RESTRICTED

International Commission for the Northwest Atlantic Fisheries

Serial No. 3322
(D.c.3)

ICNAF Res.Doc. 74/86

ANNUAL MEETING - JUNE 1974

Subarea 1 cod. Estimates of yield 1974-76.

by

Sv.Aa.Horsted

Grønlands Fiskeriundersøgelser, Charlottenlund, Denmark.

1. Introduction

The present paper updates a paper on Subarea 1 cod presented at last year's Annual Meeting of the Commission (Horsted, 1973). Most data for the years 1965-71 remain unchanged from that paper, but data for 1972 and as far as possible also for 1973 have been taken into account to give prognosis for catches in 1974-76 for various levels of effort.

The Chairman of the Assessment Subcommittee in his letter of August 28, 1973 proposed that stock assessment be summarized, if possible, in a similar way for all stocks. A routine summary as proposed has been given in Tables 7-8, whereas more fully information on the various observations and parameters is found in the other tables and in the text.

2. Nominal catches 1972-73

As for previous years the nominal catches reported as Div. 1NK have been allocated to divisions by the author.

For 1972 83% of total nominal catch is reported by divisions. The only catches reported as Div. 1NK are Norwegian liners' of 11 331 tons and Danish (Greenlandic) trawlers' catch of 8 757 tons. The former catch has been evenly allocated between divisions 1C - 1F. For the Greenland trawlers some information was available in ships' logbooks allowing an estimate of the break down on divisions as follows: 1B 13 tons, 1D 3412, 1E 873, and 1F 785 tons. Nominal catch in 1972 by division and gear is given in Table 1.

For 1973 most countries have reported provisional catch figures for Subarea 1 as a whole. The German Research Report (Meyer, 1974) contains information on the distribution of the fishery between divisions. Danish (G) catches by divisions were available to the author. For other countries, that is for about 2/3 of the total catch, the distribution between divisions was taken to be as in 1972. The resulting provisional figures for 1973 by division and gear are given in Table 2.

3. Trends in catch per effort, stock size and overall effort

The German Research Report, 1973 (Meyer, l.c.) contains up to date information on catch per day for Subarea 1 and for East Greenland. In Subarea 1 catch per day of cod in the years 1968-71 was rather constant, the mean for these years being 22.7 tons per day. However, in 1972 catch per day was only 12.9 tons per day (57% of the 1968-71 level) and fell further to 9.0 tons per day in 1973 although fishing was carried out only in the most productive season.

For the Greenland trawlers for which 2/3 to 3/4 of the catch consists of cod mean catch per hour was about 890 kg (all species, gutted weight) in 1972 but felle to about 760 kg in 1973, a decline from 1972 to 1973 by 22% which corresponds closely to the German decline in catch per day in the same period of 30%.

Both set of figures demonstrate that stock size has decreased further by about 1/4 from 1972 to 1973.

If overall c.p.u.e. has decreased by about 25% from 1972 to 1973 and catches at the same time decreased by about 40%, then overall effort seems to have decreased somewhat in the same period, probably by about 20%.

The material does not at present allow for analysis of these factors for Divs. 1A-1D and Divs. 1E-1F separately.

4. Mean length and weight of age groups in 1973

As pointed out last year (Horsted l.c.) the very important parameter of mean weight by age should be kept under constant review since it has been shown to vary much between years and year classes.

For the present analyses only Danish samples were available together with some information on UK commercial landings. The results may, therefore, need some revision when further material becomes available.

The Danish samples are set out in details in Table 3. A mean weight of each age group to be used in the analysis ought to be a weighted mean where the weighting factor should be the catch in each period (month) as pointed out by Meyer (1973). However, lacking information on monthly catches for 1973 and some further samples only a straight mean has been calculated. The sample covering 1D+1E+1F was omitted. Straight mean weight for age groups in 1973 is given in Table 4 together with weighted figures found by Meyer (l.c.).

For Divs. 1A-1D the two set of figures are in rather good agreement with each other. In Meyer's figures the age-groups 6 and especially 7 seem to have relatively high weight compared to other age groups. In the Danish 1973 figures the age-groups 7 and especially 8 seem to have a relatively high weight. This could mean that year-classes 1966 and especially 1965 have a relatively faster growth rate than other year classes present. Meyer's material was collected in the years 1965-72, but if a great part of the material is from 1971 and 1972 then the year-classes 1965 and 1966 would create the above mentioned effect for mean weight of age-groups 6 and 7 if the year classes are relatively fast growing.

For the present analyses of cod in Divs. 1A-1D the figures by Meyer have been used for the years 1965-72 whereas for the year 1973 the figures found from Danish samples as given in Table 4 are used (for age-group 14 and older a figure of 9.60 is used).

For Divs. 1E-1F the two set of figures differ very much from each other for age-groups 3-8. The reason for this is thought to be that the Danish figures originate from a landing taken by gill net. Portuguese samples (Sampling Yearbook, Vol. 17) clearly demonstrate that gill nets fish bigger cod than do other gears. Therefore, it is likely that of the younger age groups only the fast growing individuals are caught and the observed mean weights of these age groups are, therefore, heavily biassed if used in analyses of other components of the fishery. Since gill net fishing is the minor component of the fishery in Divs. 1E-1F (Table 2) the figures used for the analyses of Divs. 1E-1F cod are those by Meyer. These figures are also corresponding much better to figures given by the UK commercial landings by otter trawlers than do the Danish figures. The UK samples (advanced distribution of Sampling Yearbook, 1973) have overall mean weights as follows:

Div.1E, January: 2.61 kg, 1E, May: 3.31 kg, and 1F, January: 2.72 kg, all far below the Danish sample: 4.34 kg.

5. Numbers landed per age group in 1972 and 1973

Numbers landed per age group for the years 1965-71 were given in Res. Doc. 73/107 (Horsted, l.c.). Table 5 gives the figures for 1972 and 1973 as estimated by samples available in Sampling Yearbook for 1972 and those hitherto available for 1973. Since further material for 1973 may become available the figures for 1973 should be regarded as rough, provisional estimates.

6. Information on future recruitment

Recruitment af Subarea 1 cod to the fisheries will start at an age of 3-4 years. The year classes in question for recruitment in 1973-76 are thus year-classes 1969-1973.

Predictions of the strength of the 1973 year-class can at present be made only on hydrographic and plankton observations in 1973. As indicated in the Danish Research Report, 1973 (Horsted, 1974) the occurrence of cod larvae in 1973 was very poor. Water temperatures, however, were higher than in 1972. Although expected to be a poor year class the 1973 year-class could, therefore, be somewhat better than the very poor year-classes of 1971 and 1972.

Observations on year-class 1972 (age-group 1) has not been carried out in 1973. There is, therefore, no reason to change the former judgement of it being a poor year class (Horsted, l.c.).

Year-class 1971 has been observed in Danish research catches in Div. 1D, 1973 with fine meshed otter trawl (Danish Research Report, 1973, Table 2), but the material is too scarce for a judgment of its strength. In research

catches in January 1974 at the same locality the year class makes up 46% of the cod catch , but catch per hour of the year class is not more than 8 specimens. Further material is necessary for a judgment of its strength. At present there seems no reason to change the estimate of the 1971 year-class as being a poor one.

Year-class 1970 has hardly occurred in the Danish research catches mentioned above under year-class 1971, nor has it been observed in any quantities in the commercial catches by Denmark and the UK (see Table 5). It must, therefore, still be regarded a very poor one.

Year-class 1969 has been as poorly represented in the Danish research catches as has the 1970 year-class. Also the commercial catches in 1972 and 1973 contained very few individuals of this year class, which is a very poor one.

The conclusion that year-classes 1969-72 are poor ones is also reached by Meyer (l.c.) on the basis of the few cod of these year classes found in the research catches of R/V WALTHER HERWIG in Divs. 1C, 1D, and 1F in 1973.

Another evidence to support that the 1969-72 year-classes are poor is the nearly negligible discard rate reported by the Greenland trawlers (Table 3). Also discarding in the inshore Greenland pound net fishery, which in "normal" years discard many small cod, is reported to be relatively limited in recent years.

To give any absolute figures for the number of recruits 1974-76 is very difficult. In any case, however, stock size seems to be likely to a further decrease in the forthcoming 3-4 years since year-classes recruiting undoubtedly are smaller than year classes leaving the stock due to fishing, natural mortality and migration to East Greenland-Iceland.

For assessment purposes (the model requires some absolute figures) the following number of recruits (at age 3) are proposed:

Year-class	Divs. 1A-1D	Divs. 1E-1F
1968	90×10^6	40×10^6
1969	30 -	15 -
1970	20 -	10 -
1971	20 -	10 -
1972	20 -	10 -
1973	30 -	10 -

7. Other parameters for virtual population analyses

As in the analyses carried out last year (Horsted, l.c.) natural mortality for all age groups in the fishery is taken as M = 0.20. For Divs. 1E-1F an extra "natural mortality" of 0.15 is added for age-groups 7 and older to cover spawning migration out of the area (to East Greenland and Iceland).

Partial recruitment is taken as in former analyses (Anon., 1972)

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

Prognoses have been made for F_{max} and F_{opt}. The values of these are taken as in earlier assessments (Anon., 1972) to be

	Divs. 1A-1D	Divs. 1E-1F
F_{max}	0.56	0.65
F_{opt}	0.35	0.45

For Div. 1E-1F prognoses have also been made assuming a fishing mortality of F = 0.35.

Analyses of fishing mortality rate (F) and stock size was carried out on the basis of number caught per age group in the years 1965-73 (Table 5 of the present paper plus Tables 9 and 10 of Res.Doc. 73/107) and on estimated value of F for oldest age group (age 14) taken as straight mean F for fully recruited age groups (age 8 and older) in Table 2 of Schumacher (1971) as follows:

YEAR:	1965	1966	1967	1968	1969
Mean F_{8+} :	0.70	0.60	0.70	0.77	0.55

For the years 1970-73 F for oldest age groups was estimated to have declined somewhat from previous level due to the reported decreasing interest of fleets to fish in the area. The following F values were taken as input:

YEAR	1970	1971	1972	1973
F in Divs. 1A-1D	0.50	0.50	0.30	0.30
F in Divs. 1E-1F	0.30	0.30	0.30	0.30

8. Analyses of fishing mortality and stock size.

The results of the virtuel population analyses are set out in Table 6 (fishing mortality) and Tables 7 and 8 (stock size by age groups).

As will be seen from Tables 7 and 8 stock size by 1973 in Divs. 1A-1D is only about 19% (by number) or 27% (by weight) of stock size in 1965. For Divs. 1E-1F the 1973 stock size is about 16% (by number) or 33% (by weight) of stock size in 1965. The reason for the relatively higher percetages by weight than by number must be ascribed to the fact, that the decrease in stock size is mainly the result of poor recruitment since 1967 so that the stock by 1973 consists of relatively older fish than the stock in 1965.

In last year's assessment (Res.Doc. 73/107) the year-class 1968 was estimated to recruit to the fishery with 90×10^6 specimens (3 years old) in Divs 1A-1D and 40×10^6 specimens in Divs. 1E-1F. Present analyses indicate the number of recruits to have been about 126×10^6 and 32×10^6 recruits for the two areas respectively but these figures may well be revised when further material becomes available.

Table 6 indicates that although fishing activity and certainly catch in Divs. 1A-1D has dropped considerably in recent years the fishing mortality on older fish has been very high in 1972. This could reflect two tendencies in the fishery: a) The establishment of a set gill net fishery known from

Portuguese samples to exploit old fish (age 8 and more) and b) the tendency of the remainder of the trawlers' effort to be concentrated in the peak season on spawning schools. However, also some bias in sampling relative to fisheries may have occurred.

9. Prognosis for 1974-76.

With stock size at a level of about 1/4 (by weight) of the 1965 level and with the very poor prospects for recruitment in the mid 1970ies it is quite clear that catches themselves will continue at a very low level below 1/4 of the 1965 level, i.e. that catches are expected to be less than 90 000 tons for Subarea 1 as a whole.

Prognosis carried out on the basis of present information on stock size and stock composition by 1973 gives the results shown in Table 9.

10. Discussion

Clearly the reliability of the estimated catches in 1974-76 (Table 9) depends upon the accuracy by which the recruiting year classes are estimated. As stated earlier in this paper the information on year-classes 1969-73 is very scarce. Although present analyses tend to show that the strength of the 1968 year-class might have been somewhat underestimated the analyses do not support that the same is the case concerning the following year classes - rather the opposite is the case at present. The figures given in Table 9 may, therefore, be overestimates of the actual situation.

Another point should be brought in mind when discussing management of Subarea 1 cod: The probable relationship between spawning stock size and number of recruits, and also the heavy influence of the environmental factors on year class strength. If year class strength did not fluctuate that widely due to environmental factors as is the case in this stock, the stock/recruitment relationship may not have been so critical as it could become now. It should be remembered, however, that the spawning stock in the mid 1970ies will consist primarily, not to say exclusively, of the 1968 year-class. The spawning of this year class may, however, not result in any substantial number of surviving larvae in the years when the spawning reaches its greatest potential, simply due to the possible adverse environmental conditions. The chance of having a year with good environmental condition together with a spawning stock of sufficient size to produce a good year class will be much improved if the 1968 year-class is allowed to be maintained at an important level for a rather longer time than a fishery at F_{max} would allow.

11. Acknowledgement

Mr. Hans Lassen of the Danish Institute for Fisheries and Marine Research, Charlottenlund and Mr. Poul Johansen (same institute as the author) kindly undertook to make the programmes and run the analyses on the computer. My sincere thanks are due to my two colleagues for this help.

References:

Anon. 1972 Report of the ICES/ICNAF Working Group on Cod Stocks in the North Atlantic. Cons.Int.Expl.Mer, Coop.Res.Rep. 33:1-52 (also ICNAF Res.Doc. 72/33).

Horsted, Sv.Aa. 1973 Recent information on landings, age compositions and recruitment of Subarea 1 cod, and estimates of yield in 1972-75. Int.Comm.NW Atl.Fish., Res.Doc. 73/107.

1974 Danish Research Report, 1973. Int.Comm. NW Atl.Fish Summ. Doc. 74/

Meyer, A. 1973 Mean length and weight for various age groups of cod in the northern and the southern divisions of West Greenland. Int.Comm. NW Atl.Fish., Redbook 1973/III:41-43.

1973 German Research Report, 1973 Subarea 1 and East Greenland. Int.Comm. NW Atl.Fish., Summ. Doc. 74/

Schumacher, A. Fishing Mortality and Stock Size in the West Greenland Cod. Int.Comm. NW Atl.Fish. Res.Bull. 8:15-19.

Table 1. Nominal catch (metric tons x 10^{-3}) of cod in Subarea 1, 1972. Catches reported as Div. 1 NK have been allocated to divisions (see text, Page 1).

Div.	Otter trawl	Set gill nets	Longliners	Unknown	Total
1A				263	263
1B	1080	1966		1855	4901
1C	38748	2932	2833	8058	52571
1D	16154	3515	2833	6412	28914
1E	5895	72	2833	3461	12261
1F	4332		2832	4545	11709
Total	66209	8485	11331	24594	110619

Table 2. Preliminary (partly estimated) nominal catch (metric tons x 10^{-3}) of cod in Subarea 1, 1973.

Div.	Otter trawl	Set gill nets	Longliners	Unknown	Total
1A				261	261
1B	534	1563		1823	3920
1C	13450	2331	1935	5512	23228
1D	10743	2794	1935	5947	21419
1E	5926	57	1935	3368	11286
1F	2253		1935	2700	6888
Total	32906	6745	7740	19611	67002

Table 3. Subarea 1 cod, 1973. Danish samples. Nos. sampled of each age group refer only to fish where length as well as weight was measurd and otoliths taken, whereas "total sample" at bottom of the table gives total of numbers aged (and weighted) plus numbers only measured. Length frequencius are not reflected by numbers in each age since these were sampled stratified.
cm = Uncorrected mean total length in cm (below) ± standard deviation.
kg = Mean weight in kg round, fresh ± standard deviation. Values are calculated from observed gutted weight (head on) by conversion factor 1.22.

Age group	Division	1C offshore	1C+1D offshore	1D offshore	1D offshore
	Month	FEB	JAN	MAR	APR
	Gear	OT	OT	OT	OT
III	Nos				
	cm				
	kg				
IV	Nos	45	3		3
	cm	48.2 3.2	45.1 1.4		51.1 5.0
	kg	1.18 0.22	0.85 0.07		1.26 0.36
V	Nos	125	176	167	182
	cm	56.7 5.1	54.1 5.4	51.7 4.9	53.7 5.0
	kg	1.90 0.48	1.55 0.46	1.36 0.40	1.45 0.41
VI	Nos	92	46	26	28
	cm	64.2 5.2	62.0 5.3	56.4 4.7	60.4 4.4
	kg	2.69 0.62	2.32 0.61	1.74 0.45	2.04 0.43
VII	Nos	70	56	13	26
	cm	73.5 6.0	69.0 9.0	64.1 7.6	67.7 6.4
	kg	4.01 1.04	3.34 1.31	2.61 0.94	2.89 0.75
VIII	Nos	24	40	2	4
	cm	81.7 7.9	81.1 6.8	67.0 7.7	80.5 5.3
	kg	5.55 1.43	5.38 1.56	3.17 1.49	3.96 0.53
IX	Nos	2	5	1	4
	cm	82.5 3.5	86.0 4.6	78.0	75.8 5.9
	kg	5.50 0.59	6.33 1.30	4.39	3.88 0.92
X	Nos	1	7	1	4
	cm	98.0	87.7 12.3	64.0	74.8 8.7
	kg	8.85	6.30 2.04	2.56	3.81 1.12
XI	Nos	2	4	1	1
	cm	74.5 9.9	85.3 6.6	73.0	68.0
	kg	4.14 1.82	6.26 1.57	3.36	3.57
XII	Nos	2	7		1
	cm	99.0	93.6 8.4		77.0
	kg	10.92	8.96 2.91		3.69
XIII	Nos	1	2		
	cm	84.0	96.0 5.7		
	kg	7.08	8.85 2.16		
XIV	Nos		2		
	cm		95.0 2.1		
	kg		8.31 1.27		
XIV+	Nos	1	2		
	cm	102.0	96.0		
	kg	10.86	8.50		
Overall mean length		60.2	58.7	52.5	55.0
Overall mean weight		2.36	2.17	1.44	1.58
Discards		none	none	none	none
Nos. aged		365	350	211	253
Nos. in total sample		1075	832	877	941
Landed weight (tons round, fresh) represented by sample		189	52	93	119

Table 3 cont.....

Table 3 continued.

Age group	Division	1D offshore		1D inshore		1D+1E+1F offshore		1F inshore	
	Month	NOV		AUG		OCT		OCT	
	Gear	OT		PN		OT		SGN	
III	Nos					2			
	cm					38.5	0.7		
	kg					0.46	0.13		
IV	Nos	13		5		10			
	cm	53.6	4.3	53.1	2.3	52.1	6.2		
	kg	1.54	0.34	1.42	0.16	1.43	0.50		
V	Nos	211		177		207		4	
	cm	60.7	5.3	55.1	4.4	57.7	6.1	68.0	2.2
	kg	2.22	0.58	1.59	0.38	1.95	0.64	3.18	0.17
VI	Nos	35		6		50		7	
	cm	69.3	5.7	62.7	3.3	67.8	6.5	70.0	5.4
	kg	3.27	0.90	2.31	0.33	3.17	0.87	3.39	0.76
VII	Nos	67		2		79		29	
	cm	75.6	5.9	68.0	5.7	75.2	6.9	70.2	4.7
	kg	4.34	1.03	3.09	0.90	4.38	1.08	3.52	0.60
VIII	Nos	19		1		43		14	
	cm	84.0	5.4	68.0		82.2	6.0	77.9	4.2
	kg	5.92	1.27	2.99		5.67	1.19	4.55	0.69
IX	Nos	11		1		13		83	
	cm	85.2	6.5	72.0		81.9	5.1	77.0	6.5
	kg	6.14	1.32	3.72		5.55	1.00	4.40	0.88
X	Nos	6				10		54	
	cm	83.0	7.9			87.8	3.3	79.7	5.7
	kg	5.81	1.76			6.73	0.62	4.79	0.88
XI	Nos	3				2		6	
	cm	88.5	13.2			88.4	16.1	78.5	8.8
	kg	8.07	3.17			6.79	3.29	4.67	1.40
XII	Nos	3				5		1	
	cm	94.3	14.4			100.6	3.4	86.0	-
	kg	9.38	4.31			10.32	0.93	5.62	-
XIII	Nos	2				1			
	cm	102.0	1.4			106.0	-		
	kg	11.77	0.60			10.61	-		
XIV	Nos								
	cm								
	kg								
XIV_+	Nos								
	cm								
	kg								
Overall mean length		63.8		55.2		63.2		76.4	
Overall mean weight		2.69		1.61		2.74		4.34	
Discards		no info.		very few		no info.		no info.	
Nos. aged		370		192		422		198	
Nos. in total sample		992		693		912		198	
Landed weight (tons round, fresh) represented by sample		102		3		81		no info.	

Table 4. Mean weight (kg round, fresh) by age groups as obtained from Table 3 (straight mean) compared to figures by Meyer (Res.Doc. 73/38, Table 3).

Age	3	4	5	6	7	8	9	10	11	12	13	14	14+
Divs. 1A-1D from Table 3		1.28	1.72	2.51	3.52	4.66	5.07	5.68	5.37	8.65	9.58	8.31	9.68
Divs. 1A-1D after Meyer	0.58	1.08	1.94	2.80	3.60	3.98	4.63	5.48	6.23				
Divs. 1E-1F from Table 3			3.18	3.39	3.52	4.55	4.40	4.79	4.67	5.62			
Divs. 1E-1F after Meyer	0.41	0.82	1.27	1.88	2.68	3.25	3.90	5.02	6.23				

Table 5. Numbers of cod (x 10^{-3}) per age group in nominal catches 1972 and provisional figures for 1973.

Age group	1 9 7 2			1 9 7 3		
	1A-1D	1E-1F	Sub. 1	1A-1D	1E-1F	Sub. 1
3	14	1	15			
4	7095	2944	10039	1463	8	1471
5	8834	952	9786	12792	1958	14750
6	9802	2218	12020	3610	516	4126
7	3344	737	4081	1941	1539	3480
8	1068	1482	2550	987	711	1698
9	1049	1611	2660	467	969	1436
10	331	293	624	80	553	633
11	781	173	954	118	111	229
12	649	60	709	38	97	135
13	126	4	130	52	61	113
14	48	9	57	5		5
14+	105	17	122	12	7	19
Total	33246	10501	43747	21565	6530	28095
Nominal Catch (tons)	86649	23970	110619	48828	18174	67002
Calculated mean weight	2.61	2.28	2.53	2.26	2.78	2.38

Table 6. Fishing mortality rate (F) in 1970-72.

Age	Divs. 1A-1D 1970	1971	1972	Divs. 1E-1F 1970	1971	1972
4	0.06	0.08	0.08	0.01	0.01	0.13
5	0.36	0.33	0.42	0.15	0.09	0.24
6	0.36	0.55	0.72	0.19	0.31	0.27
7	0.64	0.40	0.54	0.41	0.31	0.19
8	0.47	1.02	0.40	0.61	0.67	0.26
9	0.28	0.56	1.32	0.60	0.71	0.45
10	0.25	0.70	0.47	0.48	0.52	0.41
11	0.18	0.52	1.66	1.29	0.33	0.30
12	0.16	0.32	1.28	0.29	0.57	0.18
13	0.28	0.11	1.83	0.50	0.42	0.57
14	0.49	0.50	0.30	0.30	0.30	0.30
Mean for age 6-14	0.35	0.52	0.95			
" 7-14				0.56	0.48	0.33

Table 7. STOCK RECORD

Species: Cod
Stock area: 1A-1D
MSY(w): 325 000 tons ++)
F_{max}: 0.56 +)
F_{opt}: 0.35 +)

Reference: Res.Doc. 73/107 and 74/
Last year of data: 1972 and partly 1973
Spawn stock at MSY(w): 830 000 tons +) (age 6 and more, 1960)
Method: Virtual population

	Age group	$\bar{w}$ (kg) 1965-72	$\bar{w}$ (kg) 1973	Part. recr.%	1965	1966	1967	1968	1969	1970	1971
STOCK	3	0.58	0.58	9	137829	112533	41101	68936	56817	45659	125618
	4	1.08	1.28	27	269467	100077	91818	32136	53051	45920	37338
	5	1.94	1.72	64	163236	171612	76634	62547	20032	32416	35253
	6	2.80	2.51	100	22370	91354	102498	38330	27994	11425	18596
	7	3.60	3.52	↓	13360	11888	43156	41542	13691	12123	6532
	8	3.98	4.66		32466	6656	5857	18564	13484	4041	5258
	9	4.63	5.07		2966	16339	3711	2899	8251	4151	2075
	10	5.48	5.68		1092	1366	9176	1584	999	3140	2557
	11	6.23	5.37		763	587	598	3656	663	398	2001
	12	↓	8.65		3769	330	298	225	1184	397	271
	13		9.58		431	1868	204	185	39	471	278
	14		9.60	↓	36	305	819	51	123	20	292
	more	↓	9.60		171	150	53	258	6	34	41
	$N_s x10^{-3}$				647785	514915	375870	270655	196378	160161	236069
	W_s (tons)				978676	935641	821850	574859	367404	275236	321230
CATCH	3				14163	350	1678	3756	662	49	272
	4				54481	5876	14021	6982	12257	2597	2453
	5				47115	42294	27246	25957	5542	8846	9054
	6				7166	35344	47457	19852	12078	3142	7219
	7				4780	4327	18762	23071	8069	5222	1963
	8				11430	1937	2117	7769	7749	1376	3104
	9				1187	4680	1627	1543	4053	936	811
	10				343	582	4320	710	470	633	1184
	11				330	204	297	2034	162	61	746
	12				1359	74	65	164	558	52	68
	13				53	795	130	32	14	104	27
	14				13	108	378	31	60	7	105
	more				171	150	53	258	6	34	41
	$N_c x10^{-3}$				145239	96721	118204	92159	51680	23059	27047
	W_c (tons)				296204	290545	343728	279539	144331	62447	76448
	Fishing effort										
	Fishing mort.(Straight mean F ages 6-14)				0.47	0.48	0.68	0.85	0.64	0.35	0.52
	TAC rec.by STACRES										

Recruitment prospects: Year-classes 1970-73 all very poor. 1970-72 probably about $2x10^7$, 1973 $3x10^7$ specimens at recruitment (age 3)

Comments: 1) TAC's were recommended for Subarea 1 as a whole. 1973: 102 000 tons, 1974: 80 000 tons. Agreed TAC for 1974: 107 000 tons.
2) M= 0.20 for all age groups.
+) Data from Anon., 1973, Tables 11 and 16.
++) Rough estimate by 1960.

CONT.....

Table 7 cont.

	Age group	$\bar{w}$ (kg) 1965-72	$\bar{w}$ (kg) 1973	Part recr.%	1972	1973 (prov.)	1974	1975	1976
STOCK	3	0.58	0.58	9	20699				
	4	1.08	1.28	27	102602	16934			
	5	1.94	1.72	64	28356	77603			
	6	2.80	2.51	100	20729	15291			
	7	3.60	3.52		8763	8222			
	8	3.98	4.66		3587	4181			
	9	4.63	5.07		1547	1978			
	10	5.48	5.68		973	339			
	11	6.23	5.37		1036	500			
	12		8.65		970	161			
	13		9.58		161	220			
	14		9.60		203	21			
	more		9.60		105	12			
	$N_s \times 10^{-3}$				189626	125450			
	W_s (tons)				310218	269121			
CATCH	3				14				
	4				7095	1463			
	5				8834	12792			
	6				9802	3610			
	7				3344	1941			
	8				1068	987			
	9				1049	467			
	10				331	80			
	11				781	118			
	12				649	38			
	13				126	52			
	14				48	5			
	more				105	12			
	$N_c \times 10^{-3}$				33246	21565			
	W_c (tons)				86649	48828			
	Fishing effort								
	Fishing mort. (straight mean F ages 6-14)				0.95	(0.30)			
	TAC rec. by STACRES					footnote 1			
	Recruitment prospects:								
	Comments:								

Table 8.

STOCK RECORD

Species: Cod
Stock area: 1E-1F
MSY(w): 150 000 tons++)
F_{max}: 0.65+)
F_{opt}: 0.45+)

Reference: Res.Doc. 73/107 and 74/
Last year of data: 1972 and partly 1973
Spawn stock at MSY(w): 350 000 tons+) (age 6 and more, 1960)
Method: Virtual population

	Age group	W (kg)	Part. recr.%	1965	1966	1967	1968	1969	1970	1971
STOCK	3	0.41	1	69018	119426	45715	18230	21015	7353	32402
	4	0.82	8	92826	56507	96712	37384	14918	17206	6020
	5	1.27	41	38736	73790	44462	78215	29710	12086	13932
	6	1.88	67	6893	26907	42599	33506	54386	21469	8547
	7	2.68	100	13413	3947	17892	30919	18483	30742	14585
	8	3.25		13903	5255	1479	7830	12323	7602	14430
	9	3.90		3916	6525	1259	564	3672	4855	2904
	10	5.02		512	1398	2761	583	247	1982	1883
	11	6.23		500	178	410	1190	309	139	864
	12	↓	↓	1351	222	61	243	579	155	27
	13			164	500	110	20	152	288	82
	14			67	97	199	48	10	85	123
	more			105	97	32	45	2	7	15
	$N_s x10^{-3}$			241299	294752	253659	208732	155804	103962	95799
	W_s (tons)			279163	306539	312222	323539	272578	213495	166339
CATCH	3				1180	49	8			
	4			2447	1996	1070	994	142	171	66
	5			5336	19836	3211	10713	3167	1496	1118
	6			1889	4597	14391	9972	15355	3323	2064
	7			5110	1588	5800	11520	6595	8763	3274
	8			3965	3018	583	2236	4662	2989	6054
	9			1662	2232	369	182	731	1874	1266
	10			223	707	917	123	43	647	657
	11			158	79	55	314	75	88	207
	12			552	56	28	23	146	33	10
	13			22	186	36	5	27	97	24
	14			24	31	75	11	2	20	29
	more			105	97	32	45	2	7	15
	$N_c x10^{-3}$			21493	35715	26616	36146	30947	19508	14784
	W_c (tons)			64137	77661	85751	114001	70476	53550	43837
Fishing effort										
Fishing mort.(straight mean F ages 7-14)				0.52	0.65	0.49	0.36	0.28	0.56	0.48
TAC rec. by STACRES										

Recruitment prospects: Yearclasses 1970-73 all very poor, probably in the order of 10^7 specimens at recruitment (age 3)

Comments: 1) TAC's were recommended for Subarea 1 as a whole. 1973: 102 000 tons, 1974: 80 000 tons. Agreed TAC for 1974: 107 000 tons.
2) M= 0.20 for all age groups. For age-groups 7 and older an emigration "mortality" of 0.15 has been added.
+) Data from Anon., 1973 cover Divs. 1E-1F plus East Greenland.
++) Rough estimate by 1960.

cont.....

Table 8 cont.

	Age group	w (kg)	Part. recr.%	1972	1973 (prov.)	1974	1975	1976
STOCK	3	0.41	1	545				
	4	0.82	8	26529	446			
	5	1.27	41	4870	19066			
	6	1.88	67	10399	3130			
	7	2.68	100	5143	6519			
	8	3.25		7568	3012			
	9	3.90		5209	4105			
	10	5.02		1010	2342			
	11	6.23		786	470			
	12	↓	↓	437	411			
	13			11	258			
	14			38	4			
	more			17				
	$N_s x10^{-3}$			62545	39763			
	W_s (tons)			119639	92640			
CATCH	3			1				
	4			2944				
	5			952	625			
	6			2218	198			
	7			737	1817			
	8			1482	995			
	9			1611	916			
	10			293	523			
	11			173	138			
	12			60	152			
	13			4	77			
	14			9				
	more			17				
	$N_c x10^{-3}$			10501	5441			
	W_c (tons)			23970	18174			
	Fishing effort							
	Fishing mort. (straight mean F ages 7-14)			0.33	(0.30)			
	TAC rec. by STACRES			footnote 1				
	Recruitment prospects:							
	Comments:							

Table 9. Prognosis for nominal catches (metric tons 10^{-3}) 1974-76 by various levels of fishing mortality. For values of F_{max} and F_{opt}, see page 5.

F	Divs. 1A-1D			Divs. 1E-1F			Subarea 1		
	1974	1975	1976	1974	1975	1976	1974	1975	1976
F_{max}	115	94	68	35	29	22	150	133	90
F_{opt}	78	76	65	26	24	21	104	100	86
0.35	78	76	65	21	21	19	99	97	84

G 2