59 |

Table 8. Year class strength of REDFISH in Sub-area I and Division IIa and IIb.

| Year class | Dragesund 1971 | .Surkova, 1960 | | Baranenkova, 1968 | | 0-group surveys Abundance indices | USSR ^{x)} 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 | average | | | | | 172 | strong |
| 1972 | average | | | | | 177 | average |
| 1973 | strong | | | | | 385 | poor ^{***} |
| 1974 | | | | | | 468 | poor ^{***} |
| 1975 | | | | | | 315 | poor ^{***} |
| 1976 | | | | | | 447 | |
| 1977 | | | | | | 472 | |
| 1978 | | | | | | 460 | |
| 1979 | | | | | | 980 | |
| 1980 | | | | | | 651 | |
| 1981 | | | | | | 861 | |

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

***) Preliminary data

Table 9. Sebastes marinus. Sub-area I and Division IIa.
Mean weight at age for different periods (kg).

| Age | Used 1965-77 | Used 1978-80 | Used 1981 |
|-----|--------------|--------------|-----------|
| 5 | .059 | .059 | .064 |
| 6 | .086 | .086 | .095 |
| 7 | .146 | .147 | .162 |
| 8 | .194 | .194 | .213 |
| 9 | .254 | .254 | .279 |
| 10 | .334 | .334 | .367 |
| 11 | .421 | .421 | .463 |
| 12 | .477 | .520 | .572 |
| 13 | .512 | .564 | .620 |
| 14 | .577 | .703 | .773 |
| 15 | .611 | .750 | .825 |
| 16 | .710 | .846 | .930 |
| 17 | .761 | .860 | .946 |
| 18 | .826 | .931 | 1.024 |
| 19 | .895 | .991 | 1.090 |
| 20 | .947 | 1.028 | 1.131 |
| 21 | 1.093 | 1.148 | 1.263 |
| 22 | 1.145 | 1.207 | 1.323 |
| 23 | 1.293 | 1.410 | 1.551 |
| 24 | 1.580 | 1.521 | 1.673 |
| 25 | 1.793 | 1.702 | 1.872 |
| 26 | 1.885 | 1.693 | 1.862 |
| 27 | 2.393 | 2.393 | 2.632 |
| 28+ | 2.454 | 2.454 | 2.699 |

Table 10. Sebastes marinus in fishing areas I and IIa.
Catch in numbers (unit: thousands).

| | 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 | 635 | 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 | 1536 | 611 | 954 | 1138 | 935 | 2014 | 2157 |
| 19 | 2231 | 2718 | 1695 | 684 | 1225 | 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 | 779 | 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 | 1981 | |
| 3 | 0 | 0 | 0 | 86 | 0 | 0 | 0 | 0 | |
| 4 | 0 | 0 | 0 | 428 | 0 | 0 | 0 | 0 | |
| 5 | 0 | 0 | 530 | 1839 | 20 | 0 | 10 | 10 | |
| 6 | 0 | 0 | 2884 | 1831 | 13 | 0 | 11 | 7 | |
| 7 | 0 | 0 | 5719 | 1621 | 30 | 12 | 13 | 121 | |
| 8 | 0 | 0 | 12162 | 4179 | 328 | 73 | 87 | 217 | |
| 9 | 0 | 0 | 10250 | 4620 | 641 | 101 | 180 | 419 | |
| 10 | 0 | 0 | 9515 | 4501 | 930 | 149 | 352 | 752 | |
| 11 | 0 | 0 | 5963 | 2359 | 615 | 145 | 517 | 854 | |
| 12 | 387 | 693 | 5008 | 5306 | 2003 | 723 | 768 | 1171 | |
| 13 | 455 | 868 | 1686 | 2557 | 2788 | 914 | 571 | 910 | |
| 14 | 1049 | 1638 | 2670 | 4242 | 5453 | 3422 | 2368 | 1609 | |
| 15 | 2079 | 2984 | 2991 | 5334 | 6404 | 3276 | 3677 | 2361 | |
| 16 | 5479 | 7397 | 6775 | 6072 | 5880 | 3554 | 3502 | 2345 | |
| 17 | 2757 | 3563 | 2707 | 2372 | 2569 | 1726 | 1073 | 821 | |
| 18 | 4164 | 5117 | 3938 | 3462 | 3669 | 2212 | 2341 | 2261 | |
| 19 | 3528 | 4402 | 3417 | 3115 | 2719 | 2237 | 1366 | 1198 | |
| 20 | 638 | 775 | 614 | 964 | 1538 | 1816 | 1330 | 1369 | |
| 21 | 2359 | 2829 | 2475 | 2408 | 1716 | 2237 | 1829 | 1308 | |
| 22 | 1573 | 1721 | 1529 | 1170 | 382 | 959 | 1040 | 688 | |
| 23 | 1527 | 1813 | 1814 | 1464 | 491 | 946 | 1507 | 945 | |
| 24 | 1103 | 1432 | 1672 | 1318 | 411 | 959 | 968 | 517 | |
| 25 | 702 | 930 | 1106 | 923 | 241 | 673 | 519 | 382 | |
| 26 | 530 | 817 | 918 | 772 | 175 | 630 | 583 | 257 | |
| 27 | 369 | 701 | 822 | 666 | 135 | 541 | 341 | 40 | |
| 28+ | 332 | 589 | 624 | 677 | 141 | 239 | 39 | 35 | |
| TOTAL | 28851 | 38269 | 87789 | 62286 | 39312 | 27542 | 24790 | 20597 | |

Table 11. Sebastes marinus. Sub-area I and Division IIa.
Results from the three VPA runs.

| Year | $\bar{F}(13-24)$ | | | | Total stock biomass (12+) | | | | Spawning stock biomass (15+) | | | |
|------|------------------|-------|-------|-------|---------------------------|-------|-------|-------|------------------------------|-------|-------|-------|
| | 1981 report | Run 1 | Run 2 | Run 3 | 1981 rep. | Run 1 | Run 2 | Run 2 | 1981 rep. | Run 1 | Run 2 | Run 3 |
| 1965 | .084 | .084 | .084 | .084 | 313 | 313 | 313 | 313 | 250 | 250 | 250 | 250 |
| 1966 | .094 | .094 | .094 | .094 | 306 | 302 | 302 | 303 | 240 | 240 | 240 | 240 |
| 1967 | .061 | .061 | .061 | .061 | 298 | 293 | 295 | 297 | 234 | 234 | 234 | 234 |
| 1968 | .040 | .041 | .041 | .041 | 306 | 296 | 302 | 304 | 235 | 235 | 235 | 235 |
| 1969 | .073 | .073 | .073 | .073 | 328 | 310 | 321 | 324 | 244 | 240 | 241 | 241 |
| 1970 | .049 | .050 | .050 | .049 | 301 | 286 | 303 | 309 | 210 | 205 | 208 | 209 |
| 1971 | .044 | .045 | .044 | .044 | 315 | 293 | 315 | 322 | 219 | 209 | 215 | 217 |
| 1972 | .072 | .076 | .074 | .073 | 321 | 302 | 332 | 341 | 233 | 216 | 227 | 230 |
| 1973 | .070 | .077 | .072 | .071 | 321 | 305 | 342 | 353 | 241 | 226 | 243 | 249 |
| 1974 | .117 | .126 | .114 | .112 | 315 | 296 | 339 | 352 | 242 | 221 | 243 | 250 |
| 1975 | .159 | .184 | .164 | .159 | 304 | 293 | 346 | 362 | 240 | 221 | 250 | 259 |
| 1976 | .158 | .177 | .150 | .143 | 285 | 264 | 320 | 337 | 216 | 200 | 237 | 248 |
| 1977 | .175 | .208 | .166 | .157 | 263 | 237 | 301 | 320 | 200 | 178 | 220 | 232 |
| 1978 | .156 | .181 | .131 | .121 | 246 | 218 | 300 | 326 | 174 | 164 | 222 | 240 |
| 1979 | .156 | .171 | .114 | .104 | 218 | 198 | 287 | 316 | 169 | 148 | 209 | 228 |
| 1980 | .138 | .189 | .117 | .105 | 186 | 165 | 258 | 288 | 157 | 127 | 196 | 217 |
| 1981 | | .138 | .079 | .070 | | 160 | 270 | 307 | | 127 | 214 | 241 |

Table 12. Sebastes mentella in Divisions IIa and IIb.
Mean weight at age.

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

Table 13. 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 | 3148 |
| 13 | 2471 | 1223 | 394 | 554 | 849 | 3983 | 4884 | 4564 | 5208 |
| 14 | 2804 | 1927 | 489 | 864 | 618 | 3526 | 5451 | 4704 | 5666 |
| 15 | 1996 | 2007 | 490 | 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 | 3777 |
| 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 | 2385 | 373 | 630 |
| 22 | 267 | 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 | 23738 | 15278 | 7246 | 7372 | 10375 | 32650 | 56671 | 46572 | 57252 |
| | | | | | | | | | |
| | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | |
| 6 | 606 | 5834 | 18891 | 0 | 2905 | 3633 | 1065 | 928 | |
| 7 | 4847 | 19417 | 29815 | 2418 | 30158 | 20497 | 7412 | 2989 | |
| 8 | 15451 | 42425 | 59395 | 17175 | 65162 | 43553 | 26296 | 8587 | |
| 9 | 28781 | 82480 | 78241 | 53454 | 53391 | 46996 | 44131 | 26614 | |
| 10 | 30144 | 108462 | 110712 | 52102 | 33569 | 37469 | 40441 | 48106 | |
| 11 | 19843 | 119075 | 112524 | 49617 | 19909 | 26298 | 27089 | 39057 | |
| 12 | 10603 | 57231 | 93144 | 53938 | 17242 | 20717 | 19950 | 33267 | |
| 13 | 8634 | 29651 | 49550 | 53287 | 9270 | 16341 | 11172 | 21097 | |
| 14 | 8634 | 20894 | 26134 | 19095 | 7410 | 6059 | 6460 | 11808 | |
| 15 | 6514 | 16499 | 13881 | 12605 | 5456 | 3589 | 5607 | 6015 | |
| 16 | 5908 | 13465 | 9839 | 5796 | 4134 | 3465 | 6801 | 2687 | |
| 17 | 3332 | 13668 | 6300 | 4874 | 2134 | 2465 | 3441 | 2164 | |
| 18 | 2878 | 12207 | 7233 | 5499 | 1545 | 1964 | 3001 | 1339 | |
| 19 | 1666 | 6757 | 3486 | 3155 | 666 | 1719 | 1406 | 630 | |
| 20 | 2121 | 7112 | 3168 | 3941 | 1061 | 1906 | 796 | 799 | |
| 21 | 757 | 5113 | 1818 | 2955 | 423 | 1962 | 145 | 358 | |
| 22 | 454 | 2242 | 1715 | 2531 | 308 | 560 | 145 | 117 | |
| 23 | 151 | 735 | 1041 | 1002 | 301 | 324 | 27 | 0 | |
| 24+ | 151 | 407 | 211 | 322 | 158 | 108 | 27 | 0 | |
| TOTAL | 151475 | 563674 | 627098 | 303766 | 255202 | 239625 | 205552 | 206562 | |

Table 14. Sebastes mentella in fishing areas IIa and IIb.
Fishing mortalities from VPA (M = 0.1).

| | 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 | 0.002 | 0.004 |
| 8 | 0.015 | 0.000 | 0.000 | 0.000 | 0.003 | 0.000 | 0.000 | 0.012 | 0.011 |
| 9 | 0.025 | 0.003 | 0.000 | 0.001 | 0.005 | 0.001 | 0.002 | 0.014 | 0.024 |
| 10 | 0.015 | 0.007 | 0.002 | 0.002 | 0.009 | 0.006 | 0.007 | 0.014 | 0.021 |
| 11 | 0.026 | 0.007 | 0.004 | 0.004 | 0.010 | 0.026 | 0.019 | 0.019 | 0.021 |
| 12 | 0.044 | 0.014 | 0.006 | 0.007 | 0.013 | 0.044 | 0.063 | 0.052 | 0.039 |
| 13 | 0.080 | 0.031 | 0.008 | 0.010 | 0.015 | 0.064 | 0.073 | 0.077 | 0.082 |
| 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 | 0.099 |
| 16 | 0.194 | 0.165 | 0.046 | 0.048 | 0.030 | 0.123 | 0.220 | 0.148 | 0.160 |
| 17 | 0.097 | 0.177 | 0.075 | 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 | 0.528 | 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 | 0.177 |
| 22 | 0.499 | 0.116 | 0.741 | 0.188 | 0.229 | 0.092 | 1.481 | 0.799 | 0.119 |
| 23 | 0.200 | 0.200 | 0.200 | 0.200 | 0.200 | 0.200 | 0.500 | 0.100 | 0.050 |
| 24+ | 0.200 | 0.200 | 0.200 | 0.200 | 0.200 | 0.200 | 0.500 | 0.100 | 0.050 |
| F(8-19),U | 0.106 | 0.070 | 0.029 | 0.034 | 0.030 | 0.093 | 0.157 | 0.084 | 0.079 |
| | | | | | | | | | |
| | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | 1974-1978 |
| 6 | 0.001 | 0.012 | 0.036 | 0.000 | 0.007 | 0.009 | 0.003 | 0.002 | 0.011 |
| 7 | 0.012 | 0.048 | 0.068 | 0.005 | 0.057 | 0.058 | 0.021 | 0.008 | 0.038 |
| 8 | 0.037 | 0.123 | 0.180 | 0.046 | 0.167 | 0.098 | 0.089 | 0.028 | 0.111 |
| 9 | 0.072 | 0.250 | 0.311 | 0.131 | 0.176 | 0.157 | 0.122 | 0.110 | 0.188 |
| 10 | 0.085 | 0.370 | 0.546 | 0.312 | 0.169 | 0.162 | 0.176 | 0.170 | 0.296 |
| 11 | 0.104 | 0.491 | 0.710 | 0.446 | 0.168 | 0.174 | 0.151 | 0.230 | 0.385 |
| 12 | 0.098 | 0.428 | 0.792 | 0.806 | 0.243 | 0.237 | 0.173 | 0.250 | 0.473 |
| 13 | 0.127 | 0.383 | 0.713 | 0.649 | 0.270 | 0.340 | 0.174 | 0.250 | 0.428 |
| 14 | 0.170 | 0.446 | 0.604 | 0.585 | 0.255 | 0.253 | 0.193 | 0.250 | 0.412 |
| 15 | 0.169 | 0.495 | 0.532 | 0.584 | 0.290 | 0.169 | 0.349 | 0.250 | 0.414 |
| 16 | 0.160 | 0.545 | 0.549 | 0.393 | 0.339 | 0.270 | 0.487 | 0.250 | 0.397 |
| 17 | 0.126 | 0.583 | 0.469 | 0.511 | 0.218 | 0.310 | 0.415 | 0.250 | 0.382 |
| 18 | 0.149 | 0.783 | 0.621 | 0.858 | 0.267 | 0.285 | 0.668 | 0.250 | 0.535 |
| 19 | 0.102 | 0.537 | 0.471 | 0.537 | 0.202 | 0.471 | 0.502 | 0.250 | 0.370 |
| 20 | 0.174 | 0.705 | 0.460 | 1.375 | 0.307 | 1.208 | 0.568 | 0.250 | 0.604 |
| 21 | 0.125 | 0.703 | 0.343 | 0.916 | 0.436 | 1.304 | 0.222 | 0.250 | 0.504 |
| 22 | 0.169 | 0.569 | 0.476 | 0.983 | 0.191 | 1.572 | 0.250 | 0.250 | 0.478 |
| 23 | 0.200 | 0.400 | 0.500 | 0.500 | 0.250 | 0.280 | 0.230 | 0.000 | 0.370 |
| 24+ | 0.200 | 0.400 | 0.500 | 0.500 | 0.250 | 0.280 | 0.230 | 0.000 | 0.370 |
| F(8-19),U | 0.117 | 0.453 | 0.542 | 0.488 | 0.230 | 0.244 | 0.275 | 0.212 | |

Table 15. *Sebastes mentella* in fishing areas IIa and IIb. Stock size in numbers ('000) from VPA.

| | | 1 January | | | | | | | | | |
|------------|--|-----------|---------|---------|---------|---------|---------|---------|-------------|---------|--|
| | | 1965 | 1966 | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 | |
| 6 | | 144541 | 151803 | 164559 | 225315 | 360604 | 597822 | 596673 | 549937 | 474597 | |
| 7 | | 141228 | 130741 | 137357 | 148718 | 203867 | 326298 | 540932 | 539892 | 497161 | |
| 8 | | 115188 | 127517 | 118299 | 124285 | 134566 | 184377 | 295211 | 489455 | 487761 | |
| 9 | | 93192 | 102713 | 115357 | 107055 | 112444 | 121371 | 166800 | 267009 | 437431 | |
| 10 | | 81456 | 82267 | 92675 | 104365 | 96765 | 101245 | 109697 | 150656 | 238191 | |
| 11 | | 64453 | 72601 | 73933 | 83681 | 94251 | 86759 | 91021 | 98610 | 134372 | |
| 12 | | 48055 | 56853 | 65250 | 66626 | 75380 | 84394 | 76486 | 80847 | 87544 | |
| 13 | | 33595 | 41608 | 50729 | 58715 | 59871 | 67300 | 73105 | 64998 | 69480 | |
| 14 | | 23029 | 28050 | 36486 | 45527 | 52601 | 53367 | 57111 | 61507 | 54476 | |
| 15 | | 15353 | 18174 | 23550 | 32549 | 40373 | 47007 | 44937 | 46497 | 51184 | |
| 16 | | 12319 | 11996 | 14539 | 20857 | 28771 | 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 | 5855 | 5393 | 8501 | |
| 21 | | 2393 | 1682 | 2424 | 3772 | 9074 | 3606 | 3058 | 1591 | 4040 | |
| 22 | | 695 | 1782 | 1194 | 1536 | 2631 | 7792 | 2519 | 529 | 1085 | |
| 23 | | 411 | 382 | 1435 | 515 | 1152 | 1892 | 6450 | 519 | 215 | |
| 24+ | | 550 | 75 | 677 | 255 | 243 | 376 | 1606 | 519 | 215 | |
| TOTAL | | 809506 | 861088 | 931278 | 1059733 | 1312157 | 1774593 | 2171506 | 2456038 | 2652028 | |
| SPAWN. ST. | | 141987 | 157968 | 182649 | 215191 | 248286 | 284404 | 307225 | 315321 | 355118 | |
| | | | | | | | | | | | |
| | | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | |
| 6 | | 484299 | 531299 | 564761 | 655102 | 422655 | 411486 | 436758 | 488066***** | | |
| 7 | | 429269 | 437635 | 475193 | 495060 | 574664 | 379672 | 368874 | 594164 | 440738 | |
| 8 | | 448271 | 383811 | 377535 | 401639 | 445840 | 491315 | 324062 | 326725 | 353812 | |
| 9 | | 436719 | 390925 | 306988 | 285213 | 347093 | 339751 | 403182 | 268238 | 287470 | |
| 10 | | 386555 | 367810 | 275460 | 203571 | 226299 | 263370 | 262773 | 322895 | 217430 | |
| 11 | | 211117 | 321127 | 229993 | 144430 | 134786 | 172890 | 202728 | 199370 | 246492 | |
| 12 | | 119081 | 172175 | 177805 | 101742 | 85699 | 103056 | 131468 | 157711 | 143532 | |
| 13 | | 76220 | 97675 | 101565 | 72893 | 41112 | 59373 | 73589 | 100016 | 171137 | |
| 14 | | 57920 | 60766 | 60276 | 45062 | 34475 | 28405 | 38229 | 55979 | 70480 | |
| 15 | | 43910 | 44210 | 35189 | 29814 | 22705 | 24163 | 19953 | 28516 | 39448 | |
| 16 | | 41964 | 33546 | 24379 | 18700 | 15049 | 15369 | 18456 | 12738 | 20095 | |
| 17 | | 29438 | 32360 | 17608 | 12746 | 11427 | 9698 | 10619 | 10259 | 8977 | |
| 18 | | 21820 | 23472 | 16347 | 9965 | 6918 | 8314 | 6457 | 6348 | 7229 | |
| 19 | | 17978 | 17010 | 9706 | 7949 | 3825 | 4794 | 5660 | 2987 | 4473 | |
| 20 | | 13919 | 14684 | 8995 | 5481 | 4206 | 2829 | 2710 | 3788 | 2105 | |
| 21 | | 6768 | 10581 | 6564 | 5138 | 1253 | 2800 | 765 | 1697 | 2669 | |
| 22 | | 3057 | 5405 | 4740 | 4215 | 1860 | 735 | 687 | 555 | 1196 | |
| 23 | | 874 | 2335 | 2769 | 2665 | 1427 | 1391 | 138 | 0 | 391 | |
| 24+ | | 874 | 1293 | 561 | 856 | 749 | 464 | 158 | 0 | 0 | |
| TOTAL | | 2830057 | 2948119 | 2696433 | 2480265 | 2378044 | 2319853 | 2307206 | 2580051 | | |
| SPAWN. ST. | | 410366 | 466415 | 382934 | 276268 | 222893 | 248787 | 274492 | 308056 | | |

1 JANUARY

Table 16. *Sebastes mentella* in fishing areas IIA and IIB. Biomass results from VPA ('000).

| | 1965 | 1966 | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 |
|------------------|--------|---------|--------|--------|--------|--------|--------|--------|--------|
| 6 | 24283 | 25503 | 27612 | 37853 | 60581 | 100434 | 100241 | 92389 | 79732 |
| 7 | 25845 | 23926 | 25136 | 27215 | 37308 | 59705 | 98990 | 98800 | 90980 |
| 8 | 25917 | 28691 | 26617 | 27964 | 30277 | 41485 | 66622 | 110127 | 109746 |
| 9 | 28983 | 31944 | 35876 | 33288 | 34970 | 37747 | 51875 | 83040 | 136041 |
| 10 | 29887 | 30192 | 34011 | 38302 | 35513 | 37157 | 40259 | 55291 | 87416 |
| 11 | 27835 | 31564 | 31939 | 56150 | 40716 | 37480 | 39521 | 42600 | 58048 |
| 12 | 24412 | 28871 | 33147 | 33846 | 38293 | 42872 | 38855 | 41071 | 44472 |
| 13 | 20527 | 25622 | 30996 | 35875 | 36581 | 41120 | 44667 | 39714 | 42452 |
| 14 | 15637 | 19046 | 24774 | 30913 | 35716 | 36236 | 38778 | 41763 | 36989 |
| 15 | 11560 | 13685 | 17735 | 24509 | 30401 | 35397 | 33838 | 35013 | 38542 |
| 16 | 10114 | 9849 | 11936 | 17107 | 25980 | 29616 | 32730 | 29530 | 31345 |
| 17 | 15735 | 8009 | 8024 | 10951 | 15669 | 21993 | 25163 | 25251 | 24484 |
| 18 | 7065 | 13482 | 6334 | 7046 | 9740 | 14406 | 18396 | 19885 | 20704 |
| 19 | 4336 | 5194 | 11545 | 5340 | 5884 | 8195 | 10105 | 10430 | 15474 |
| 20 | 2543 | 3188 | 4232 | 10260 | 4499 | 4946 | 5748 | 5312 | 8374 |
| 21 | 2527 | 1776 | 2560 | 3455 | 9582 | 3808 | 3230 | 1680 | 4266 |
| 22 | 781 | 2002 | 1342 | 1727 | 2957 | 8759 | 2851 | 595 | 1220 |
| 23 | 490 | 456 | 1712 | 614 | 1574 | 2258 | 7672 | 619 | 257 |
| 24+ | 668 | 91 | 823 | 309 | 295 | 457 | 1951 | 630 | 262 |
| TOTAL SPAWN. ST. | 279145 | 302692 | 336349 | 382725 | 453938 | 564070 | 661071 | 733739 | 830806 |
| | 94241 | 103875 | 121073 | 142857 | 169943 | 198306 | 214301 | 207069 | 230750 |
| | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | |
| 6 | 81562 | 89258 | 94880 | 106697 | 71006 | 44029 | 46751 | 49783 | |
| 7 | 78556 | 80087 | 86960 | 90230 | 105163 | 58849 | 57175 | 54395 | |
| 8 | 100861 | 86557 | 84945 | 90369 | 99864 | 98263 | 64812 | 61424 | |
| 9 | 135820 | 121378 | 95473 | 88702 | 107946 | 85612 | 101602 | 67596 | |
| 10 | 141866 | 134986 | 101094 | 74711 | 83052 | 81645 | 81460 | 100098 | |
| 11 | 91202 | 138727 | 99357 | 62402 | 58228 | 64661 | 75820 | 72571 | |
| 12 | 60493 | 87465 | 90325 | 51685 | 42519 | 48642 | 62053 | 69393 | |
| 13 | 46571 | 59680 | 62056 | 44538 | 25120 | 33724 | 41799 | 56009 | |
| 14 | 39528 | 41260 | 40927 | 30597 | 23408 | 20310 | 27354 | 38066 | |
| 15 | 33064 | 33290 | 26498 | 22450 | 17097 | 21698 | 17918 | 23611 | |
| 16 | 34452 | 27541 | 20615 | 15353 | 12356 | 14354 | 17258 | 11541 | |
| 17 | 23670 | 28218 | 15354 | 11114 | 9964 | 9930 | 10874 | 9951 | |
| 18 | 19856 | 21259 | 14876 | 9069 | 6295 | 8730 | 6759 | 6665 | |
| 19 | 16594 | 15700 | 8959 | 7337 | 3531 | 5158 | 6090 | 3214 | |
| 20 | 13710 | 14464 | 8860 | 5399 | 4143 | 3194 | 3059 | 4276 | |
| 21 | 7147 | 11173 | 6931 | 5426 | 1324 | 3220 | 880 | 1952 | |
| 22 | 3436 | 6075 | 5328 | 4738 | 2091 | 862 | 808 | 652 | |
| 23 | 1043 | 2786 | 3303 | 3179 | 1702 | 1669 | 165 | 0 | |
| 24+ | 1062 | 1571 | 682 | 1041 | 910 | 566 | 168 | 0 | |
| TOTAL SPAWN. ST. | 932092 | 1001576 | 866824 | 725036 | 675719 | 605117 | 622745 | 631195 | |
| | 263356 | 297050 | 237554 | 171938 | 129583 | 143170 | 154703 | 169303 | |

Table 17. Sebastes mentella in Divisions IIa and IIb.
Parameters used in catch prediction.

| AGE | Stock size at the beginning of 1982 | F-PATTERN | M | MATURITY OGIVE | WEIGHT IN THE CATCH | WEIGHT IN THE STOCK |
|-----|---|-----------|-------|-------------------|------------------------|------------------------|
| 6 | 420757.00 1) | 0.0090 | 0.100 | 0.0000 | 0.1020 | 0.1020 |
| 7 | 440738.00 | 0.0380 | 0.100 | 0.0000 | 0.1380 | 0.1380 |
| 8 | 353812.00 | 0.1320 | 0.100 | 0.0300 | 0.1880 | 0.1880 |
| 9 | 287470.00 | 0.5190 | 0.100 | 0.0600 | 0.2520 | 0.2520 |
| 10 | 217430.00 | 0.8020 | 0.100 | 0.0800 | 0.3100 | 0.3100 |
| 11 | 246492.00 | 1.0850 | 0.100 | 0.2200 | 0.3640 | 0.3640 |
| 12 | 143332.00 | 1.1790 | 0.100 | 0.3600 | 0.4400 | 0.4400 |
| 13 | 111137.00 | 1.1790 | 0.100 | 0.5500 | 0.5600 | 0.5600 |
| 14 | 70480.00 | 1.1790 | 0.100 | 0.7200 | 0.6800 | 0.6800 |
| 15 | 39448.00 | 1.1790 | 0.100 | 0.8500 | 0.8280 | 0.8280 |
| 16 | 20095.00 | 1.1790 | 0.100 | 0.8800 | 0.9060 | 0.9060 |
| 17 | 8977.00 | 1.1790 | 0.100 | 0.9500 | 0.9700 | 0.9700 |
| 18 | 7229.00 | 1.1790 | 0.100 | 0.9700 | 1.0500 | 1.0500 |
| 19 | 4473.00 | 1.1790 | 0.100 | 1.0000 | 1.0760 | 1.0760 |
| 20 | 2105.00 | 1.1790 | 0.100 | 1.0000 | 1.1290 | 1.1290 |
| 21 | 2669.00 | 1.1790 | 0.100 | 1.0000 | 1.1500 | 1.1500 |
| 22 | 1196.00 | 1.1790 | 0.100 | 1.0000 | 1.1750 | 1.1750 |
| 23 | 391.00 | 1.1790 | 0.100 | 1.0000 | 1.2000 | 1.2000 |
| 24+ | 0.00 | 1.1790 | 0.100 | 1.0000 | 1.2200 | 1.2200 |

1) Average recruitment 1965-77 used for 1982-84.

Table 18. Nominal catches of REDFISH (in tonnes) by countries in Division Va (Iceland).
(As reported officially to ICES.)

| Country | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 ^{x)} |
|----------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|--------------------|
| Belgium | 2 798 | 2 484 | 1 622 | 2 114 | 1 945 | 1 522 | 1 395 | 1 549 | 1 385 | 1 381 | 929 |
| Faroe Isl. | 35 | 9 | 243 | 254 | 82 | 211 | 292 | 242 | 629 | 1 055 | 1 253 |
| German Dem.Rep. | 238 | 135 | - | 11 | - | - | - | - | - | - | - |
| Germany, Fed.Rep. | 46 580 | 43 963 | 38 358 | 36 398 | 33 602 | 32 948 | 31 632 | - | - | - | - |
| Iceland | 29 118 | 26 973 | 26 470 | 27 799 | 32 659 | 34 028 | 28 119 | 33 318 | 62 253 | 69 780 | 93 389 |
| Netherlands | - | - | - | - | - | - | - | - | - | - | - |
| Norway | 1 | 1 | 4 | 15 | 22 | 31 | 87 | 93 | 43 | 33 | 30 |
| Poland | 17 | 35 | - | 18 | - | - | - | - | - | - | - |
| U.K. | 3 552 | 3 697 | 2 951 | 2 519 | 2 424 | 1 124 | + | - | - | - | - |
| USSR | 31 | 28 | 2 | - | - | - | - | - | - | - | - |
| Total | 82 370 | 77 325 | 69 650 | 69 129 | 70 734 | 69 864 | 61 525 | 35 202 | 64 310 | 72 249 | 95 601 |

x) Provisional data

Table 19. Nominal catches of REDFISH (in tonnes) by countries in Division Vb (Faroe Islands).
(As reported officially to ICES.)

| Country | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 ^{x)} |
|----------------------|-------|-------|-------|-------|-------|-------|-------|-------|--------|--------|--------------------|
| Faroe Isl. | - | - | 121 | 28 | 9 | 33 | 54 | 1 525 | 5 693 | 5 509 | 3 231 |
| France | - | - | - | 300 | 800 | - | 1 368 | 448 | 862 | 627 | 40 ^{xx)} |
| German Dem.Rep. | - | - | - | 1 | 1 | - | - | - | - | - | - |
| Germany, Fed.Rep. | 2 328 | 4 034 | 9 490 | 7 328 | 7 628 | 5 255 | 5 854 | 7 767 | 6 108 | 3 891 | 3 903 |
| Netherlands | - | - | - | - | 105 | - | - | + | - | - | - |
| Norway | - | - | - | 10 | 7 | 17 | 10 | 9 | 11 | 12 | 10 |
| U.K. | 24 | 53 | 85 | 98 | 41 | 59 | 116 | 57 | + | - | - |
| Total | 2 352 | 4 087 | 9 696 | 7 765 | 8 591 | 5 364 | 7 402 | 9 806 | 12 674 | 10 039 | 7 184 |

x) Provisional data

xx) As reported to the Faroese authorities

Table 20. Nominal catch of REDFISH (in tonnes) by countries in Sub-area XIV (East Greenland).
(As reported officially to ICES.)

| Country | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 ^{x)} |
|----------------------|--------|--------|-------|--------|--------|---------|--------|----------------------|----------------------|----------------------|----------------------|
| Canada | - | - | - | - | - | 420 | - | - | - | - | - |
| Greenland | - | - | - | - | - | 129 | 1 | 3 | - | - | 1 |
| Faroe Isl. | - | - | 13 | 43 | 1 | 3 | 19 | - | - | - | - |
| France | - | - | - | - | - | - | - | - | 490 | - | - |
| German Dem.Rep. | 611 | 703 | 841 | 1 275 | 4 490 | - | - | - | - | - | - |
| Germany, Fed.Rep. | 17 062 | 7 287 | 4 491 | 2 632 | 4 979 | 4 403 | 13 347 | 20 711 ¹⁾ | 20 428 ¹⁾ | 32 520 ¹⁾ | 46 674 ¹⁾ |
| Iceland | 2 380 | 5 490 | 2 144 | 9 777 | 5 632 | 7 410 | 81 | 151 | - | 89 | - |
| Norway | - | - | - | - | 63 | 5 | 112 | 2 | - | - | - |
| Poland | 312 | 464 | 281 | 6 | 276 | - | - | - | - | - | - |
| U.K. | + | 5 | 65 | 127 | 56 | 286 | 622 | 13 | - | - | - |
| USSR | 71 | 21 | 64 | 118 | 9 850 | 101 000 | 251 | - | - | - | - |
| Total | 20 436 | 13 970 | 7 899 | 13 978 | 25 329 | 113 656 | 14 433 | 20 880 | 20 918 | 32 609 | 46 675 |

x) Provisional data

1) Catches updated for Sub-area XII included

Table 21. Nominal catch (in tonnes) of REDFISH in Sub-area XIV, Divisions Va and Vb. by species for Sub-area XIV and Sub-area V combined.

(As reported officially to ICES.)

| Year | Division Va | Division Vb | Sub-area XIV | Total | <u>S. marinus</u> | <u>S. mentella</u> |
|--------------------|-------------|-------------|----------------------|---------|-------------------|--------------------|
| 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 | 23 079 | 126 191 | 68 712 | 57 479 |
| 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 ¹⁾ | 65 888 | 47 791 | 18 097 |
| 1979 | 64 310 | 12 674 | 20 918 ¹⁾ | 97 902 | 75 056 | 22 846 |
| 1980 | 72 249 | 10 039 | 32 609 ¹⁾ | 114 897 | 88 085 | 26 812 |
| 1981 ^{x)} | 95 601 | 7 184 . | 46 675 ¹⁾ | 149 460 | 103 927 | 45 533 |

x) Provisional data.

1) Catches updated for Sub-area XII included.

Table 22. Nominal catch of REDFISH (1 000 tonnes) in Division Va by countries. Separation into the species components according to the method used by the Redfish Working Group.

| Div. Va Year | Belgium | Faroe Islands | German Dem. Republic | Germany, Fed.Rep. | Iceland | Norway | Poland | United Kingdom | USSR | Total |
|-----------------|---------|------------------|----------------------------|----------------------|---------|--------|--------|-------------------|------|-------|
| 1970 | | | | | | | | | | |
| 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 |
| 1971 | | | | | | | | | | |
| 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 |
| 1972 | | | | | | | | | | |
| 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 |
| 1973 | | | | | | | | | | |
| 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 |
| 1974 | | | | | | | | | | |
| Total | 2,1 | 0,3 | + | 36,4 | 27,8 | + | + | 2,5 | - | 69,1 |
| S.mar. | 2,1 | 0,3 | | 4,3 | 27,0 | | | 2,5 | | 36,2 |
| S.ment. | - | - | | 32,1 | 0,8 | | | - | | 32,9 |
| 1975 | | | | | | | | | | |
| Total | 1,9 | 0,1 | - | 33,6 | 32,7 | + | - | 2,4 | - | 70,7 |
| S.mar. | 1,9 | 0,1 | | 4,3 | 31,3 | | | 2,4 | | 40,0 |
| S.ment. | - | - | | 29,3 | 1,4 | | | - | | 30,7 |
| 1976 | | | | | | | | | | |
| Total | 1,5 | 0,2 | - | 32,9 | 34,0 | + | - | 1,1 | - | 69,7 |
| S.mar. | 1,5 | 0,2 | | 4,3 | 33,3 | | | 1,1 | | 40,4 |
| S.ment. | - | - | | 28,6 | 0,7 | | | - | | 29,3 |
| 1977 | | | | | | | | | | |
| Total | 1,4 | 0,3 | - | 31,6 | 28,1 | 0,1 | - | + | - | 61,5 |
| S.mar. | 1,4 | 0,3 | | 9,2 | 27,5 | 0,1 | | - | | 38,5 |
| S.ment. | - | - | | 22,4 | 0,6 | - | | - | | 23,0 |
| 1978 | | | | | | | | | | |
| Total | 1,5 | 0,2 | - | - | 33,3 | 0,1 | - | - | - | 35,1 |
| S.mar. | 1,5 | 0,2 | | | 29,4 | 0,1 | | - | | 31,2 |
| S.ment. | - | - | | | 3,9 | - | | - | | 3,9 |
| 1979 | | | | | | | | | | |
| Total | 1,4 | 0,6 | - | - | 62,3 | 0,1 | - | - | - | 64,4 |
| S.mar. | 1,4 | 0,6 | | | 54,6 | 0,1 | | - | | 56,7 |
| S.ment. | - | - | | | 7,7 | - | | - | | 7,7 |
| 1980 | | | | | | | | | | |
| Total | 1,4 | 1,1 | - | - | 69,8 | + | - | - | - | 72,3 |
| S.mar. | 1,4 | 1,1 | | | 59,6 | | | - | | 62,1 |
| S.ment. | - | - | | | 10,2 | | | - | | 10,2 |
| 1981 | | | | | | | | | | |
| *Total | ,9 | 1,3 | - | - | 93,4 | + | - | - | - | 95,6 |
| S.mar. | ,9 | 1,3 | | | 73,7 | | | - | | 75,9 |
| S.ment. | - | - | | | 19,7 | | | - | | 19,7 |

* Preliminary

Table 23. 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.Rep. | 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> | 5.5 4.9 0.6 | 0.6 - 0.6 | - | 3.9 - 3.9 | - | + | - | 10.0 4.9 5.1 |
| 1981* Total <u>S.mar.</u> <u>S.ment.</u> | 3.2 2.5 0.7 | + | - | 3.9 - 3.9 | - | + | - | 7.1 2.5 4.6 |

* Preliminary

Table 24. 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.Rep. | Iceland | Norway | Poland | United Kingdom | USSR | Total |
|--|-----------------|-----------------|------------------|----------------------------|----------------------|-----------------|-----------------|-----------------|-------------------|-----------------------|-----------------------|
| 1970 Total <u>S.mar.</u> <u>S.ment.</u> | - | - | - | 0,4 0,4 - | 16,3 16,3 - | 1,0 1,0 - | - | 0,4 0,4 - | + | - | 18,1 18,1 - |
| 1971 Total <u>S.mar.</u> <u>S.ment.</u> | - | - | - | 0,6 0,6 - | 17,1 17,1 - | 2,4 2,4 - | - | 0,3 0,3 - | + | 0,1 0,1 | 20,5 20,5 - |
| 1972 Total <u>S.mar.</u> <u>S.ment.</u> | - | - | - | 0,7 0,7 - | 7,3 7,3 - | 5,5 5,5 - | - | 0,5 0,5 - | + | + | 14,0 14,0 - |
| 1973 Total <u>S.mar.</u> <u>S.ment.</u> | - | - | + | 0,8 0,8 - | 4,5 4,5 - | 2,1 2,1 - | - | 0,3 0,3 - | 0,1 0,1 - | 0,1 0,1 - | 7,9 7,9 - |
| 1974 Total <u>S.mar.</u> <u>S.ment.</u> | - | - | + | 1,3 1,3 - | 2,6 2,6 - | 9,8 9,8 - | - | + | 0,1 0,1 - | 0,1 0,1 - | 13,9 13,9 - |
| 1975 Total <u>S.mar.</u> <u>S.ment.</u> | - | - | + | 4,5 4,5 - | 5,0 5,0 - | 5,6 5,6 - | 0,1 0,1 - | 0,3 0,3 - | 0,1 0,1 - | 9,8 5,4 4,4 | 25,4 21,0 4,4 |
| 1976 Total <u>S.mar.</u> <u>S.ment.</u> | 0,4 0,4 - | 0,1 0,1 - | + | - | 4,4 4,4 - | 7,4 7,4 - | + | - | 0,3 0,3 - | 101,0 41,3 59,7 | 113,6 53,9 59,7 |
| 1977 Total <u>S.mar.</u> <u>S.ment.</u> | - | + | + | - | 13,3 13,3 - | 0,1 0,1 - | 0,1 0,1 - | - | 0,6 0,6 - | 0,3 0,3 - | 14,4 14,4 - |
| 1978 Total <u>S.mar.</u> <u>S.ment.</u> | - | + | - | - | 20,7 15,3 5,4 | 0,2 0,2 - | + | - | + | - | 20,9 15,5 5,4 |
| 1979 Total <u>S.mar.</u> <u>S.ment.</u> | - | - | + | - | 21,1 15,8 5,3 | - | - | - | - | - | 21,1 15,8 5,3 |
| 1980 Total <u>S.mar.</u> <u>S.ment.</u> | - | - | - | - | 32,5 22,1 10,4 | 0,1 0,1 - | - | - | - | - | 32,6 22,2 10,4 |
| * 1981 Total <u>S.mar.</u> <u>S.ment.</u> | - | - | - | - | 46,7 25,6 21,1 | - | - | - | - | - | 46,7 25,6 21,1 |

* Preliminary

Table 25. *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 | 5009 |
| 13 | 2075 | 1996 | 2141 | 1790 | 1565 | 4539 | 4017 | 4987 | 5320 |
| 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 | 5200 | 2306 | 2424 | 1928 | 2074 | 2518 | 2704 |
| 18 | 9205 | 6618 | 7740 | 5700 | 5798 | 4269 | 4287 | 5159 | 6545 |
| 19 | 7317 | 5272 | 6047 | 4730 | 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 | 5533 | 4252 | 4608 | 4502 | 4939 | 2304 | 1798 | 1956 | 2973 |
| 23 | 7410 | 5892 | 6240 | 6467 | 7342 | 3269 | 2349 | 2537 | 5724 |
| 24 | 6970 | 5619 | 6204 | 6722 | 7235 | 3066 | 2556 | 2549 | 3763 |
| 25 | 2966 | 2502 | 2868 | 3016 | 3189 | 1268 | 1239 | 1229 | 1740 |
| 26 | 1882 | 1630 | 1894 | 1918 | 2205 | 726 | 783 | 845 | 1160 |
| 27 | 829 | 774 | 910 | 898 | 981 | 303 | 300 | 407 | 558 |
| 28 | 650 | 527 | 717 | 670 | 762 | 211 | 255 | 306 | 425 |
| 29 | 382 | 210 | 324 | 270 | 259 | 59 | 84 | 118 | 197 |
| 30+ | 143 | 117 | 284 | 180 | 121 | 29 | 11 | 12 | 110 |
| TOTAL | 76595 | 60218 | 69102 | 59313 | 62554 | 47415 | 44102 | 52860 | 56304 |
| | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | | | |
| 7 | 0 | 0 | 0 | 7 | 13 | 8 | | | |
| 8 | 0 | 0 | 0 | 8 | 30 | 165 | | | |
| 9 | 2023 | 50 | 89 | 64 | 297 | 1262 | | | |
| 10 | 2715 | 71 | 170 | 311 | 837 | 1609 | | | |
| 11 | 6229 | 556 | 1039 | 1049 | 1723 | 2344 | | | |
| 12 | 19819 | 3539 | 5957 | 2607 | 7306 | 9811 | | | |
| 13 | 19604 | 5398 | 5667 | 2839 | 9238 | 8642 | | | |
| 14 | 15776 | 7820 | 8023 | 6192 | 14052 | 10582 | | | |
| 15 | 8889 | 5327 | 6451 | 6260 | 18617 | 16331 | | | |
| 16 | 9193 | 5898 | 5702 | 10174 | 13521 | 10568 | | | |
| 17 | 3780 | 2392 | 2188 | 9134 | 4620 | 11330 | | | |
| 18 | 8440 | 5108 | 3173 | 10300 | 9586 | 9254 | | | |
| 19 | 5596 | 3512 | 2959 | 5635 | 5563 | 8011 | | | |
| 20 | 1844 | 1213 | 3186 | 4777 | 2123 | 5279 | | | |
| 21 | 5552 | 3753 | 3401 | 5672 | 5516 | 9245 | | | |
| 22 | 3389 | 2484 | 1511 | 3216 | 2297 | 4220 | | | |
| 23 | 4348 | 3323 | 1746 | 3912 | 1943 | 2899 | | | |
| 24 | 3817 | 2832 | 1474 | 2368 | 2395 | 3860 | | | |
| 25 | 1751 | 1170 | 827 | 2212 | 1430 | 1979 | | | |
| 26 | 1283 | 798 | 611 | 2125 | 750 | 1107 | | | |
| 27 | 587 | 364 | 378 | 1272 | 461 | 551 | | | |
| 28 | 429 | 271 | 156 | 747 | 249 | 140 | | | |
| 29 | 173 | 112 | 99 | 452 | 33 | 42 | | | |
| 30+ | 73 | 69 | 37 | 263 | 68 | 7 | | | |
| TOTAL | 125310 | 56060 | 54844 | 81596 | 102668 | 119226 | | | |

Table 26. Sebastes marinus in fishing areas V and XIV.
Fishing mortalities from VPA (M = 0.1).

| | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 |
|------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 7 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 8 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 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 | 0.002 |
| 11 | 0.002 | 0.001 | 0.001 | 0.002 | 0.001 | 0.004 | 0.003 | 0.004 | 0.005 |
| 12 | 0.013 | 0.012 | 0.012 | 0.011 | 0.008 | 0.025 | 0.026 | 0.026 | 0.024 |
| 13 | 0.026 | 0.026 | 0.027 | 0.022 | 0.018 | 0.050 | 0.038 | 0.057 | 0.030 |
| 14 | 0.060 | 0.057 | 0.073 | 0.051 | 0.051 | 0.079 | 0.074 | 0.082 | 0.057 |
| 15 | 0.064 | 0.054 | 0.073 | 0.054 | 0.056 | 0.065 | 0.064 | 0.082 | 0.047 |
| 16 | 0.119 | 0.099 | 0.123 | 0.093 | 0.107 | 0.089 | 0.094 | 0.117 | 0.104 |
| 17 | 0.066 | 0.057 | 0.071 | 0.052 | 0.058 | 0.049 | 0.049 | 0.058 | 0.062 |
| 18 | 0.193 | 0.152 | 0.206 | 0.156 | 0.160 | 0.124 | 0.130 | 0.149 | 0.188 |
| 19 | 0.164 | 0.144 | 0.181 | 0.167 | 0.167 | 0.104 | 0.104 | 0.127 | 0.178 |
| 20 | 0.064 | 0.054 | 0.076 | 0.070 | 0.082 | 0.044 | 0.039 | 0.044 | 0.073 |
| 21 | 0.226 | 0.180 | 0.231 | 0.252 | 0.307 | 0.179 | 0.148 | 0.156 | 0.264 |
| 22 | 0.205 | 0.158 | 0.182 | 0.220 | 0.318 | 0.161 | 0.129 | 0.132 | 0.197 |
| 23 | 0.394 | 0.311 | 0.325 | 0.369 | 0.583 | 0.320 | 0.220 | 0.242 | 0.350 |
| 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(14-23),U | 0.155 | 0.127 | 0.154 | 0.148 | 0.189 | 0.122 | 0.105 | 0.119 | 0.152 |
| | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | | | |
| 7 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | | | |
| 8 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | | | |
| 9 | 0.015 | 0.000 | 0.000 | 0.000 | 0.001 | 0.002 | | | |
| 10 | 0.014 | 0.001 | 0.001 | 0.001 | 0.003 | 0.006 | | | |
| 11 | 0.046 | 0.003 | 0.010 | 0.008 | 0.006 | 0.009 | | | |
| 12 | 0.147 | 0.030 | 0.039 | 0.028 | 0.066 | 0.037 | | | |
| 13 | 0.192 | 0.049 | 0.055 | 0.021 | 0.116 | 0.094 | | | |
| 14 | 0.173 | 0.098 | 0.086 | 0.071 | 0.126 | 0.170 | | | |
| 15 | 0.145 | 0.073 | 0.098 | 0.081 | 0.279 | 0.189 | | | |
| 16 | 0.145 | 0.122 | 0.094 | 0.198 | 0.224 | 0.226 | | | |
| 17 | 0.087 | 0.046 | 0.055 | 0.192 | 0.117 | 0.264 | | | |
| 18 | 0.249 | 0.145 | 0.071 | 0.344 | 0.282 | 0.320 | | | |
| 19 | 0.217 | 0.139 | 0.105 | 0.156 | 0.281 | 0.358 | | | |
| 20 | 0.088 | 0.060 | 0.162 | 0.220 | 0.073 | 0.415 | | | |
| 21 | 0.352 | 0.231 | 0.212 | 0.425 | 0.377 | 0.452 | | | |
| 22 | 0.269 | 0.234 | 0.123 | 0.283 | 0.271 | 0.490 | | | |
| 23 | 0.432 | 0.406 | 0.229 | 0.466 | 0.247 | 0.566 | | | |
| 24 | 0.643 | 0.492 | 0.282 | 0.486 | 0.513 | 0.943 | | | |
| 25 | 0.541 | 0.366 | 0.230 | 0.775 | 0.540 | 0.943 | | | |
| 26 | 0.469 | 0.450 | 0.294 | 1.304 | 0.578 | 0.943 | | | |
| 27 | 0.374 | 0.208 | 0.353 | 1.512 | 1.036 | 0.943 | | | |
| 28 | 0.352 | 0.264 | 0.116 | 2.414 | 1.450 | 0.943 | | | |
| 29 | 0.130 | 0.130 | 0.130 | 0.500 | 0.700 | 0.943 | | | |
| 30+ | 0.130 | 0.130 | 0.130 | 0.500 | 0.700 | 0.943 | | | |
| F(14-23),U | 0.216 | 0.155 | 0.124 | 0.244 | 0.228 | 0.345 | | | |

Table 27. *Sebastes marinus* in fishing areas V and XIV. Stock size in numbers ('000) from VPA.

| | | 1 January | | | | | | | | |
|------------|--|-----------|---------|---------|---------|---------|---------|---------|---------|---------|
| | | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 |
| 7 | | 213690 | 177699 | 222141 | 221081 | 251781 | 218640 | 271958 | 169545 | 198894 |
| 8 | | 161993 | 193555 | 160789 | 201001 | 200042 | 227821 | 197834 | 246077 | 153411 |
| 9 | | 140635 | 146577 | 174955 | 145488 | 181874 | 181006 | 206141 | 179008 | 222660 |
| 10 | | 120896 | 127252 | 152628 | 158306 | 131635 | 164562 | 163725 | 186504 | 161927 |
| 11 | | 104813 | 109592 | 115142 | 120007 | 143227 | 119104 | 148840 | 148118 | 168691 |
| 12 | | 92637 | 94692 | 98850 | 104055 | 108417 | 129500 | 107291 | 134294 | 133516 |
| 13 | | 86058 | 82713 | 84634 | 88390 | 93082 | 97336 | 114262 | 94587 | 118385 |
| 14 | | 82089 | 75896 | 72945 | 74545 | 78277 | 82736 | 83759 | 99570 | 80846 |
| 15 | | 70764 | 69957 | 64899 | 61355 | 64097 | 67299 | 69164 | 70418 | 83028 |
| 16 | | 63710 | 60078 | 59955 | 54586 | 52597 | 54839 | 57052 | 58680 | 58717 |
| 17 | | 58176 | 51178 | 49256 | 47965 | 45007 | 42764 | 45374 | 46993 | 47252 |
| 18 | | 55118 | 49254 | 43725 | 41528 | 41209 | 38421 | 36862 | 39085 | 40128 |
| 19 | | 50671 | 41134 | 38282 | 32211 | 32163 | 31781 | 30709 | 29283 | 30466 |
| 20 | | 45324 | 38901 | 32213 | 28898 | 24654 | 24628 | 25904 | 25048 | 23341 |
| 21 | | 42300 | 38462 | 33333 | 27014 | 24370 | 20559 | 21315 | 22551 | 21687 |
| 22 | | 31310 | 30537 | 29081 | 23928 | 19006 | 16216 | 15548 | 16641 | 14665 |
| 23 | | 23845 | 23078 | 23593 | 21939 | 17378 | 12514 | 12485 | 12361 | 13200 |
| 24 | | 15896 | 14553 | 15294 | 15430 | 13721 | 8777 | 8223 | 9067 | 8777 |
| 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 | 3167 | 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 | | 1489376 | 1450063 | 1477251 | 1489559 | 1541274 | 1551581 | 1630345 | 1602303 | 1598565 |
| SPAWN. ST. | | 445549 | 403694 | 380237 | 347573 | 325385 | 304475 | 309314 | 318989 | 325553 |
| | | | | | | | | | | |
| | | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | | |
| 7 | | 471065 | 411367 | 381902 | 810721 | 191731 | 8411 | ***** | | |
| 8 | | 179966 | 426237 | 372220 | 345559 | 733564 | 173473 | 7603 | | |
| 9 | | 138812 | 162840 | 385675 | 336799 | 312667 | 663728 | 156808 | | |
| 10 | | 201212 | 123679 | 147296 | 348889 | 304687 | 282631 | 599366 | | |
| 11 | | 146162 | 179483 | 111842 | 133118 | 315392 | 274896 | 254205 | | |
| 12 | | 151803 | 126332 | 161874 | 100211 | 119452 | 283740 | 246508 | | |
| 13 | | 117949 | 118536 | 110946 | 140807 | 88196 | 101142 | 247413 | | |
| 14 | | 103963 | 88114 | 102125 | 95002 | 124709 | 71028 | 83507 | | |
| 15 | | 69083 | 79091 | 72300 | 84783 | 80077 | 99494 | 54221 | | |
| 16 | | 71686 | 54067 | 66502 | 59290 | 70767 | 54797 | 74522 | | |
| 17 | | 47870 | 56134 | 43320 | 54756 | 43990 | 51200 | 39552 | | |
| 18 | | 40185 | 39723 | 48518 | 37118 | 40874 | 35416 | 35579 | | |
| 19 | | 30095 | 28353 | 31092 | 40886 | 23820 | 27891 | 23270 | | |
| 20 | | 23063 | 21920 | 22319 | 25322 | 31644 | 16276 | 17643 | | |
| 21 | | 19628 | 19116 | 18681 | 17170 | 18379 | 26615 | 9725 | | |
| 22 | | 15070 | 12496 | 13735 | 13676 | 10162 | 11401 | 15325 | | |
| 23 | | 12981 | 10421 | 8950 | 10993 | 9323 | 7015 | 6320 | | |
| 24 | | 8413 | 7626 | 6280 | 6441 | 6241 | 6593 | 3604 | | |
| 25 | | 4381 | 4003 | 4219 | 4284 | 3585 | 3380 | 2323 | | |
| 26 | | 3588 | 2307 | 2513 | 3032 | 1787 | 1891 | 1191 | | |
| 27 | | 1970 | 2031 | 1332 | 1694 | 745 | 907 | 666 | | |
| 28 | | 1515 | 1226 | 1492 | 846 | 338 | 239 | 320 | | |
| 29 | | 1490 | 964 | 852 | 1202 | 68 | 72 | 84 | | |
| 30+ | | 629 | 594 | 319 | 699 | 141 | 12 | 29 | | |
| TOTAL | | 1862581 | 1976661 | 2116304 | 2673300 | 2532342 | 2202247 | | | |
| SPAWN. ST. | | 527734 | 309324 | 317379 | 329259 | 312476 | 304961 | | | |

Table 28. Sebastes marinus in fishing areas V and XIV.
Biomass results from VPA ('000).

1 JANUARY

| | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 |
|------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| 7 | 25643 | 21324 | 26657 | 26530 | 30214 | 26237 | 32635 | 20345 | 23867 |
| 8 | 29483 | 35191 | 29264 | 36582 | 36408 | 41463 | 36006 | 44786 | 27921 |
| 9 | 33190 | 34592 | 41289 | 34335 | 42922 | 42717 | 48649 | 42246 | 52548 |
| 10 | 36390 | 38303 | 39921 | 47650 | 39622 | 49533 | 49281 | 56138 | 48740 |
| 11 | 39934 | 41678 | 43869 | 45723 | 54569 | 45379 | 56708 | 56433 | 64271 |
| 12 | 43632 | 44600 | 46559 | 49010 | 51064 | 60994 | 50534 | 63253 | 62886 |
| 13 | 46557 | 44748 | 45787 | 47819 | 50357 | 52659 | 61816 | 51171 | 64046 |
| 14 | 53522 | 49484 | 47560 | 48603 | 51037 | 53944 | 54611 | 64920 | 52712 |
| 15 | 50950 | 50369 | 46727 | 44176 | 46150 | 48455 | 49798 | 50701 | 59780 |
| 16 | 50585 | 47702 | 47605 | 43341 | 41762 | 43542 | 45299 | 46592 | 46622 |
| 17 | 50962 | 44832 | 45148 | 42017 | 39426 | 37462 | 39748 | 41165 | 41392 |
| 18 | 53244 | 47579 | 42238 | 40116 | 39807 | 37114 | 35609 | 37756 | 38763 |
| 19 | 54015 | 43849 | 40808 | 34337 | 34286 | 33879 | 32736 | 31215 | 32477 |
| 20 | 53301 | 45748 | 37882 | 33984 | 28994 | 28963 | 30463 | 29456 | 27449 |
| 21 | 54863 | 49885 | 43233 | 35037 | 31608 | 26665 | 27646 | 29249 | 28128 |
| 22 | 44804 | 43698 | 41615 | 34242 | 27198 | 23205 | 22249 | 23814 | 24993 |
| 23 | 37651 | 36440 | 37255 | 34641 | 27441 | 19759 | 19714 | 19518 | 20843 |
| 24 | 27690 | 25351 | 26642 | 26880 | 23902 | 15290 | 14324 | 15795 | 15290 |
| 25 | 20060 | 14970 | 15084 | 15311 | 14612 | 10730 | 9682 | 9681 | 11124 |
| 26 | 14684 | 14060 | 9915 | 9297 | 9227 | 8186 | 8159 | 7172 | 7191 |
| 27 | 11434 | 10485 | 10420 | 5705 | 5037 | 4338 | 6560 | 6407 | 5285 |
| 28 | 6914 | 9382 | 8569 | 8172 | 3500 | 2633 | 3587 | 5665 | 5398 |
| 29 | 9361 | 5146 | 7940 | 6617 | 6347 | 1446 | 2059 | 2892 | 4828 |
| 30+ | 4808 | 3934 | 9550 | 6053 | 4069 | 975 | 370 | 404 | 3699 |
| TOTAL | 853678 | 803350 | 789535 | 756176 | 739557 | 715569 | 738243 | 756773 | 770251 |
| SPAWN. ST. | 504842 | 455422 | 433695 | 389386 | 353895 | 313594 | 318215 | 328542 | 337539 |
| | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | | | |
| 7 | 56528 | 49364 | 45828 | 97287 | 23008 | 1009 | | | |
| 8 | 32754 | 77575 | 67744 | 62892 | 133509 | 31572 | | | |
| 9 | 32760 | 38430 | 91019 | 79484 | 73789 | 156640 | | | |
| 10 | 60565 | 37227 | 44336 | 105016 | 91711 | 85072 | | | |
| 11 | 55688 | 68383 | 42612 | 50718 | 120164 | 104736 | | | |
| 12 | 71499 | 59503 | 76243 | 47199 | 56262 | 133642 | | | |
| 13 | 63811 | 64128 | 60022 | 76177 | 47714 | 54718 | | | |
| 14 | 67784 | 57451 | 66585 | 61941 | 81310 | 46310 | | | |
| 15 | 49740 | 56945 | 52056 | 61044 | 57656 | 71636 | | | |
| 16 | 56919 | 42929 | 52803 | 47077 | 56189 | 43508 | | | |
| 17 | 41934 | 49173 | 37948 | 47966 | 38536 | 44851 | | | |
| 18 | 38819 | 38373 | 46869 | 35856 | 39485 | 34211 | | | |
| 19 | 32082 | 30224 | 33144 | 43584 | 25392 | 29732 | | | |
| 20 | 27122 | 25778 | 26247 | 29779 | 37214 | 19140 | | | |
| 21 | 25457 | 24794 | 24230 | 22269 | 23837 | 34520 | | | |
| 22 | 21565 | 17882 | 19655 | 19570 | 14541 | 16315 | | | |
| 23 | 20497 | 16455 | 14131 | 17358 | 14722 | 11077 | | | |
| 24 | 14656 | 13285 | 10940 | 11220 | 10873 | 11484 | | | |
| 25 | 8421 | 7693 | 8109 | 8234 | 6891 | 6496 | | | |
| 26 | 7606 | 4891 | 5327 | 6429 | 3788 | 4008 | | | |
| 27 | 4608 | 4751 | 3114 | 3962 | 1742 | 2121 | | | |
| 28 | 3910 | 3164 | 3850 | 2184 | 872 | 617 | | | |
| 29 | 4240 | 2745 | 2426 | 3421 | 195 | 204 | | | |
| 30+ | 2455 | 2320 | 1244 | 2731 | 551 | 47 | | | |
| TOTAL | 801418 | 793461 | 836483 | 943399 | 959949 | 943668 | | | |
| SPAWN. ST. | 331089 | 308453 | 312390 | 327542 | 300487 | 290286 | | | |

Table 29. Sebastes marinus in Sub-areas V and XIV.
Parameters used for catch projections.

| AGE | Stock size at 1 Jan. 1982 | F-PATTERN | M | MATURITY OGIVE | WEIGHT IN THE CATCH | WEIGHT IN THE STOCK |
|-----|------------------------------|-----------|-------|-------------------|------------------------|------------------------|
| 7 | 282000.00 | 0.0010 | 0.100 | 0.0000 | 0.3280 | 0.1200 |
| 8 | 255151.00 | 0.0010 | 0.100 | 0.0000 | 0.3610 | 0.1820 |
| 9 | 156808.00 | 0.0020 | 0.100 | 0.0000 | 0.3990 | 0.2360 |
| 10 | 599366.00 | 0.0060 | 0.100 | 0.0000 | 0.4400 | 0.3010 |
| 11 | 254205.00 | 0.0100 | 0.100 | 0.0000 | 0.4860 | 0.3810 |
| 12 | 246508.00 | 0.0400 | 0.100 | 0.0600 | 0.5360 | 0.4710 |
| 13 | 247413.00 | 0.1000 | 0.100 | 0.1300 | 0.5910 | 0.5410 |
| 14 | 83307.00 | 0.1800 | 0.100 | 0.2600 | 0.6520 | 0.6520 |
| 15 | 54221.00 | 0.2000 | 0.100 | 0.4400 | 0.7200 | 0.7200 |
| 16 | 74522.00 | 0.2400 | 0.100 | 0.6900 | 0.7940 | 0.7940 |
| 17 | 39552.00 | 0.2800 | 0.100 | 0.8400 | 0.8760 | 0.8760 |
| 18 | 35579.00 | 0.3400 | 0.100 | 0.9000 | 0.9660 | 0.9660 |
| 19 | 23270.00 | 0.3800 | 0.100 | 0.9300 | 1.0660 | 1.0660 |
| 20 | 17643.00 | 0.4400 | 0.100 | 0.9700 | 1.1760 | 1.1760 |
| 21 | 9725.00 | 0.4800 | 0.100 | 1.0000 | 1.2970 | 1.2970 |
| 22 | 15325.00 | 0.5200 | 0.100 | 1.0000 | 1.4310 | 1.4310 |
| 23 | 6320.00 | 0.6000 | 0.100 | 1.0000 | 1.5790 | 1.5790 |
| 24 | 3604.00 | 1.0000 | 0.100 | 1.0000 | 1.7420 | 1.7420 |
| 25 | 2323.00 | 1.0000 | 0.100 | 1.0000 | 1.9220 | 1.9220 |
| 26 | 1191.00 | 1.0000 | 0.100 | 1.0000 | 2.1200 | 2.1200 |
| 27 | 666.00 | 1.0000 | 0.100 | 1.0000 | 2.3390 | 2.3390 |
| 28 | 320.00 | 1.0000 | 0.100 | 1.0000 | 2.5800 | 2.5800 |
| 29 | 84.00 | 1.0000 | 0.100 | 1.0000 | 2.8460 | 2.8460 |
| 30+ | 29.00 | 1.0000 | 0.100 | 1.0000 | 3.9050 | 3.9050 |

Recruitment (age 7) =
282 million fish (average
1969-78) for 1981-83.

Table 30. *Sebastes mentella* in fishing areas V and XIV.
Input catch data for VFA ('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 | ? | 0 | 1 |
| 12 | 52 | 12 | 46 | // | 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 | 3549 | 3433 | 3000 | 3019 | 2284 | 3500 | 2586 | 2790 | 2202 |
| 20 | 1060 | 1136 | 844 | 847 | 699 | 993 | 779 | 795 | 605 |
| 21 | 8121 | 9195 | 6378 | 6013 | 5609 | 6885 | 5741 | 5467 | 4474 |
| 22 | 3203 | 3945 | 2610 | 2110 | 2528 | 2483 | 2379 | 2029 | 1785 |
| 23 | 10430 | 12819 | 9176 | 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+ | 569 | 441 | 899 | 533 | 385 | 492 | 565 | 489 | 581 |
| TOTAL | 43515 | 48512 | 41071 | 36340 | 34274 | 38961 | 39128 | 35735 | 34327 |
| | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | | | |
| 8 | 0 | 0 | 0 | 216 | 22 | 1588 | | | |
| 9 | 3202 | 2 | 321 | 186 | 74 | 3285 | | | |
| 10 | 2948 | 2 | 656 | 485 | 394 | 5362 | | | |
| 11 | 6533 | 3 | 908 | 647 | 1359 | 5798 | | | |
| 12 | 22608 | 142 | 1521 | 1517 | 7256 | 10903 | | | |
| 13 | 21121 | 362 | 664 | 1373 | 5989 | 5162 | | | |
| 14 | 14107 | 1438 | 816 | 2622 | 3811 | 3124 | | | |
| 15 | 5547 | 1334 | 1206 | 2726 | 3685 | 6683 | | | |
| 16 | 4431 | 3411 | 1577 | 1980 | 2422 | 4937 | | | |
| 17 | 2619 | 2897 | 882 | 1035 | 1344 | 1922 | | | |
| 18 | 2841 | 3722 | 1581 | 1565 | 1405 | 2930 | | | |
| 19 | 2229 | 3454 | 1371 | 2022 | 1256 | 2509 | | | |
| 20 | 541 | 802 | 1089 | 915 | 1252 | 1579 | | | |
| 21 | 3625 | 4884 | 1688 | 3133 | 3398 | 3081 | | | |
| 22 | 1192 | 1314 | 1264 | 1937 | 2070 | 2273 | | | |
| 23 | 4050 | 3958 | 2070 | 1741 | 2024 | 2218 | | | |
| 24 | 2403 | 2172 | 1388 | 1449 | 1419 | 2207 | | | |
| 25 | 1232 | 1089 | 823 | 842 | 590 | 1270 | | | |
| 26 | 1061 | 928 | 506 | 297 | 225 | 484 | | | |
| 27 | 544 | 480 | 104 | 54 | 121 | 113 | | | |
| 28+ | 331 | 377 | 0 | 0 | 0 | 279 | | | |
| TOTAL | 103165 | 32771 | 20435 | 26742 | 40116 | 67707 | | | |

Table 31. GREENLAND HALIBUT. Nominal catch (tonnes) in Sub-area I.
(As officially reported to ICES.)

| Country | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 ^{x)} |
|------------------------|------------------|-----------------|-------|-------|-------|-------|-------|-------|------|------|--------------------|
| German Dem.Rep. | 14 ¹⁾ | 1 ¹⁾ | - | - | 5 | - | - | - | - | - | - |
| Germany, Fed.Rep. | - | - | 25 | 22 | 6 | 2 | 1 | - | - | - | 19 |
| Norway | 1 951 | 3 116 | 2 947 | 2 167 | 2 160 | 1 203 | 1 371 | 1 148 | 727 | 490 | 562 ¹⁾ |
| Poland | 7 | 117 | - | 1 | - | 9 | - | - | - | - | - |
| U.K. (Engl. and Wales) | - | 949 | 995 | 732 | 550 | 665 | 541 | 232 | 36 | 12 | 5 |
| USSR | 3 441 | 4 366 | 1 700 | 2 329 | 3 774 | 600 | 360 | 211 | 182 | 100 | 816 |
| Total | 5 413 | 8 549 | 5 667 | 5 251 | 6 495 | 2 479 | 2 273 | 1 591 | 945 | 602 | 1 402 |

x) Provisional data

1) From national statistics

Table 32. GREENLAND HALIBUT. Nominal catch (tonnes) in Division IIa.
(As reported officially to ICES.)

| Country | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 ^{x)} |
|-------------------------|-------------------|---------------------|-------|-------|-------|-------|--------|--------|--------|-------|--------------------|
| Faroe Isl. | - | - | - | - | - | 2 | 21 | - | 3 | - | - |
| German Dem.Rep. | 353 ¹⁾ | 1 069 ¹⁾ | 52 | 656 | 172 | 354 | 1 641 | 1 398 | 787 | 570 | 18 |
| Germany, Fed.Rep. | 3 | 3 | + | 49 | 41 | 17 | 22 | 321 | 481 | 303 | 99 |
| Norway | 4 974 | 11 715 | 7 861 | 6 593 | 2 265 | 3 490 | 1 446 | 2 084 | 2 051 | 2 529 | 3 287 |
| Poland | 5 036 | 2 643 | 137 | 499 | 66 | 31 | 95 | 197 | 4 | - | - |
| U.K.(England and Wales) | - | 182 | 118 | 55 | 107 | 48 | 211 | 82 | 11 | 9 | 4 |
| USSR | 491 | 21 | 22 | - | 515 | 43 | 6 960 | 8 809 | 6 929 | 2 014 | 2 031 |
| Others | - | - | - | - | - | - | - | 1 | 21 | 48 | - |
| Total | 10 857 | 15 633 | 8 190 | 7 852 | 3 166 | 3 985 | 10 396 | 12 892 | 10 287 | 5 473 | 5 439 |

x) Provisional data

1) From national statistics

Table 33. GREENLAND HALIBUT. Nominal catch (tonnes) in Division IIb.
(As Reported officially to ICES.)

| Country | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 ^{x)} |
|-------------------------|---------------------|-------------------|--------|--------|--------|--------|--------|--------|-------|-------|--------------------|
| German Dem.Rep. | 2 582 ¹⁾ | 563 ¹⁾ | 3 902 | 5 258 | 8 295 | 8 601 | 6 535 | 3 213 | 2 701 | 1 510 | 1 340 |
| Germany, Fed.Rep. | - | - | 34 | 17 | 47 | 12 | 125 | - | - | - | - |
| Norway | 2 541 | 1 152 | 3 181 | 31 | 433 | 1 312 | 1 400 | 850 | 65 | 138 | 357 ¹⁾ |
| Poland | 7 234 | 5 221 | 2 003 | 4 646 | 3 579 | 3 526 | 129 | 347 | 102 | - | - |
| U.K.(England and Wales) | - | 131 | 122 | 79 | 74 | 222 | 307 | 93 | 12 | 5 | - |
| USSR | 50 407 | 11 806 | 6 839 | 14 629 | 16 083 | 15 937 | 7 725 | 5 631 | 3 200 | 5 556 | 6 418 |
| Total | 62 764 | 18 873 | 16 081 | 24 660 | 28 511 | 29 610 | 16 221 | 10 134 | 6 080 | 7 209 | 8 115 |

x) Provisional data

1) From national statistics

Table 34. GREENLAND HALIBUT. Nominal catch (tonnes) in Sub-areas I and II, 1971-81.
(Data for 1971-80 from Bulletin Statistique)

| Country | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 ^{x)} |
|--|---------------------|---------------------|--------|--------|--------|--------|--------|--------|--------|--------|---------------------|
| Faroe Isl. | - | - | - | - | - | 2 | 21 | - | 24 | - | - |
| German Dem.Rep. | 2 949 ¹⁾ | 1 633 ¹⁾ | 3 954 | 5 914 | 8 472 | 8 955 | 8 176 | 4 611 | 3 488 | 2 080 | 1 358 |
| Germany, Fed.Rep. | 3 | 3 | 59 | 88 | 94 | 31 | 148 | 321 | 481 | 303 | 118 |
| Norway: trawl catch ¹⁾ | 2 309 | 9 656 | 10 217 | 4 656 | 1 686 | 4 030 | 2 564 | 2 302 | 921 | 1 559 | 2 996 ¹⁾ |
| long-line catch and gill net ¹⁾ | 7 157 | 6 327 | 3 772 | 4 135 | 3 172 | 1 975 | 1 653 | 1 780 | 1 992 | 1 598 | 1 210 ¹⁾ |
| Poland | 12 277 | 7 981 | 2 140 | 5 146 | 3 645 | 3 566 | 224 | 544 | 106 | - | - |
| U.K. (England and Wales) | - | 1 262 | 1 235 | 866 | 731 | 935 | 1 059 | 407 | 59 | 26 | 9 |
| USSR | 54 339 | 16 193 | 8 561 | 16 958 | 20 372 | 16 580 | 15 045 | 14 651 | 10 311 | 7 670 | 9 265 |
| Others | - | - | - | - | - | - | - | 1 | 5 | 48 | - |
| Total | 79 034 | 43 055 | 29 938 | 37 763 | 38 172 | 36 074 | 28 890 | 24 617 | 17 312 | 13 284 | 14 956 |

x) Provisional data

1) From national statistics

Table 35. 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 | | | 2.55 | 13.7 | |
| 1966 | .77 | | | 2.45 | 10.7 | |
| 1967 | .70 | | | 2.23 | 10.8 | |
| 1968 | .65 | | | 2.07 | 12.6 | |
| 1969 | .53 | | | 1.69 | 25.9 | |
| 1970 | .53 | | | 1.69 | 52.9 | 1.59 |
| 1971 | .46 | | | 1.47 | 53.8 | 1.38 |
| 1972 | .37 | | | 1.18 | 36.5 | 1.05 |
| 1973 | .37 | 8.6 | .506 | 1.26 | 23.8 | 1.22 |
| 1974 | .40 | 8.4 | .432 | 1.22 | 31.0 | 1.14 |
| 1975 | .39 | 8.9 | .479 | 1.28 | 29.8 | 1.22 |
| 1976 | .40 | 7.1 | .452 | 1.17 | 30.8 | 1.09 |
| 1977 | .27 | 5.0 | .361 | .85 | 33.9 | .73 |
| 1978 | .21 | 4.6 | .223 | .65 | 37.9 | .53 |
| 1979 | .23 | 4.8 | .298 | .74 | 23.4 | .53 |
| 1980 | .24 | 6.6 | .271 | .82 | 16.2 | .71 |
| 1981 | .37 | | .443 | 1.18 | 12.7 | .86 |

Table 36. The four sets of mean weight at age data, one used for the period 1970-78, one used for 1979, another for 1980, and the last for 1981 in the predictions.

| Age | \bar{w} (kg) 1970-78 | \bar{w} (kg) 1979 | \bar{w} (kg) 1980 | \bar{w} (kg) 1981 |
|-----|---------------------------|------------------------|------------------------|------------------------|
| 3 | 0.200 | 0.3 | 0.200 | .20 |
| 4 | 0.441 | 0.6 | 0.482 | .50 |
| 5 | 0.567 | 0.9 | 0.702 | .66 |
| 6 | 0.737 | 1.2 | 0.872 | .84 |
| 7 | 1.079 | 1.5 | 1.141 | 1.15 |
| 8 | 1.421 | 1.8 | 1.468 | 1.56 |
| 9 | 1.848 | 2.2 | 1.778 | 2.04 |
| 10 | 2.281 | 2.6 | 2.302 | 2.57 |
| 11 | 2.887 | 3.0 | 2.664 | 2.98 |
| 12 | 3.247 | 3.5 | 3.046 | 3.43 |
| 13 | 4.303 | 4.1 | 3.368 | 4.13 |
| 14 | 4.931 | 4.8 | 4.285 | 4.68 |
| 15 | 5.765 | 5.6 | 5.025 | 5.81 |
| 16 | 6.308 | 7.0 | 6.589 | 6.59 |

Table 37. The estimated catch (sum of products) compared with the observed catch using the age compositions (Table 38) and the mean weights in Table 36.

| 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 | 13 284 | 12 339 | 1.077 |
| 1981 | 14 956 | 14 709 | 1.017 |

Table 38. 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 | 846 | 830 | 2037 | 1897 |
| 6 | 2792 | 4486 | 3521 | 1117 | 2519 | 2357 | 2982 | 3255 | 5589 |
| 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 | 3060 | 1670 | 1509 |
| 10 | 6671 | 4339 | 1734 | 1919 | 1942 | 1654 | 1350 | 1164 | 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 | 206 | 251 | 531 | 606 | 526 | 384 | 147 |
| 15 | 266 | 123 | 40 | 70 | 137 | 270 | 234 | 93 | 83 |
| 16+ | 15 | 20 | 40 | 56 | 79 | 98 | 164 | 87 | 29 |
| TOTAL | 54852 | 45882 | 29201 | 17013 | 21972 | 23573 | 22796 | 18626 | 17014 |
| | 1979 | 1980 | 1981 | | | | | | |
| 3 | 88 | 64 | 660 | | | | | | |
| 4 | 887 | 275 | 1140 | | | | | | |
| 5 | 2218 | 731 | 1886 | | | | | | |
| 6 | 3155 | 1138 | 1907 | | | | | | |
| 7 | 2727 | 1665 | 1912 | | | | | | |
| 8 | 1234 | 1341 | 930 | | | | | | |
| 9 | 495 | 944 | 484 | | | | | | |
| 10 | 319 | 473 | 446 | | | | | | |
| 11 | 296 | 511 | 481 | | | | | | |
| 12 | 243 | 275 | 377 | | | | | | |
| 13 | 103 | 242 | 383 | | | | | | |
| 14 | 45 | 145 | 149 | | | | | | |
| 15 | 30 | 62 | 47 | | | | | | |
| 16+ | 21 | 16 | 15 | | | | | | |
| TOTAL | 11861 | 7882 | 10817 | | | | | | |

Table 39. 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 | 0.002 |
| 4 | 0.001 | 0.000 | 0.015 | 0.001 | 0.011 | 0.015 | 0.004 | 0.032 | 0.019 |
| 5 | 0.014 | 0.003 | 0.037 | 0.007 | 0.037 | 0.039 | 0.037 | 0.107 | 0.100 |
| 6 | 0.067 | 0.151 | 0.159 | 0.045 | 0.101 | 0.118 | 0.180 | 0.190 | 0.263 |
| 7 | 0.296 | 0.454 | 0.515 | 0.252 | 0.351 | 0.384 | 0.450 | 0.388 | 0.367 |
| 8 | 0.697 | 0.630 | 0.413 | 0.338 | 0.394 | 0.392 | 0.538 | 0.338 | 0.371 |
| 9 | 0.599 | 0.490 | 0.263 | 0.269 | 0.280 | 0.401 | 0.519 | 0.311 | 0.328 |
| 10 | 0.620 | 0.532 | 0.234 | 0.276 | 0.319 | 0.412 | 0.418 | 0.345 | 0.286 |
| 11 | 0.523 | 0.518 | 0.299 | 0.316 | 0.374 | 0.538 | 0.397 | 0.641 | 0.517 |
| 12 | 0.555 | 0.746 | 0.447 | 0.405 | 0.470 | 0.689 | 0.774 | 0.754 | 0.564 |
| 13 | 0.876 | 1.254 | 0.741 | 0.478 | 0.473 | 0.871 | 0.741 | 1.092 | 0.758 |
| 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 |
| FC (7-11),U | 0.547 | 0.525 | 0.345 | 0.290 | 0.344 | 0.425 | 0.465 | 0.405 | 0.374 |
| | 1979 | 1980 | 1981 | | | | | | |
| 3 | 0.001 | 0.002 | 0.020 | | | | | | |
| 4 | 0.026 | 0.005 | 0.040 | | | | | | |
| 5 | 0.097 | 0.025 | 0.037 | | | | | | |
| 6 | 0.228 | 0.063 | 0.081 | | | | | | |
| 7 | 0.309 | 0.171 | 0.135 | | | | | | |
| 8 | 0.168 | 0.232 | 0.129 | | | | | | |
| 9 | 0.116 | 0.178 | 0.116 | | | | | | |
| 10 | 0.100 | 0.147 | 0.115 | | | | | | |
| 11 | 0.129 | 0.219 | 0.207 | | | | | | |
| 12 | 0.230 | 0.160 | 0.235 | | | | | | |
| 13 | 0.233 | 0.355 | 0.330 | | | | | | |
| 14 | 0.188 | 0.559 | 0.364 | | | | | | |
| 15 | 0.380 | 0.400 | 0.332 | | | | | | |
| 16+ | 0.380 | 0.400 | 0.332 | | | | | | |
| FC (7-11),U | 0.164 | 0.189 | 0.140 | | | | | | |

able 40. GREENLAND HALIBUT in fishing areas I and II.
Stock size in numbers ('000) from VPA.

| 1 January | | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 |
|------------|--|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| 3 | | 44453 | 45089 | 36631 | 32096 | 35282 | 29212 | 29703 | 35531 | 43607 |
| 4 | | 34887 | 38261 | 38808 | 31528 | 27624 | 28645 | 25122 | 25616 | 30525 |
| 5 | | 40044 | 29996 | 52930 | 52975 | 27119 | 23521 | 24545 | 21532 | 21349 |
| 6 | | 46323 | 34495 | 25744 | 27316 | 28185 | 22492 | 19466 | 20185 | 16647 |
| 7 | | 43868 | 37285 | 25540 | 18901 | 22476 | 21928 | 17196 | 13997 | 14364 |
| 8 | | 39501 | 28094 | 20375 | 13157 | 12643 | 13620 | 12859 | 9433 | 8173 |
| 9 | | 23790 | 16942 | 12885 | 11601 | 8065 | 7342 | 7925 | 6462 | 5789 |
| 10 | | 15437 | 11245 | 8935 | 8526 | 7628 | 5246 | 4250 | 4058 | 4076 |
| 11 | | 6608 | 7151 | 5683 | 6088 | 5566 | 4773 | 2990 | 2396 | 2474 |
| 12 | | 3137 | 3370 | 3666 | 3628 | 3822 | 3294 | 2398 | 1729 | 1086 |
| 13 | | 1124 | 1550 | 1376 | 2018 | 2083 | 2056 | 1424 | 952 | 701 |
| 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 | | 301543 | 254087 | 213101 | 188656 | 179970 | 163843 | 149338 | 142783 | 149270 |
| SPAWN. ST. | | 51865 | 40867 | 33072 | 32684 | 28641 | 24426 | 20287 | 16488 | 14605 |
| | | | | | | | | | | |
| | | 1979 | 1980 | 1981 | 1982 | | | | | |
| 3 | | 75879 | 36426 | 35884 | ***** | | | | | |
| 4 | | 37461 | 65228 | 31295 | 30274 | | | | | |
| 5 | | 25780 | 31421 | 55887 | 25878 | | | | | |
| 6 | | 16619 | 20136 | 26367 | 46355 | | | | | |
| 7 | | 11013 | 11388 | 16277 | 20929 | | | | | |
| 8 | | 8564 | 6961 | 8262 | 12240 | | | | | |
| 9 | | 4853 | 6229 | 4752 | 6250 | | | | | |
| 10 | | 3590 | 3719 | 4489 | 3642 | | | | | |
| 11 | | 2634 | 2794 | 2763 | 3451 | | | | | |
| 12 | | 1269 | 1993 | 1933 | 1934 | | | | | |
| 13 | | 532 | 868 | 1461 | 1315 | | | | | |
| 14 | | 282 | 362 | 524 | 904 | | | | | |
| 15 | | 102 | 202 | 178 | 313 | | | | | |
| 16+ | | 71 | 52 | 57 | 145 | | | | | |
| TOTAL | | 188648 | 187779 | 190127 | | | | | | |
| SPAWN. ST. | | 13333 | 16219 | 16157 | | | | | | |

Table 41. GREENLAND HALIBUT in fishing areas I and II.
Biomass results from VPA ('000).

1 JANUARY

| | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 |
|------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| 3 | 8891 | 9018 | 7326 | 6419 | 6656 | 5842 | 5953 | 7106 | 8721 |
| 4 | 15385 | 16873 | 17114 | 13914 | 12182 | 12632 | 11179 | 11297 | 13461 |
| 5 | 23045 | 17008 | 18671 | 18697 | 15376 | 13336 | 13864 | 12209 | 12105 |
| 6 | 34140 | 25473 | 18973 | 20132 | 20773 | 16576 | 14347 | 14877 | 12269 |
| 7 | 47334 | 40230 | 27558 | 20394 | 24252 | 23660 | 18554 | 15103 | 13499 |
| 8 | 56131 | 39922 | 28953 | 18667 | 17906 | 19354 | 18272 | 13404 | 11614 |
| 9 | 43964 | 31309 | 23811 | 21438 | 14900 | 13568 | 14645 | 11942 | 10698 |
| 10 | 35217 | 25649 | 20380 | 19448 | 17400 | 11965 | 9050 | 9256 | 9297 |
| 11 | 19078 | 20645 | 16407 | 17575 | 16669 | 13779 | 8631 | 6913 | 7142 |
| 12 | 11187 | 10942 | 11902 | 11780 | 12409 | 10696 | 7787 | 5613 | 3526 |
| 13 | 4838 | 6668 | 5921 | 8682 | 8965 | 8848 | 6126 | 4095 | 3014 |
| 14 | 6753 | 1987 | 1877 | 2783 | 5310 | 5507 | 3654 | 2882 | 1355 |
| 15 | 2178 | 1625 | 426 | 831 | 1470 | 2532 | 2369 | 913 | 877 |
| 16+ | 134 | 182 | 466 | 728 | 927 | 1006 | 1061 | 935 | 335 |
| TOTAL | 307270 | 246881 | 199786 | 181478 | 174654 | 159303 | 135932 | 116550 | 109914 |
| SPAWN. ST. | 122344 | 98407 | 81190 | 83265 | 77449 | 67902 | 53923 | 42556 | 36245 |
| | 1979 | 1980 | 1981 | | | | | | |
| 3 | 22764 | 7285 | 7177 | | | | | | |
| 4 | 22477 | 31440 | 15647 | | | | | | |
| 5 | 23202 | 22058 | 36886 | | | | | | |
| 6 | 19943 | 17558 | 22148 | | | | | | |
| 7 | 16519 | 12994 | 18718 | | | | | | |
| 8 | 15414 | 10219 | 12888 | | | | | | |
| 9 | 10676 | 11076 | 9694 | | | | | | |
| 10 | 9333 | 8360 | 11336 | | | | | | |
| 11 | 7903 | 7444 | 8234 | | | | | | |
| 12 | 4442 | 6072 | 6630 | | | | | | |
| 13 | 2180 | 2922 | 6035 | | | | | | |
| 14 | 1336 | 1333 | 2450 | | | | | | |
| 15 | 570 | 1013 | 1037 | | | | | | |
| 16+ | 498 | 343 | 373 | | | | | | |
| TOTAL | 157275 | 140370 | 159455 | | | | | | |
| SPAWN. ST. | 36957 | 38960 | 45991 | | | | | | |

Table 42. GREENLAND HALIBUT in fishing areas I and II. Input used in catch prediction. List of input variables by age group:

| Age | Stock size in 1982 $\times 10^{-3}$ | F-pattern | M | Maturity ogive | Weight in the catch (kg) | Weight in the stock (kg) |
|-----|---|-----------|-------|-------------------|--------------------------------|--------------------------------|
| 3 | 36600.00 | 0.0050 | 0.150 | 0.0000 | 0.2000 | 0.2000 |
| 4 | 30274.00 | 0.0650 | 0.150 | 0.0000 | 0.5000 | 0.5000 |
| 5 | 25878.00 | 0.2640 | 0.150 | 0.0000 | 0.6600 | 0.6600 |
| 6 | 46355.00 | 0.5790 | 0.150 | 0.0000 | 0.8400 | 0.8400 |
| 7 | 20929.00 | 0.9690 | 0.150 | 0.0000 | 1.1500 | 1.1500 |
| 8 | 12240.00 | 0.9210 | 0.150 | 0.0000 | 1.5600 | 1.5600 |
| 9 | 6250.00 | 0.8290 | 0.150 | 1.0000 | 2.0400 | 2.0400 |
| 10 | 3642.00 | 0.8070 | 0.150 | 1.0000 | 2.5700 | 2.5700 |
| 11 | 3451.00 | 1.4790 | 0.150 | 1.0000 | 2.9800 | 2.9800 |
| 12 | 1934.00 | 1.6790 | 0.150 | 1.0000 | 3.4300 | 3.4300 |
| 13 | 1315.00 | 2.3570 | 0.150 | 1.0000 | 4.1300 | 4.1300 |
| 14 | 904.00 | 2.6000 | 0.150 | 1.0000 | 4.6800 | 4.6800 |
| 15 | 313.00 | 2.3710 | 0.150 | 1.0000 | 5.8100 | 5.8100 |
| 16+ | 145.00 | 2.3710 | 0.150 | 1.0000 | 6.5900 | 6.5900 |

Average recruitment at age 3 1983 and 1984 $36\ 600 \times 10^3$.

Catch 1982: 12 000 tonnes

Table 43. GREENLAND HALIBUT. Nominal catch (tonnes) in Division Va.
(As reported officially to ICES.)

| Country | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 ^{x)} |
|---------------------|---------------------|-------------------|--------------|--------------|--------------|--------------|---------------|---------------|---------------|---------------|--------------------|
| Faroe Isl. | 1 316 | 1 180 | 188 | 41 | 2 | 373 | 947 | 256 | 42 | 91 | 324 |
| German Dem.Rep. | 3 317 ¹⁾ | 159 ¹⁾ | 320 | 388 | - | - | - | - | - | - | - |
| Germany, Fed.Rep. | 882 | 1 119 | 826 | 1 786 | 887 | 1 719 | 4 642 | - | - | - | - |
| Iceland | 5 020 | 4 640 | 2 115 | 2 842 | 1 212 | 1 687 | 10 090 | 11 319 | 16 934 | 27 836 | 15 455 |
| Norway | 369 | 186 | - | - | - | - | + | 13 | + | - | - |
| Poland | 899 | 31 | - | 485 | - | - | - | - | - | - | - |
| U.K.(Engl. & Wales) | - | 2 223 | 3 648 | 2 314 | 1 207 | 1 669 | - | - | - | - | - |
| USSR | 3 246 | 1 128 | 289 | 10 | - | - | - | - | - | - | - |
| Total | 15 049 | 10 666 | 7 386 | 7 866 | 3 308 | 5 448 | 15 679 | 11 588 | 16 976 | 27 927 | 15 779 |

x) Provisional data

1) From national statistics

Table 44. GREENLAND HALIBUT. Nominal catch (tonnes) in Division Vb.
(As Reported officially to ICES.)

| Country | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 ^{x)} |
|------------------------|------|------|------|------|------|------|-----------------|------|------|-------|--------------------|
| Faroe Isl. | - | - | - | 7 | 6 | 2 | 304 | 2 | 108 | 951 | 923 |
| France | - | - | - | - | - | - | - | 12 | 66 | 51 | - |
| German Dem.Rep. | - | - | - | 147 | 91 | - | - | - | - | - | - |
| Germany, Fed.Rep. | 11 | 405 | 287 | 163 | 437 | 309 | 341 | 570 | 234 | 172 | 99 |
| Norway | - | - | - | - | 7 | 7 | 5 ¹⁾ | 3 | 1 | 3 | - |
| Poland | - | - | 9 | - | 18 | - | - | - | - | - | - |
| U.K.(Engl. & Wales) | - | 12 | 61 | 8 | + | 6 | 8 | 8 | - | - | - |
| USSR | - | - | 1 | - | - | - | - | - | - | - | - |
| Total | 11 | 417 | 358 | 325 | 559 | 324 | 658 | 595 | 409 | 1 177 | 1 022 |

x) Provisional data

1) From national statistics

Table 45. GREENLAND HALIBUT. Nominal catch (tonnes) in Sub-area XIV.
(As reported officially to ICES.)

| Country | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 ^{x)} |
|---------------------|---------------------|---------------------|--------|--------|--------|------|-----------------|-------|-------|-------|--------------------|
| France | - | - | - | - | - | - | - | - | 4 | - | - |
| German Dem.Rep. | 3 491 ¹⁾ | 7 328 ¹⁾ | 8 806 | 25 266 | 16 872 | - | - | - | - | - | - |
| Germany, Fed.Rep. | 270 | 5 | 7 | + | 64 | 191 | 224 | 2 156 | 6 227 | 2 146 | 2 798 |
| Greenland | 2 | 3 | 4 | 2 | 1 | 1 | 1 | 6 | - | - | - |
| Iceland | + | - | 3 | 1 | + | 2 | - | - | - | 2 | - |
| Norway | - | - | - | - | - | - | 2 ¹⁾ | 3 | - | - | - |
| Poland | 7 190 | 7 847 | 3 122 | 1 057 | 1 054 | - | - | - | - | - | - |
| U.K.(Engl. & Wales) | - | 1 | 1 | 1 | 2 | 5 | 11 | 1 | - | - | - |
| USSR | 2 240 | 205 | 776 | 1 762 | 1 634 | 74 | - | - | - | - | - |
| Total | 13 913 | 15 389 | 12 719 | 28 089 | 19 627 | 273 | 241 | 2 166 | 6 231 | 2 148 | 2 798 |

x) Provisional data

1) From national statistics

Table 46. GREENLAND HALIBUT. Nominal catch (tonnes) in Sub-areas V and XIV, 1971-81.
(Data for 1971-80 from Bulletin Statistique)

| Country | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 ^{x)} |
|-------------------------|---------------------|---------------------|--------|--------|--------|-------|--------|--------|--------|--------|--------------------|
| Faroe Isl. | 1 316 | 1 180 | 188 | 48 | 8 | 375 | 1 251 | 258 | 150 | 1 042 | 1 247 |
| France | - | - | - | - | - | - | - | 12 | 70 | 51 | - |
| German Dem.Rep. | 6 808 ¹⁾ | 7 487 ¹⁾ | 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 | 2 318 | 2 897 |
| Greenland | 2 | 3 | 4 | 2 | 1 | 1 | 4 | 6 | - | - | - |
| Iceland | 5 020 | 4 640 | 2 118 | 2 843 | 1 212 | 1 689 | 10 090 | 11 319 | 16 934 | 27 838 | 15 455 |
| Norway | 369 | 186 | - | - | 7 | 7 | 7 | 19 | 1 | 3 | - |
| Poland | 8 809 | 7 878 | 3 131 | 1 542 | 1 072 | - | - | - | - | - | - |
| U.K. (Engl. & Wales) | - | 2 236 | 3 710 | 2 323 | 1 209 | 1 680 | 19 | 9 | - | - | - |
| USSR | 5 486 | 1 333 | 1 066 | 1 772 | 1 634 | 74 | - | - | - | - | - |
| Total | 28 973 | 26 472 | 20 463 | 36 280 | 23 494 | 6 045 | 16 578 | 14 349 | 23 616 | 31 252 | 19 599 |

x) Provisional data

1) From national statistics

Table 47. GREENLAND HALIBUT in Sub-areas V and XIV.
Catch per unit effort from Icelandic
trawler reports in April-May 1978-81. Hauls
with Greenland halibut 80% or more of the
total catch included.

| Years | Hours trawling | Catch (tonnes) | Cpue (tonnes) | Total effort (calculated) |
|--------------------|-------------------|-------------------|------------------|------------------------------|
| 1978 | 563 | 1 364 | 2.42 | 5 929 |
| 1979 | 388 | 936 | 2.41 | 9 802 |
| 1980 | 1 731 | 5 634 | 3.25 | 9 616 |
| 1981 ^{x)} | 375 | 952 | 2.54 | 7 716 |

x) Preliminary

Table 48. GREENLAND HALIBUT in fishing areas V and XIV.
Input catch data for VPA ('000).

| | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 |
|-------|------|------|------|------|-------|-------|------|
| 4 | 1 | 1 | 0 | 1 | 0 | 6 | 6 |
| 5 | 120 | 43 | 0 | 23 | 29 | 47 | 27 |
| 6 | 800 | 296 | 34 | 91 | 197 | 502 | 162 |
| 7 | 1775 | 584 | 671 | 347 | 1605 | 1536 | 592 |
| 8 | 1782 | 621 | 1727 | 1037 | 2253 | 2630 | 1184 |
| 9 | 1259 | 431 | 2289 | 1214 | 3090 | 3126 | 1459 |
| 10 | 926 | 240 | 834 | 848 | 1693 | 2324 | 1800 |
| 11 | 464 | 121 | 420 | 567 | 880 | 1739 | 1326 |
| 12 | 459 | 86 | 423 | 312 | 394 | 849 | 678 |
| 13 | 279 | 37 | 174 | 232 | 246 | 578 | 444 |
| 14 | 193 | 32 | 120 | 218 | 189 | 306 | 257 |
| 15 | 137 | 14 | 28 | 114 | 147 | 143 | 180 |
| 16 | 39 | 6 | 86 | 112 | 101 | 82 | 116 |
| 17 | 2 | 1 | 41 | 64 | 15 | 29 | 183 |
| 18+ | 44 | 2 | 14 | 28 | 9 | 5 | 29 |
| TOTAL | 8280 | 2515 | 6861 | 5208 | 10848 | 13902 | 8443 |

Table 49. GREENLAND HALIBUT in fishing areas V and XIV.
Fishing mortalities from VPA (M = 0.15).

| | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 |
|------------|--------|--------|--------|--------|--------|--------|--------|
| 4 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0003 | 0.0003 |
| 5 | 0.0044 | 0.0017 | 0.0000 | 0.0014 | 0.0013 | 0.0027 | 0.0015 |
| 6 | 0.0419 | 0.0128 | 0.0015 | 0.0060 | 0.0141 | 0.0255 | 0.0110 |
| 7 | 0.1267 | 0.0370 | 0.0344 | 0.0184 | 0.1322 | 0.1379 | 0.0360 |
| 8 | 0.2232 | 0.0565 | 0.1385 | 0.0649 | 0.1504 | 0.3126 | 0.1420 |
| 9 | 0.2566 | 0.0730 | 0.2855 | 0.1294 | 0.2632 | 0.3027 | 0.2700 |
| 10 | 0.2746 | 0.0671 | 0.1863 | 0.1537 | 0.2529 | 0.3051 | 0.2700 |
| 11 | 0.1430 | 0.0493 | 0.1520 | 0.1765 | 0.2233 | 0.4196 | 0.2700 |
| 12 | 0.4332 | 0.0337 | 0.2292 | 0.1528 | 0.1694 | 0.3287 | 0.2700 |
| 13 | 0.5569 | 0.0524 | 0.0840 | 0.1794 | 0.1640 | 0.3767 | 0.2700 |
| 14 | 0.2845 | 0.1052 | 0.2258 | 0.1363 | 0.2058 | 0.2972 | 0.2700 |
| 15 | 0.4263 | 0.0282 | 0.1196 | 0.3275 | 0.1216 | 0.2241 | 0.2700 |
| 16 | 2.1124 | 0.0276 | 0.2279 | 0.8799 | 0.5074 | 0.0875 | 0.2700 |
| 17 | 0.2500 | 0.2500 | 0.2500 | 0.2500 | 0.2500 | 0.2500 | 0.2700 |
| 18+ | 0.2500 | 0.2500 | 0.2500 | 0.2500 | 0.2500 | 0.2500 | 0.2700 |
| F(8-13),U | 0.3146 | 0.0553 | 0.1795 | 0.1428 | 0.2039 | 0.3409 | 0.2487 |

Table 50. GREENLAND HALIBUT in fishing areas V and XIV.
Stock size in numbers ('000) from VPA.

1 January

| | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 |
|------------|--------|--------|--------|--------|--------|--------|--------|-------|
| 4 | 32284 | 21990 | 20424 | 29030 | 21582 | 22544 | 21541 | ***** |
| 5 | 29339 | 27780 | 18926 | 17579 | 24985 | 18576 | 19398 | 18535 |
| 6 | 20904 | 25141 | 23876 | 16290 | 15109 | 21478 | 15945 | 10671 |
| 7 | 16033 | 17303 | 21365 | 20518 | 13936 | 12822 | 18021 | 13574 |
| 8 | 9568 | 12157 | 14351 | 17767 | 17339 | 10510 | 9015 | 14962 |
| 9 | 5972 | 6588 | 9888 | 10754 | 14332 | 12839 | 6018 | 7180 |
| 10 | 4138 | 3977 | 5271 | 6397 | 8133 | 9481 | 8104 | 4348 |
| 11 | 3743 | 2706 | 3200 | 3766 | 4721 | 5436 | 6014 | 5364 |
| 12 | 1398 | 2792 | 2217 | 2366 | 2717 | 3250 | 3075 | 3952 |
| 13 | 699 | 781 | 2324 | 1518 | 1748 | 1974 | 2014 | 2021 |
| 14 | 836 | 345 | 638 | 1839 | 1092 | 1277 | 1106 | 1323 |
| 15 | 423 | 542 | 267 | 438 | 1381 | 765 | 816 | 766 |
| 16 | 47 | 238 | 453 | 204 | 272 | 1053 | 326 | 536 |
| 17 | 10 | 5 | 199 | 311 | 73 | 141 | 830 | 346 |
| 18+ | 214 | 10 | 68 | 136 | 44 | 24 | 132 | 632 |
| TOTAL | 125666 | 122358 | 123467 | 128911 | 127462 | 122168 | 115874 | |
| SPAWN. ST. | 21521 | 23047 | 29916 | 33757 | 38805 | 38512 | 33152 | |

Table 51. GREENLAND HALIBUT in fishing areas V and XIV.
Biomass results from VPA ('000).

1 JANUARY

| | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 |
|------------|--------|--------|--------|--------|--------|--------|--------|
| 4 | 23954 | 14953 | 13888 | 19740 | 16014 | 16727 | 14260 |
| 5 | 28400 | 32148 | 21897 | 17016 | 22761 | 20898 | 20775 |
| 6 | 25135 | 39849 | 24974 | 19531 | 14233 | 27556 | 20042 |
| 7 | 22815 | 30591 | 30530 | 29198 | 17810 | 19066 | 25950 |
| 8 | 17738 | 26502 | 25746 | 32940 | 29060 | 18455 | 15960 |
| 9 | 13472 | 16931 | 22031 | 24262 | 29096 | 26359 | 13017 |
| 10 | 10788 | 12001 | 14165 | 16677 | 18974 | 21607 | 18435 |
| 11 | 11532 | 10095 | 9056 | 11602 | 12856 | 13579 | 15126 |
| 12 | 5022 | 11314 | 8679 | 8497 | 8957 | 9943 | 9072 |
| 13 | 3217 | 5758 | 9387 | 6987 | 6965 | 7467 | 6948 |
| 14 | 3927 | 1843 | 3005 | 8633 | 5096 | 5755 | 4701 |
| 15 | 2178 | 3115 | 1442 | 2255 | 6618 | 3931 | 3798 |
| 16 | 275 | 1480 | 2291 | 1202 | 1420 | 5929 | 2480 |
| 17 | 63 | 41 | 1245 | 2022 | 418 | 937 | 5184 |
| 18+ | 1669 | 87 | 476 | 1160 | 287 | 190 | 958 |
| TOTAL | 170186 | 204709 | 189411 | 201722 | 191165 | 198398 | 176707 |
| SPAWN. ST. | 57857 | 69823 | 79555 | 92084 | 96077 | 97961 | 84770 |

Table 52. GREENLAND HALIBUT in fishing areas V and XIV.
Parameters used in catch projections.

Proportion of F before the spawning season: 0.0000

Proportion of M before the spawning season: 0.0000

List of input variables by age group:

| AGE | Stock size at the beginning of 1982 | F-PATTERN | M | MATURITY GIVE | WEIGHT IN THE CATCH | WEIGHT IN THE STOCK |
|-----|---|-----------|-------|------------------|------------------------|------------------------|
| 4 | 22852.00 ¹⁾ | 0.0011 | 0.150 | 0.0000 | 0.6620 | 0.6620 |
| 5 | 18535.00 | 0.0056 | 0.150 | 0.0000 | 1.0710 | 1.0710 |
| 6 | 16671.00 | 0.0410 | 0.150 | 0.0300 | 1.2570 | 1.2570 |
| 7 | 13574.00 | 0.1330 | 0.150 | 0.1000 | 1.4400 | 1.4400 |
| 8 | 14902.00 | 0.5300 | 0.150 | 0.3500 | 1.6600 | 1.6600 |
| 9 | 7180.00 | 1.0000 | 0.150 | 0.7700 | 1.9670 | 1.9670 |
| 10 | 4348.00 | 1.0000 | 0.150 | 0.9000 | 2.2580 | 2.2580 |
| 11 | 5304.00 | 1.0000 | 0.150 | 1.0000 | 2.5150 | 2.5150 |
| 12 | 3952.00 | 1.0000 | 0.150 | 1.0000 | 2.9500 | 2.9500 |
| 13 | 2021.00 | 1.0000 | 0.150 | 1.0000 | 3.4500 | 3.4500 |
| 14 | 1323.00 | 1.0000 | 0.150 | 1.0000 | 4.0330 | 4.0330 |
| 15 | 766.00 | 1.0000 | 0.150 | 1.0000 | 4.6520 | 4.6520 |
| 16 | 536.00 | 1.0000 | 0.150 | 1.0000 | 4.7140 | 4.7140 |
| 17 | 346.00 | 1.0000 | 0.150 | 1.0000 | 6.2450 | 6.2450 |
| 18+ | 632.00 | 1.0000 | 0.150 | 1.0000 | 7.2810 | 7.2810 |

1) Based on average recruitment 1976-81.

Table 53. Sebastes mentella. Length frequencies used in the mesh assessment.

| Length in 2 cm groups | Div. Va | Div. Vb |
|-----------------------------|---|---|
| | Federal Republic of Germany fishery $\Sigma(1965-75)$ | Federal Republic of Germany fishery $\Sigma(1965-75)$ |
| | $C \times 10^{-3}$ | $C \times 10^{-3}$ |
| 20-21 | | |
| 22-23 | | |
| 24-25 | | |
| 26-27 | 8 | |
| 28-29 | 3 | |
| 30-31 | 510 | 7 |
| 32-33 | 2 339 | 36 |
| 34-35 | 8 517 | 128 |
| 36-37 | 19 185 | 253 |
| 38-39 | 36 561 | 547 |
| 40-41 | 67 010 | 1 704 |
| 42-43 | 91 463 | 3 601 |
| 44-45 | 85 698 | 6 834 |
| 46-47 | 52 452 | 6 078 |
| 48-49 | 18 483 | 2 596 |
| 50-51 | 5 851 | 496 |
| 52-53 | 1 240 | 48 |
| 54-55 | 545 | 13 |
| 56-57 | 102 | 15 |
| 58-59 | 19 | |
| 60-61 | | 2 |
| Total | 389 986 | 22 358 |

Table 54. Sebastes marinus. Length frequencies used in the mesh assessment.

| Length in 3 cm groups | Division Va | | Sub-area XIV |
|-----------------------------|--|--|--|
| | Iceland fishery $\Sigma(1965-66$ + 1972-75) | Germany, Fed. Rep. fishery $\Sigma(1965-75)$ | Germany, Fed. Rep. fishery $\Sigma(1965-75)$ |
| | $C \times 10^{-3}$ | $C \times 10^{-3}$ | $C \times 10^{-3}$ |
| 21-23 | 81 | | |
| 24-26 | 195 | | 29 |
| 27-29 | 1 243 | 84 | 200 |
| 30-32 | 10 175 | 1 320 | 3 291 |
| 33-35 | 34 174 | 10 350 | 11 592 |
| 36-38 | 48 504 | 23 954 | 18 210 |
| 39-41 | 36 869 | 27 864 | 20 392 |
| 32-44 | 20 007 | 21 989 | 22 179 |
| 45-47 | 8 448 | 15 203 | 27 671 |
| 48-50 | 5 484 | 10 760 | 23 458 |
| 51-53 | 3 266 | 5 377 | 9 574 |
| 54-56 | 846 | 1 449 | 2 406 |
| 57-59 | 120 | 122 | 581 |
| 60-62 | 69 | 1 | 400 |
| 63-65 | 115 | | 391 |
| 66-68 | 25 | | 280 |
| 69-71 | | | 168 |
| 72-74 | 22 | | 97 |
| 75-77 | 11 | | 22 |
| 78-80 | | | 3 |
| Total | 169 654 | 118 473 | 140 944 |

Table 55. Parameters used in the mesh assessment.

| | <u>Sebastes marinus</u> | | | <u>Sebastes mentella</u> | |
|-------------------------|-------------------------|-------------------------------|-------------------|--------------------------|------------------|
| | Total SA XIV | Germany, Fed. Rep. Div. Va | Others Div. Va | Total Div. Va | Total Div. Vb |
| R75/R50 | 1.10 | 1.05 | 1.05 | 1.07 | 1.04 |
| L _∞ | 96.4 | 96.4 | 96.4 | 75.9 | 75.9 |
| k | 0.028 | 0.028 | 0.028 | 0.031 | 0.031 |
| t ₀ | -1.63 | -1.63 | -1.63 | -5.49 | -5.49 |
| F _{tot} | 0.200 | 0.200 | 0.200 | 0.800 | 0.800 |
| M | 0.100 | 0.100 | 0.100 | 0.100 | 0.100 |
| 25% derecruitment | No derecruitment | | | 53.00 cm | 53.00 cm |
| 50% derecruitment | | | | 51.00 cm | 51.00 cm |
| 50% selection | 32.40 cm | 32.40 cm | 32.40 cm | 34.80 cm | 34.80 cm |
| 75% selection | 37.90 cm | 37.90 cm | 37.90 cm | 40.70 cm | 40.70 cm |
| 50% discard | 32.00 cm | 32.00 cm | 28.50 cm | 28.50 cm | 28.50 cm |
| 25% discard | 34.00 cm | 34.00 cm | 31.50 cm | 31.50 cm | 31.50 cm |
| Splitting of total F | 0.350 | 0.200 | 0.450 | 0.800 | 0.200 |

Table 56. Sebastes mentella. Summary results from simulation based on length distribution.

| | 50% recruitment | Sum of squares | Percentage distribution | | | |
|---------------------------------|--------------------|-------------------|-------------------------|------------------------------|-------------|-----------|
| | | | Catch by number | Catch by weight (observ.) | Discards | |
| | | | | | From number | By weight |
| Total fishery in Division Va | 46.2 cm | 506 | 89.6 | 88.1 (89.4) | 1.6 | 1.0 |
| Total fishery in Division Vb | 46.9 cm | 974 | 10.4 | 11.9 (10.6) | 0.4 | 0.3 |
| | | 1 481 | 100.0 | 100.0 (100.0) | | |

Table 57. Sebastes marinus. Summary results from simulation based on length distribution.

| | 50% recruitment | Sum of squares | Percentage distribution | | | |
|--|--------------------|-------------------|-------------------------|------------------------------|-------------|-----------|
| | | | Catch by number | Catch by weight (observ.) | Discards | |
| | | | | | From number | By weight |
| Total fishery in SA XIV | 36.0 cm | 31 168 | 28.6 | 30.6 (32.8) | 11.9 | 5.2 |
| Germany, Fed. Rep. fishery in Div. Va | 36.0 cm | 2 008 | 17.0 | 18.5 (18.1) | 5.2 | 2.8 |
| Total other fishery in Div. Va | 32.0 cm | 6 297 | 54.4 | 50.9 (49.1) | 6.9 | 3.9 |
| | | 39 473 | 100.0 | 100.0 (100.0) | | |

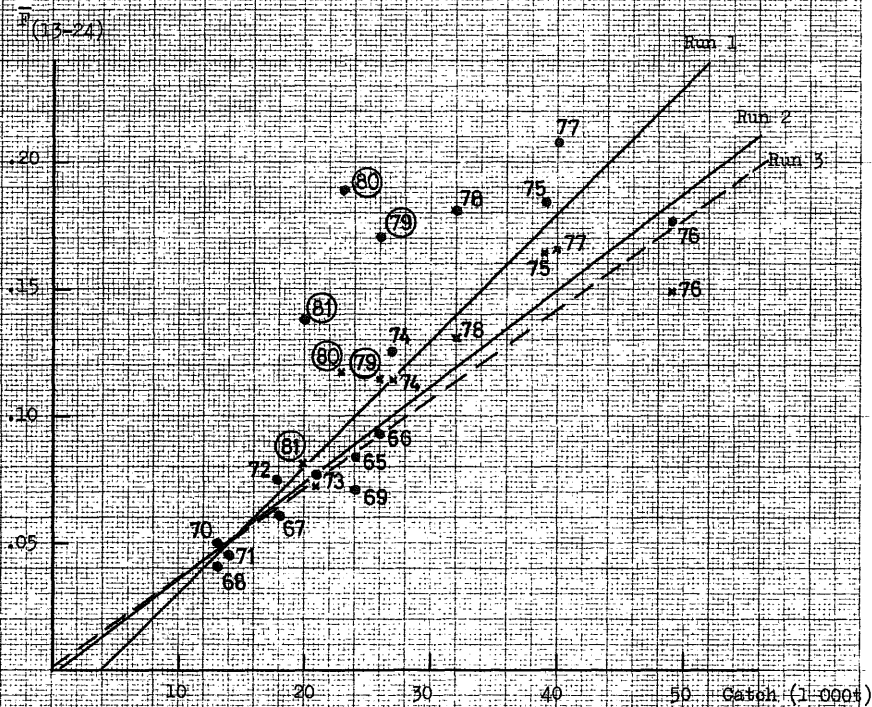


Figure 1. *Sepastes marinus* in Sub-area I and Division 11a.

Plots of $\bar{F}(13-24)$ versus catch.

Dots are values from the first VPA run, and crosses from the second.

1. VPA run : $y = .005x - .02$ $r^2 = .86$

2. VPA run : $y = .004x - .002$ $r^2 = .90$

3. VPA run : $y = .003x + .002$ $r^2 = .90$

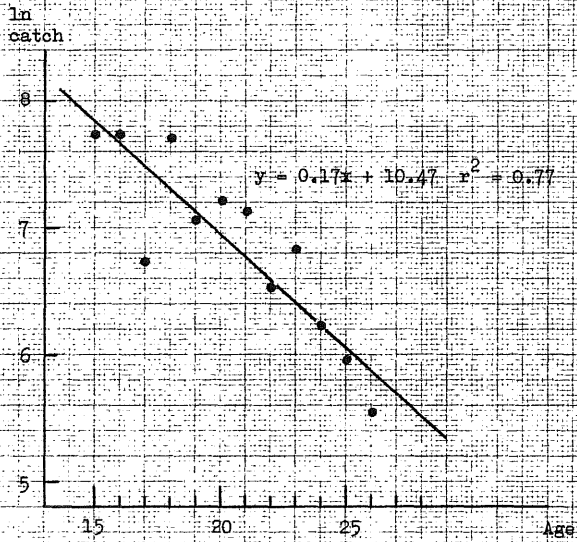


Figure 2. Sebastes marinus in Sub-area I and Division IIIa.
Catch curve for 1981.

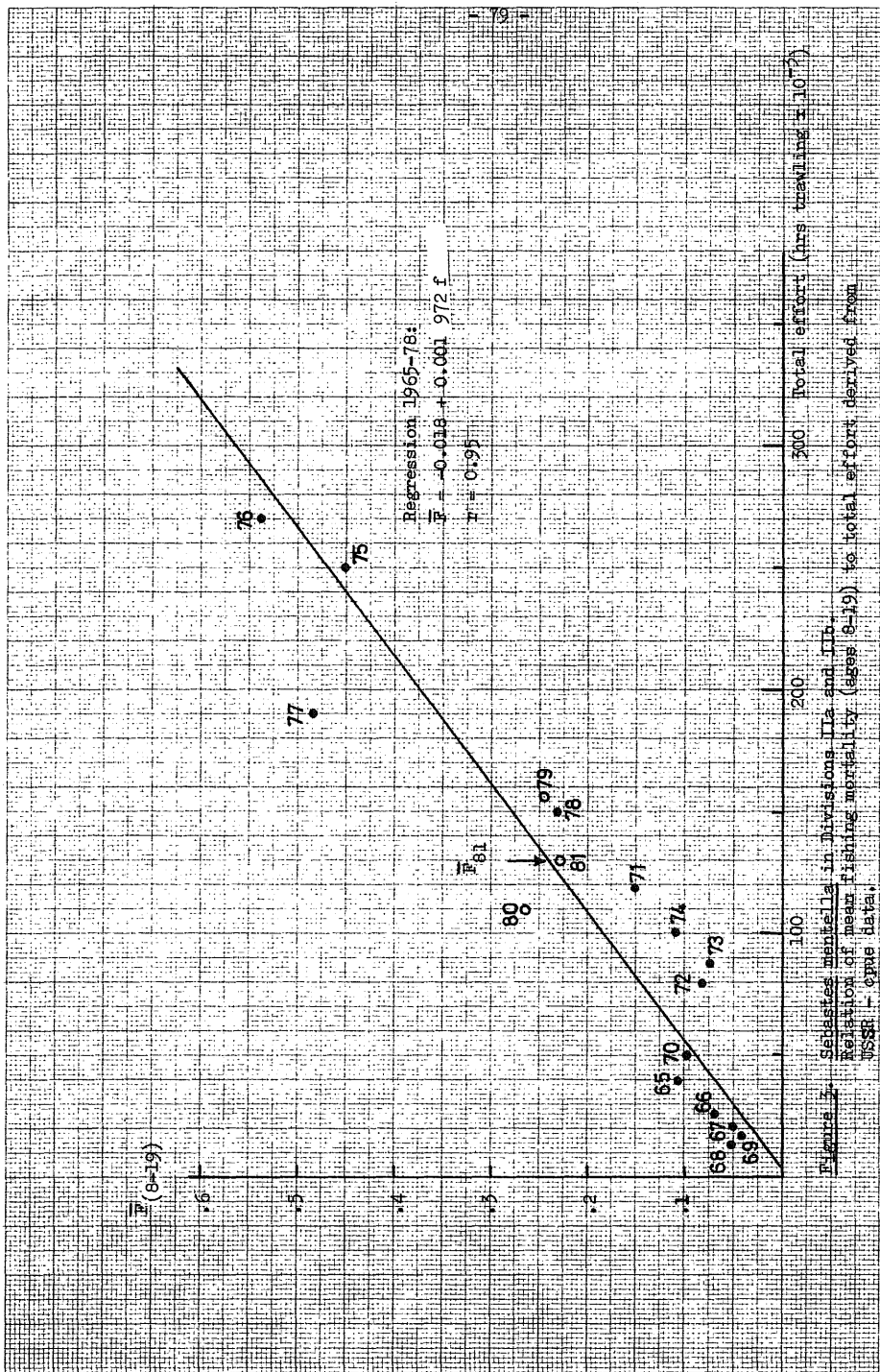


Figure 4. *Sebastes mentella* in Divisions IIA and IIB. Relation of mean fishing mortality (ages 8-19) to total effort derived from German Democratic Republic - opue data.

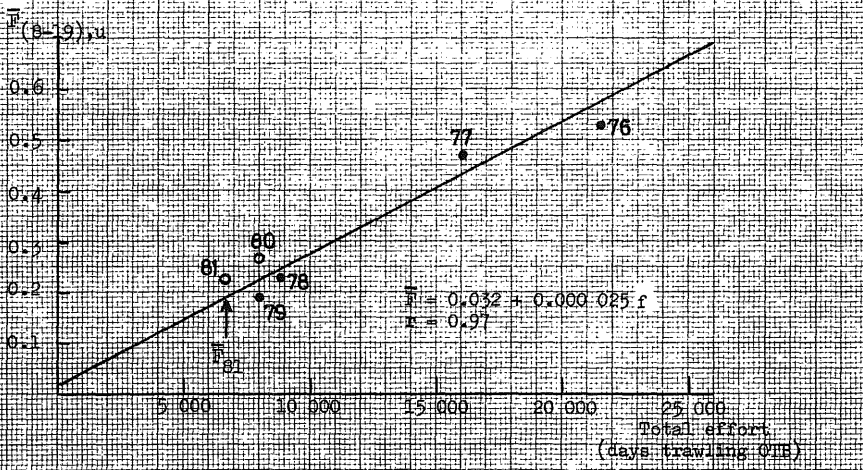
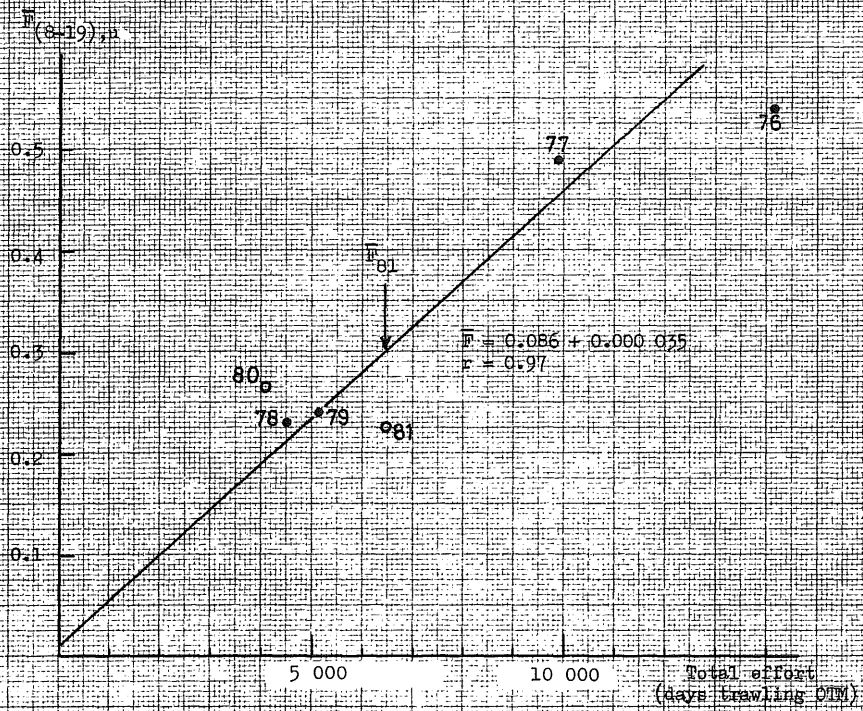


Figure 5. Sebastes mentella in Divisions I1a and I1b.

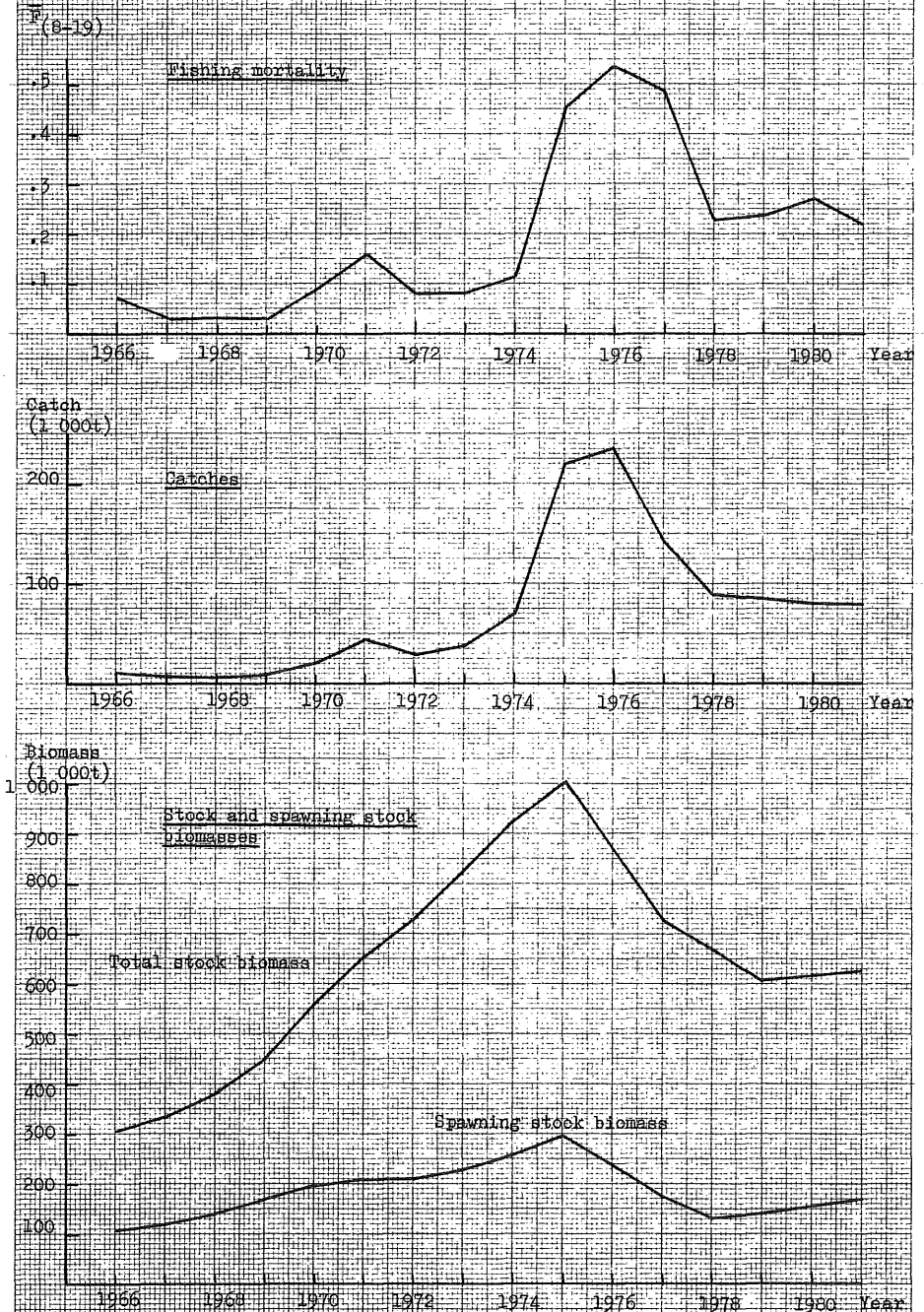


Figure 6. *Sebastes mentella* in Divisions IIa and IIb. Yield and spawning stock biomass per 6-year-old recruit curves for the present exploitation pattern ($M = 0.1$).



Average fishing mortality on age groups 8 to 10

Figure 7. *Sebastes mentella* in Divisions IIa and IIb. Catch in 1983, total biomass and spawning stock biomass at the beginning of 1984 at different levels of $F(8-19)$ in 1983.

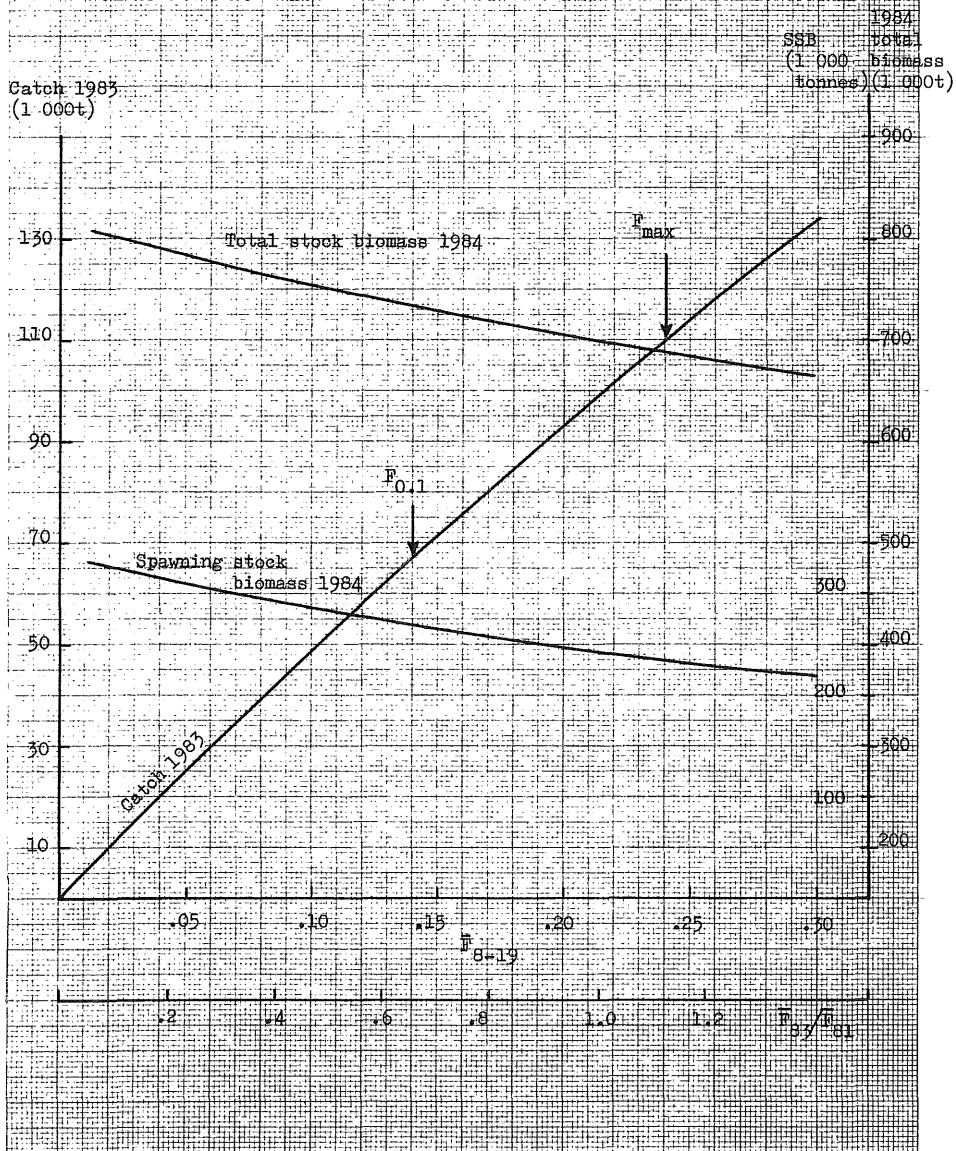


Figure 8. Sebastes maxims in Sub-series V and XIV. Fishing mortality from WPA (I Run 1980) against total catches 1970-79 (1976 exp-1).

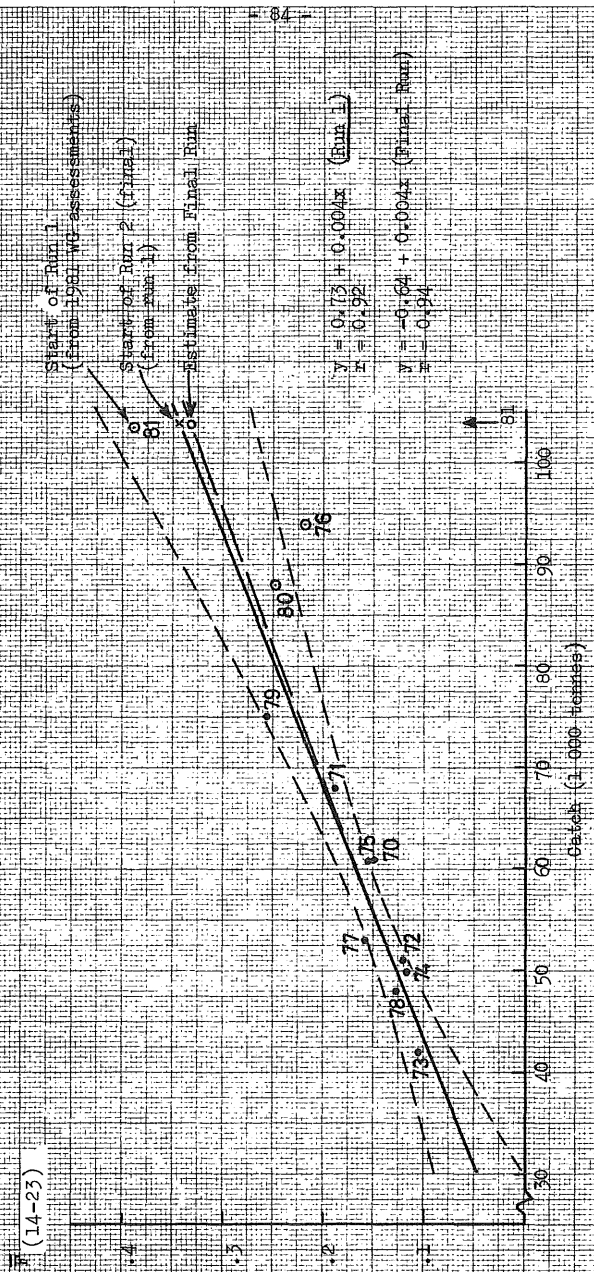


Figure 9. *Sebastes marinus* in Sub-areas V and XIV.

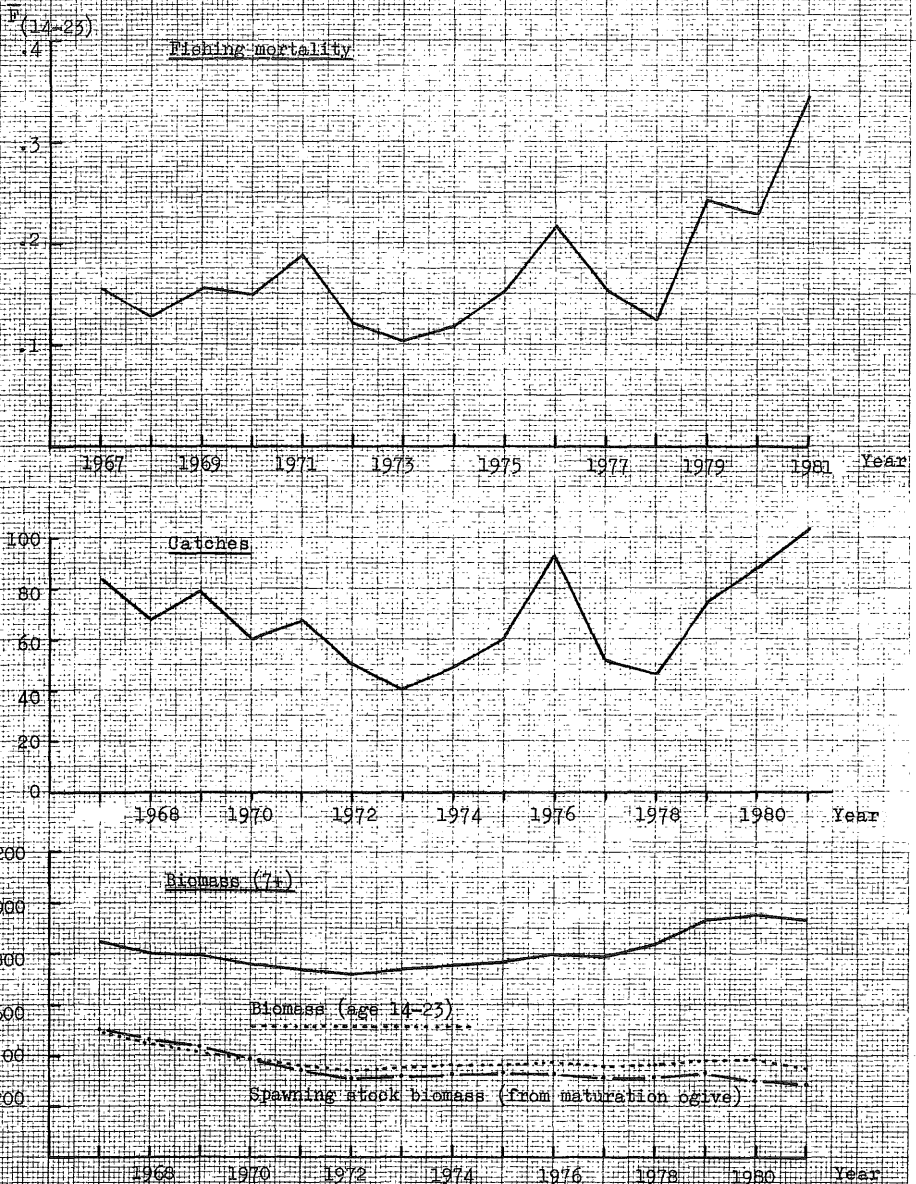


Figure 10. *Sebastes marinus* in Sub-areas V and XIV.
Yield per recruit and spawning stock biomass per recruit.

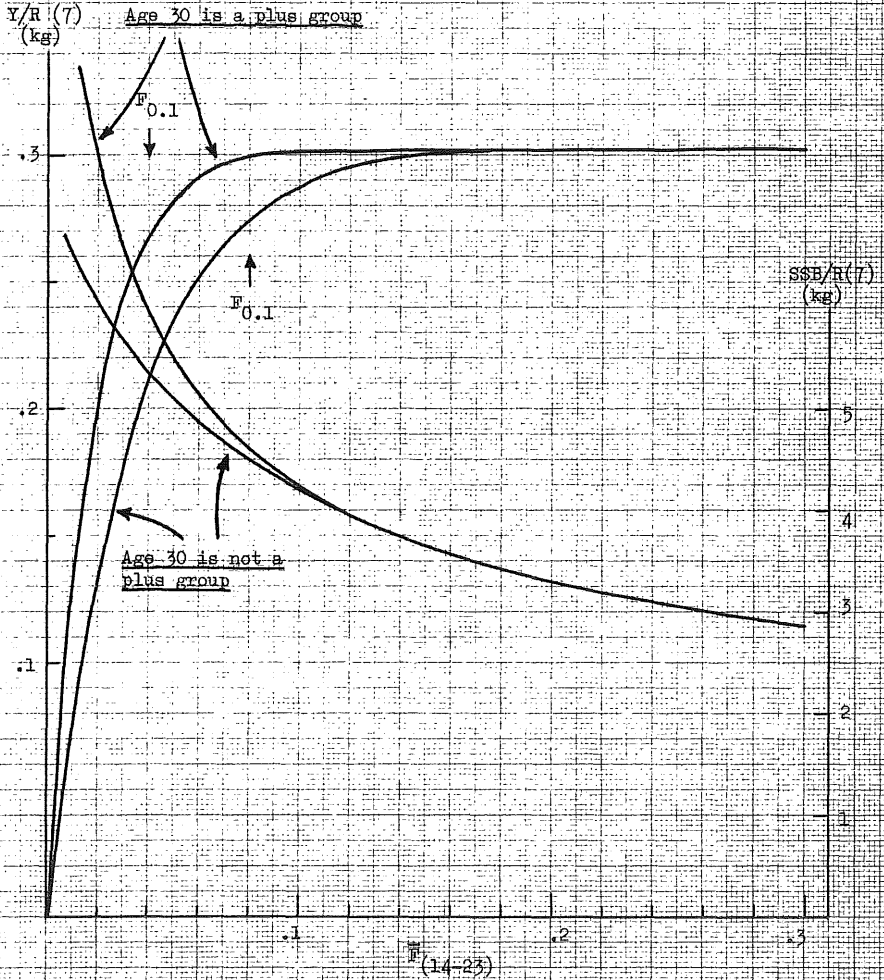


Figure 11. *Sebastes marinus* in Sub-areas V and XIV.

Projections for catch in 1983, total biomass and spawning stock biomass at the beginning of 1984 at different levels of fishing mortality in 1983 and for different catch levels in 1982.

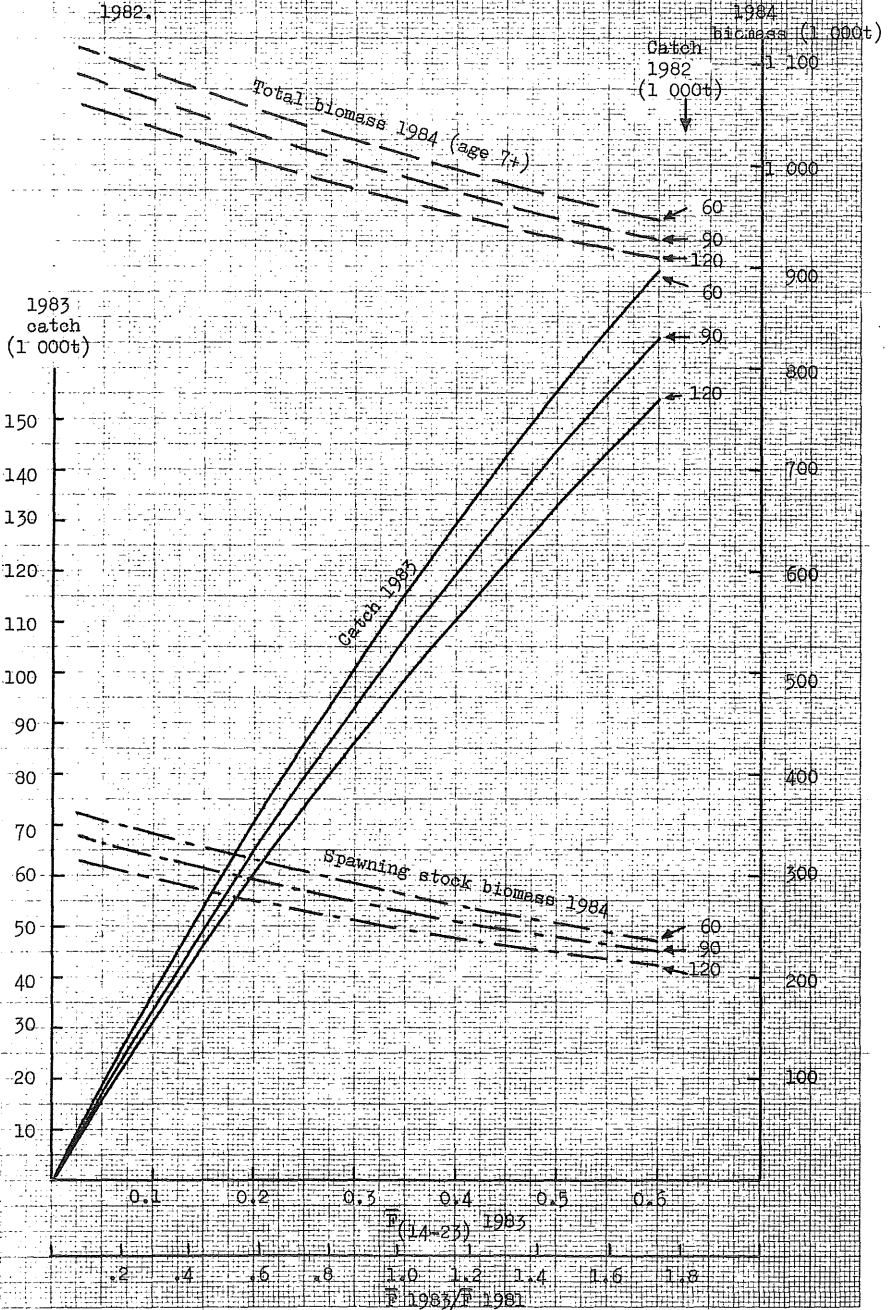


Figure 12. Greenland halibut in Sub-areas I and II. Total effort versus unweighted fishing mortalities on 7 to 11 year olds.

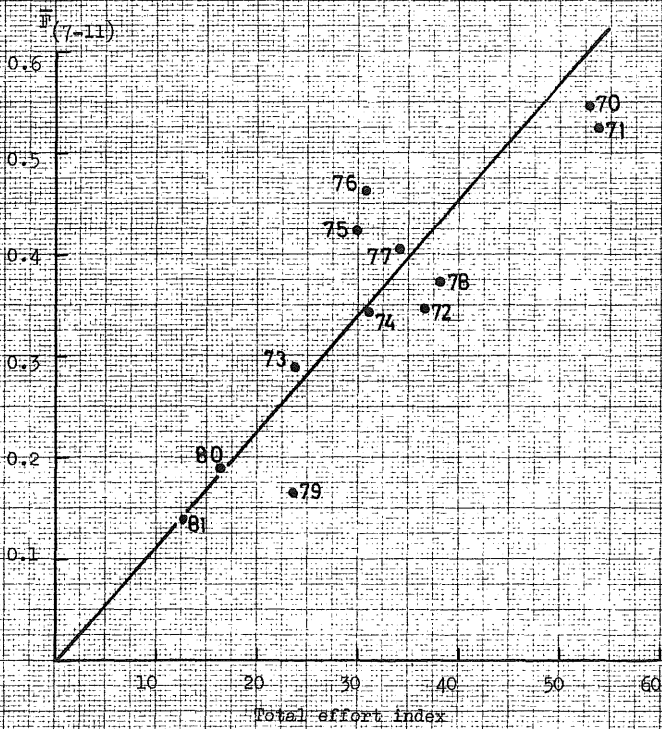


Figure 15a,b. Greenland halibut in Sub-areas I and II. Biomass in mid-season versus catch per unit effort. The biomass estimates as well as catch per unit effort of 7 years and older have been corrected by the SOP factors.

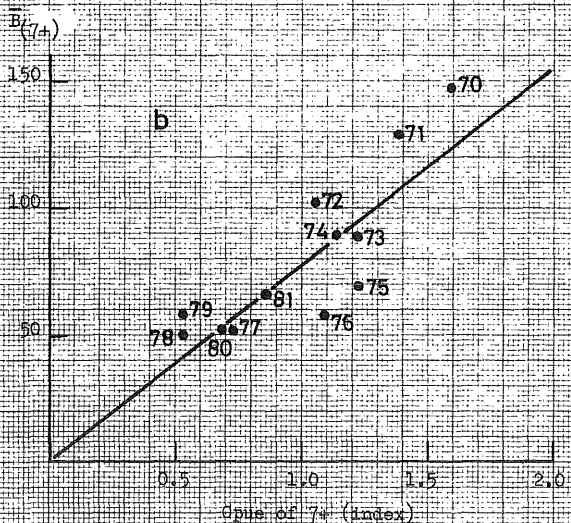
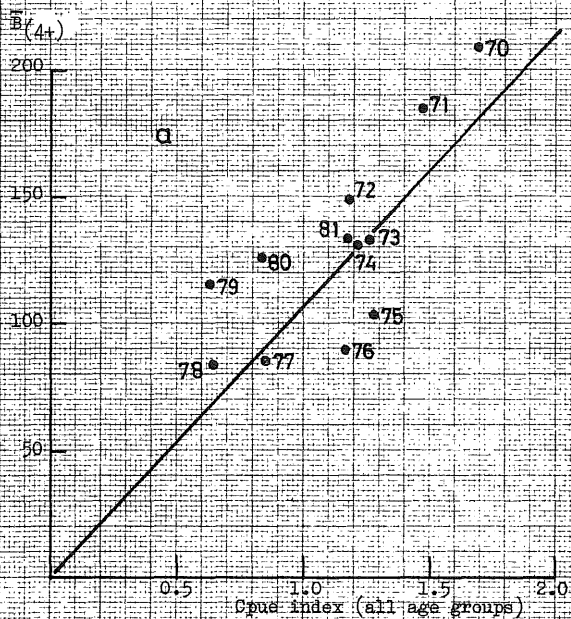


Figure 14. Greenland halibut in Sub-areas I and II. Exploitation pattern. Legend: 1) 1977-78, and 1981 for age groups 5-16+; 2) 1979; 3) 1980; 4) 1981 for age groups 3 and 4.

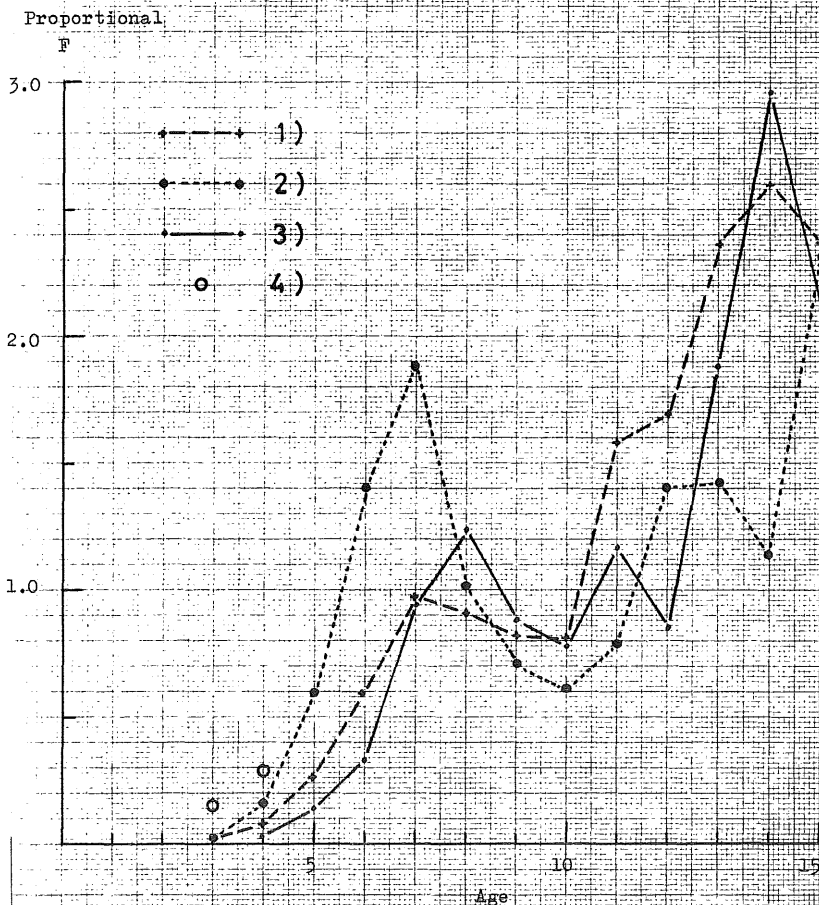


Figure 15. Greenland halibut in Sub-areas I and II. The fishing mortality, catch and development of the stock from 1970-80.

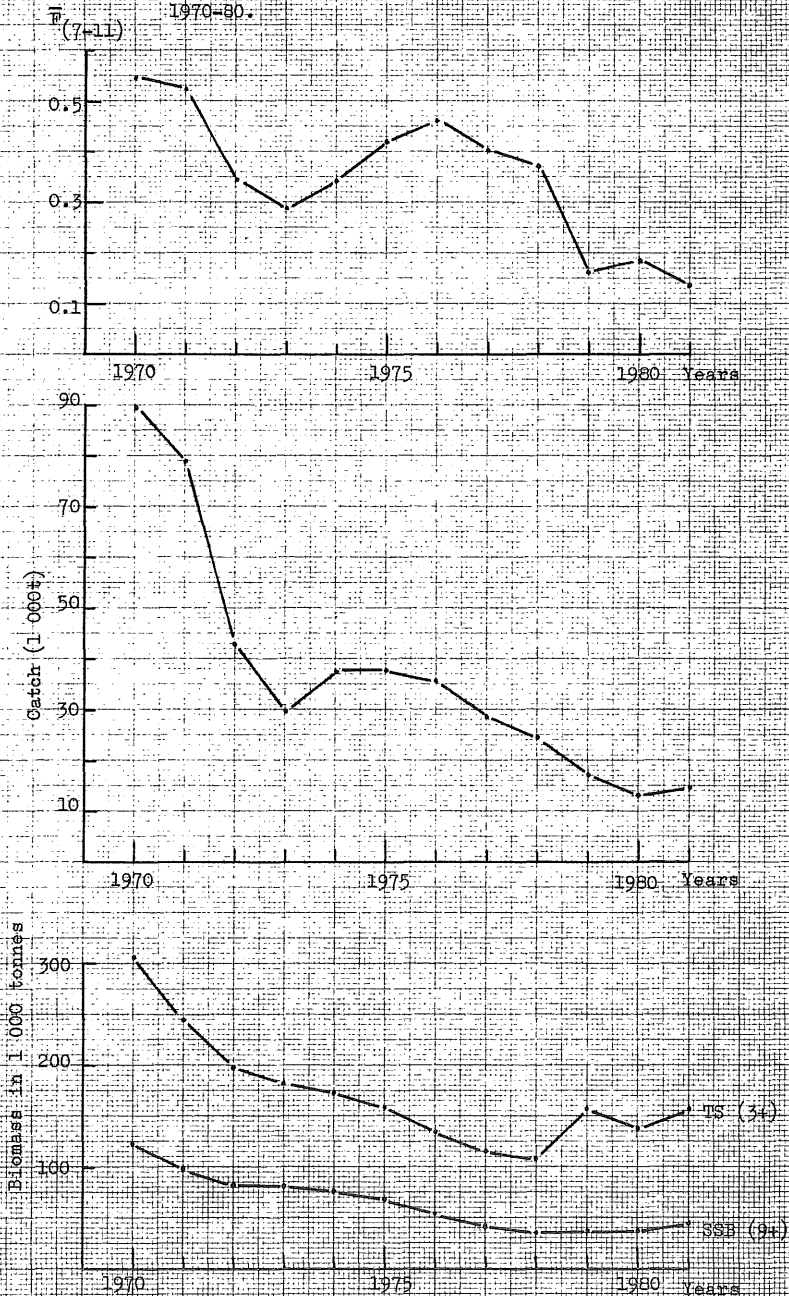


Figure 16. Greenland halibut in Sub-areas I and II.
Yield per recruit and spawning stock biomass per recruit.

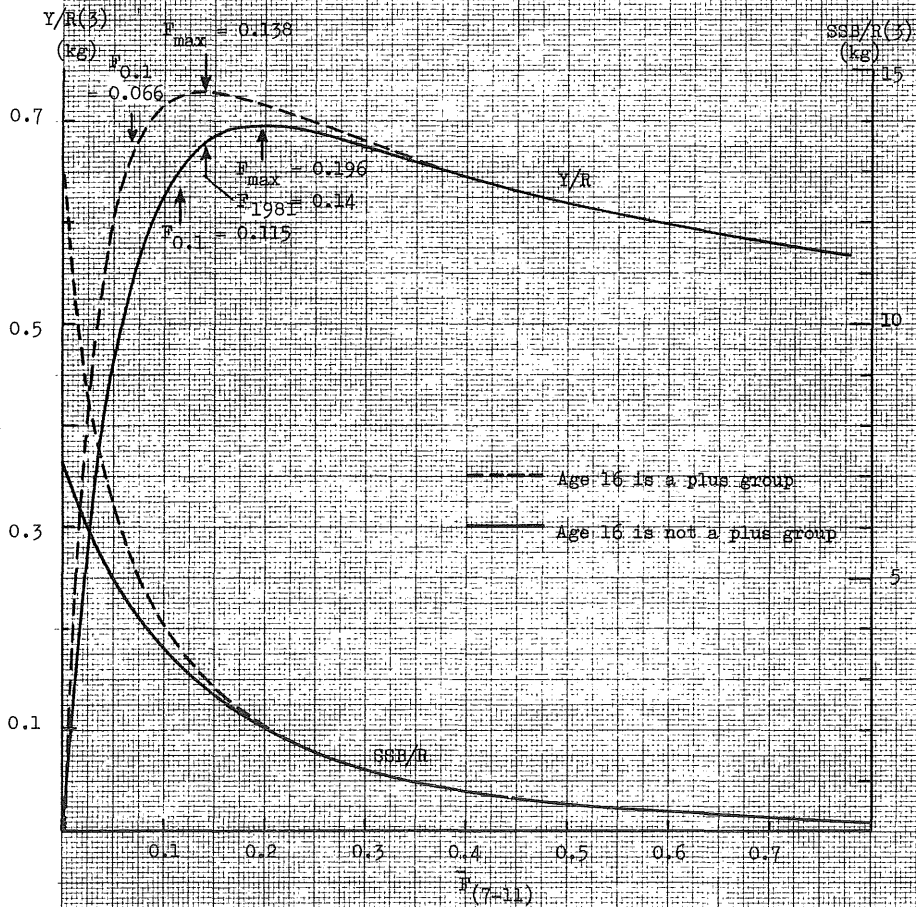


Figure 17. Greenland halibut in Sub-areas I and II. Predictions for catch in 1983, and spawning stock (9+) and total stock (3+) at the beginning of 1984.

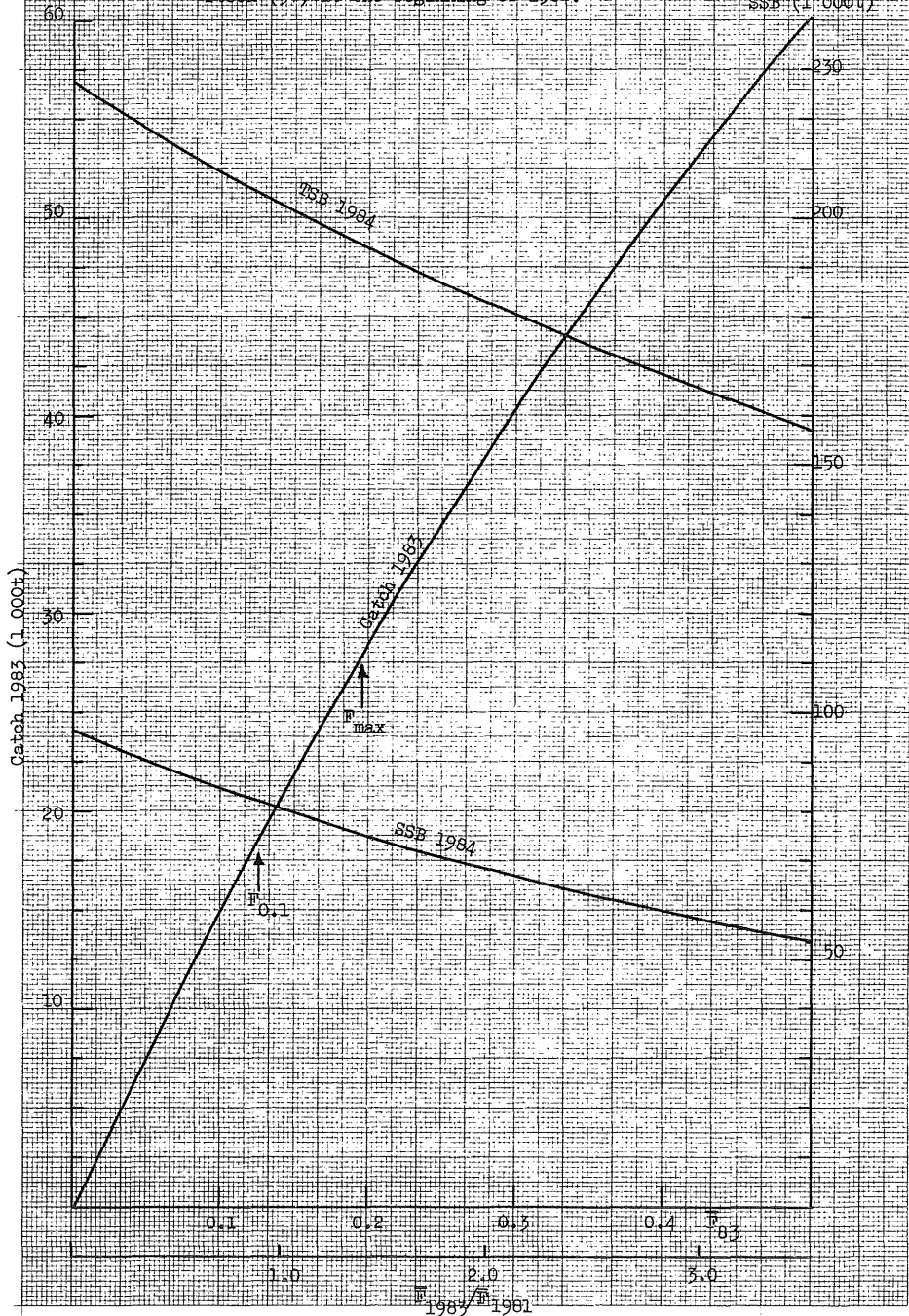


Figure 18. Greenland halibut in Sub-areas V and XIV.

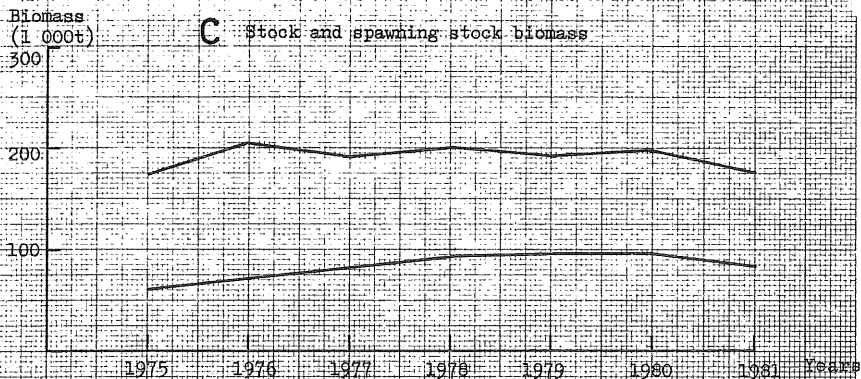
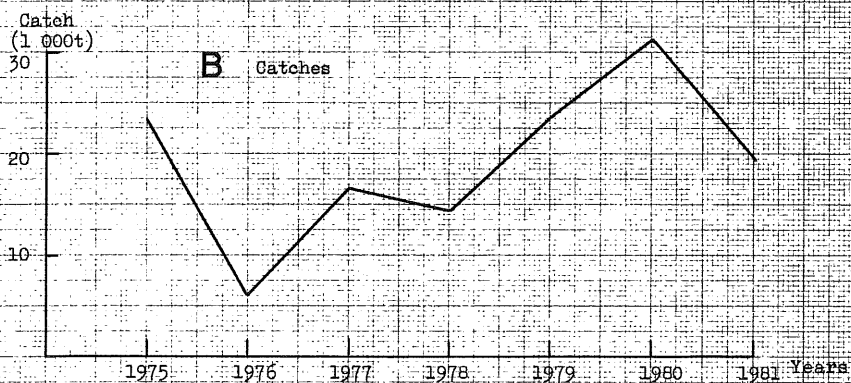
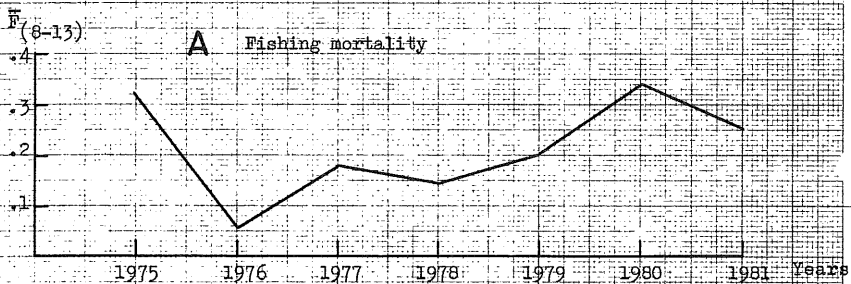


Figure 19. Greenland halibut in Sub-areas V and XIV. Yield and spawning stock biomass per recruit.



Figure 20. Greenland halibut in Sub-areas V and XIV. Production of catches in 1985, total stock biomass and spawning stock biomass at the beginning of 1984.

1985
Yield (1000t)

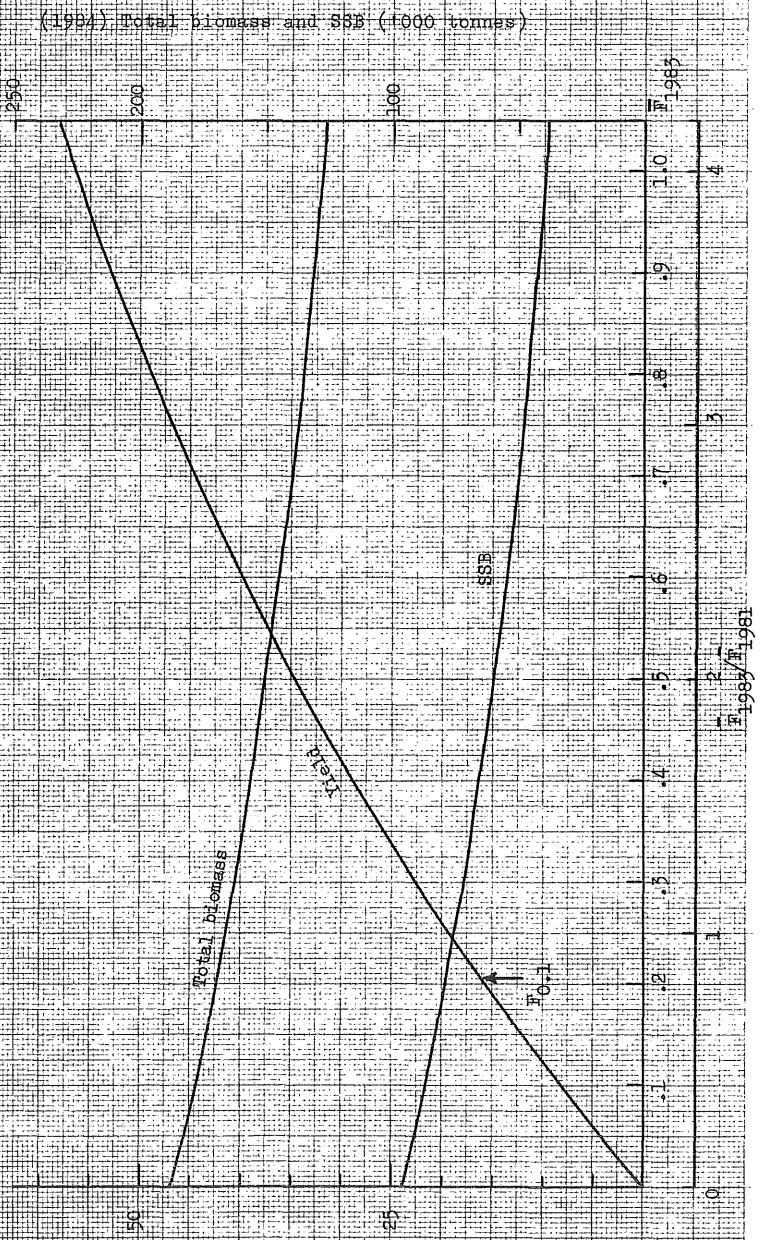


Figure 21. Sebastes mentella. Relative length distribution in the total fishery in Division Va (1965-75).

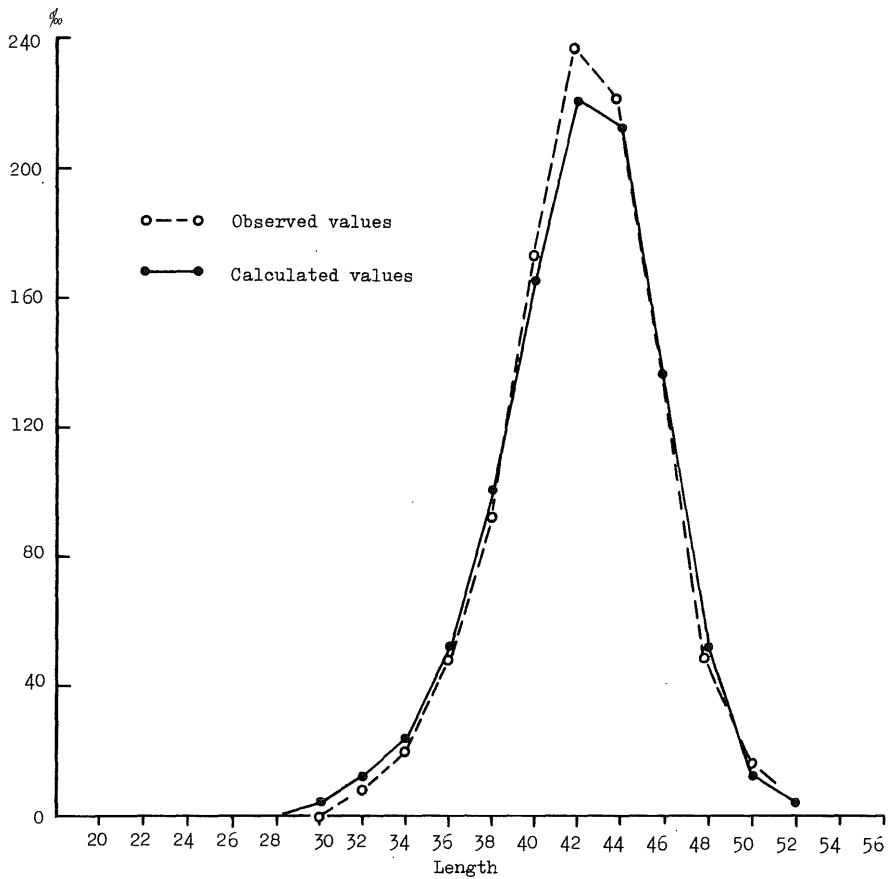


Figure 22. Sebastes mentella. Relative length distribution in the total fishery in Division Vb (1965-75).

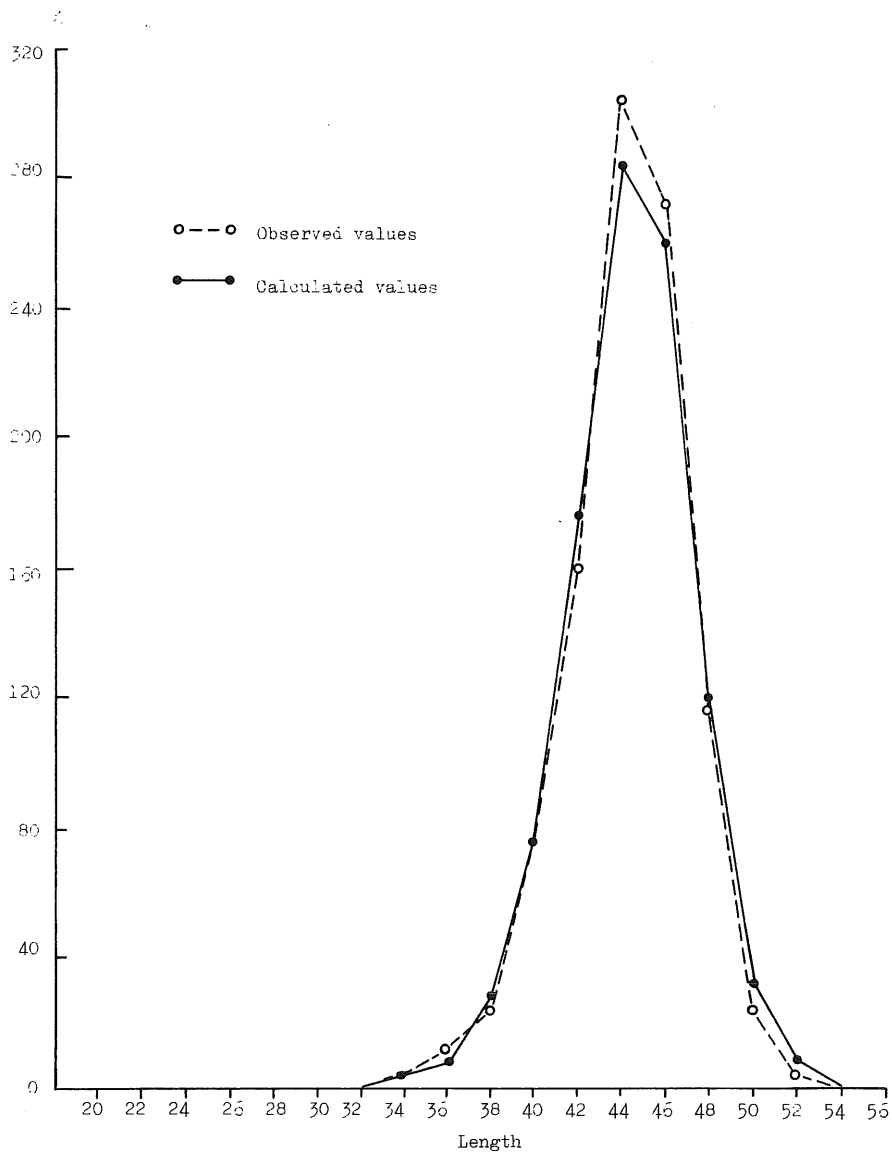


Figure 23. Sebastes mentella in Sub-areas V and XIV.

Total fishing mortalities as estimated by VPA for 1967-75 (G.M.1981/G:7, Table 32), and as estimated from the length distribution (1965-75) by the mesh assessment model.

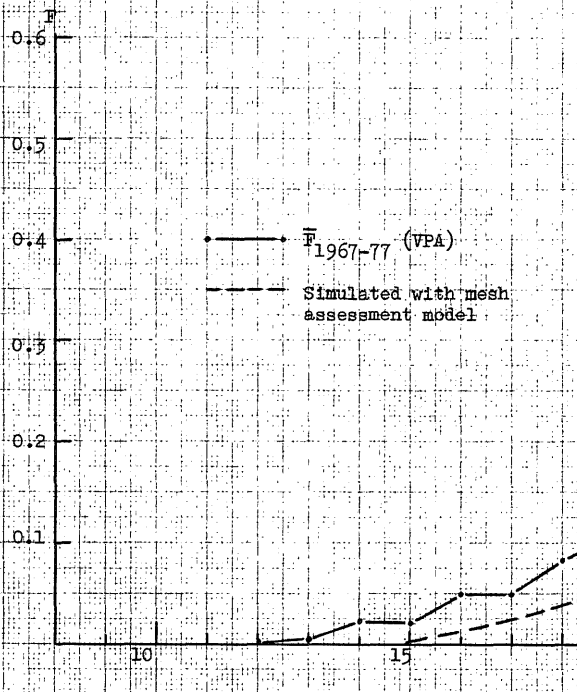


Figure 24. *Sebastes marinus*. Relative length distribution in the total fishery in Sub-area XIV (1955-75).

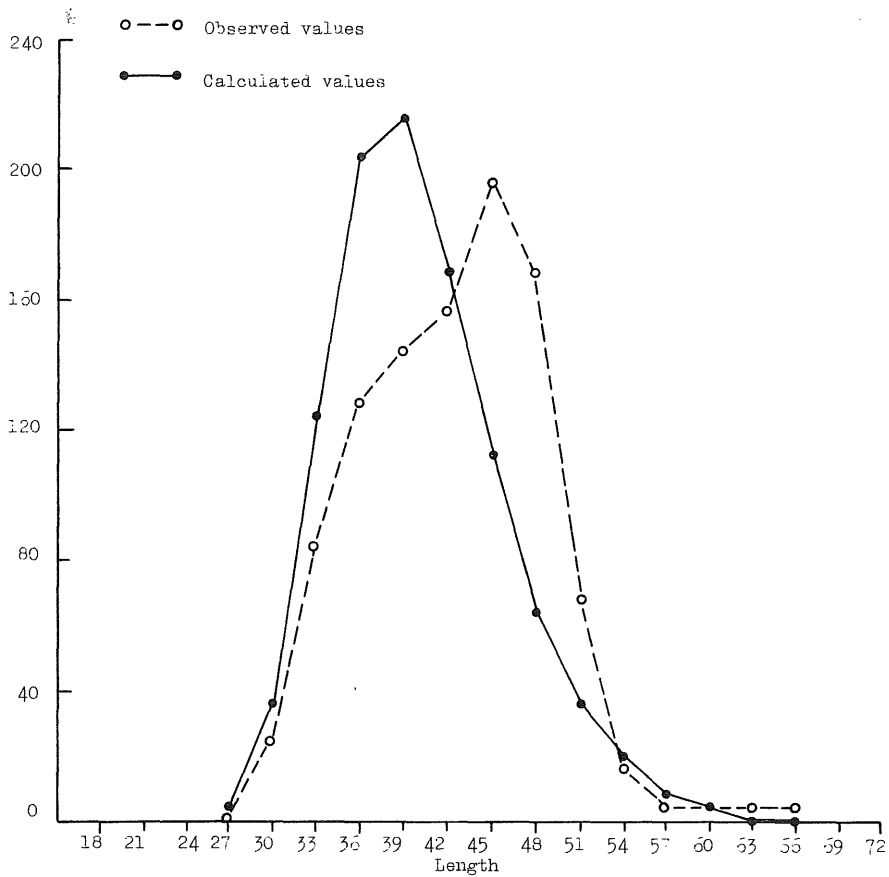


Figure 25. *Sebastes marinus*. Relative length distribution in the Federal Republic of Germany fishery in Division Va (1965-75).

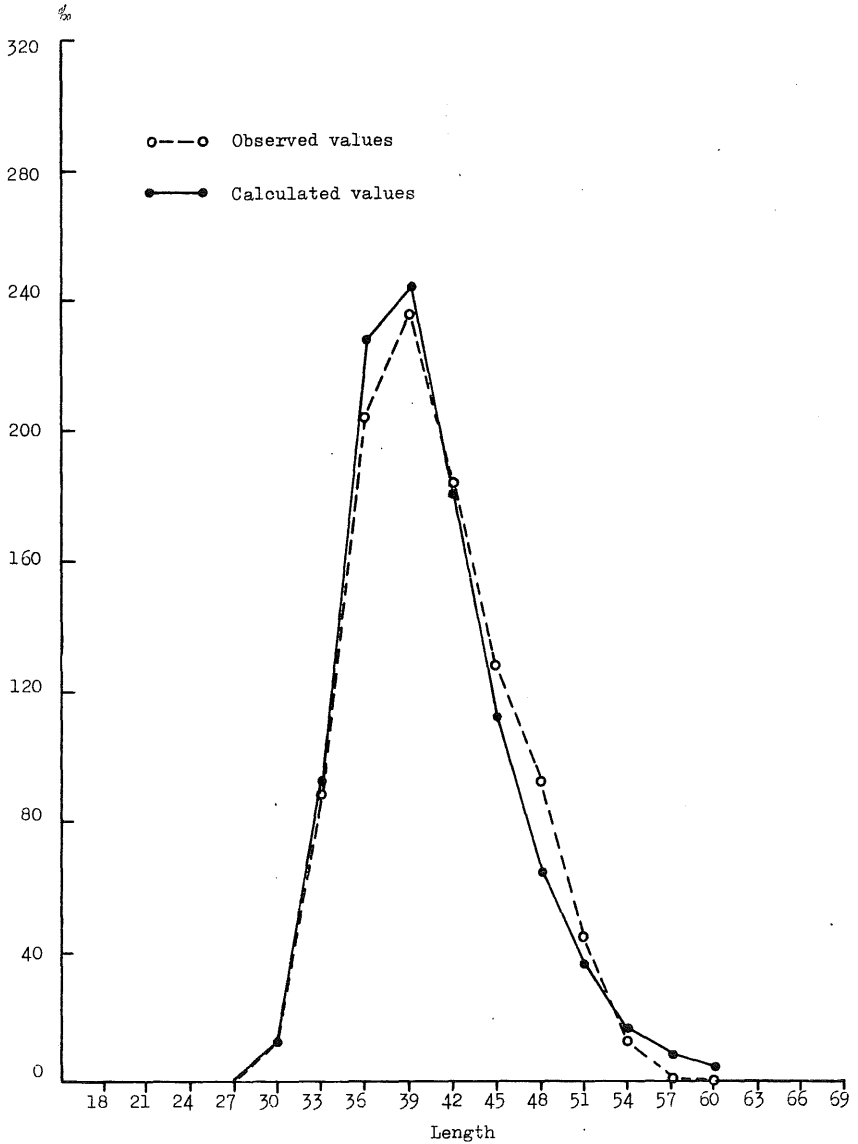


Figure 26. *Sebastes marinus*. Relative length distribution in the fishery in Division Va except for the Federal Republic of Germany fishery (1955-75).

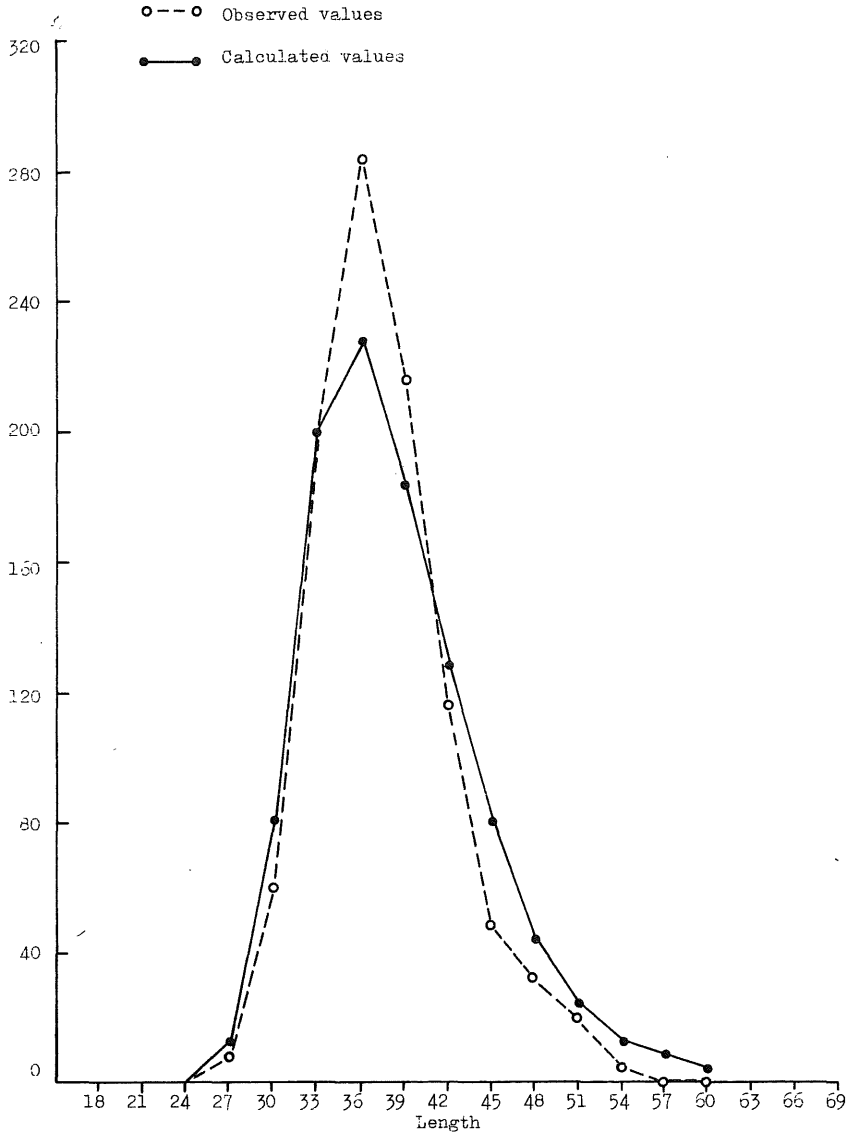


Figure 27. *Sebastes marinus* in Sub-areas V and XIV.
 Total fishing mortalities estimated by VPA for 1967-75 (C.M.1981/G:7, Table 27) and as
 estimated from the length distribution (1965-75) by the mesh assessment model.

