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Subarea 1 cod: Data for 1975 and estimates of yield for 1976-78

by

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1. INTRODUCTION

The present paper follows the same lines as papers on Subarea 1 cod presented at the recent years' mid-term meetings of the Subcommittee on Assessment and at the Annual Meetings of the Commission (Horsted 1973, 1974, and 1975). However, following discussion on the East Greenland cod and on the relation between cod stocks at West Greenland and those at Iceland and East Greenland held by the ICES North-Western Working Group, March 1976, also a section on East Greenland cod has been incorporated in the paper.

Although some statistical information on the 1975 fisheries and some further samples may still occur the 1975 data seem to be fairly fully reported at the time when the paper was produced. However, the adequacy of sampling is still far from good and great uncertainty exists in the analyses due to incomplete sampling.

2. NOMINAL CATCHES 1974 and 1975

Complete statistics for 1974 has been published recently in Statistical Bulletin, Vol.24. The quality of data has been improved insofar as the break down by areas and gear is concerned. For the first time all catches have been reported by division, but not all by month and gear.

Table 1 gives the 1974 nominal catch by division and gear category.

The 1975 catches have generally been fairly well reported currently month by month in the provisional monthly TAC-species reporting, and also preliminary annual statistics was received from several countries prior to the Assessment Meeting, April 1976. However, some uncertainty exists as to the break down by gear. Taking the 1974 break down by gear as a guideline it does, however, seem possible to give the provisional 1975 catches by division and gear as in Table 2.

Of the 47-48 thousand tons landed in 1975 about 7000 tons were taken in local fisheries outside the Convention Area. Thus the catch under the quota regulation may be only 40 thousand tons as compared to the quota of 51 thousand tons. The 1975 catch is, however, slightly above the TAC for 1976 (45 100 tons).

3. TRENDS IN EFFORT AND CATCH PER UNIT EFFORT

A comparison of effort between years is rather difficult, partly due to some changes in gear and vessel type (introduction of set gill nets, for example), and partly due to the wide fluctuations in catch per unit effort between various seasons, especially for the trawlers.

Some analyses to evaluate the trends in overall effort since 1968 have, however, been attempted here.

i) Regarding cod as most evenly distributed in the months July-October incl. and considering the Spanish Fleet of 150-499 GRT pair trawlers as the one in which the least changes have taken place since 1968 the Spanish effort of this category in the months mentioned have been raised to effort corresponding to total catches for the years 1968-1971. Thereafter the Spanish effort has decreased to a level so low that the use of Spanish effort as a basis for total effort seems to be too uncertain.

The actual calculation was based on figures for each division. The Spanish basis effort for Subarea 1 as a whole is set out in Table 3, whereas the resultant overall effort is given in Table 4.

This analysis points to a 50% decrease in effort from the 1968-69 level to the 1970-71 level. Catch per effort seems to have decreased by about 1/3 from 1968 to 1969 but remained rather stable from 1969 to 1971. The decrease in effort was most pronounced in the northern divisions (Divs. 1A-1D) and correspondingly less pronounced in Divs. 1E-1F. Catch per unit effort was higher in all years in Divs. 1A-1D than in Divs. 1E-1F, but trends in catch per unit effort was the same in the two areas.

ii) The above analyses only allowed consideration of material up to the end of 1971. However, since catches have declined further since then another exercise to illustrate trends in effort was made.

For a number of vessel and gear categories (by countries) the catch and effort are reported throughout the period 1968-74. Setting each country/vessel/gear category effort by 1968 to index 1000 the trend in effort for each category can be followed through the period by the annual index relative to 1968. For each of the categories used the 1968 index was then weighted, weighting factor being the corresponding 1968 catch. The annual sum of the weighted indices was then raised (by total Subarea 1 catch) to an overall index for Subarea 1 effort. The details of the exercise are given in Table 5. Fig. 1 illustrates the trends for the four most important categories (by 1968), viz. French otter trawlers 1000-1999 GRT, German (FRG) otter trawlers 1000-1999 GRT, German (FRG) otter trawlers 2000 GRT or more, and Spanish pair trawlers 150-499 GRT. These four categories accounted for 39% of the 1968-72 catch in Subarea 1. The categories given in Table 5 account for 56-66% of the total Subarea 1 catch in the years 1968-71, thereafter for 41% in 1972, 28% in 1973 but only 8% in 1974.

The low proportion of the total catch and effort for the proper categories for 1973 and especially 1974 does, of course, increase the uncertainty of the raised 1973 and 1974 effort figures. The major reason for the declining proportion of the vessel categories in Table 5 is not only

their absolute decline but also the increase in fishing by categories not contained in the table. This applies especially to fleets operating gill nets and to the Greenlandic trawlers. These latter were not in operation before 1969 and only with rather low effort in 1969 and 1970. Only for 1972-74 is their effort recorded as "hours trawled" whereas for 1969-71 and for 1972-74 the number of "days absent" is recorded. Converting "days absent" to "hours trawled" by means of the overall 1972-74 conversion factor (11.2 for the 150-499 GRT category, 12.0 for the 500-999 GRT category) the effort of the Greenland trawlers is as given in Table 6.

The catch per hour of the Greenland trawlers is of the same order as that of Spanish pair trawlers, 150-499 GRT. The Greenland effort in 1974 would thus correspond very roughly to the Spanish effort in Table 5 for the years 1969 and 1971, i.e. the Greenland 1974 effort would contribute by a weighted index value of about 150 in Table 5. The corresponding Greenland catch in 1974 was 11 294 tons. Using these extra values for 1974 would mean to raise a weighted effort of 200 at a catch of 15 185 to a catch of 47 935. This would lead to a total raised value of 631 or 355 relative to 1968. This seems to confirm the 1974 value found by the exercise in Table 5.

The trends in effort occurring from this exercise are that there was a decrease in effort by about 30% from 1968 to 1969, and further by some 40% from 1969 to 1970 whereas the effort has remained rather stable in the 1970-74 period at a level of about 1/3 of the 1968 level.

No learning factor or factors for possible increasing efficiency of gears have been taken into account in these analyses. However, if such factors do act then the decline in stock abundance is more pronounced than expressed by the catch-per-effort figures obtained from Table 5. These abundance indices are as follows:

YEAR	1968	1969	1970	1971	1972	1973	1974
c.p.u.e.-INDEX	100	80	75	87	66	46	35

If the effort and catch-per-unit-effort figures found (p.3) reflect the true situation in the cod fishery in the Subarea then it can be stated that the drastic reduction in catches since 1968 can be ascribed partly to a reduction in the stock and partly to a reduction in effort, both of about the same effect, viz. to reduce the 1968 level by about 1/3 each, leading to a 1974 catch level of 1/8 - 1/9 of the 1968 level.

4. MEAN LENGTH AND WEIGHT OF AGE GROUPS IN 1974

A length sample supplied by the UK for 1975 gives mean length for the total sample of 64.9 cm and mean weight 2.098 kg. Supposing this is gutted weight and applying a conversion factor of 1.22 the corresponding round fresh mean weight is 2.56 kg, which seems to fit well with the normal mean length/mean weight relation.

For analysis of mean length and weight by age groups, however, only Danish samples were available to the author when the present paper was produced. These samples are presented in Table 7.

As will be seen the inshore sample contains fish which in most age groups have a somewhat smaller mean length than the offshore sample, probably due to another selectivity in pound nets than in trawls but maybe also due to the tendency of cod to leave the inshore waters when they grow up to maturity. The small material of fish older than five years in the inshore sample seems to point to this latter explanation. In the following only the offshore samples are considered.

For each age group and for each quarter an unweighted mean of the mean weights given in Table 7 is taken. This unweighted mean is given in the left-hand part of Table 9. An overall weighted mean of the quarterly mean figures is given at the right-hand part of the same table, weighting factor being the quarterly catches in 1974 given as percentages of the total catch in that year as shown in Table 8.

Also given in Table 8 are the provisional quarterly catches in 1975 as known by mid-March, 1976. However, since information is lacking from some countries, which traditionally have their main fishing in the third quarter, the preliminary 1975 quarterly break down may be so heavily biased that the 1974 figures may be more proper to use as weighting factors.

The mean weights obtained from the 1975 samples are compared to those obtained from the 1974 samples (Horsted, ICNAF Res.Doc. 75/31) in Table 9. It is seen that for the younger age groups (III-V) the 1975 figures are somewhat higher than the 1974 figures. For age-groups VI-X (among these is the predominant 1968 year-class) there are only minor differences. For age groups older than 10 the material is so limited that a comparison between years is meaningless.

In former years' assessment three sets of mean weight by age have been used, viz. one set for Divs. 1A-1D, another for Divs. 1E-1F and yet another for Subarea 1 as a whole. The 1975 samples do not allow a divisional break down. This is due in part to the fact that the samples from June and July were obtained from catches taken on trips which covered Divs. 1C-1E. However, comparing the sample from Div. 1E, August to the March and May samples from Div. 1C and Divs. 1C+1D, respectively, it does not seem to lead to any severe bias to use the same mean weight for Divs. 1A-1D and Divs. 1E-1F for 1975 and for the prognosis, since the most important age groups have about the same mean size in the samples mentioned above.

For age groups older than 10 years it seems most proper to adopt a slowly increasing weight. Plotting the 1974 and 1975 mean weights for ages X-XV+ leads to the round figures given below for these year classes. For age-groups III-X the 1975 figures are used. Thus for the present analyses the following age/weight table is used:

AGE	3	4	5	6	7	8	9	10	11	12
KG	0.71	1.30	1.85	2.67	3.99	4.43	5.06	5.60	6.0	6.6
AGE	13	14	15+							
KG	7.7	9.0	10.5							

It should be pointed out, however, that the use of a single set of mean weights seems proper at present only because the predominant year class (1968) shows no significant difference in mean weight between divisions.

5. RESULTS OF RECENT TAGGING EXPERIMENTS

Tagging experiments on cod in recent years have unfortunately been made to a less extent than previously and have been made mainly on small cod discarded from pound net catches in coastal waters and in various fjords.

For judging fishing mortality on fully recruited cod in the offshore fisheries only tagging experiments from offshore and coastal waters are used, and from these only cod bigger than 50 cm when tagged are used.

Such tagging experiments have been pooled for the years 1965-67, 1968-69 and 1970-71 respectively, and for Divs. 1A-1D and Divs. 1E-1F respectively. The recaptures in Subarea 1 from these experiments are given in Table 10.

Provided effort (or rather fishing mortality rate) is constant throughout the period when recaptures are analyzed then the slope of the regression line of log (recapture rate by year) should indicate the instantaneous total mortality rate, Z, in the area.

The equations for the regression lines are also found in Table 10. However, as demonstrated in Section 3, the effort in the period 1968-74 has not been stable, but decreasing. Therefore the regression lines in Table 10 will overestimate the total mortality rate. As a first rough estimation to overcome this bias the number of recaptures for the 1968-69 experiments have been adjusted by the factor of 1.4 for recapture years 2-4, corresponding to the relation between the 1969-70 level of effort and the level in the following couples of years (see Table 5, bottom line). The recapture rates for the 1968-69 experiments for Subarea 1 as a whole is hereby changed to

YEAR	1	2	3	4
% recaptures	1.44	0.63	0.25	0.06

The regression line on \log_e (recapture rate) is expressed by $y = 1.54 - 1.05 x$.

This slope is practically the same as that obtained from the 1965-67 pooled experiments also given in Table 10. One would, therefore, be inclined to state that no significant change in mortality rates has taken place in recent years. However, the material of recaptures is very scarce since 1968 with low recapture percentages compared to former years when percentages of about 20 were common. Uncertainty as to recovery of tags in modern fisheries and to proper reporting of recovered tags does also seem to have increased. Therefore, less attention should probably be paid to the slope in these experiments than to the fact that total recapture rate has decreased considerably and especially to the fact that effort has decreased as mentioned in Section 3. The tagging experiments do therefore, not point to a need for a revision of the F value used in last year's analyses, i.e. that overall F in 1973 is set about 0.35. The same value is initially adopted for 1974 and 1975 for fully recruited age groups.

6. NUMBERS LANDED BY AGE GROUPS IN 1974 and 1975

Numbers landed per age group for the years 1965-73 were given in Res. Doc. 75/31 (Horsted l.c.) together with preliminary figures for 1974.

Revised figures for 1974 and preliminary figures for 1975 are found in Table 11. It will be seen that the 1968 year-class was the most predominant one in both years and in northern and southern divisions. Although fish of the 1968 year-class are considered to have increased their mean weight by about 44% from 1974 to 1975 the mean weight of the total landings does not seem to vary much. This seems to be due to a rather strong inflow of younger age groups in 1975 as compared to 1974.

In both years the catches by otter trawls are represented by samples, and the variation between these samples is rather small. For the F.R.Germany estimates of numbers landed were directly supplied (A.Meyer, pers. communication) except for Divs. 1A-1D in 1975. For most of the other countries Danish samples were used. The greatest uncertainty is connected with the gill net and long line catches for which no samples were available in 1974 and 1975.

It was, therefore, necessary to construct a sample. This was done in the way that a Portuguese gill net sample for 1973 from Div 1D was compared to a Danish otter trawl sample for the same division and year. The ratio between each age group for these two samples was then taken as valid also for 1974 and 1975 and a gill net sample constructed from the otter trawl samples from these years.

For the fisheries off East Greenland the same figures as those used by the ICES North-Western Working Group, March 1976, have been adopted. These are based on estimates by A.Meyer (pers.comm.) of numbers by age in the German catches and were raised to the total catch for the ICES Subarea XIV. The figures are set out in Table 12 for the years 1965-75. The mean weights in the bottom line of the table is calculated on the basis of the 1975 mean weights for West Greenland cod as set out in Table 9.

7. INFORMATION ON FUTURE RECRUITMENT

Recruitment of Subarea 1 cod to the fisheries starts at an age of 3-4 years. The year classes in question for recruitment in 1975-78 are thus year-classes 1971-75.

Predictions of the strength of the 1975 year-class can at present be made only on hydrographic and plankton observations in 1975. These will be described in details in the Danish Research Report, 1975. Temperatures indicate that the year class could be relatively better than those after 1968, and the occurrence of larvae in the plankton in Divs. 1B-1D in July also seems to point to the possibility of a year class of moderate to average strength.

The 1974 year-class so far has shown no signs of a noteworthy strength, although the temperatures in 1974 were better than in the previous years after 1968, but not as good as in 1975. The year class is, therefore, considered poor in the prognosis.

The greatest interest for the prognosis is connected with the new information on the 1973 year-class. On the basis of temperatures and larval surveys this year class was previously judged to be slightly better than the preceding 1971 and 1972 year-classes, but up to the beginning of 1975

it was not considered to be more than just better than these very poor year classes.

However, the Danish hauls with fine meshed otter trawls in Divs. 1C-1E revealed a great inflow of this year class throughout 1975.^{x)} Furthermore the year class seems to have accounted for a considerable discard rate in the coastal poundnet fishery in 1975. Also German groundfish surveys in Div. 1F in December 1974 showed the 1973 year-class to be relatively very abundant (Meyer, 1975). Probably the year class originates to a great extent from spawning off East Greenland. Its' absolute strength is difficult to judge as long as it has not been fished commercially, but as a preliminary judgment it is considered to be of the same order as the 1966 and 1968 year-classes. These two year classes in the VPA-analyses are both in the order of 60 million fish in Divs.1A-1D but seem to differ somewhat in Divs. 1E-1F, the 1966 year-class being in the order of 15 million fish, the 1968 year-class in the order of 35 million fish, all figures as 3 years old (beginning of the year). A mean figure of 25 million fish is chosen as the strength for Divs.1E-1F.

The 1972 and 1971 year-classes have been considered poor in the past. The 1975 samples do not lead to a revision regarding the 1972 year-class. However, it should be noted that the 1971 year-class has been observed as relatively abundant both in the only commercial F.R.Germany sample in Div.1C (otter trawl, April), where 83% of the sample was made up of this year class. Also in some Danish samples the 1971 year-class has had a higher abundance than expected. The only UK sample (length sample, Div.1E, May) converted by Danish age/length key to age frequency shows 38% of the 1968 year-class and 31% of the 1971 year-class. However, the high relative abundance of this newly recruited year class may be due to a rather steep decline of the 1968 year-class at West Greenland, possibly due to emigration to East Greenland, where in 1975 about 50% by numbers of the FRG landings seem to consist of this year class.

The following values for recruitment (thousands of 3 years old fish) have been used in the forecasts.

Year class	Numbers x 10 ⁻³ at age 3		
	1A-1D	1E-1F	Subarea 1
1970	13 000	7 000	20 000
1971	30 000	10 000	40 000
1972	20 000	5 000	25 000
1973	60 000	25 000	85 000
1974	30 000	10 000	40 000
1975	40 000	10 000	50 000

8. VALUES OF INSTANTANEOUS FISHING MORTALITY RATE (F) FOR VIRTUAL POPULATION ANALYSES

In Section 5 it was argued that a probable value of F for fully recruited age groups in the years 1973-1975 could be 0.35.

For years prior to 1973 the values of F for oldest age group used in last year's VPA-analyses (Horsted l.c.) were

YEAR	1965	1966	1967	1968	1969	1970	1971	1972
input F	0.70	0.60	0.70	0.77	0.55	0.30	0.30	0.30

The values for 1965-69 were adopted from Schumacher (1971, Table 2).

These values together with F for 1973 = 0.35 gave the following straight mean values of F for fully recruited age groups (ages 6-14 for Divs.1A-1D, 7-14 for 1E-1F and Subarea 1 as a whole).

YEAR	1965	1966	1967	1968	1969	1970	1971	1972
F, Divs.1A-1D	0.45	0.52	0.68	0.80	0.62	0.29	0.45	0.65
F, " 1E-1F	0.49	0.61	0.55	0.51	0.39	0.59	0.62	0.52
F, Subarea 1	0.46	0.54	0.62	0.69	0.54	0.36	0.49	0.61

Most of the many analyses carried out by various persons and working groups (e.g. Horsted, l.c., Schumacher, l.c., Anon. 1973) have used values of F in 1968 about 0.80 for the Subarea 1 as a whole with F in Divs.1A-1D above this value and F in Divs.1E-1F below the value.

If the 1968 value of F = 0.80 for Subarea 1 as a whole is maintained as the likely one, and if one considers the trends in effort as described in Section 3, Table 5 as indication of changes in F values, then one would assume approximate F values for Subarea 1 as a whole to be

1968	1969	1970-74
0.80	0.55	0.30

Remembering that the effort values did not take learning factor and gear development into account it may be proper to raise the last figure from 0.30 to 0.35, the same value as initially adopted in Section 5.

Taking into account that the decrease in effort has been most pronounced in the northern divisions (Table 4) it may be proper to assume the following set of F values for the northern and southern divisions, respectively.

	1968	1969	1970-74
Divs.1A-1D	1.00	0.59	0.35
" 1E-1F	0.50	0.50	0.35
Subarea 1	0.80	0.55	0.35

For analyses of Divs.1E-1F and East Greenland combined the values for 1965-69 are taken as for Divs.1E-1F separately, whereas for the years 1970-75 the value of 0.22 used by the North-Western Working Group for 1975 is used.

For the years 1965-67 the initial input F is taken as the mean values for fully recruited age groups mentioned in the beginning of this section. The stock-record tables have been worked out on the basis of these values and other parameters already mentioned. However, also other runs of the VPA were made with various input values of F. These runs, available to the Assessment Subcommittee, includes the following sets of F-values.

<u>RUN 1.</u>	1965	1966	1967	1968	1969	1970	1971	1972	1973-75
1.-4. All areas	0.70	.60	.70	.77	.55	.30	.30	.30	.35

These values are those used in last years' VPA-analyses as mentioned in the beginning of this section

RUN 2.

	1965	1966	1967	1968	1969	1970	1971	1972	1973-75
1. Subarea 1	0.46	.54	.62	.69	.54	.35	.35	.35	.35
2. Divs. 1A-1D	0.45	.52	.68	.80	.62	.35	.35	.35	.35
3. " 1E-1F	0.49	.61	.55	.51	.39	.35	.35	.35	.35
4. " "	0.49	.61	.55	.51	.39	.22	.22	.22	.22
+East Grl.									

The values are for the years 1965-69 those obtained as mean values in last year's VPA-analyses by the F-values in Run 1 (see first part of this section). The value of 0.22 for Divs. 1E-1F plus East Greenland for recent years is the one used by the North-Western Working Group for the year 1975.

RUN 3.

1. Subarea 1	0.46	.54	.62	.80	.55	.35	.35	.35	.35
2. Divs. 1A-1D	0.45	.52	.68	1.00	.59	.35	.35	.35	.35
3. " 1E-1F	0.49	.61	.55	.50	.50	.35	.35	.35	.35
4. " "	0.49	.61	.55	.50	.50	.22	.22	.22	.22
+East grl.									

These values are those referred to in the text above and in the stock-record sheets.

For all three runs and all four areas the runs were made both with 1974 and with 1975 as the last year of data. (The computer outprints are coded accordingly, e.g. 2, 3, 75 = run 2, Divs. 1E-1F with 1975 as last year of data).

9. OTHER PARAMETERS FOR VPA-ANALYSES AND PROGNOSIS

The natural mortality for all age groups is taken as $M = 0.20$, the value used in all previous assessments.

A coefficient of emigration is added to the above mentioned M-value for age-group 7 and older fish to cover the spawning migration to East Greenland - Iceland. As in former years this coefficient is 0.15 for Divs. 1E-1F and 0.05 for Subarea 1 as a whole. When Divs. 1E-1F and East Greenland are combined the coefficient is set at 0.29, the same value as used by the ICES North-Western Working Group, March 1976.

Partial recruitment is taken as in former analyses (Anon., 1973). The values for Divs. 1E-1F are considered valid also for East Greenland.

The values are

Age group	Divs. 1A-1D	Divs. 1E-1F	Subarea 1
3	9%	1%	10%
4	27	8	25
5	64	41	50
6	100	67	80
older	100	100	100

Prognosis have been made both with 1974 and with 1975 as the last year with data. In both cases the 1975 weight-by-age values are adopted (Section 4, Table 9). For calculation of biomass prior to 1975 the 1974 weight-by-age figures are used.

For the prognosis inside Subarea 1 the recruitment given in Section 7 was used. For the recruitment at East Greenland the arbitrary assumption was made that recruitment is equal to the predicted recruitment in Divs. 1E-1F, but this assumption may be far from the actual situation.

Prognosis were carried out for the following set of future F values (for fully recruited age groups)

- 1) $F = 0.35$ in all areas and years
- 2) $F = 0.56$ in Divs. 1A - 1D
 $F = 0.65$ in " 1E - 1F and at East Greenland
 $F = 0.60$ in Subarea 1 as a whole
These values are considered to be the F_{max} values
- 3) $F = 0.35$ in Divs. 1A - 1D
 $F = 0.45$ in " 1E - 1F and at East Greenland
 $F = 0.40$ in Subarea 1 as a whole
These values are considered to be the $F_{0.1}$ values

10. RESULTS OF THE ANALYSES AND DISCUSSION

The various VPA runs all gave results very similar to those obtained last year for the years 1965-1970. However, for 1971 and more recent years one remarkable difference between last year's analyses and the present analyses occur, viz. that the stock figures for the important 1968 year-class now are only about half the values obtained last year. Did we overestimate the strength of the year class last year or are the present input data biased so that the strength of the year class is now underestimated? Anyway, the author was rather surprised to see that the 1968 year-class did not account for a rather higher percentage of the 1975 otter trawl catches than was the case. Evidently, so was Dr. Arno Meyer. In his personal communication to the author when supplying FRG data for 1975 Dr. Meyer refrained from giving German catch by numbers and age groups for Divs. 1A-1D because his only sample was a commercial sample from a factory trawler (Div. 1C, April) consisting mostly of the 1970-71 year-classes. Dr. Meyer writes: "Probably this sample is not representative for all the catches. ... I suppose, that especially the March catches consisted mostly of 1968 cod". The Danish otter trawl samples did, however, confirm that although the 1968 year-class was very important also an unexpected inflow of small cod occurred in the first quarters of the year when the best trawl catches are obtained (Figs. 2 and 3). The actual Subarea 1 catches of the 1968 year-class as calculated from the 1974 and 1975 samples was 6938 and 4935 thousand fish for the two years respectively (Table 11) as compared to forecasts ranging from 8949 to 12253 thousand fish for 1974 and from 7484 to 10247 thousand fish for 1975, F in both years taken as only 0.20. So evidently the year class strength was overestimated previously or the year class has had an extremely abrupt decline due to a higher exploitation rate in 1973 than assumed or due to higher natural mortality, including not least emigration. Also one other factor should be mentioned in the discussion, namely the increasing proportion of catches taken by gill nets and long lines in the years after 1970. By 1974 these two gears accounted for slightly more than 1/3 of the total catch against less than 10% in 1970. This could drastically have changes the partial recruitment figures used due to the tendency of these gears to catch big and old fish. If the 1968 year-class was actually recruited to a less extent than presumed then the stock figures obtained in the analyses carried out here are somewhat underestimated. This does, however,

not explain the difference between last year's forecasts and the actual catches. It does, therefore, seem likely that the strength of the 1968 year-class was overestimated previously, although present judgment may be somewhat on the low side of the true figures.

The results of the VPA runs regarding values of F are shown in Tables 15 a-h (for VPA runs 3174 through to 3475). The corresponding results regarding stock size and composition are given in Tables 16 a-h. The forecasts for the years 1976-78 based on the F values mentioned in Section 9, p.11 are available as computer printouts. The total catches and biomass forecasted for each of the areas are also set out in Table 17. In the same table is indicated that part of the predicted catches which is made up of the year-classes 1971-75. The prediction of this part of the catch is, of course, associated with exactly the same uncertainties as those associated with the judgment of the year-class strength of these year classes (plus uncertainties on all other parameters).

11. COD AT EAST GREENLAND

In its' report to the Commission at the Annual Meeting 1975 STACRES pointed out that the matter of managing the Subarea 1 cod fisheries, so as to take stock/recruitment relationship into account, also involves regulation of fisheries off East Greenland (in the NEAPC Area).

The status of the East Greenland cod and the fisheries there has recently been examined by the ICES North-Western Working Group, March 1976. Their findings will be made available to ICNAF. It should be noted here, that data for Divs. 1E-1F catches by numbers have been slightly revised after the N.-W. Working Group's Meeting. However, the East Greenland catch-by-number data here used are the same as those used by the Working Group. Also VPA runs for Divs. 1E-1F and East Greenland combined carried out here differ from the runs in the N.-W. Working Group in that input F values for the years 1970-75 are taken as 0.22, while the Working Group used this figure for 1975 only but a figure of F = 0.50 for all preceding years. In the forecasts various F values have been used as indicated in Table 17.

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TABLE 1 Nominal catch (metric tons $\times 10^{-3}$) of cod in Subarea 1, 1974 according to ICNAF Stat.Bull. Vol.24.

Catches reported as taken by unknown gear by Denmark F (total 4911 tons) have been assumed to be mainly gill-net catches (4000 tons) but may include some long-line catches, the rest (911 tons) trawl catches. These trawl catches have been allocated to the divisions in the same proportion as the Danish (G) trawl catches for Divs. 1C-1F.

Catches under unknown gear in the table are Greenland small-boat catches, the main gear being pound net.

Div.	Otter trawl	Set gill net	Long line	Unknown	TOTAL
1A	36	-	-	454	490
1B	387	1 004	112	926	2 429
1C	7 309	4 845	298	1 449	13 901
1D	7 737	7 305	38	2 588	17 668
1E	5 439	1 884	1 434	1 628	10 385
1F	1 214	234	21	1 593	3 062
TOTAL	22 122	15 272	1 903	8 638	47 935

TABLE 2 Preliminary nominal catch (metric tons $\times 10^{-3}$) of cod in Subarea 1, 1975. Catches obtained either as reported for the Assessment Meeting, April 1976 or from provisional monthly catch statistics (ICNAF C.L. 76/15). In cases where only total catch for the subarea was reported the break-down on divisions (and in some cases also gear) was taken to be proportionally equal to the 1974 break-down. Catches reported under unknown gear in the table are Greenland small-boat catches, the main gear being pound net.

Div.	Otter trawl	Set gill net	Long line	Unknown	TOTAL
1A	24	-	-	170	194
1B	366	502	194	1 036	2 098
1C	17 572	2 788	513	1 269	22 142
1D	4 454	4 312	227	2 286	11 279
1E	3 490	1 711	1 029	1 062	7 292
1F	2 846	146	364	1 158	4 514
TOTAL	28 752	9 459	2 327	6 981	47 519

TABLE 3. Subarea 1 cod. Catch (tons), effort (hours trawled) and catch per unit effort (tons/hour) of Spanish pair trawlers, 150 - 499 GRT, July - October incl., 1968 - 74.

YEAR	1968	1969	1970	1971	1972	1973	1974
Spanish catch (tons) July-Oct.	17748	18545	12509	16062	1047	1000	211
Spanish effort(hrs) July-Oct.	10697	17263	12623	14541	2431	2072	657
Spanish c.p.u.e. July-Oct.	1.66	1.07	0.99	1.10	0.43	0.48	0.32
Spanish catch July-Oct in % of Spanish annual catch	82.6	84.6	71.5	72.7	59.0	53.4	39.7
Spanish catch July-Oct in % of total annual Subarea 1 catch	4.5	8.6	10.8	13.2	1.0	1.6	0.4

TABLE 4. Subarea 1 cod. Total annual nominal catch, effort and catch per unit effort 1968 - 1971. Effort unit is one hour fished by Spanish pair trawlers 150-499 GRT. Total effort has been obtained by raising (for each division) the Spanish effort and catch in the month July - October incl. to total catch. The basic Spanish effort for Subarea 1 as a whole is given in Table 3.

YEAR		1968	1969	1970	1971
Divs.1A - 1D	tons	279539	144331	62447	77017
	hrs.	171022	137155	65532	67340
	tons/hr.	1.63	1.05	0.95	1.14
Divs.1E - 1F	tons	114001	70476	53550	44163
	hrs.	94506	96258	65160	47396
	tons/hr.	1.21	0.73	0.82	0.93
Subarea 1.	tons	393540	214807	115997	121180
	hrs.	265528	233683	130692	114736
	tons/hr.	1.48	0.92	0.89	1.06

Table 5. Subarea 1 cod. Catch (tons), effort and effort indices relative to 1968 for the major vessel/gear categories, 1968-1974. d.f. = days fished, hrs = hours fished.

Country	vessel/gear category		1968	1969	1970	1971	1972	1973	1974
FRANCE	OT, Si	tons	33225	18082	3238	4108	4952	38	0
		d.f.	799	774	179	189	363	5	0
	1000-1999	f-index	1000	969	224	237	454	6	0
		weighted "	150	145	34	36	68	1	0
FRANCE	OT, St	tons	2384	7083	1502	0	563	0	0
		d.f.	69	267	82	0	15	0	0
	1000-1999	f-index	1000	3870	1188	0	217	0	0
		weighted "	11	43	13	0	2	0	0
FRG	OT, Si	tons	9586	2295	1341	345	40	35	5
		d.f.	708	155	105	25	4	7	7
	500-999	f-index	1000	219	148	35	6	10	10
		weighted "	43	9	6	2	+	+	+
FRG	OT, St	tons	11373	3862	453	155	257	160	50
		d.f.	638	277	31	5	36	24	8
	500-999	f-index	1000	434	49	8	56	38	13
		weighted "	51	22	2	+	3	2	1
FRG	OT, Si	tons	10087	5886	5984	439	190	7	0
		d.f.	495	398	364	32	26	2	0
	1000-1999	f-index	1000	804	735	65	53	4	0
		weighted "	46	37	34	3	2	+	0
FRG	OT, St	tons	80482	41848	18541	19841	7350	964	76
		d.f.	3502	1769	735	786	632	126	24
	1000-1999	f-index	1000	505	210	224	180	36	7
		weighted "	364	184	76	82	66	13	2
FRG	OT, St	tons	21689	24669	14193	18899	8996	4617	1550
		d.f.	657	645	442	216	585	489	73
	≥ 2000	f-index	1000	982	673	329	890	744	111
		weighted "	98	96	66	32	87	73	11
NORWAY	OT, St	tons	2544	0	0	1331	10741	5298	412
		hrs	1762	0	0	1690	4912	5044	1026
	150-499	f-index	1000	0	0	959	2788	2863	582
		weighted "	12	0	0	11	33	34	7
NORWAY	OT, St	tons	3660	1174	0	754	9468	4192	0
		hrs	4302	477	0	437	3260	3410	0
	500-999	f-index	1000	111	0	102	758	793	0
		weighted "	17	2	0	2	13	13	0
PORTUGAL	OT, Si	tons	1322	1864	801	577	0	0	0
		hrs	297	1122	459	586	0	0	0
	1000-1999	f-index	1000	3778	1545	1973	0	0	0
		weighted "	6	23	9	12	0	0	0
PORTUGAL	OT, St	tons	12972	11506	2677	728	0	7	0
		hrs	2013	2732	1290	544	0	32	0
	≥ 2000	f-index	1000	1357	641	270	0	16	0
		weighted "	59	80	38	16	0	1	0
SPAIN	PT	tons	21492	21925	17499	22086	1776	1874	532
		hrs	12315	19546	15802	19276	3191	3847	1007
	151-500	f-index	1000	1587	1283	1565	259	312	82
		weighted "	97	154	124	152	25	30	8
UK	OT	tons	1829	0	2038	767	406	367	1138
		hrs	997	0	1108	953	749	444	1938
	500-999	f-index	1000	0	1111	956	751	445	1943
		weighted "	8	0	9	7	6	4	16
UK	OT	tons	8460	542	1329	1447	350	2	128
		hrs	4403	338	926	1903	976	4	594
	1000-1999	f-index	1000	77	210	432	222	1	135
		weighted "	38	3	8	16	8	+	5
Total tons above			221105	140736	69596	71477	45089	17561	3891
Total f-indices			14000	14693	8017	7155	6634	5268	2883
Total weighted f-indices			1000	798	419	371	311	171	50
Total Subarea 1 tons			393540	214807	115997	121180	110619	62942	47935
Total raised f			1779	1218	698	629	763	613	616
Total f-index			1000	685	392	354	429	345	346

TABLE 6. Subarea 1 cod. Effort for the Greenland trawlers 1969 - 74.
Hours trawled in 1969 - 71 obtained from "days absent" converted by the 1972 - 74
proportion between "days absent" and "hours trawled".

	Year	1969	1970	1971	1972	1973	1974
150 - 499 GRT	Days absent	146	281	270	252	244	178
	Hours trawled	1642	3160	3036	3072	2614	1894
500 - 999 GRT	Days absent	-	-	323	643	1241	1313
	Hours trawled			3867	7265	13779	17232

TABLE 2: Subarea 1 cod, 1975. Danish samples. Only fish which were aged and weighted are given here, and since these were sampled stratified the table does not give the length nor the age frequency. Overall mean lengths and weights are, however, calculated on basis of the total (random) length sample.
 cm = uncorrected mean total length in cm (below) ± standard deviation.
 kg = mean weight in kg round, fresh weight ± standard deviation. Most fish were actually weighted as gutted ices fish, head on and converted to round, fresh weight by the Greenland standard conversion factor of 1.22.

Age group	Divs.	1C offshore		1C+D offshore		1C+D+E offshore		1C+E offshore	
	Month	March		May		July		June	
	Gear	OT comm.		OT comm.		OT comm.		OT comm.	
	Nos.	-		5		-		-	
III	cm			41.8	0.8				
	kg			0.71	0.08				
	Nos.	26		107		86		117	
IV	cm	51.8	2.7	50.3	4.5	51.6	3.7	51.9	4.4
	kg	1.31	0.17	1.38	0.31	1.25	0.29	1.31	0.32
	Nos.	73		91		81		52	
V	cm	58.5	2.8	57.9	5.0	58.1	3.7	57.8	4.3
	kg	1.88	0.31	1.84	0.41	1.79	0.33	1.79	0.33
	Nos.	120		32		19		24	
VI	cm	69.1	4.6	65.8	5.9	65.2	5.1	69.0	5.9
	kg	3.23	0.65	2.74	0.75	2.52	0.60	2.91	0.69
	Nos.	86		155		204		188	
VII	cm	75.8	5.6	75.1	6.3	72.6	6.3	73.2	5.4
	kg	4.22	0.92	4.00	0.80	3.41	0.87	3.44	0.73
	Nos.	51		22		18		25	
VIII	cm	81.8	6.1	80.5	8.1	76.4	6.3	80.8	5.0
	kg	5.30	1.26	4.60	1.06	3.93	0.90	4.57	0.80
	Nos.	68		17		2		32	
IX	cm	88.5	5.8	86.4	6.0	78.1	6.1	85.7	5.0
	kg	6.73	1.42	5.34	1.01	4.13	1.03	5.34	0.91
	Nos.	49		4		3		20	
X	cm	96.8	6.9	90.8	3.4	75.6	11.7	88.4	7.4
	kg	9.02	2.01	6.14	0.58	3.89	1.93	5.87	1.40
	Nos.	-		3		-		-	
XI	cm			98.0	11.5				
	kg			7.92	2.46				
	Nos.	1		1		1		-	
XII	cm	98.0		81.0		79.0		-	
	kg	9.15		4.78		4.15		-	
	Nos.	-		-		-		2	
XIII	cm							89.5	5.0
	kg							6.11	1.08
	Nos.	1		1				2	
XIV	cm	109.0		107.0				95.0	2.8
	kg	11.35		12.44				7.49	0.88
	Nos.	1		-		1		-	
IV+	cm	103.0				100.0		-	
	kg	12.41				9.27		-	
Overall mean length		73.4		64.2		65.6		70.4	
Overall mean weight		4.08		2.77		2.64		3.18	
Discards		none		no info.		none		no info.	
Nos. aged and weighted		476		438		415		462	
Ref.no.		2513		2522		2552		2533	

TABLE 7 cont.

Age group	Divs. Month Gear	1E offshore		1E offshore		1D inshore	
		August		November		June	
		OT research		OT research		Pound net	
	Nos.	43	x)	80	x)	4	
III	cm	34.8	3.0	36.7	2.5	42.7	1.0
	kg	-		0.45	0.11	0.84	0.05
	Nos.	23	x)	14	x)	105	
IV	cm	50.3	7.8	47.4	3.9	47.8	3.1
	kg	-		1.01	0.40	1.23	0.22
	Nos.	24		4		141	
V	cm	60.7	3.4	58.8	8.8	53.9	5.8
	kg	-		1.99	0.61	1.79	0.50
	Nos.	9		1		15	
VI	cm	62.4	7.0	63.0	-	57.6	6.0
	kg	-		2.30		2.16	0.54
	Nos.	59		2		5	
VII	cm	75.4	5.5	82.0	7.1	60.9	4.3
	kg	-		5.25	1.5	2.49	0.44
	Nos.	3		-		-	
VIII	cm	68.3	2.3				
	kg	-					
	Nos.	2		-		2	
IX	cm	81.5	7.8			65.7	4.0
	kg	-				3.00	0.42
	Nos.	1		-		-	
X	cm	77.0					
	kg	-					
	Nos.	-		-		-	
XI	cm						
	kg						
	Nos.	-		-		-	
XII	cm						
XII	kg						
	Nos.	-		-		-	
XIII	cm						
	kg						
	Nos.	-		-		1	
XIV	cm					93.0	
	kg					-	
	Nos.	-		-		-	
IV+	cm						
	kg						
Overall mean length		51.2		37.8		50.4	
Overall mean weight		-		0.52		1.47	
Discards		II-group fish in the samples are not included here				50% by numbers (below 40 cm)	
Nos. aged and weighted		164		101		273	
Ref.no.		5117		5161		2534	

x) Includes some fish below 40 cm which would be discarded before landing in a commercial fishery or which to some extent would escape through meshes in a trawl fishery with 130 mm cod-end mesh size.

TABLE 8 Nominal catch of Subarea 1 cod by quarter of the year. Only catches specified by month are used for the percentages.

Quarter:		1	2	3	4	Total specified catch (% of total)
1974	tons	4 593	14 602	12 667	8 191	40 053
	%	11.5	36.5	31.6	20.4	(83.6%)
1975	tons	13 430	12 037	4 907	5 487	35 861
	%	37.4	33.6	13.7	15.3	(75.5%)

TABLE 9 Mean weight (kg round, fresh) by age as obtained from Table 7, offshore samples and weighted by quarterly mean catch index for 1974 as given in Table 8. The weighted mean figures obtained by the 1974 samples as presented in Res.Doc. 75/31 are shown for comparison.

Age group	Unweighted mean by quarter				Weighted annual mean	Res.Doc.75/31
	1	2	3	4		
III	-	0.71	-	-	0.71	0.65
IV	1.31	1.34	1.25	-	1.30	0.99
V	1.88	1.81	1.79	1.99	1.85	1.68
VI	3.23	2.83	2.52	2.30	2.67	2.77
VII	4.22	3.72	3.41	5.25	3.99	3.84
VIII	5.30	4.59	3.93	-	4.43	4.72
IX	6.73	5.34	4.13	-	5.06	5.34
X	9.02	6.00	3.89	-	5.60	5.34
XI	-	7.92	-	-	7.92	5.48
XII	9.15	4.78	4.15	-	5.16	5.39
XIII	-	6.11	-	-	6.11	8.70
XIV	11.35	7.61	-	-	8.51	10.19
XV+	12.41	-	9.27	-	10.11	10.74

TABLE 10 Cod tagged by Denmark in ICNAF Subarea 1 (excluding fjords) 1965-67, 1968-69 and 1970-71. Only cod 50 cm or more when tagged are included. Some recaptures may still occur in the 1970-71 experiments' 4th year. x) indicates that although no recaptures are reported one recapture has been used in the regression analyses.

Division and period of tagging		Nos. tagged	Recaptures in Subarea 1 in year of tagging (0) and first to fourth calendar years after year of tagging in numbers and as percentage of numbers tagged						Regression lines of \log_e (% recapt.) excl. year 0.
			0	1	2	3	4+	TOTAL	
1965-67	1A - 1D	1890	Nos. 64	141	44	11	6	266	$y = 3.02 - 1.09x$
			% 3.39	7.46	2.33	0.58	0.31	14.07	
	1E - 1F	869	Nos. 11	42	30	14	3	100	
			% 1.27	4.83	3.45	1.61	0.35	11.51	$y = 2.72 - 0.86x$
	Subarea 1	2759	Nos. 75	183	74	25	9	366	$y = 2.95 - 1.01x$
			% 2.72	6.63	2.68	0.91	0.33	13.27	
1968-69	1A - 1D	1574	Nos. 15	22	6	1	-	44	$y = 2.00 - 1.58x$
			% 0.95	1.40	0.38	0.06	-	2.80	
	1E - 1F	651	Nos. 6	10	4	3	-	23	
			% 0.92	1.54	0.61	0.46	x)	3.53	$y = 1.13 - 0.73x$
	Subarea 1	2225	Nos. 21	32	10	4	-	67	$y = 1.57 - 1.17x$
			% 0.94	1.44	0.45	0.18	x)	3.01	
1970-71	1A - 1D	801	Nos. -	16	1	-	-	17	$y = 1.63 - 1.41x$
			% -	2.00	0.12	x)	-	2.12	
	1E - 1F	779	Nos. 47	21	9	-	-	77	
			% 6.03	2.70	1.16	x)	-	9.88	$y = 2.73 - 1.52x$
	Subarea 1	1580	Nos. 47	37	10	-	-	94	$y = 2.85 - 1.83x$
			% 2.97	2.34	0.63	x)	-	5.95	

TABLE 11. Numbers of cod ($\times 10^{-3}$) per age group in nominal catches 1974 and provisional figures for 1975.

Age group	1974			1975		
	1A - 1D	1E - 1F	Sub.1	1A - 1D	1E - 1F	Sub.1
3	242	101	343	6	38	44
4	875	204	1079	1440	544	1984
5	2109	275	2384	1590	528	2118
6	4324	2614	6938	2399	135	2534
7	937	198	1135	2901	2034	4935
8	1363	443	1806	1129	235	1364
9	702	98	800	901	198	1099
10	119	75	194	505	140	645
11	99	78	177	10	17	27
12	92	60	152	20	5	25
13	193	79	272	5	10	15
14	106	41	147	16	23	39
15+	11	-	11	12	0	12
Total	11172	4266	15438	10934	3907	14841
Nom. catch(tons)	34488	13447	47935	35713	11806	47519
Calculated mean weight	3.09	3.15	3.11	3.27	3.02	3.20

TABLE 12. Numbers of cod ($\times 10^{-3}$) per age group in nominal catches off East Greenland (ICES Subarea XIV). German figures (A.Meyer, pers.comm.) as raised to total catch by the ICES North-Western Working Group, March 1976.

Age group	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975(prov.)
3	-	28	-	-	-	-	-	-	4	4	25
4	131	21	145	104	31	66	25	27	25	63	25
5	35	470	302	630	252	76	171	85	197	22	149
6	91	89	2346	502	849	500	159	254	126	488	38
7	879	137	564	2505	770	1539	1051	295	250	176	344
8	661	1071	210	238	2103	1060	3785	1299	82	185	68
9	1484	359	1292	62	170	1715	1580	3184	710	52	36
10	59	418	492	144	38	237	1326	818	959	329	9
11	27	23	371	69	82	32	171	470	222	259	29
12	139	3	37	27	68	63	19	136	72	65	23
13	29	27	17	5	24	48	4	26	19	11	7
14	41	18	49	10	7	16	9	22	-	-	2
15+	137	18	32	15	29	11	5	31	7	2	-
Total	3713	2682	5857	4311	4423	5363	8305	6647	2673	1656	755
Nom. catch (tons)	14497	12870	24732	15701	17771	20907	31516	26629	11752	6553	3435
Calculated mean weight	3.90	4.80	4.22	3.64	4.02	3.90	3.79	4.01	4.40	3.96	4.55

TABLE 13 Number of cod per hour trawled on the standard station GODTHÅB DYBBET, 63°48'N, 52°14'W, depth app. 300 m. Otter trawl, 36 mm cod end mesh size. + indicates less than one cod per hour but not total absence (indicated by 0).

Year	Date	Ref.No.	No. of hauls	Total time trawled (minutes)	Number of cod per hour and age group							
					II	III	IV	V	VI	VII	VIII+	
1966	1 Apr	3941	2	105	2	96	214	395	78	22	3	
	1-2 Apr	3964/-5	2	95	0	31	33	57	11	1	5	
1969	8-9 Jan	4142	3	183	0	70	208	68	27	8	13	
	21 Feb	4164	1	45	0	103	261	109	41	8	4	
	4 Mar	4168	2	120	0	65	157	89	47	9	6	
	7-8 May	4213	3	180	2	273	130	12	8	0	1	
1970	4-5 Jun	4376	3	171	6	6	35	7	1	1	1	
1971	17-21 Jan	4512	3	146	2	240	60	95	9	2	3	
	13-14 May	4530	4	217	0	229	29	16	2	0	1	
1973	6-7 Feb	4718	3	180	1	+	0	2	2	1	2	
	17-18 Apr	4738	3	180	8	5	+	1	+	0	1	
	22 Jun	4754	2	120	0	+	+	6	+	+	1	
	23 Oct	4865	2	120	0	+	+	3	+	2	1	
1974	8+21 Jan	4876/7	3	180	0	35	15	2	5	0	1	
	10 Jun	4913	3	180	0	1	2	1	4	1	2	
1975	9-16 Jan	5016	3	165								
	23-24 Apr	5031	3	180	12	1						
	18-19 Jun	5043	3	180	1	1	4	2	1	2	2	
	19-20 Aug	5110	3	157	0	0	0	0	0	0	0	
	7 Oct	5134	1	30	0	0	0	0	0	0	0	
	10-11 Nov	5158	2	120	0	0	0	0	0	0	0	
1976	20-21 Jan	5176	3	165		114 ^{x)}						

x) Otoliths from this sample not yet received, but to judge from length distribution more than 90% of the total of 114 cod per hour are of the 1973 year-class.

TABLE 14 Number of cod per hour trawled on the standard station FREDERIKSHÅB ISBLINK, 62°27'N 52°14'W, depth ab. 240 m. Otter trawl, 36 mm cod end mesh size. + indicates less than one cod per hour but not total absence (indicated by 0).

YEAR	DATE	REP.NO.	NO. OF HAULS	TOTAL TIME TRAWLED (minutes)	NUMBER OF COD PER HOUR AND AGE GROUP							
					II	III	IV	V	VI	VII	VIII+	
1975	29 Apr	5032	3	180	48	9	+	0	0	0	0	
	6 May	5033	3	150	59	11	+	0	0	0	+	
	26 Jun	5049	3	180	44	2	1	+	0	2	0	
	26 Aug	5117	3	180	23	14	8	8	3	20	2	
	20 Nov	5161	3	150	38	32	6	2	+	1	0	

VIRTUAL POPULATION ANALYSIS

DFH

COD 1A-1D COD 1E-1F

TABLE 15a. Run 3174

FISHING MORTALITIES BY YEAR AND BY AGE

AGE	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974
3	0.08	0.01	0.03	0.05	0.01	0.00	0.00	0.00	0.01	0.04
4	0.18	0.06	0.10	0.17	0.24	0.05	0.10	0.15	0.12	0.09
5	0.33	0.30	0.33	0.36	0.29	0.32	0.29	0.70	0.39	0.18
6	0.40	0.45	0.56	0.63	0.51	0.36	0.54	0.65	0.49	0.28
7	0.55	0.51	0.57	0.73	0.77	0.56	0.58	0.50	0.29	0.35
8	0.46	0.64	0.49	0.52	0.69	0.59	0.97	0.68	0.34	0.35
9	0.63	0.40	0.63	0.72	0.54	0.34	0.67	0.94	0.88	0.35
10	0.45	0.72	0.66	0.63	0.52	0.28	0.42	0.46	0.54	0.35
11	0.63	0.46	0.46	0.77	0.39	0.29	0.37	0.42	0.22	0.35
12	0.53	0.36	0.29	0.51	0.59	0.25	0.26	0.56	0.18	0.35
13	0.19	0.61	1.20	0.19	0.21	0.35	0.25	1.00	0.14	0.35
14	0.09	0.70	0.69	1.41	0.57	0.22	0.44	0.51	0.99	0.35
15	0.46	0.54	0.62	0.80	0.55	0.35	0.35	0.35	0.35	0.35
MEAN-F A>= 7	0.50	0.51	0.58	0.68	0.68	0.49	0.69	0.60	0.36	0.35

THE LAST AGEGROUP IS A PLUS GROUP

VIRTUAL POPULATION ANALYSIS

DFI

COD 1A-1D COD 1E-1F

Table 15b. Run 3175

FISHING MORTALITIES BY YEAR AND BY AGE

AGE	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974
3	0.08	0.01	0.03	0.05	0.01	0.00	0.00	0.00	0.01	0.01
4	0.18	0.06	0.10	0.18	0.23	0.05	0.08	0.15	0.12	0.06
5	0.34	0.31	0.34	0.37	0.30	0.30	0.28	0.51	0.39	0.17
6	0.40	0.46	0.57	0.65	0.52	0.38	0.49	0.62	0.30	0.29
7	0.55	0.51	0.60	0.77	0.82	0.58	0.64	0.42	0.27	0.18
8	0.46	0.64	0.49	0.56	0.76	0.66	1.05	0.81	0.27	0.32
9	0.63	0.40	0.63	0.72	0.62	0.41	0.86	1.18	1.38	0.25
10	0.45	0.72	0.66	0.63	0.52	0.35	0.54	0.74	0.92	0.97
11	0.63	0.46	0.46	0.77	0.39	0.29	0.52	0.65	0.47	0.96
12	0.53	0.36	0.29	0.51	0.59	0.25	0.26	1.02	0.35	1.19
13	0.19	0.61	1.20	0.19	0.21	0.35	0.25	1.00	0.36	0.95
14	0.09	0.70	0.69	1.41	0.57	0.22	0.44	0.51	0.99	1.95
15	0.46	0.54	0.62	0.80	0.55	0.35	0.35	0.35	0.35	0.35
MEAN-F A>= 7	0.50	0.51	0.60	0.71	0.75	0.54	0.79	0.67	0.39	0.31

AGE 1975

3	0.04
4	0.09
5	0.18
6	0.28
7	0.35
8	0.35
9	0.35
10	0.35
11	0.35
12	0.35
13	0.35
14	0.35
15	0.35

MEAN-F A>= 7 0.35

THE LAST AGEGROUP IS A PLUS GROUP

VIRTUAL POPULATION ANALYSIS

DFH

COD 1A-1D

Table 15c. Run 3274

FISHING MORTALITIES BY YEAR AND BY AGE

AGE	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974
3	0.12	0.00	0.05	0.06	0.01	0.00	0.01	0.00	0.01	0.03
4	0.25	0.07	0.18	0.30	0.29	0.07	0.12	0.18	0.16	0.09
5	0.38	0.31	0.49	0.59	0.41	0.33	0.34	0.79	0.49	0.22
6	0.43	0.54	0.67	0.83	0.62	0.44	0.54	0.74	0.43	0.35
7	0.51	0.50	0.62	0.84	1.01	0.60	0.54	0.51	0.25	0.35
8	0.49	0.41	0.49	0.57	0.78	0.46	0.89	0.65	0.33	0.35
9	0.53	0.38	0.71	0.82	0.67	0.19	0.54	0.89	0.66	0.35
10	0.41	0.54	0.71	0.81	0.63	0.20	0.39	0.45	0.36	0.35
11	0.66	0.46	0.60	0.91	0.43	0.15	0.39	0.49	0.24	0.35
12	0.51	0.30	0.26	0.79	0.69	0.24	0.25	0.70	0.23	0.35
13	0.21	0.64	1.30	0.20	0.14	0.26	0.19	1.04	0.17	0.35
14	0.05	0.88	0.74	1.48	0.69	0.09	0.45	0.59	1.06	0.35
15	0.45	0.52	0.68	1.00	0.59	0.35	0.35	0.35	0.35	0.35
MEAN-F A>= 7	0.49	0.44	0.63	0.77	0.82	0.42	0.58	0.58	0.30	0.35

THE LAST AGEGROUP IS A PLUS GROUP

VIRTUAL POPULATION ANALYSIS

DFH

COD 1A-1D

Table 15d. Run 3275

FISHING MORTALITIES BY YEAR AND BY AGE

AGE	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974
3	0.12	0.00	0.05	0.06	0.01	0.00	0.00	0.00	0.01	0.01
4	0.25	0.07	0.18	0.31	0.28	0.06	0.10	0.17	0.14	0.09
5	0.38	0.31	0.50	0.60	0.44	0.34	0.33	0.59	0.45	0.19
6	0.43	0.55	0.69	0.85	0.63	0.48	0.51	0.70	0.27	0.31
7	0.51	0.50	0.64	0.89	1.10	0.62	0.62	0.47	0.23	0.18
8	0.49	0.41	0.49	0.61	0.88	0.54	0.98	0.85	0.29	0.31
9	0.53	0.38	0.71	0.82	0.75	0.24	0.73	1.14	1.21	0.29
10	0.41	0.54	0.71	0.81	0.63	0.24	0.52	0.76	0.59	1.34
11	0.66	0.46	0.60	0.91	0.43	0.15	0.50	0.80	0.56	0.78
12	0.51	0.30	0.26	0.79	0.69	0.24	0.25	1.17	0.50	1.68
13	0.21	0.64	1.30	0.20	0.14	0.26	0.19	1.04	0.43	1.35
14	0.05	0.88	0.74	1.48	0.69	0.09	0.45	0.59	1.06	1.78
15	0.45	0.52	0.68	1.00	0.59	0.35	0.35	0.35	0.35	0.35
MEAN-F A>= 7	0.49	0.44	0.64	0.81	0.90	0.47	0.69	0.67	0.32	0.32

AGE 1975

3	0.03
4	0.09
5	0.22
6	0.35
7	0.35
8	0.35
9	0.35
10	0.35
11	0.35
12	0.35
13	0.35
14	0.35
15	0.35

MEAN-F A>= 7 0.35

THE LAST AGEGROUP IS A PLUS GROUP

VIRTUAL POPULATION ANALYSIS

DFH

COD 1E-1F

Table 15e. Run 3374

FISHING MORTALITIES BY YEAR AND BY AGE

AGE	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974
3	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.02	0.04	0.01	0.04	0.02	0.02	0.02	0.11	0.02	0.03
5	0.17	0.28	0.08	0.18	0.18	0.25	0.14	0.35	0.29	0.14
6	0.36	0.21	0.34	0.40	0.42	0.29	0.64	0.43	0.75	0.23
7	0.59	0.63	0.48	0.56	0.55	0.49	0.57	0.54	0.39	0.35
8	0.42	1.08	0.62	0.41	0.56	0.63	0.95	0.67	0.43	0.35
9	0.71	0.54	0.42	0.48	0.27	0.56	0.75	0.92	1.10	0.35
10	0.62	0.96	0.53	0.28	0.23	0.49	0.47	0.46	0.69	0.35
11	0.60	0.56	0.20	0.42	0.33	1.31	0.34	0.26	0.20	0.35
12	0.65	0.53	0.48	0.14	0.42	0.28	0.58	0.19	0.09	0.35
13	0.15	0.58	0.99	0.17	0.29	0.68	0.41	0.60	0.05	0.35
14	0.12	0.40	0.59	1.28	0.11	0.44	0.53	0.32	0.35	0.35
15	0.49	0.61	0.55	0.50	0.50	0.35	0.35	0.35	0.35	0.35
MEAN-F A>= 7	0.53	0.75	0.49	0.52	0.52	0.53	0.74	0.64	0.50	0.35

THE LAST AGEGROUP IS A PLUS GROUP

VIRTUAL POPULATION ANALYSIS

DFH

COD 1E-1F

Table 15f. Run 3375

FISHING MORTALITIES BY YEAR AND BY AGE

AGE	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974
3	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.03	0.04	0.01	0.04	0.01	0.02	0.01	0.12	0.05	0.04
5	0.18	0.29	0.09	0.18	0.19	0.20	0.14	0.25	0.31	0.30
6	0.36	0.23	0.35	0.41	0.43	0.30	0.47	0.45	0.45	0.26
7	0.59	0.63	0.53	0.58	0.58	0.51	0.60	0.33	0.41	0.16
8	0.42	1.08	0.62	0.49	0.60	0.69	1.04	0.74	0.21	0.38
9	0.71	0.54	0.42	0.48	0.35	0.62	0.91	1.16	1.45	0.14
10	0.62	0.96	0.53	0.28	0.23	0.72	0.57	0.67	1.27	0.65
11	0.60	0.56	0.20	0.42	0.33	1.31	0.65	0.34	0.35	1.42
12	0.65	0.53	0.48	0.14	0.42	0.28	0.58	0.48	0.13	0.80
13	0.15	0.58	0.99	0.17	0.29	0.68	0.41	0.60	0.16	0.54
14	0.12	0.40	0.59	1.28	0.11	0.44	0.53	0.32	0.35	2.83
15	0.49	0.61	0.55	0.50	0.50	0.35	0.35	0.35	0.35	0.35
MEAN-F A>= 7	0.53	0.75	0.53	0.55	0.55	0.57	0.82	0.69	0.57	0.34

AGE 1975

3	0.00
4	0.03
5	0.14
6	0.23
7	0.35
8	0.35
9	0.35
10	0.35
11	0.35
12	0.35
13	0.35
14	0.35
15	0.35

MEAN-F A>= 7 0.35

THE LAST AGEGROUP IS A PLUS GROUP

VIRTUAL POPULATION ANALYSIS

DFH

COD 1E-1F COD ICES SUBAREA XIV

Table 15g. Run 3474

FISHING MORTALITIES BY YEAR AND BY AGE

AGE	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974
3	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.02	0.02	0.01	0.02	0.02	0.02	0.02	0.10	0.03	0.03
5	0.10	0.17	0.05	0.10	0.09	0.19	0.11	0.26	0.26	0.14
6	0.21	0.12	0.20	0.20	0.20	0.14	0.44	0.32	0.49	0.23
7	0.29	0.34	0.28	0.30	0.25	0.22	0.26	0.43	0.31	0.35
8	0.25	0.47	0.36	0.23	0.32	0.30	0.47	0.38	0.34	0.35
9	0.51	0.30	0.51	0.25	0.16	0.39	0.50	0.65	0.50	0.35
10	0.29	0.49	0.37	0.20	0.17	0.33	0.55	0.53	0.54	0.35
11	0.24	0.22	0.50	0.22	0.23	0.57	0.32	0.50	0.35	0.35
12	0.49	0.15	0.29	0.14	0.25	0.30	0.36	0.38	0.20	0.35
13	0.14	0.38	0.28	0.09	0.28	0.38	0.19	1.23	0.12	0.35
14	0.22	0.27	0.58	0.23	0.15	0.45	0.23	0.46	0.15	0.35
15	0.49	0.61	0.55	0.50	0.50	0.35	0.35	0.35	0.35	0.35
MEAN-F A>= 7	0.31	0.38	0.33	0.28	0.27	0.26	0.41	0.51	0.40	0.35

THE LAST AGEGROUP IS A PLUS GROUP

VIRTUAL POPULATION ANALYSIS

DFH

COD 1E-1F COD ICES SUBAREA XIV

Table 15h. Run 3475

FISHING MORTALITIES BY YEAR AND BY AGE

AGE	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974
3	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.02	0.02	0.01	0.03	0.01	0.02	0.01	0.10	0.05	0.04
5	0.11	0.17	0.05	0.11	0.11	0.15	0.12	0.19	0.27	0.26
6	0.21	0.14	0.20	0.22	0.22	0.16	0.32	0.34	0.33	0.25
7	0.29	0.34	0.32	0.31	0.27	0.24	0.33	0.28	0.34	0.20
8	0.25	0.47	0.36	0.27	0.33	0.33	0.55	0.52	0.19	0.40
9	0.51	0.30	0.51	0.25	0.21	0.41	0.59	0.87	0.85	0.17
10	0.29	0.49	0.37	0.20	0.17	0.45	0.61	0.72	0.98	0.94
11	0.24	0.22	0.50	0.22	0.23	0.57	0.51	0.59	0.59	1.14
12	0.49	0.15	0.29	0.14	0.25	0.30	0.36	0.80	0.26	0.84
13	0.14	0.38	0.28	0.09	0.28	0.38	0.19	1.23	0.36	0.50
14	0.22	0.27	0.58	0.23	0.15	0.45	0.23	0.46	0.15	2.57
15	0.49	0.61	0.55	0.50	0.50	0.35	0.35	0.35	0.35	0.35
MEAN-F A>= 7	0.31	0.38	0.36	0.29	0.29	0.29	0.49	0.63	0.54	0.44

AGE 1975

3	0.00
4	0.03
5	0.14
6	0.23
7	0.35
8	0.35
9	0.35
10	0.35
11	0.35
12	0.35
13	0.35
14	0.35
15	0.35

MEAN-F A>= 7 0.35

THE LAST AGEGROUP IS A PLUS GROUP

VIRTUAL POPULATION ANALYSIS

DFH

COD 1A-1D COD 1E-1F

Table 16 a. Run 3174

STOCK IN NUMBERS AT BEGINNING OF YEAR

AGE	1965	1966	1967	1968	1969
3	203029	218245	69318	82042	71150
4	382196	153449	177302	55193	63773
5	204987	261644	118530	131553	38004
6	30270	120707	158373	69682	74781
7	26023	16657	63015	74307	30388
8	47141	11660	7820	27710	27876
9	6776	23290	4777	3738	12867
10	1735	2802	12105	1986	1415
11	1163	857	1064	4880	823
12	5216	482	421	522	1766
13	480	2399	262	246	243
14	506	308	1015	61	160
15	426	361	119	398	12
TOT.	909948	812861	614120	452316	323258

AGE	1970	1971	1972	1973	1974
3	35075	97430	27484	17475	10997
4	57655	28673	79523	22488	14189
5	41057	44706	21204	56062	16336
6	23286	24322	27457	8621	31199
7	36654	13260	11602	11738	4312
8	10961	16377	5772	5481	6862
9	10939	4741	4850	2282	3040
10	5857	6063	1889	1480	737
11	655	3441	3115	927	673
12	434	380	1848	1594	578
13	763	264	228	822	1033
14	154	419	161	65	559
15	70	96	209	75	19
TOT.	223560	240171	185342	129111	90533

RUN AT. 76 3 25 - 14 . 3
RUN NO. 3174

VIRTUAL POPULATION ANALYSIS

DFH

Table 16 b. Run 3175

COD 1A-1D COD 1E-1F

STOCK IN NUMBERS AT BEGINNING OF YEAR

AGE	1965	1966	1967	1968	1969
3	200277	215951	67387	65784	72672
4	377573	151197	175424	53612	66837
5	201648	257860	116685	130015	36711
6	30270	117979	155280	68175	73525
7	26023	16657	60788	71788	29163
8	47141	11660	7820	25988	25937
9	6776	23290	4777	3738	11535
10	1735	2602	12105	1986	1415
11	1163	857	1064	4880	823
12	5216	482	421	522	1766
13	480	2399	262	246	243
14	506	308	1015	61	160
15	426	361	119	398	12
TOT.	899234	801803	603148	447193	320797

AGE	1970	1971	1972	1973	1974
3	43201	96189	27789	23249	32244
4	58901	35326	78507	22738	18916
5	43563	45726	26650	55231	16541
6	22228	26371	28291	13054	30520
7	35630	12396	13272	12416	7933
8	10019	15585	5104	6776	7389
9	9445	4013	4247	1768	4046
10	4826	4903	1329	1021	347
11	655	2640	2216	494	318
12	434	380	1226	897	241
13	763	264	228	344	492
14	154	419	161	65	186
15	70	96	209	75	19
TOT.	229890	244306	189229	138127	119193

AGE	1975
3	1411
4	26090
5	14514
6	11395
7	18750
8	5183
9	4176
10	2451
11	103
12	95
13	57
14	148
15	21
TOT.	84392

RUN AT 76 3 25 - . 14 . 22

VIRTUAL POPULATION ANALYSIS

DFI

Table 16c. Run 3274

COO 1A-1D

STOCK IN NUMBERS AT BEGINNING OF YEAR

AGE	1965	1966	1967	1968	1969
3	137983	113845	37952	69675	56188
4	274363	100202	92892	29558	53655
5	165064	175616	76737	63427	17924
6	22581	92847	105771	38414	28710
7	13003	12061	44372	44201	13759
8	32550	6365	5998	19553	15633
9	3154	16407	3473	3014	9056
10	1110	1520	9232	1391	1092
11	748	601	723	3702	506
12	3726	317	309	326	1220
13	304	1833	193	195	121
14	268	201	790	43	131
15	247	208	69	310	8
TOT.	655102	522023	378511	273807	198003

AGE	1970	1971	1972	1973	1974
3	29614	57459	20262	13196	8606
4	45405	24202	46798	16576	10690
5	32910	34831	17603	31925	11552
6	9703	19000	20384	6535	16062
7	12705	5126	9092	7942	3481
8	4095	5731	2440	4449	5063
9	5888	2120	1929	1043	2608
10	3794	3978	1009	645	442
11	474	2536	2194	529	368
12	269	333	1407	1097	342
13	501	173	211	572	717
14	86	317	118	61	394
15	53	64	165	53	17
TOT	145498	155870	123612	84625	60339

RUN AT 76 3 25 - 14 45
RUN NO. 3274

VIRTUAL POPULATION ANALYSIS

DFH

COD 1A-1D

Table 16d. Run 3275

STOCK IN NUMBERS AT BEGINNING OF YEAR

AGE	1965	1966	1967	1968	1969
3	136578	112961	36825	71204	57620
4	271599	99052	92168	28635	54907
5	163435	173355	75795	62834	17170
6	22581	91516	103923	37646	28228
7	13003	12061	43288	42700	13138
8	32550	6365	5998	18671	14419
9	3154	16407	3473	3014	8338
10	1110	1520	9232	1391	1092
11	748	601	723	3702	506
12	3726	317	309	326	1220
13	304	1833	193	195	121
14	268	201	790	43	131
15	247	208	69	310	8
TOT.	649304	516398	372786	270670	196898

AGE	1970	1971	1972	1973	1974
3	35620	40837	22727	14310	21754
4	46578	29119	49564	18595	11601
5	33934	35791	21629	34188	13204
6	9087	19836	21168	9805	17908
7	12313	4624	9774	8579	6153
8	3596	5412	2031	5005	5584
9	4905	1712	1671	711	3062
10	3211	3174	678	438	174
11	474	2059	1538	260	199
12	269	333	1018	563	122
13	501	173	211	258	281
14	86	317	118	61	137
15	53	64	165	53	17
TOT.	150628	163453	132292	92827	80194

AGE	1975
3	213
4	17592
5	8709
6	8911
7	10776
8	4194
9	3347
10	1876
11	37
12	74
13	19
14	59
15	19
TOT.	55826

RUN AT. 76 3 25 - 14 . 58
RUN NO. 3275

VIRTUAL POPULATION ANALYSIS

DFH

COD 1E-1F

Table 16 e. Run 3374

STOCK IN NUMBERS AT BEGINNING OF YEAR

AGE	1965	1966	1967	1968	1969
3	68475	109714	32891	11356	14673
4	110032	36062	88760	26885	9291
5	38544	87877	44098	71704	21114
6	6889	26750	54114	33208	49058
7	13423	3944	17763	31379	18240
8	13557	5263	1477	7740	12645
9	3804	6282	1264	562	3609
10	563	1320	2591	586	246
11	410	214	356	1072	311
12	1344	159	86	205	496
13	183	495	66	37	125
14	245	111	196	17	22
15	180	153	52	76	3
TOT.	257649	298343	243714	184829	129834

AGE	1970	1971	1972	1973	1974
3	5344	37411	3460	9956	31893
4	12014	4375	30629	2832	8148
5	7478	9681	3522	22423	2264
6	14434	4777	6919	2029	13744
7	26391	8831	2066	3675	787
8	7432	11382	3533	850	1760
9	5080	2786	3099	1275	389
10	1937	2039	928	873	298
11	138	833	896	413	310
12	157	26	416	488	238
13	229	83	10	243	314
14	66	82	39	4	163
15	14	30	34	20	2
TOT.	80714	82336	55551	45081	60310

RUN AT. 76 3 25 - 15 . 11
RUN NO. 3374

VIRTUAL POPULATION ANALYSIS

DFH

COD 1E-1F

STOCK IN NUMBERS AT BEGINNING OF YEAR

Table 16 of Run 3375

AGE	1965	1966	1967	1968	1969
3	66953	107801	32106	13698	14277
4	108603	54817	87194	26242	11208
5	36485	86707	43078	70422	20588
6	6889	25065	53157	32373	48009
7	13423	3944	16384	30597	17558
8	13557	5263	1477	6776	12099
9	3804	6282	1264	562	2933
10	563	1320	2591	586	246
11	410	214	356	1072	311
12	1344	159	86	205	496
13	183	495	66	37	125
14	245	111	196	17	22
15	180	153	52	76	3
TOT.	252640	292330	238008	182665	127877

AGE	1970	1971	1972	1973	1974
3	7073	35582	1826	6765	26649
4	11689	5791	29132	1494	5535
5	9048	9416	4682	21197	1169
6	14004	6061	6701	2977	12742
7	25535	8479	3112	3498	1558
8	6956	10783	3287	1583	1636
9	4699	2454	2689	1105	905
10	1463	1774	699	593	183
11	138	501	710	253	117
12	157	26	184	357	126
13	229	83	10	80	222
14	66	82	39	4	48
15	14	30	34	20	2
TOT.	81070	81063	53105	39925	50892

AGE	1975
3	11999
4	21728
5	4347
6	710
7	8081
8	934
9	787
10	556
11	68
12	20
13	40
14	91
15	2
TOT.	49362

RUN AT. 76 3 25 - 15 . 24

VIRTUAL POPULATION ANALYSIS

DFH

COD 1E-1F COD ICES SUBAREA XIV
STOCK IN NUMBERS AT BEGINNING OF YEAR

Table 16g. Run 3474

AGE	1965	1966	1967	1968	1969
3	121863	200676	66640	15393	20504
4	182071	99773	163209	54516	12595
5	61529	146739	79866	132527	43642
6	11288	45532	101847	62218	98274
7	29406	7460	33054	68316	41510
8	26298	13429	3251	15373	31114
9	9735	12562	5118	1386	7518
10	1414	3576	5712	1875	662
11	1080	650	1336	2424	943
12	2215	519	320	495	1191
13	487	832	273	146	265
14	420	259	347	127	82
15	484	207	121	119	61
TOT.	448289	532214	461094	354913	258362

AGE	1970	1971	1972	1973	1974
3	7543	42450	3764	13034	33156
4	16788	6176	34755	3081	10664
5	10156	13530	4974	25776	2445
6	32648	6899	9916	3140	16309
7	65871	23284	3655	5897	1579
8	19781	32441	10949	1453	2652
9	13885	9018	12394	4585	633
10	3912	5769	3363	3972	1706
11	343	1721	2031	1217	1423
12	457	119	765	756	528
13	565	207	51	319	380
14	123	236	105	9	173
15	43	48	115	41	5
TOT.	172115	141898	86836	63280	71655

RUN AT. 76 3 25 - 15 . 37
RUN NO. 3474

VIRTUAL POPULATION ANALYSIS

DFH

COD 1E-1F COD ICES SUBAREA XIV
STOCK IN NUMBERS AT BEGINNING OF YEAR

Table 16 h. Run 3475

AGE	1965	1966	1967	1968	1969
3	114929	186931	57709	18880	19564
4	178612	94096	151955	47204	15451
5	55718	143907	75218	123313	37656
6	11288	40775	99530	58412	90732
7	29406	7460	29160	66420	38397
8	26298	13429	3251	12996	29956
9	9735	12562	5118	1386	6065
10	1414	3576	5712	1875	662
11	1080	650	1336	2424	943
12	2215	519	320	495	1191
13	487	832	273	146	265
14	420	259	347	127	82
15	484	207	121	119	61
TOT.	432085	505202	430050	333796	241025

AGE	1970	1971	1972	1973	1974
3	9728	41293	2260	8684	27873
4	16018	7965	33808	1849	7103
5	12494	12900	6439	25000	1437
6	27747	8812	9400	4338	15675
7	59700	19273	5218	5475	2558
8	17879	28669	8500	2406	2395
9	13179	7857	10106	3097	1216
10	3023	5339	2660	2602	809
11	343	1180	1771	793	601
12	457	119	436	599	270
13	565	207	51	120	284
14	123	236	105	9	51
15	43	48	115	41	5
TOT.	161300	133897	80868	55012	60277

AGE	1975
3	19894
4	22726
5	5574
6	910
7	10043
8	1280
9	988
10	629
11	194
12	118
13	72
14	106
15	2
TOT.	62536

RUN AT. 76 3 25 - 16 18
RUN NO. 3475

TABLE 17, Part 1. Forecasts for cod catches and spawning biomass (age 6+) at the beginning of the year at Greenland (1975-) 1976-78 by various levels of exploitation. F is instantaneous fishing mortality rate for fully recruited age groups. Figures in brackets (given only in Part 1 and 4) indicate that proportion (%) of the catch and spawning biomass which is made up of year-classes 1971-75. Catch and biomass figures in thousand metric tons, round fresh weight.

Area	Basic year	F in basic year	1975			1976			1977			1978		
			F	catch	sp.biom.	F	catch	sp.biom.	F	catch	sp.biom.	F	catch	sp.biom.
Sub-area 1	1974	0.35	.20	29.2 (7.3)	161.5	.20	29.0 (21.3)	145.8	.20	31.1 (43.3)	158.0 (30.8)	.20	35.7 (65.3)	158.6 (51.5)
			.35	48.2 (7.6)	161.5	.35	43.0 (23.8)	128.0	.35	43.2 (49.1)	127.0 (34.3)	.35	47.8 (72.2)	118.0 (57.2)
			.40	54.0 (7.8)	161.5	.40	46.6 (24.7)	122.5	.40	45.9 (51.1)	118.3 (35.4)	.40	50.3 (74.3)	107.3 (59.0)
			.60	74.9 (8.2)	161.5	.60	56.6 (28.4)	103.0	.60	52.4 (58.7)	89.6 (56.5)	.60	56.0 (81.8)	74.6 (66.1)
	1975	0.35	-	-	-	.20	27.5 (21.9)	137.6	.20	30.3 (43.5)	153.2 (30.6)	.20	35.1 (65.4)	154.7 (51.3)
			-	-	-	.35	45.4 (22.6)	137.6	.35	45.4 (46.6)	135.6 (32.1)	.35	49.3 (70.0)	123.7 (54.5)
			-	-	-	.40	50.9 (22.8)	137.6	.40	49.4 (47.7)	130.4 (32.6)	.40	52.5 (71.4)	115.0 (55.6)
			-	-	-	.60	70.9 (23.7)	137.6	.60	61.2 (51.9)	111.1 (34.5)	.60	60.7 (77.0)	86.2 (59.9)

TABLE 17, Parts 2 and 3. (See text to Part 1).

Area	Basic year	F in basic year	1975			1976			1977			1978		
			F	catch	sp.biom.	F	catch	sp.biom.	F	catch	sp.biom.	F	catch	sp.biom.
Divs. 1A-1D	1974	0.35	.20	19.7	99.8	.20	20.7	92.7	.20	23.4	106.5	.20	28.0	112.0
			.35	32.4	99.8	.35	30.5	80.5	.35	32.3	84.2	.35	37.2	81.2
			.56	47.6	99.8	.56	38.9	66.1	.56	38.2	61.1	.56	42.6	53.0
	1975	0.35	-	-	-	.20	20.7	93.8	.20	23.6	107.8	.20	28.1	112.8
			-	-	-	.35	34.1	93.8	.35	35.1	94.4	.35	39.1	88.1
			-	-	-	.56	50.3	93.8	.56	45.2	78.5	.56	46.4	62.7
Divs. 1E-1F	1974	0.35	.20	8.6	52.1	.20	7.4	43.9	.20	7.2	45.1	.20	8.4	41.0
			.35	14.1	52.1	.35	10.9	38.7	.35	10.0	37.1	.35	11.5	31.6
			.45	17.5	52.1	.45	12.5	35.7	.45	11.1	32.7	.45	12.8	26.9
			.65	23.3	52.1	.65	14.6	30.3	.65	12.2	25.8	.65	14.4	19.8
1975	0.35	-	-	-	.20	6.0	35.0	.20	6.3	39.0	.20	7.8	37.1	
		-	-	-	.35	9.9	35.0	.35	9.5	35.0	.35	11.2	30.5	
		-	-	-	.45	12.3	35.0	.45	11.0	32.6	.45	12.8	26.9	
		-	-	-	.65	16.6	35.0	.65	13.2	28.3	.65	14.9	21.0	

TABLE 17, Parts 4 and 5. (See text to Part 1)

Area	Basic year	F in basic year	1975			1976			1977			1978		
			F	catch	sp.biom.	F	catch	sp.biom.	F	catch	sp.biom.	F	catch	sp.biom.
Divs. 1E-1F plus East Greenland	1974	0.22	.20	18.2 (1.8)	116.9 -	.20	14.0 (14.0)	87.1 -	.20	13.1 (35.8)	84.5 (31.4)	.20	15.0 (69.1)	73.5 (56.6)
			.35	29.9 (1.9)	116.9 -	.35	20.7 (16.0)	76.8 -	.35	18.2 (41.2)	69.9 (35.2)	.35	20.9 (75.7)	57.6 (62.8)
			.45	37.0 (1.9)	116.9 -	.45	23.8 (17.4)	70.7 -	.45	20.4 (44.9)	62.0 (37.9)	.45	23.6 (79.6)	49.4 (66.6)
			.65	49.5 (2.1)	116.9 -	.65	27.9 (20.4)	60.0 -	.65	22.7 (52.2)	49.3 (43.2)	.65	27.3 (86.0)	37.3 (73.6)
	1974	0.50	.20	8.0 (4.0)	45.7 -	.20	7.9 (24.7)	45.0 -	.20	9.6 (48.5)	60.8 (43.5)	.20	13.0 (79.0)	60.5 (68.7)
			.35	13.3 (4.2)	45.7 -	.35	12.0 (27.3)	40.3 -	.35	14.0 (53.4)	52.2 (47.0)	.35	19.0 (83.6)	49.2 (73.3)
			.45	16.4 (4.3)	45.7 -	.45	14.2 (29.0)	37.5 -	.45	16.1 (56.6)	47.3 (49.4)	.45	21.8 (86.2)	43.2 (76.1)
			.65	22.1 (4.6)	45.7 -	.65	17.3 (32.8)	32.5 -	.65	18.9 (62.8)	39.3 (53.9)	.65	25.9 (90.4)	33.8 (81.1)
			.22	8.8 (4.0)	45.7 -	.22	8.5 (25.1)	44.3 -	.22	10.3 (49.3)	59.5 (44.0)	.22	14.0 (79.6)	58.8 (60.3)
	1975	0.22	-	-	-	.20	11.3	68.7	.20	11.5	73.6	.20	14.0	67.8
			-	-	-	.35	18.8	68.7	.35	17.4	66.3	.35	20.6	56.1
			-	-	-	.45	23.3	68.7	.45	20.3	61.8	.45	23.7	49.7
			-	-	-	.65	31.4	68.7	.65	24.5	53.9	.65	28.1	39.3

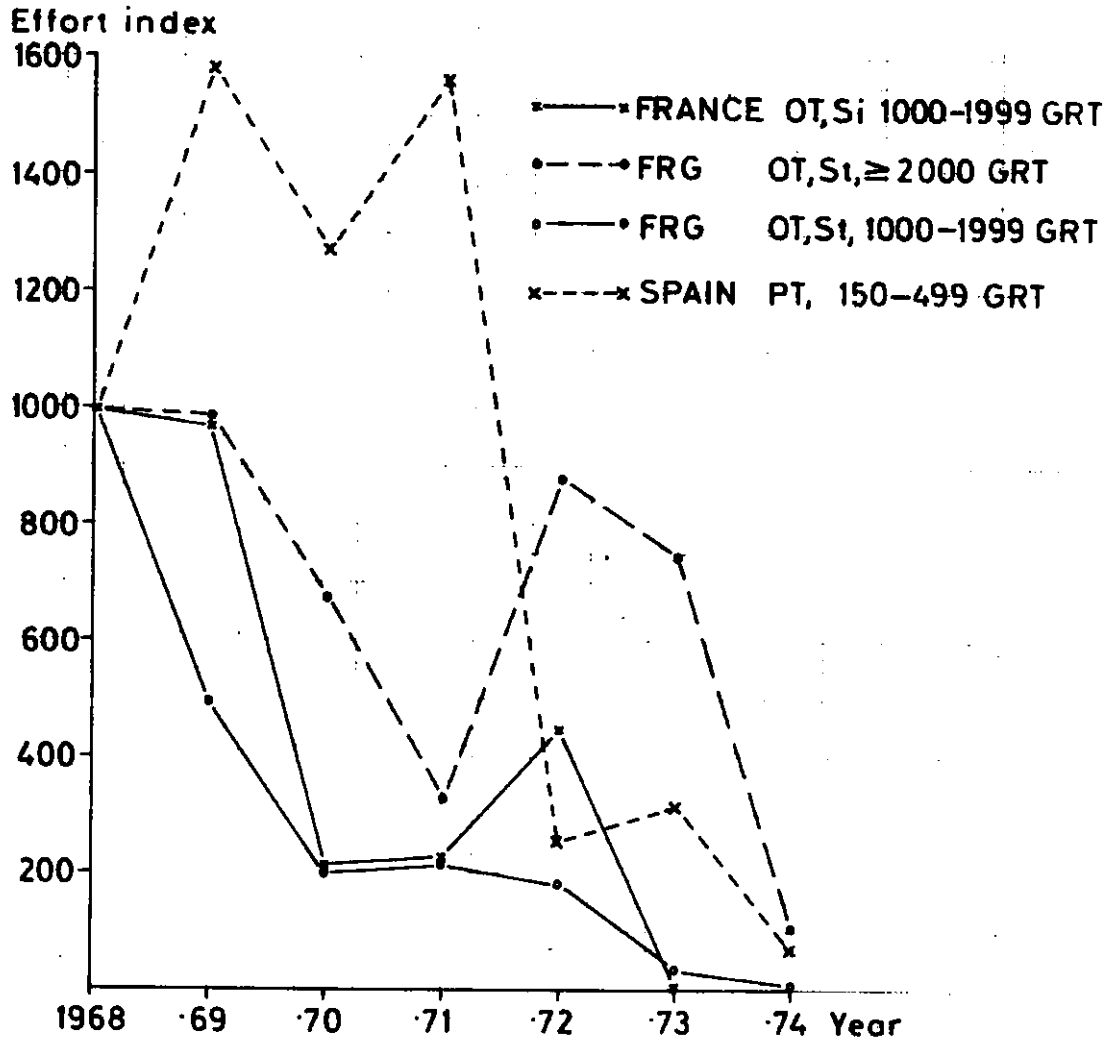


Fig. 1. Subarea 1 cod: trends in effort for some vessel categories, 1968-74.

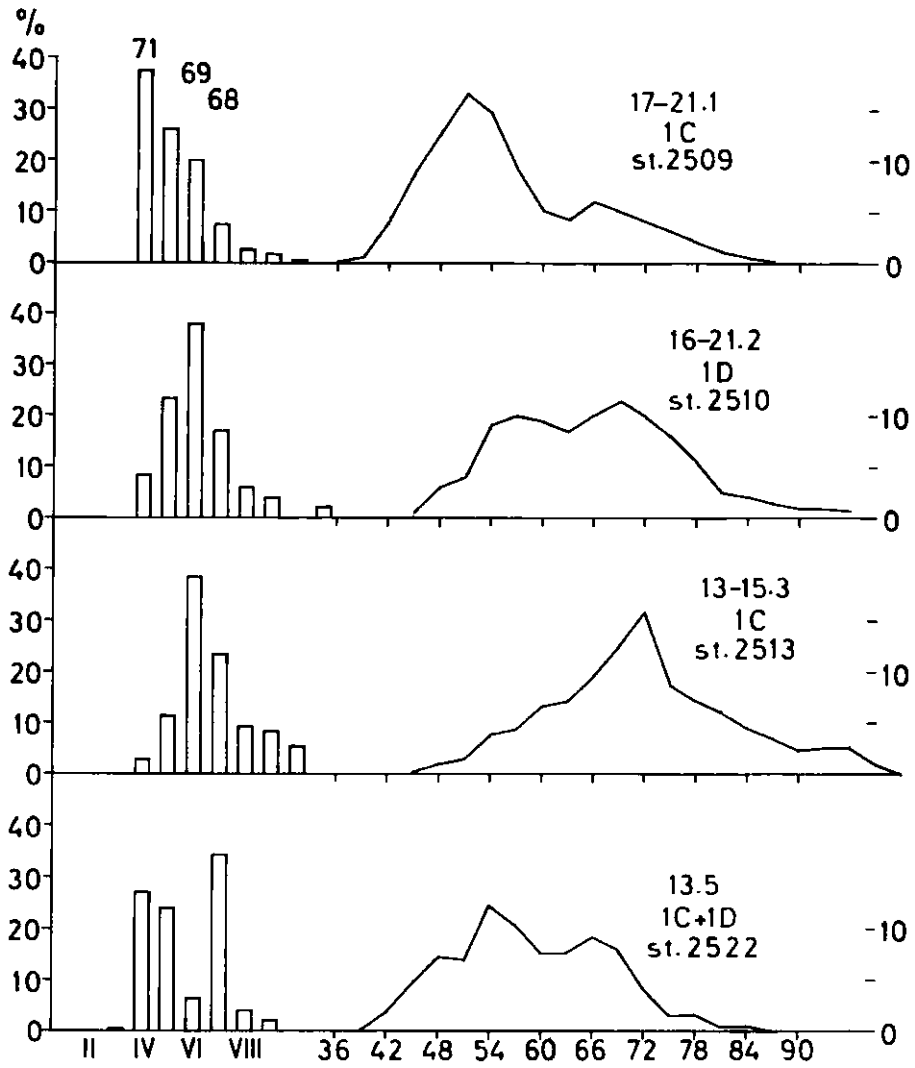


Fig. 2. Subarea 1 cod samples, 1975. Commercial otter trawlers.

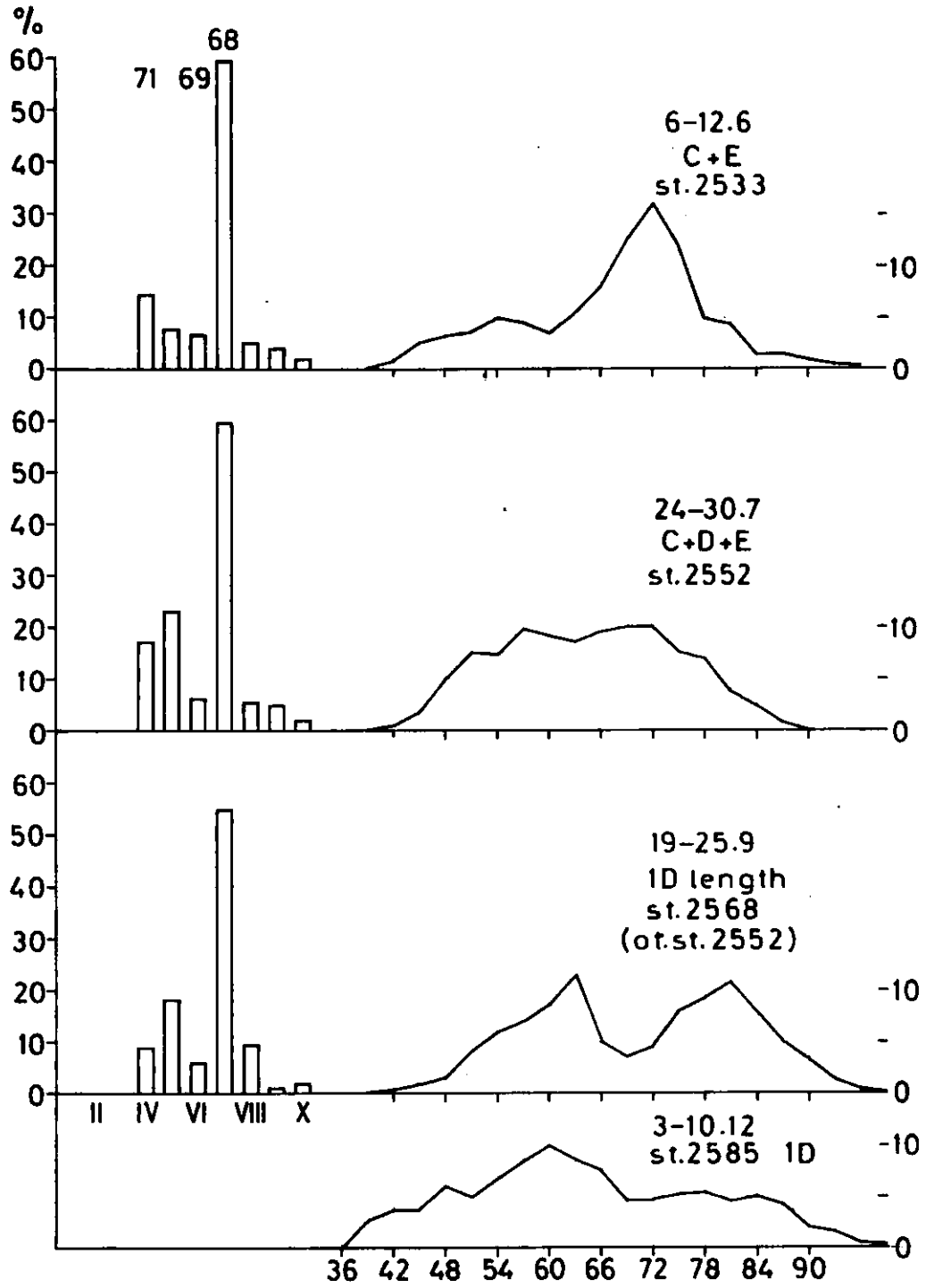


Fig. 3. Subarea 1 cod samples, 1975. Commercial otter trawlers.