ERRATA

Page 5, line 3	"... implications of an overall TAC ..."
Page 9, App. II	"... Special Working Group on ICNAF ..."
Page 68, sec. 6(ii)	"... TAC be set to include ..."
Page 74, sec. 6, line 7	"... and distribution is continuing. STACRES ..."
Page 78, sec. 2(a), line 4	"... is due primarily to ..."
line 17	"... set by the Commission for 1974."
Page 94, sec. 1(a), line 9	"... showed increases from 1972 ..."
Page 102, sec. (q), line 5	"... of the varied importance of ..."
Page 112, Table 7, last column	"Stock size at start of 1976"
Page 135, Rec. (13), line 4	"... points raised in the ..."
Page 135, sec. 1, line 22	Delete "of agreement"
Page 137, sec. 9, line 24	"... other problem is ..."
Page 152, Res.Doc. 74/116	"... rediscovered whelping population ..."

INTERNATIONAL COMMISSION

FOR THE

NORTHWEST ATLANTIC FISHERIES

REDBOOK 1974

STANDING COMMITTEE ON RESEARCH AND STATISTICS

PROCEEDINGS
OF
SPECIAL MEETING OCTOBER 1973
SPECIAL MEETING JANUARY 1974
ANNUAL MEETING MAY-JUNE 1974

Dartmouth • Canada
August 1974

PREFACE

In accordance with a recommendation of the Standing Committee on Research and Statistics (STACRES) at the 1974 Annual Meeting that the publication of Redbook, Parts II and III, be discontinued (this volume, pages 75 and 141), REDBOOK 1974 is issued in one volume only and contains four sections (A, B, C and D), the first three of which cover the reports of STACRES Meetings held at Ottawa, Canada in October 1973, at Rome, Italy in January 1974, and at Dartmouth, Canada in May-June 1974. The fourth section contains (1) the STACRES Agenda for the 1974 Annual Meeting, (2) lists of recommendations from the 1974 Mid-term and Annual Meetings, and (3) lists of Research and Summary Documents presented to the 1974 Mid-term and Annual Meetings.

In view of the rapidly-increasing volume of sampling data becoming available, STACRES decided to discontinue the publication of Sampling Yearbook and to include in Redbook an annual list of all commercial and research samples available. However, since the inclusion of a list of 1973 sampling data would significantly delay the publication of this volume, the Secretariat, in consultation with the Chairman of STACRES, decided to proceed with the issuing of the Redbook and to issue an index of 1973 sampling data as a separate volume, pending reconsideration by STACRES at the 1975 Annual Meeting.

The STACRES Reports in Sections A, B and C of this volume correspond to Proceedings No. 1 of the October 1973, January 1974 and June 1974 Meetings of the Commission.

This issue of Redbook was produced in the Secretariat largely through the efforts of Mrs E.R. Cornford and Messrs G.M. Moulton, R.A. Myers and B.T. Crawford.

V. M. Hodder
Assistant Executive Secretary

1 August 1974

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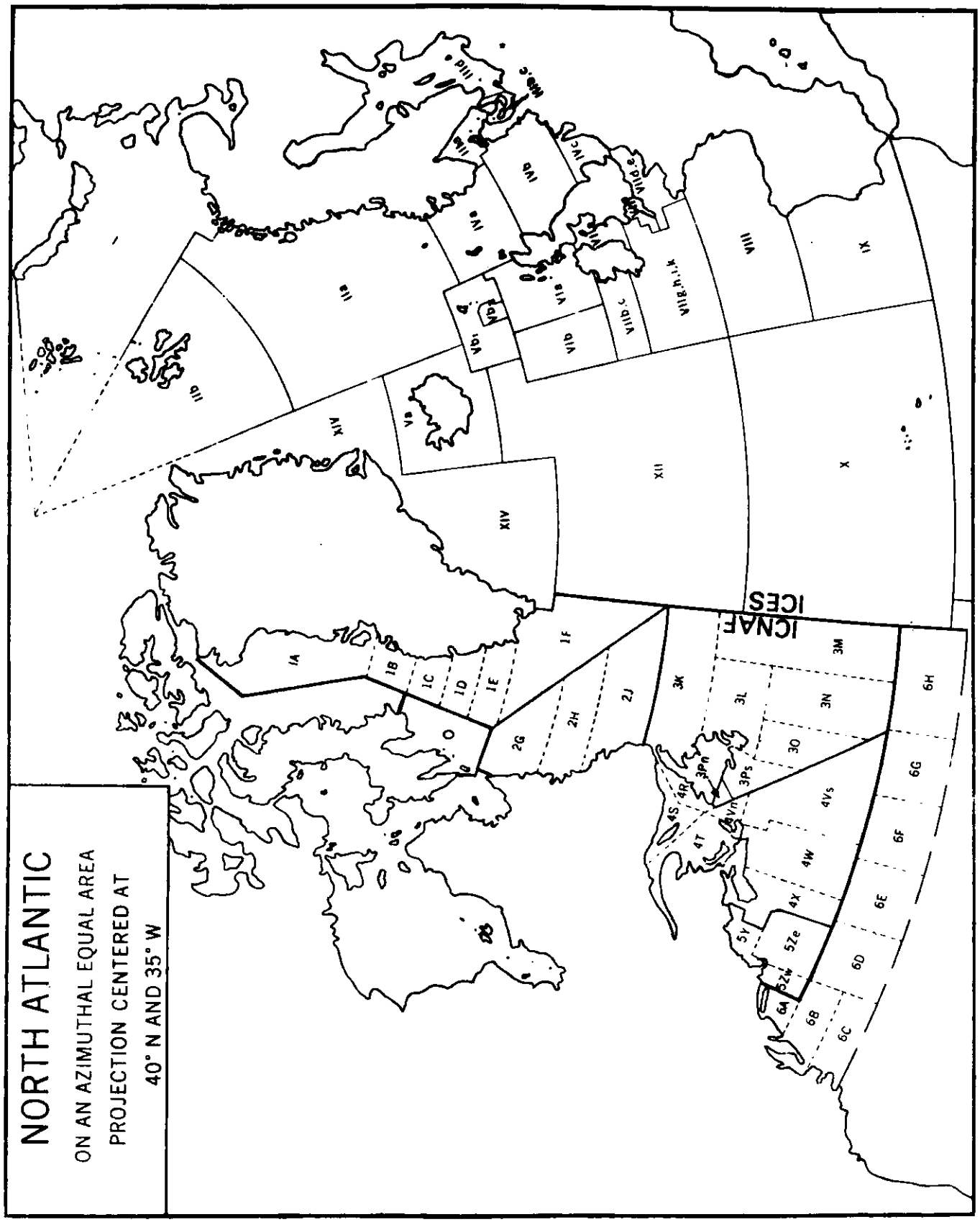
(More detailed Content Lists are given on page 9 of the January 1974 Mid-term Meeting and on page 63 for the 1974 Annual Meeting.)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PART A

STACRES REPORT

OCTOBER 1973

A. REPORT OF STANDING COMMITTEE ON RESEARCH AND STATISTICS (STACRES)

Special Commission Meeting - October 1973

Chairman: A. W. May Rapporteur: V. M. Hodder

STACRES met at Ottawa, Canada, on 15 October 1973 at the request of Panel 5 to (a) review the latest information available on catches and effort in Subarea 5 and Statistical Area 6, and (b) consider the implications of an over TAC together with TACs for individual species. Representatives were present from 13 Member Countries (none from Iceland, Portugal and Romania) and observers were present from the German Democratic Republic. A further meeting was held on 16 October to approve the Report.

1. Review of Latest Catch Information for Subarea 5 and Statistical Area 6

The latest statistics for 1972 (Table 1) indicate that the nominal catch of finfish (except menhaden) and squids totalled 1,188,000 tons compared with 1,142,000 tons in 1971. The various representatives present were requested to provide information on their countries' fisheries in 1973. Some countries provided catch data for a portion of the calendar year and projected catches for the entire year; others gave their 1973 projected catches only; and in cases where no 1973 data were available (no representative at the meeting) the 1972 catches were used. On the basis of this preliminary information (Table 2), the projected catch of finfish (except menhaden) and squids is estimated at 1,169,000 tons for 1973. It must be noted that the US herring catch given in Table 2 does not include juvenile herring, and therefore, the overall totals for 1972 and 1973 are not directly comparable. However, since the juvenile catch in 1973 was about 11,000 tons, then the overall total for 1973 would be about 1,180,000 tons, slightly less than the catch in 1972.

2. Review of Fishing Activity in 1973

Canada, Japan, USSR and German Democratic Republic indicated that no significant change in fishing activity was anticipated between 1972 and 1973. Spain reported no change in the cod fishery but an increase from 19 to 25 vessels taking part in the squid fishery. Federal Republic of Germany anticipates a slight decrease in fishing effort in attaining its herring quota due to a slight increase in catch per unit effort from 1972 to 1973. USA expects a 5% decline in effective fishing effort. Poland reported a decline of about 30% in fishing effort (standard days fished) to the end of August and noted that this would mean a projected 10-15% reduction in the 1973 Polish total catch.

3. The Potential Yield and Future Management of the Fisheries in Subarea 5 and Statistical Area 6

At its Mid-Term Meeting STACRES estimated the potential catch for 1973 to be about 846,000 tons, excluding herring (*Redbook* 1973, Part I, p. 19-20). That estimate also excluded squids but it included about 30,000 tons of pollock attributable to Subarea 4. Adjustments for these species indicate a potential catch of 1,056,000 tons. Bearing in mind that this includes a permitted catch of mackerel greater than that included in the estimate of surplus yield, the projected catch for 1973 exceeds the previously estimated potential catch by 100,000 tons.

The adjusted figure of 1,056,000 tons, however, is believed to be a very generous estimate of the harvestable surplus in 1973 for the following reasons:

(a) The haddock and herring quotas set for 1973 were known at the time to exceed the TACs recommended by STACRES, the hake and mackerel quotas have remained generous owing to the provisional nature of the assessments, and quotas for some other species have been set in relation to average catch levels which, because of redeployment of fishing on them in recent years, are likely to have exceeded their sustainable yields.

(b) The total harvestable surplus defined in answer to Canadian Question 2 (Redbook 1973, Part I, p. 19) was estimated by summing TACs and it excluded the effect of interaction between fisheries in reaching the individual species quotas (the by-catch problem). STACRES concluded (*Redbook* 1973, Part I, p. 26) that such an aggregate TAC would tend to over-estimate the true harvestable surplus. Analyses of the by-catch problem (Comm.Doc. 73/18 and Res.Doc. 73/99) indicate that a reduction in catch of between 5 and 20% from the sum of the individual species TACs might be required to ensure compatibility between quotas on individual species, the upper limit depending on what the Commission's objectives might be in relation to the various directed fisheries.

(c) The estimate does not take account of longer term biological interaction between the resources.

[1] Presented to the Special Commission Meeting, FAO, Rome, January 1974 as Summ.Doc. 74/1.

STACRES, therefore, concludes that the catches in 1973 will have exceeded the true harvestable surplus of the total resources and that this situation has obtained for some years, with the result that the total biomass of the resources has not been maintained. This is corroborated by the continuing decline monitored by the groundfish surveys (e.g. *Redbook* 1973, Part I, Fig. 1, p. 11). Neither the stock nor the catch appears to be stabilizing, and, at least up until 1973, catch levels have been maintained by increasing fishing. Total biomass assessments which do take into account longer term interactions of resources indicate the average sustainable yield to be about 850,000 tons (*Redbook* 1973, Part I, Table 4, p. 12), although in particular years the figure would be higher as one or more of the major resource components was particularly strong.

At its Mid-Term Meeting STACRES also estimated that in 1971 fishing effort was 25% in excess of the level necessary to fully exploit the total stock (*Redbook* 1973, Part I, p. 19), although the degree of excess was partly related to the state of the mackerel resource which is still subject to discussion. There was some further increase in fishing activity in 1972, based on US overflight information (*Redbook* 1973, Part I, p. 14). Taking into account (i) a stabilization and perhaps a decrease in 1973, and (ii) some redistribution of fishing onto hitherto less valued species, and also the generous level of fishing on some species permitted by existing quotas, then 25% remains the best estimate of the surplus fishing effort at the present time. A reduction of this amount represents an objective which would enable the fishery to stabilize at a level giving the maximum sustainable yield.

In short, the fishery has developed beyond the level of fishing required to harvest the surplus and, if maintained, the fishery will gradually stabilize at a level lower than the maximum sustainable yield. Catches have been maintained by increased fishing and reduction of the stock. The stock size now is, in fact, lower than if the stock were in equilibrium with the present level of fishing. A reduction of fishing to the level associated with the maximum sustainable yield in one year, therefore, would not give that yield but something rather below it. STACRES believes this to be in the region of 800,000 tons. The catch would then gradually return to the MSY level as the stock recovered. In principle, the greater the degree of reduction that can be achieved, the more rapid this recovery would be.

Although this framework of relationships is valid, STACRES cannot be confident of the specific levels of catch or effort associated with the objective. The Commission might, therefore, wish to approach it by phasing the reduction in catch. The short-term objective of such a phased reduction would be to halt the current decline in biomass and, depending on the level of catch that achieves this, it might be desirable to temporarily reduce catches further to permit a recovery of the stock and thence a re-expansion of the catch to the sustainable yield level. Stabilization of the biomass could be judged by the biomass of the groundfish species as recorded in the coordinated groundfish surveys and, since these are subject to sampling error, two consecutive years of stability would represent the minimum criterion of adequacy of the reduction.

Since the available evidence indicates the eventual requirement to stabilize and recover the biomass might be a reduction in catch to 800,000 tons, the level selected for the initial reduction must be significantly less than recent catches and might be guided by the total quota which it has been estimated would permit compatibility between individual species quotas (Comm.Doc. 73/18, Tables 4 and 5). This figure would be 15-20% below the sum of the anticipated TACs for 1974 which is likely to be similar to those in 1973. Had this been applied to the TAC's in 1973, this would have given total catch of 850,000 to 900,000 tons. But it must be appreciated that, while such a reduction contributes to a solution of the by-catch problem, it does not necessarily resolve the conservation issue.

4. Note on TAC for Pollock in Subareas 4 and 5

STACRES wishes to draw attention to the fact that the pollock TAC adopted at the 1973 Annual Meeting refers to pollock in Div. 4VWX as well as in Subarea 5. It is noted that catches of pollock in Div. 4VWX on the one hand, and in Subarea 5 on the other, were approximately the same in 1971 and 1972 and that the total catch for both areas in these years was substantially less than the TAC adopted (i.e., 55,000 tons for 1974). It is not known whether the catches in these respective areas would be about equal if the TAC for 1974 were fully achieved. However, it is clear that, in considering an overall TAC for Subarea 5 and Statistical Area 6, only that part of the pollock TAC expected to be caught in Subarea 5 and Statistical Area 6 should be included.

Table 1. 1972 nominal catches of finfish and squid in Subarea 5 and Statistical Area 6.

	BUL	CAN	FRA	FRG	JAP	POL	ROM	SPA	USSR	USA	DEN	ITA	GDR	CUBA	TOTAL
Cod	76	2,598	-	17	100	271	14	6,704	1,889	19,970	-	-	135	2	31,776
Had	-	632	-	-	-	1	-	1,098	141	4,772	-	-	5	-	6,649
Red	15	124	-	3	15	5	14	-	5,641	13,162	-	-	127	14	19,120
S H	3,543	-	-	226	205	-	169	-	101,877	8,313	-	-	220	828	115,381
R H	1,514	-	-	131	392	16	43	-	71,333	2,529	-	-	45	-	76,003
Pol	-	1,366	-	467	4	8	-	78	1,043	5,234	-	-	4,802	-	13,002
Yel	573	9	-	-	5	-	74	-	4,876	32,980	-	-	-	-	38,517
Flo[1]	8	83	-	-	13	2	-	-	5,928	17,884	-	-	-	118	24,036
Her	2,355	11,691	500	30,633	1,161	49,492	2,156	-	48,316	40,994	-	-	49,312	-	236,610
Mac	23,556	1	-	770	1,104	141,999	2,519	6	134,057	1,996	-	-	80,537	9	386,554
O G	87	895	-	-	1,759	635	69	30	16,153	13,649	-	-	302	-	33,579
O P[2]	2,583	165	-	24	3,896	22	184	-	5,262	1,580	-	-	46	-	13,762
O F	4,960	3	-	154	1,463	8,795	36	225	85,458	37,706	260	-	4,242	586	143,888
Squ	499	-	296	463	18,691	5,428	66	11,859	6,976	1,214	-	4,000	-	-	49,492
Total	39,769	17,567	796	32,888	28,808	206,674	5,344	20,000	488,950	201,983	260	4,000	139,773	1,557	1,188,369[3]

[1] Flounders. except yellowtail.

[2] Other pelagics, except menhaden.

[3] Norway caught 87 tons of other pelagics in Subareas 3, 4 and 5.

Table 2. Estimated catches of finfish (except menhaden) and squid in Subarea 5 and Statistical Area 6 for 1973 (bracketed figures are projections for ~~the calendar year~~). ~~Also~~ given are TACs for 1973 and TACs recommended by STACRES for 1974.

	1973 TAC ('000 tons)	BUL[7]	CAN[8]	DEN	FRA	FRG[8]	ITA	JAP	POL[9]	ROM	SPA[8]	USSR[8]	USA[9]	GDR	Others[7]	Recommended 1974 TAC ('000 tons)
Cod	45	-	2339 (2839)	-	-	-	-	-	-	-	-	1586	14047 (19304)	-	-	45
Had	6	-	1144 (1644)		-	-	-	-	-	-	-	548	2536 (3235)	-	-	0[12]
Red	30	-	144 (204)	-	-	-	-	-	-	-	-	2226	10207 (12467)	-	-	30
S H	170	-	-		-	-	-	-	-	-	-	76967 (102000)	9030 (12757)	-	-	170
R H	40[5]	-	-	-	-	-	-	-	-	-	-	35278	-	-	-	50-70
Pol	50[6]	-	1491 (1991)	-	-	-	-	-	-	-	-	1137	2363 (6638)	-	-	55[12,13]
Yel[1]	26		11 (16)	-	-	-	-	-	-	-	-	1103	17009 (26798)	-	-	26
Flo[2]	25	-	66 (95)	-	-	-	-	-	-	-	-		9480 (12640)	-	-	25
Her[3]	175	-	8374 (9110)	-	- (500)	30000 (32600)	- -	- (1200)	11500[10] (49600)	-	-	48400 (48400)	10054 (16430)[11]	- (45000)	-	175
Mac	450	-	53 (60)	-	-	-	-	-	79400 (130000)	-	-	82637 (148000)	784 (877)	- (80000)	-	245
O G		-	702 (970)	-	-	-	-	-	-	-	-	23291	-	-	-	
O P[4]		-	630 (630)	-	-	-	-	-	-	-	-	949	-	-	-	
O F		-	4 (6)	- (300)	-	-	-	-	-	-	-	11623	-	-	-	
Squ		-	-	-	- (300	- (3000)	- (5000)	- (20000)	8200 (8200)	-	14200 (18000)	5107	677 (831)	-	-	
NK		-	-	-	-	- (2000)	- (1000)	- (8800)	- (2200)	-	- (8000)	-	57993 (68283)	- (15000)	-	
		- (40000)	14958 (17565)	- (300)	- (800)	- (37600)	- (6000)	- (30000)	108000 (190000)	- (9000)	- (26000)	290852 (490000)	134180 (180260)	- (140000)	- (1500)	

1973 Estimated Total (1169025)

1 Subarea 5 only.
2 Flounders, except yellowtail.
3 Adult herring only.
4 Other pelagics, except menhaden.
5 Applies to Subdiv. 5Zw and Statistical Area 6.
6 Applies to Div. 4X and Subarea 5.
7 Based on 1972 total catch.
8 Preliminary catches for Jan-Sep.
9 Preliminary catches for Jan-Aug.
10 Catch to 10 Oct 1973 of 37500 tons.
11 Excludes about 11000 tons of juveniles by USA.
12 Adopted by Commission in June 1973.
13 Applies to Div. 4VWX and Subarea 5.

PART B

STACRES REPORT

JANUARY 1974

B. REPORT OF STANDING COMMITTEE ON RESEARCH AND STATISTICS (STACTES)[1]

Special Commission Meeting - January 1974

CONTENTS

[1] Also January 1974 Meeting Proceedings No. 1.

B. REPORT OF STANDING COMMITTEE ON RESEARCH AND STATISTICS (STACRES)

Special Commission Meeting - January 1974

Chairman: A. W. May Rapporteur: V. M. Hodder

STACRES met at FAO, Rome, Italy, during 14-18 January 1974 with representatives present from 12 member countries and observers from FAO and the German Democratic Republic (Bulgaria, Iceland, Italy and Romania were not represented). A further meeting was held on 29 January to consider items arising from the Commission Meeting and to discuss the plan of work prior to the 1974 Annual Meeting. The Assessments Subcommittee met at the Sea Fisheries Institute, Hamburg, Fed.Rep. Germany, during the week of 7-12 January with representatives from seven countries (Canada, Fed.Rep. Germany, Japan, Poland, USSR, UK and USA) and an observer from FAO. The main tasks at those meetings were: (a) assessments of various species and stocks proposed for regulation in 1974, (b) consideration of a proposal to establish an ICNAF data base for detailed catch and effort statistics and associated sampling data, and (c) coordinated surveys for fishery assessment, including hydro-acoustic surveys. The Reports of the Assessments Subcommittee, the Special Working Group on ICNAF Data Base Improvement, and the Working Group on Coordinated Surveys, presented by their respective Chairmen, Mr D.J. Garrod, Mr J.G. Pope (acting for Mr R.C. Hennemuth) and Dr J. Messtorff, were adopted by STACRES and are included as Appendices I, II and III to this Report. Brief summaries of these reports, together with other matters considered by STACRES are given below.

I. ASSESSMENTS (APP. I)

1. Review of Fisheries

Provisional statistics were available from most member countries for their fisheries in 1973, allowing a preliminary estimate of total catches for all major species. The following brief review is confined to those stocks for which substantial changes in 1973 catches occurred relative to 1972. The cod catch in SA 1[1] declined to 70,000 tons (111,000 tons in 1972), and in Div. 2J-3KL declined to 390,000 tons (455,000 tons in 1972). The catch of cod in Div. 3NO was 68,000 tons (102,000 tons in 1972). The redfish catch doubled in SA 2 + Div. 3K (20,000 to 40,000 tons) and was halved in Div. 3M (42,000 to 20,000 tons). The catch of silver hake in Div. 4VWX increased from 114,000 to 283,000 tons. The catch of red hake in Subdiv. 5Ze decreased from 40,000 to 25,000 tons. Capelin catches in SA 2 + Div. 3K increased from 46,000 to 132,000 tons, and in Div. 3LNOPs from 25,000 to 131,000 tons. The 1973 catches of cod in Div. 2J-3KL, and Div. 3NO, and of mackerel in SA 5 + 6, were considerably below the TACs established for these stocks in 1973. The capelin catch in 1973 was above the TAC established for 1974.

Recent catches and proposed TACs for the stocks, for which quota regulation is to be considered at the present meeting, are listed in Table 1. A similar tabulation for all species under quota regulation, and including the above, may be found in Table 1 of Appendix I (Report of the Assessments Subcommittee).

2. Mackerel

Interpretation of data from the 1973 fishery was critical to the assessment for mackerel, and these data could be interpreted in different ways relative to fishing mortality and recruitment to the fishery. Using the extremes given by these interpretations as limiting situations leads to a recommended TAC in the range of 251,000 to 312,000 tons for SA 5 + 6. It is suspected that mixing occurs between mackerel in these areas and those fished in SA 3 and 4, but it is not yet possible to give advice on a catch level appropriate to the mackerel fishery in these northern areas.

3. Herring

Advice on TACs for 1974 is broadly the same for all stocks, i.e. that the TACs should not exceed those agreed for 1973. While it is believed that the stocks in Div. 5Y and Div. 5Z + SA 6 have begun to recover, it is certain that they had not increased to the MSY levels by the end of 1973. An increase in TACs in 1974 cannot, therefore, be recommended. It is considered that these TACs will allow the minimum stock requirements at the end of 1974, as defined by the Commission last year, to be met. In Div. 4XW(b) catch estimates in 1974 are dependent largely on estimates of the size of the 1970 year-class. Assuming this to follow the pattern expected in the other stocks, it is recommended that the TAC in 1974 be at the same level as in 1973 (90,000 tons).

The provision of advice to the Commission has become more difficult because of uncertainties regarding:

a) identification of components of the fisheries and hence catch quantities on which assessments should be based in order to be related to the TAC; and

[1] Subareas 1 to 5 and Statistical Area 6 are hereinafter referred to as SA 1 to 6.

Table 1. Recent catches and proposed TACs for stocks to be considered for regulation at this Commission Meeting.

Species	Stock Area	Nominal Catches ('000 tons) 1966-70[1]	1971	1972	1973[2]	TACs ('000 tons) 1972	1973	1974[3]
Cod	4TVn	60	67	77	59	-	-	70[4]
	4X	31	23	22	26	-	-	8[5]
Redfish	SA 2 + 3K	25	19	20	40	-	-	25
Red hake	5Ze	...	6	40	25	-	-	20[6]
Amer. plaice	SA 2 + 3K	13[7]	5	9	5	-	-	8
	3M	+[7]	1	1	+	-	-	2
	3Ps	12[7]	7	7	12	-	-	10
Gr. halibut	SA 2 + 3K	30	24	30	28	-	-	30
RN. grenadier	SA 2	3	57	3	7	-	-	30
	SA 3	19	18	21	15			
Herring	4W(b)	16	23	16	13	65[9]	90[9]	90[9]
	4X(a)	174[8]	69[8]	144[8]	122[8]	-	-	-
	4X(b)							
	5Y	45[10]	51[10]	62[10]	33	30[9]	25[9]	25[9]
	5Z + 6	259	267	175	200	150	150	150
Mackerel	SA 3	+	1	2	2	-	-	-
	4VWX	12	17	13	25	-	-	-
	SA 5 + 6	83	349	387	360	-	450	251-312
Argentine	4VWX	6	7	6	2	-	-	50[11]
	SA 5	8	7	33	2	-	-	
Capelin	SA 2 + 3K	1	+	46	132	-	-	250[13]
	3LNOPs	2	3	25	131	-	-	
O. Finfish[12]	SA 5 + 6	151	146	147	...	-	-	150
Squids	SA 3	2	2	+	1	-	-	-
	SA 4	+	7	2	8	-	-	-

1 Average catch for 1966-70 period.
2 Provisional statistics.
3 TACs recommended by STACRES, January 1974.
4 Seasonal partition of TAC to be considered.
5 Recommended TAC for offshore stock only.
6 Recommended TAC for Div. 5Z (E of 69°).
7 Catches for 1970 only.
8 Catches include juveniles which are estimated as 62 (1966-70), 22 (1971), 64 (1972), 24 (1973).
9 TACs pertain to adult catches only.
10 Catches include juveniles which are estimated as 20 (1966-70), 8 (1971), 20 (1972), 16 (1973).
11 TAC for 4VWX + SA 5; partition equally between 4VWX and SA 5 to be considered; also consider removal from "other finfish" in SA 5 + 6.
12 Other finfish excludes all regulated species and also excludes menhaden, billfishes, tunas and large sharks (ICNAF Summ.Doc. 74/4).
13 Partition of TAC between areas to be considered (suggested maximum 150,000 tons in Div. 3LNOPs).

b) identification of adult as opposed to juvenile fisheries.

Since meaningful assessments should be based on the total catch of each stock, clarification of the first point by the Commission would assist in providing clear advice.

4. Other Finfish in Subarea 5 and Statistical Area 6

The existence of the second tier overall TAC limits the risk of unrestricted increase in catches, but it can only be completely overcome by establishing a TAC for the "other finfish" group as a whole. A TAC of 150,000 tons is recommended, and this would allow limited development in some fisheries, notably argentine, dogfish and skates. On the other hand, STACRES considered that argentine might be managed

more appropriately by separation from the "other finfish" category, and because of the overlap with stocks in Div. 4VWX, might be treated in a manner similar to that agreed for pollock. Should this be done, consideration of a downward adjustment of the "other finfish" TAC would be appropriate.

5. Other Stocks

Advice on catch levels for 1974 from other stocks for which the Commission will consider establishing TACs and quota allocations at this meeting is summarized in Table 1. The Commission should be aware that in most cases the TACs are suggested as a practical figure to prevent an undesirable sudden expansion of fishing in SA 2, 3 and 4, rather than to provide adequate management of the individual species.

6. Review of TACs at the 1974 Annual Meeting

It is vital, for purposes of reviewing groundfish TACs at the Annual Meeting in June, that 1973 catches and sampling data be available to scientists before the meeting takes place. STACRES therefore

recommends (1)

that all countries be requested to provide:

a) revised monthly catches for 1973 of each groundfish stock for which TACs will be considered; and

b) sampling data for 1973 pertaining to these catches.

These data should be airmailed to reach the Secretariat not later than 31 March 1974, on appropriate forms to be provided by the Secretariat.

II. ICNAF DATA BASE IMPROVEMENT (APP. II)

1. Further research on topics relevant to the terms of reference of this Special Working Group is essential if it is to be able to give the specific information and recommendations requested. In adopting the Report of the Working Group, STACRES therefore

recommends (2)

a) that a pilot study be conducted for Div. 5Z to examine the implications and cost of reporting catch and effort data in finer detail on a routine basis than at present;

b) that all member countries fishing in Div. 5Z report the detailed catch and effort statistics required, in accordance with the Protocol set out in Annex 1 of the Report of the Special Working Group on ICNAF Data Base Improvement;

c) that the Commission make funds available to the Secretariat for the purpose of processing this pilot study in an amount up to $6,000.00;

d) that all member countries supply the Secretariat with a document describing in detail their various fisheries and sampling schemes in the ICNAF Area;

e) that all member countries examine their current sampling schemes for possible bias and report the results of these investigations as research documents at the 1974 Annual Meeting;

f) that the Secretariat request by Circular Letter information on age validation studies already conducted on ICNAF stocks and for comments relevant to those stocks for which age reading was considered to be a problem, and report the results of the survey at the 1974 Annual Meeting so that STACRES can consider initiating suitable studies where problems exist;

g) that the countries, nominated in the Report of the Special Working Group on ICNAF Data Base Improvement, conduct certain statistical studies and report the results as research documents to the 1974 Annual Meeting;

h) that the Assistant Executive Secretary assess the costs to the Commission of requiring the Secretariat to accomodate the reporting and processing of raw sampling data, assuming the current level of sampling; and

i) that the terms of reference of this Working Group be extended to include all aspects of biological sampling of catches.

III. COORDINATED SURVEYS (APP. III)

With the agreement of STACRES, the Working Group agreed to broaden the scope of discussions to include all survey work, not only those for groundfish.

1. Stratification Schemes for Groundfish Surveys

A revised stratification scheme for SA 2 and a proposed scheme for Div. 3K were presented and it was noted that these stratifications had been used successfully in 1973 surveys. However, attempts to use a stratified random sampling scheme in SA 1 were unsuccessful, implying that some other sampling design is required for this area.

It was suggested that stratification schemes for SA 2-6 be brought together (including calculations of stratum sizes) for review and standardization. The Secretariat was requested to solicit this information by Circular Letter and collate the material for presentation at the 1974 Annual Meeting.

2. Hydro-acoustic Surveys

In view of the potential importance of this technique for fish abundance estimation, a special meeting was held at which Mr J. Suomala (USA) presented details on the methodology of hydro-acoustic equipment calibration as well as on the necessary instrumentation, which can be provided by National Marine Fisheries Service, Woods Hole, USA, for deployment on vessels undertaking cooperative surveys. The measurement of aquatic biomass by means of hydro-acoustical methods cannot at this time be considered to be a reliable information source for ICNAF deliberations and decisions. However, properly developed and executed hydro-acoustic experiments and subsequent surveys will likely result in additional information on the rate of change of pelagic fish abundance in the ICNAF Area.

It was noted that arrangements have already been made to conduct basic hydro-acoustic experiments in cooperation with USA, USSR and Polish research vessels during the first half of 1974. Other member countries are encouraged to participate in such experiments. The USA will be preparing a manual for such hydro-acoustic joint surveys.

3. Reporting of Survey Data

US scientists will review the various procedures and techniques associated with their stratified-random groundfish surveys and will present a document at the 1974 Annual Meeting. The Working Group will then discuss the desirability and feasibility of including this in a proposed manual on surveys to be produced by the Secretariat.

The desirability of obtaining data on the physical environment in time for use by STACRES in their deliberations was discussed. Proposals will be forthcoming at the 1974 Annual Meeting concerning programs for monitoring the physical environment.

4. Survey by R/V *Professor Siedlecki*

The Polish Government has offered the R/V *Professor Siedlecki* for a cooperative survey of herring and mackerel in SA 5 and 6. Participation of scientists from other countries is invited, and initial expressions of intent to participate were made by scientists from Canada, France (St. Pierre Laboratory), Fed.Rep. Germany, Spain and USA. Plans for this survey will be discussed within STACRES at the 1974 Annual Meeting.

5. Manual on ICNAF Groundfish Surveys

To promote standardization of techniques used in groundfish surveys, STACRES

recommends (3)

that a Manual on ICNAF Coordinated Groundfish Surveys be produced subsequent to the 1974 Annual Meeting with format and content to be decided at that meeting.

IV. STEERING AND PUBLICATIONS

1. Organization and Operation of STACRES

The Subcommittee briefly reviewed the present organization and operation of STACRES in the light of the functions of the various Subcommittees and Working Groups. An organizational chart giving the present setup was circulated to Subcommittee members with a view to having a full discussion on the subject at the 1974 Annual Meeting.

2. Annual *List of Vessels*

The ICNAF *List of Vessels* is normally published triennially, the last in 1972 for the calendar year 1971. Noting that requests for this publication have increased substantially, especially for use on inspection vessels, STACRES

recommends (4)

a) that the complete list be published for 1974; and

b) that the list be updated annually in a summary document which would indicate additions to and/or deletions from the most recent published List of Vessels.

3. Review of *Statistical Bulletin* Format

The publication and distribution of *Statistical Bulletin*, Vol. 22 for the year 1972, has been delayed, largely due to the incorporation of the many changes recommended at the 1973 Annual Meeting, but also to the late receipt of STATLANT 21B statistics from two countries. The 1972 issue, which should be ready for distribution in late February 1974, contains four parts:

Part I. Tabular Summaries of Catches, 1958-72, for all TAC species; 15 tables, 8 pages.

Part II. Fishery Statistics, 1972; 7 tables, 196 pages.

Part III. Seal Statistics, 1972; 2 tables, 2 pages.

Part IV. Corrections and Additions to Previous Bulletins; 6 tables, 23 pages (including monthly catch and effort data for German Dem.Rep. for the years 1969, 1970 and 1971).

4. Review of Status of *Redbook*, Parts I, II and III

The Subcommittee noted that *Redbook*, Parts I and II, contain reports which record the proceedings of STACRES and research conducted by member countries, while Part III, containing selected papers from the Annual Meetings, is more closely associated with ICNAF *Research Bulletin* and consequently has a significantly larger mailing list than Parts I and II. Since both the National Research Reports and the Selected Papers are published in the Meeting Document series, there was some question as to whether these needed to be published in *Redbook*, Parts II and III, as the latter required considerable editing at the Secretariat. A final decision on this matter was deferred to the 1974 Annual Meeting.

The Subcommittee noted some of the problems associated with the quality of the material selected for publication in both the *Redbook* and the *Research Bulletin*, especially the lack of attention by some authors in the proper revision of papers submitted. The need for guidelines in the selection, editing and refereeing of papers was stressed and the Secretariat was requested to ask the heads of institutes concerned with ICNAF research for comments on this matter.

5. Distribution of Publications and Meeting Documents

A brief review of the problems indicated that a fuller discussion was required than was possible at this meeting and the matter was deferred to the 1974 Annual Meeting.

V. OTHER MATTERS

1. ICNAF Statistics

In light of discussions within the Panels relative to statistics of national fisheries, STACRES agreed that it would be desirable to remind the Commission of the following statistical definitions and procedures:

a) Nominal catches. Catch figures in the ICNAF *Statistical Bulletins* are of "nominal catch", defined as the live weight equivalent of the landings. The nominal catch should include all fish landed as food, however processed, plus all whole fish reduced to fish meal. It should not include fish discarded at sea.

b Discards. These are whole fish thrown overboard at sea that have not been processed in any way. Statistics on discards should be supplied on the forms provided annually by the Secretariat for that purpose.

STACRES wished to emphasize the importance of accurate reporting of both types of statistics in relation to provision of advice on TACs for the various stocks.

2. Delimitation of Division 4X Offshore Cod Stock

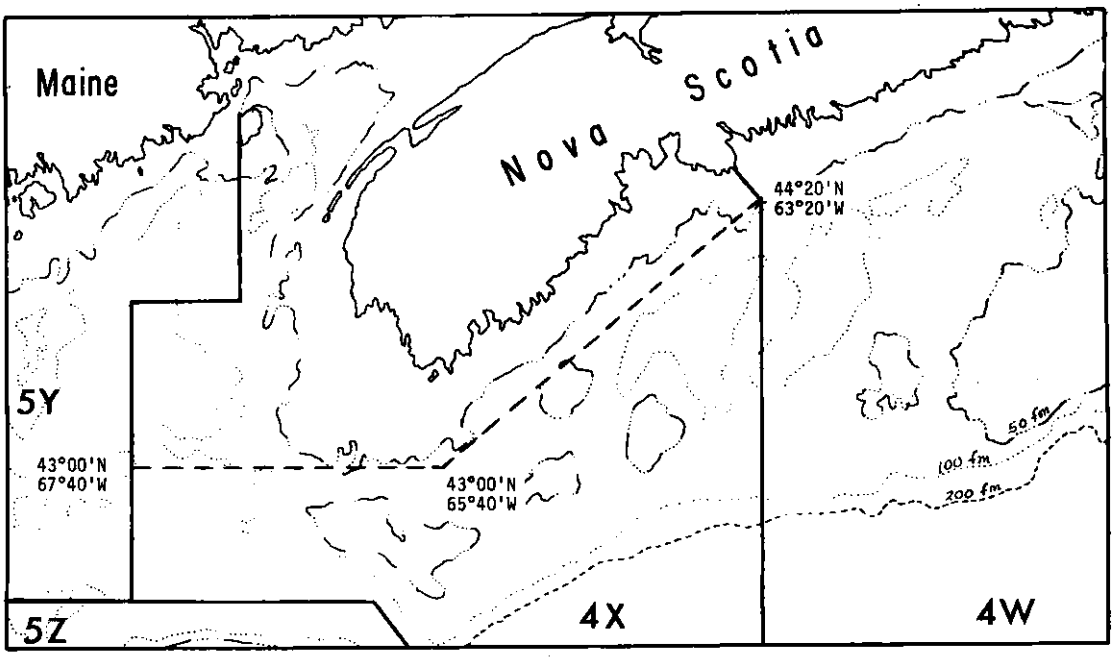
It was anticipated that the Commission would require a delimitation of the area occupied by the Div. 4X offshore cod stock. Accordingly STACRES

recommends (5)

that the following wording would achieve the appropriate distinction between fisheries on offshore and inshore stocks:

"that the Contracting Governments take appropriate action to include in the offshore 4X cod quota all cod catches made in that portion of Div. 4X of Subarea 4 lying south and east of the straight lines connecting the coordinates in the order listed:

44°20'N, 63°20'W 43°00'N, 65°40'W 43°00'N, 67°40'W



3. Identification of Components in the Herring Fisheries

After STACRES informed the Commission of the problems listed in Section I, paragraph 3 above, the Chairman of the Herring Working Group (Mr T.D. Iles) was requested by the Commission to elaborate on the problems. STACRES at its final session took note of the statement accepted by the Commission, a copy of which is at Appendix IV.

4. STACRES Report

It was agreed that the Chairmen of STACRES Subcommittees and Working Groups would forward editorial suggestions as necessary to the Assistant Executive Secretary, who will be responsible for production of the Report in the Redbook series.

5. Annual Meeting, May - June 1974

It was noted that the 1974 Annual Meeting of the Commission will be held at Halifax, Canada, during 4-15 June 1974. STACRES accordingly

recommends (6)

that the scientific meetings of STACRES and its various subcommittees and working groups should meet in the Halifax - Dartmouth area during 21-31 May 1974.

Since some overlap of subcommittee and working group meetings will be necessary, STACRES advises that national delegations should be prepared, if at all possible, to accept such an arrangement.

APPENDIX I - REPORT OF ASSESSMENTS SUBCOMMITTEE

Chairman: D. J. Garrod

The Subcommittee met at the Institut für Seefischerei, Hamburg, 7-12 January, and continued its meetings at the Fisheries Division, FAO, Rome, during the following week. Its task was to recommend TACs for 1974 for herring, mackerel, red hake, and "other finfish" in SA 5 and 6 and for a number of species in SA 2, 3 and 4 not regulated by agreement at the 1973 Annual Meeting (Comm.Doc. 74/1 and 2).

1. Review of Preliminary Statistics of Nominal Catches and Fishery Trends in 1973

Table 1 summarizes the nominal catches and TACs of the stocks for which catch regulations have been agreed or are under consideration. Since 1973 nominal catches by Spain were not available, the preliminary statistics for 1973 include for Spain quantities which are assumed to have remained at the 1972 level or to have reached the TAC allocated to Spain in 1973 where applicable.

Table 1. Summary of previous stock assessments: recent catches for 1966-72 and provisional catches for 1973, with allocated TACs for 1972-74 (TACs recommended by STACRES in parentheses). Asterisks (*) denote stocks to be dealt with at the January 1974 meeting.

Species	Stock area	MSY	Nominal catches (000 tons)				TACs (000 tons)			F_{max} ($F_{0.1}$)	F_{74}
			1966-70	1971	1972	1973[9]	1972	1973	1974		
Cod	SA 1	300	304	121	111	70	-	-(102)	107.0 (80)	0.6	<0.6
	2GH	30	62	13	14	3	-	-	20.0 (20)	0.7	
	2J + 3KL	550	657	421	455	390	-	665.5(650)	656.7(650)	0.4	0.4
	3M	35	28	25	57	28	-	-	40.0 (35)	0.5	0.5
	3NO	130	140	118	102	68	-	103.5 (70)	101.1 (85)	0.2	0.2
	3Ps	60	66	60	44	3	-	70.5 (70)	70.0 (70)	0.3	0.3
	3Pn + 4RS		83	84	58	60	-	-	-		
	4TVn		60	67	77	59	-	-	*		
	4VsW	60	62	53	62	57	-	60.5 (60)	60.0 (60)	0.45	0.5
	4X		31	23	22	26	-	-	*		
	5Y	10	7	8	7	6	-	10.0 (10)	10.0 (10)		
	5Z	35	39	28	25	28	-	35.0 (35)	35.0 (35)		
Haddock	SA 3		8	5	4	4	-	-	-		
	4VW	25	14	13	5	5	4.0 (0)	4.0 (0)	0 (0)	0.5	
	4X	18	32	18	13	15	9.0 (0)	9.0 (0)	0 (0)	0.5	
	5YZ		53	12	7	6	6.0 (0)	6.0 (0)	0 (0)		
Redfish	SA 2 + 3K		25	19	20	40	-	-	*		
	3LN		20	34	29	38	-	-	28.0 (20)	Gen. production study	
	3M		4	8	42	20	-	-	40.0 (..)		
	3O		14	20	16	10	-	-	16.0 (15)	Gen. production study	
	3P		28	28	26	17	-	-	25.0 (23)	Gen. production study	
	4VWX		25	62	50	45	-	-	40.0 (30)	Av. catch 1962-71	
	5YZ		11	20	19	15	-	30.0 (30)	30.0 (30)	Av. catch over stable period	
Silver hake	4VWX		26	129	114	283	-	-	100.0 (50-100)		
	5Y		17	8	7	9	-	10.0 (10)	10.0 (10)		
	5Ze	160	110	70	78	62	-	80.0 (80)	80.0 (80)		
	5Zw + 6			30	31	64	-	80.0 (80)	80.0 (80)		
Red hake	5Ze		2[3]	6	40	25	-	-	*	(50-	
	5Zw + 6	40	11[3]	24	36	38	-	40.0 (40)	50.0[1]	70)	
Pollock	4VWX		17	12	20	29	-	50.0 (50)[2]	55.0 (50)		
	SA 5		9	14	13	12	-				

Table 1. Continued

Species	Stock area	MSY	Nominal catches (000 tons) 1966-70	1971	1972	1973[9]	TACs (000 tons) 1972	1973	1974	F_{max} ($F_{0.1}$)	F_{74}
A. plaice	SA 2 + 3K		13[3]	5	9	5	-	-	*		
	3M		+[3]	1	1	+	-	-	*		
	3LNO		67[3]	68	59	46	-	60.5 (60)	60.0 (60)	(0.5)	0.5
	3Ps		12[3]	7	7	12	-	-	*		
Witch	2J + 3KL		18[3]	16	17	22	-	-	22.0 (17)		
	3NO		7[3]	15	9	7	-	-	10.0 (10)		
	3Ps		3[3]	2	2	3	-	-	3.0 (3)		
Yellowtail	3LNO		26[3]	37	39	30	-	50.0 (50)	40.0 (40)	(0.7)	0.75
	5 (E 69°)		35	24	30	28	16.0(16)	16.0 (16)	16.0 (16)		
	5 (W 69°)						10.0(10)	10.0 (10)	10.0 (10)		
Gr. halibut	SA 2 + 3KL		30	24	30	28	-	-	*		
A. plaice	4VWX	32	13	14	11	12	-	-	32.0 (32)		
Witch			13	18	11	13					
Yellowtail			7	2	2	2					
Flounders(ex yellowtail)	SA 5 + 6		28	27	24	18	-	25.0 (25)	25.0 (25)		
RN grenadier	SA 2 + 3		22	75	24	16	-	-	*		
Herring	4VW(a)		46	72	33	25	-	-	45.0 (45)		
	4W(b)		16	23	16	13	65.0[6]	90.0[6]	*		
	4X(a)		174[4]	69[4]	144[4]	122[4]	-	-	-		
	4X(b)										
	5Y		45[5]	51[5]	62[5]	33[5]	30.0[6]	25.0[6]	*		
	5Z + 6		259	267	175	201	150.0	150.0	*		
Mackerel	SA 3		+	1	2	2	-	-	*		
	SA 4		16	23	21	35	-	-	*		
	SA 5 + 6		83	349	387	366	-	450.0	(245)*		
Argentine	4VWX		6	7	6	2	-	-	*		
	SA 5		8	7	33	3	-	-	*		
Capelin	SA 2 + 3K		1	+	46	132	-	-	250.0*		
	3LNOPs		2	3	25	131	-	-			
O. finfish[7]	SA 5 + 6		151	146	147	...	-	-	*		
Squids	SA 3		2	2	+	1	-	-	*		
	SA 4		+	7	2	8	-	-	*		
	SA 5 + 6		7	22	49	52	-	-	71.0 (50-80)		
All finfish and squids	SA 5 + 6		911	1125	1145	...	-	-	923.9[8]		

[1] Red hake TAC in 1974 pertains to Div. 5Z (W 69°) + SA 6.
[2] Pollock TAC in 1974 pertains to Div. 4X + SA 5.
[3] Catches for 1970 only.
[4] Catches include juveniles which are estimated as 62 (1966-70), 22 (1971), 64 (1972), 24 (1973).
[5] Catches include juveniles which are estimated as 20 (1966-70), 8 (1971), 20 (1972), 16 (1973).
[6] TACs pertain to adult catches only.
[7] Other finfish excludes all regulated species and also excludes menhaden, billfishes, tunas and large sharks (ICNAF Summ.Doc. 74/4).
[8] Overall TAC pertains to all finfish (except menhaden, billfishes, tunas and large sharks) and squids (ICNAF Summ.Doc. 74/4).
[9] Provisional data.

The preliminary statistics show that the TAC for cod in Div. 2J-3KL was not reached, mainly due to a reduction in fishing activity caused by severe ice conditions. A shortfall is also expected on the TAC for cod in Div. 3NO, but at present there is no information on changes in fishing activity in that area. There was also a considerable shortfall on the TAC for mackerel in SA 5 and 6. The other fisheries remained at levels similar to those of 1972, except for silver hake (Div. 4VWX) and capelin (SA 2 and 3). Nominal catches of silver hake more than doubled from 114,000 tons in 1972 to 283,000 tons in 1973, believed to have resulted from an increase in stock size coupled with an increase in fishing activity. Nominal catches of capelin increased to 263,000 tons, already exceeding the TAC for 1974 established at the 1973 Annual Meeting to control the development of the fishery.

The recommended TACs for those species stocks for which regulation will be considered at this meeting of the Commission are given in Table 2.

Table 2. Recommended 1974 TACs (together with those for 1972 and 1973) for species stocks under consideration at this January 1974 Meeting of the Commission.

Species	Stock area	TACs (000 tons) 1972	1973	1974[1]
Cod	4TVn	-	-	70[2]
	4X (offshore)	-	-	8
Redfish	SA 2 + 3K	-	-	25
Red hake	5Z (E of 69°)	-	-	20
Amer. plaice	SA 2 + 3K	-	-	8
	3M	-	-	2
	3Ps	-	-	10
Gr. halibut	SA 2 + 3KL	-	-	30
RN grenadier	SA 2 + 3	-	-	30
Herring	4XW(b)	65[3]	90[3]	90[3]
	5Y	30[3]	25[3]	25[3]
	5Z + SA 6	150	150	150
Mackerel	SA 3 + 4	-	-	-[4]
	SA 5 + 6	-	450	251-312
Argentine	4VWX	-	-	50[5]
	SA 5	-	-	
Capelin	SA 2 + 3K	-	-	250[6]
	3LNOPs	-	-	
Other finfish[7]	SA 5 + 6	-	-	150
Squids	SA 3 + 4	-	-	-[4]

[1] TACs recommended by Assessments Subcommittee, January 1974.
[2] Seasonal partition of TAC to be considered.
[3] TACs pertain to catches of adults only.
[4] No TACs recommended.
[5] Partition equally between Div. 4VWX and SA 5 to be considered; also removal from "other finfish" in SA 5 + 6.
[6] Partition of TAC between areas to be considered (suggested maximum 150,000 tons in Div. 3LNOPs).
[7] Excludes all regulated species and also excludes menhaden, billfishes, tunas and large sharks; reduction of TAC to be considered if definitive TAC decided for argentines in SA 5.

2. Mackerel

a) Subareas 3 and 4 (Res.Doc. 74/8, 9)

Nominal catches of mackerel in SA 3 and 4 reached 37,000 tons in 1973. These were taken from a group of mackerel which spawn in a different area from the major stock in SA 5 and 6, but it is suspected that, if they are drawn from a separate stock, both stocks may be mixed together at the time of the fishery in SA 5 and 6. If this is so, it may influence the allocation of the existing TAC between subareas; if they are not mixing, it may be necessary to establish a separate TAC for mackerel in SA 3 and 4.

The information is not yet sufficient to assess the degree of mixing between mackerel in SA 5 and 6 and in SA 3 and 4, or to estimate the quantity of mackerel in SA 3 and 4, and thus it is not yet possible to advise the Commission on a level of catch for mackerel which would be appropriate to the fishery in these northern areas. However, the importance of the degree of mixing of mackerel between the two areas must be stressed, since it could influence the efficiency of the existing management of mackerel in SA 5 and 6. There is an urgent need for further research on the distribution of the mackerel involved, with a particular need for a co-ordinated tagging program.

b) Subarea 5 and Statistical Area 6 (Res.Doc. 74/10)

Nominal catches of mackerel in 1973 reached 366,000 tons, substantially less than the TAC of 450,000 tons. The reassessment of the stock was actually based on a nominal catch of 372,000 tons estimated on the data available at Hamburg. The catches contained a high percentage of 2-year-old fish from the 1971 year-class, and 4-year-old fish from the strong 1969 year-class.

The interpretation of data from the 1973 fishery depends heavily on one biological factor, whether or not the distribution of mackerel shoals enables the fleet to concentrate on particular age-groups within the stock. One view is that all fish above a certain size, except perhaps the very largest, are all equally likely to be fished; the other view is that because mackerel do shoal by size, if some age-groups are more abundant in particular years, then the fleet would be capable of concentrating its activity on that more abundant section of the stock. The first view leads to the interpretation that in 1973 the fishing mortality was low and fish were not fully available to the fishery until they were 5 years old. The other leads to the interpretation that in 1973 the fishing mortality was high, with recruitment to the fishery at a comparatively early age, the pattern of fishing having been influenced either by fluctuation in year-classes or by the effect of fishing on stock structure. It is not yet possible to distinguish between these two interpretations, so the Subcommittee used each as a limiting situation in an assessment based on an agreed estimate of age composition of the catches.

Other parameters used in the assessment are listed in the Report of the Mackerel Working Group at Annex 1. These were agreed to give the best available representation of the stock, although, as always, there remain other options that could take account of variations with time of the parameters. As yet there is no definitive evidence that this has occurred. The results of the assessment are summarized in Table 3.[1]

The two interpretations of the fishery also lead to different views on the level of fishing mortality that could be advised as an objective for the Commission in 1974. Both indicate that the level of exploitation is harvesting close to the sustainable yield; if fishing mortality is low, it would be possible to allow some increase, but, if it is high, then fishing mortality should be reduced. With a low fishing mortality, the biomass of the stock will remain essentially the same in 1974, if the 1973 level of fishing is maintained; if fishing mortality is high, the biomass will decline. This decline may or may not be biologically significant, but the Subcommittee considered that, at least, the trend should not be accelerated by allowing fishing mortality to increase above the 1973 level until the true situation has been determined. It is possible to estimate a TAC for 1974, provided that fishing mortality remains at the 1973 level, but it is not yet possible to advise what that level is or what it should become under management. If fishing mortality is low and is maintained at that level in 1974, catches are expected to reach 312,000 tons, but, if fishing mortality is high and is maintained in 1974, because the biomass has been depleted to a greater extent in earlier years, the expected catch in 1974 would be lower at 251,000 tons. At present there is no scientific basis for choosing either 251,000 or 312,000 tons as being the more appropriate level, except that a TAC towards the lower end

[1] The fishery 1968-1973 was reconstructed to estimate correctly the known number of fish in the catches and then converted to weight landed, using an estimated average weight of each age. The data available related to mackerel in SA 4 which are known to be larger per age-group than those in SA 5 and 6, so the initial projection of catch weight had to be corrected to obtain the correct observed catch weight.

of the range would provide more safeguards for the future in the event of fishing mortality being at the higher of the two limits.

The different interpretations of this fishery will be resolved as the time series of data increases, but in the short term there is a crucial need for a measurement of stock size, independent of that estimated from the commercial fishery data.

Table 3. Summary of mackerel assessment for Subarea 5 and Statistical Area 6.

Hypothesis	1973 F	% Recruitment to fishery by age				
		1	2	3	4	5+
(1)	0.9	25	50	90	100	100
(2)	0.4	10	30	40	60	100

	Year	Recruitment at age 1 (10^6)	F (100%) average of age-groups 5 to 9	Yield (000 tons)	Population biomass (age 2 and older) at end of year (000 tons)
Hypothesis (1)	1967				424
	1968	5801	0.028	60	756
	1969	2082	0.067	108	923
	1970	2322	0.42	200	959
	1971	1011	0.44	349	745
	1972	(1450)	0.73	386	520
	1973	(2320)	0.90	372	320
	1974	2320	0.90	251	283
Hypothesis (2)	1967				495
	1968	7146	0.028	60	897
	1969	2936	0.05	108	1134
	1970	4410	0.31	200	1313
	1971	3203	0.34	349	1262
	1972	(1790)	0.47	382	1260
	1973	(2860)	0.40	372	1068
	1974	2860	0.40	312	1021

( ) 1972: recruitment at age 1 = 25% of 1967 year-class.
( ) 1973: recruitment at age 1 = 40% of 1967 year-class.

c) Age at Capture and Size Limit Considerations

The assessment for mackerel, carried out at the 1973 Annual Meeting, has established that delaying the age at first capture by avoiding the capture of very young fish (0, 1 and 2 years old) would improve the yield per recruit and the biomass of the adult stock. Seasonal or area closure of the fishery could not achieve this, but research is in hand to determine whether it could best be achieved by regulation of mesh size or a minimum size limit and to estimate how the degree of benefit would vary according to the level at which a regulation might be set. For example, it may be appropriate to establish a minimum size limit close to the length at maturity (30 cm), similar to that imposed in the Norwegian national fishery in the North Sea on mackerel for fishmeal.

3. Herring

Nominal catches of herring in the Convention Area and in SA 6 in 1973 totalled about 475,000 tons, 86% of the 1972 level of 548,663 tons. There was a larger decline in catches from the Gulf of St. Lawrence and Newfoundland (SA 3 and Div. 4RST). The TAC and actual catches for the southern stocks are listed in Table 2 of the Report of the Herring Working Group at Annex 2. Catches by non-members in 1973 from the Div. 5Y and the Div. 5Z + SA 6 stocks were higher than had been anticipated in the proposal for these stocks, but total catches by all countries in Div. 5Y were less than expected, the decrease being thought to be due to a change in availability.

a) Georges Bank Stock (Div. 5Z and SA 6)

The 1973 TAC for Georges Bank herring was 150,000 tons, and the 1973 catch was just over 200,000 tons. Updating the 1973 assessment gave new values of F in 1973 which indicated a redistribution of fishing mortality between age-groups, particularly towards the relatively large 1970 year-class, which provided a large part of the 1973 catch and is expected to make up a larger proportion of the catch in 1974. The year-class is now believed to be considerably larger than the 1966 year-class.

Estimates of the 1974 fishing mortality, catch and the expected stock at the end of 1974 were made assuming that the 1970 year-class might be 1.0, 1.5 or 2.0 times the 1966 year-class, the latter being considered by some scientists to be a realistic rather than an optimistic view. The results are summarized in Table 4 below and are shown in Fig. 2 of the Report of the Herring Working Group (Annex 2).

Table 4. Georges Bank herring assessment: population size as a function of 1974 catch for different assumed levels of 1974 F and of the size of the 1970 year-class.

1970 y.c. as % of 1966 y.c.	1974 Stock size[1]		1974 F by age				Mean F[2]	1974 Catch		1975 Stock size[1]	
	Number (10^6)	Weight (000 t)	3	4	5	5+		Number (10^6)	Weight (000 t)	Number (10^6)	Weight (000 t)
100%	726	155	0.33	0.31	0.26	0.10	0.28	286	51	795	152
			0.98	0.94	0.77	0.30	0.83	662	118	463	92
			1.31	1.26	1.03	0.40	1.11	783	140	358	73
			1.97	1.88	1.54	0.60	1.66	946	170	221	48
150%	1378	272	0.18	0.31	0.26	0.10	0.24	387	70	1238	230
			0.35	0.63	0.51	0.20	0.49	685	124	973	182
			0.62	1.05	0.90	0.35	0.85	1012	184	686	130
			0.89	1.57	1.29	0.50	1.21	1238	225	491	94
200%	2028	389	0.12	0.31	0.26	0.10	0.25	522	95	1648	304
			0.25	0.63	0.51	0.20	0.49	921	168	1294	239
			0.43	1.05	0.90	0.35	0.86	1354	247	914	170
			0.62	1.57	1.29	0.50	1.23	1650	301	660	123
200%			0.20	0.52	0.42	0.17	0.41	829	150	1375	255

[1] Stock size at beginning of the year.
[2] Weighted over age-groups by stock size in numbers.

In setting the TAC for 1973, the Commission agreed

i) that the TAC for 1974 should be established to restore the adult stock (4 years and older at the beginning of the year as it was then defined) to a minimum level of 225,000 tons by the end of 1974; and

ii) that the TAC for 1974 could only be increased over that of 1973 if the adult stock at the end of 1973 had reached a level which will provide the MSY at the end of 1974.

The second constraint means that the adult stock would have to reach the MSY level of 500,000 tons by the end of 1973 if the TAC were to be increased in 1974. Since Table 4 shows that for all assumptions the stock at the end of 1973 (beginning of 1974) was in all cases less than 500,000 tons, the TAC for 1974 should not be increased over 150,000 tons.

The first constraint requires that the TAC for 1974 be set at a level providing a minimum adult stock of 225,000 tons at the end of 1974. It can be seen in Table 4 that a TAC of 150,000 tons can be taken in 1974 and the constraint met, provided that the 1970 year-class exceeds the 1966 year-class by more than 1.5 times. If the 1970 year-class is 2.0 times the 1966 year-class, the adult stock at the end of 1974 would be increased to 255,000 tons for a 1974 TAC of 150,000 tons. From the evidence available, and particularly that concerning the 1970 year-class, the Subcommittee recommends that the TAC for 1974 remain at 150,000 tons.

b) Gulf of Maine Stock (Div. 5Y)

The catches (metric tons) in the juvenile and adult herring fisheries on this stock in 1973 were as follows:

		Adult Fishery	Juvenile Fishery	Total
USA	- Ages 1-3	1,124	15,110	16,234
	- Age 4 & older	4,878	1,259	6,137
Canada	- Ages 1-3	276		276
	- Age 4 & older	3,833		3,833
FRG	Age compositions	690		690
GDR	not yet reported	5,284		5,284
Total		16,085	16,369	32,454

The separation between juvenile and adult fisheries has changed in the last year, owing to an unusual distribution of the stock and to changes in the seasonal distribution of fishing. As a result, 3-year-old herring have been caught in fisheries that have in the past traditionally been based on 4-year-old and older herring. The assessment carried out has taken account of 3-year-olds that did appear in the "adult" fisheries, but the method of assessment will have to be adjusted in future years to take account of the total catch of 3-year-olds. The total catch in the adult herring fisheries was 16,085 tons and the TAC for adult herring in 1973 was 25,000 tons.

The assessment for this stock was updated, using the same assumptions concerning the 1970 year-class as were applied to the assessment of Georges Bank herring. The results are summarized in Table 5 below and are illustrated in Fig. 1 of the Report of the Herring Working Group (Annex 2).

Table 5. Gulf of Maine (Div. 5Y) herring assessment: stock size in 1974, 1975 and 1976 for different assumed levels of the 1970 year-class with a 1974 adult catch of 25,000 tons.

1970 Year-class as % of 1966 year-class	1974 Catch (Age 3 and older)	F (100%)	F (1970 Year-class)	Stock size at start of year (age 4 and older in 000 tons) 1974	1975	1976
100%	25,000	1.21	.42	64	37	40
150%	25,000	0.90	.32	85	55	55
200%	25,000	0.70	.25	106	72	71

Advice to the Commission is also subject to two constraints on this stock:

i) that the TAC for 1974 should be established to restore the adult stock (4 years and older as then defined) to a minimum level of 60,000 tons at the end of 1974; and

ii) that the TAC for 1974 could only be increased over that of 1973 if the adult stock at the end of 1973 had reached a level which would provide the MSY at the end of 1974.

Interpreting the second constraint as before, if the TAC in 1974 is to be increased over the TAC in 1973, the stock at the end of 1973 should be capable of providing a catch at the MSY level at the end of 1974 (i.e. should have reached 110,000 tons). Table 5 shows that the stock at the end of 1973 (beginning of 1974) will be less than 110,000 tons and, since the second constraint is not met, the TAC should not be increased. Table 5 also shows that the minimum stock at the end of 1974 (60,000 tons) could be met by a TAC of 25,000 tons, assuming, as for Georges Bank herring, that the 1970 year-class exceeds the 1966 year-class by more than 1.5 times This is uncertain in the Gulf of Maine stock, so the evidence is not strong enough to recommend a reduction in quota below 25,000 tons.

c) Nova Scotia Stock (Div. 4XW(b)) (Res.Doc. 74/13)

Catches from the Nova Scotia stock are classified according to whether herring are greater or less than the minimum length criterion (23 cm). Catches in the various sections of the fishery were as follows:

	Catch by size category (tons)		
	Adults (≥23 cm)	Juveniles (<23 cm)	Total
Canada - Purse seine	57,069	7,162	64,231
- Weir	14,339	16,984	31,323
- Gillnets	5,715		5,715
- Misc. gear	945		945
Sub-total	78,068	24,146	102,214
Japan	1,271		1,271
USSR	31,042		31,042
FRG	228		228
Sub-total	32,541		32,541
TOTAL	110,609	24,146	134,755

The TAC for 1973 was 90,000 tons.

Stock distribution within this area is confused by the separation of fisheries along the Nova Scotia and New Brunswick coasts and offshore in the Bay of Fundy. It was considered desirable to attempt an assessment with data for all fisheries exploiting the Nova Scotia stock (excluding the New Brunswick inshore fisheries) as a single unit and then to estimate the TAC for 1974 in relation to the principle of the constraints adopted by the Commission for the Georges Bank and Gulf of Maine stocks, i.e. by reference to the expected catch in the adult fisheries. Owing to the complexity of the fisheries in Div. 4XW(b), it is not possible to provide a reliable estimate of the catch in 1974, but it is clear that it will also be determined largely by the size of the 1970 year-class. Assuming this to follow the pattern expected in the other stocks, estimates of catch in 1974 ranged above and below the TAC for 1973, and so the Subcommittee recommends that the TAC for 1974 for the adult fishery be held at the same level as in 1973.

d) Conclusions re Herring TACs

The advice on TAC for 1974 is broadly the same for all stocks. Although it is believed that the stocks in Div. 5Y and Div. 5Z + SA 6 have begun to increase, it is certain that they had not increased to the MSY level by the end of 1973, and therefore, according to the constraints laid down by the Commission, an increase in TAC in 1974 cannot be recommended. It is less clear what level of TAC should be set in 1974 to ensure that these stocks will reach the minimum prescribed level by the end of 1974, because this depends almost entirely on the size of the 1970 year-class. The best judgement available indicates it to be at least 1.5 times the 1966 year-class, which will just enable the TAC for 1973 to be maintained through 1974 and still meet the minimum requirements for the Georges Bank and Gulf of Maine stocks at the end of 1974. The Subcommittee recommends that the TACs for 1974 remain at the 1973 levels for all stocks, but it must emphasize that more precise estimates can only be achieved in future years by improved estimates of the size of new year-classes. In this connection it must also be noted that the young fish survey data suggest that the next year-class to recruit (1971 year-class) will be rather small. If the 1970 year-class is smaller than anticipated and if it is fished more heavily to achieve the recommended TACs (if adopted), then it becomes less likely that the present levels of TAC can be maintained in 1975.

The provision of advice to the Commission has become difficult owing to uncertainties within the Subcommittee regarding:

i) the identification of components of the fisheries and hence of the quantity of catch on which the stock assessment should be based in order to be related to the TAC (meaningful assessment should be based on total catch of each stock); and

ii) the identification of adult as opposed to juvenile fisheries, where landings are classified according to the 23 cm size limit, when the adult stock is defined in terms of herring age 4 years and older at the beginning of the year and when, for biological reasons, mature fish of 3 years old appear in the catches.

Clarification of these points by the Commission would assist the Subcommittee in providing better advice.

e) Other Matters

i) Ageing. A set of conventions to be used in reporting herring age data to ICNAF was agreed upon and is listed in the Report of the Herring Working Group at Annex 2.

ii) Larval and juvenile surveys (Res.Doc. 74/14, 15, 16, 17, 18). Preliminary results of the 1973 ICNAF Herring Larval Surveys proved valuable and, besides confirming and extending knowledge relevant to stock identity, indicated an increase in the spawning stock size on Georges Bank. The Subcommittee recommends that these surveys be continued and also suggests that attempts should be made in 1974 to link up the larval and juvenile surveys by use of larval-collecting gear simultaneously with juvenile gear during the juvenile surveys.

4. Other Fish in Subarea 5 and Statistical Area 6

a) Red Hake in Division 5Z and Statistical Area 6 (Res.Doc. 74/19)

At its 1973 Annual Meeting, the Commission considered regulations for red hake in two management areas (east and west of 69°W in Div. 5Z) and, at its Special Meeting in Ottawa, agreed to a 1974 TAC of 50,000 tons for red hake in the area west of 69°W. The 1974 TAC for red hake east of 69°W is to be considered at this meeting, following reassessment of the state of the stock.

Nominal catches from the Georges Bank stock (Div. 5Z east of 69°W) decreased from 29,200 tons in 1972 to an estimated 18,400 tons in 1973 (i.e. 74% of the catch in the whole of Subdiv. 5Ze, as judged from the proportional distribution of effort in the area and assuming that the distribution of effort remained the same). It is possible that the proportion of the total catch of red hake caught on Georges Bank changed in 1973. The 1973 survey data indicated that the stock doubled in size from the autumn of 1972 to the autumn of 1973. These and data from earlier surveys suggest that the 1969, 1971 and 1973 year-classes are strong, and that both USA and USSR assessments indicated a stock biomass of 43,000-48,000 tons at the beginning of 1974. Assuming $M = 0.4$ and fishing mortality not to exceed $F_{max} = 0.75$, the TAC for 1974 should be 20,000 tons.

Nominal catches from the Southern New England - Middle Atlantic stock (west of 69°W) remained approximately the same in 1973 as in 1972, at about 43,000 tons. The 1973 US autumn survey indicated that the stock size decreased by 50% from the autumn of 1972 to the autumn of 1973. A US reassessment of the stock west of 69°W, based on the same techniques as were used to reassess the Georges Bank stock, indicates a stock biomass there of 76,000 tons at the beginning of 1974. This is 25% lower than the estimate of 100,000 tons used at the 1973 Annual Meeting as a basis for the recommended TAC of 50,000 tons which was agreed at the 1973 Special Meeting in Ottawa. The downward adjustment of stock size is supported by the results of the US autumn groundfish surveys. Taking this into account and applying the same level of exploitation recommended for the Georges Bank stock, the TAC set for 1974 in Div. 5Z (W of 69°) and SA 6 might be too high.

b) "Other Finfish" in Subarea 5 and Statistical Area 6

Table 6 summarizes the nominal catches of the various species within the "other finfish" category and in Table 7 these are grouped according to trends in recent years. The total nominal catches of other finfish have averaged 146,000 tons in the last three years, 36% being unsorted and miscellaneous species. Taken overall, nominal catches reached a peak in 1969 but have since declined to the level of earlier years, a greater decline in some (ocean pout, sculpins, scup, black sea bass, alewife and butterfish) being offset by an increase in nominal catches of argentine, dogfish and skates. These trends are confirmed by groundfish survey data, but no assessments are available. Hence, although the increase in fishing, which led to peak landings in 1969 and has since maintained them, must have decreased the biomass to some extent, it is not possible to decide on the level of exploitation and its overall effect, or on the effect of possible natural changes.

In view of the observed decline in several species, it is desirable to avoid the possibility of an unrestricted increase in catches. The existence of the second-tier overall TAC agreed at the 1973 Special Meeting in Ottawa limits this risk, but it can only be completely overcome by establishing a TAC for this "other finfish" group as a whole. However, within the overall group there are species fisheries which may be capable of further development, notably those for argentine, dogfish and skates. The Subcommittee considers that, by careful management of national fleets, limited development of particular species fisheries would be possible within a TAC of

150,000 tons for "other finfish" and that the collection of data in such a fishery could be presented to later meetings to justify the allocation of a separate TAC for it. Likewise there are species (e.g. alewife), which are important to restricted small directed fisheries and which might at a later date merit conservation by separation from the "other finfish" group.

Discussion of argentine in SA 4 (see Section 5 below) indicated that this species might be managed more appropriately by separation from the "other finfish" category at the present time and regulated in a manner comparable to that agreed for pollock. If the Commission does decide to regulate argentine separately, then an appropriate adjustment should be made to the 1974 TAC for "other finfish".

Table 6. Contributions of species to the nominal catches of "other finfish", 1970-72. (Group 1 includes species or categories showing no consistent trend in nominal catches in recent years; Group 2 includes species showing a decline in nominal catches following a peak in 1969; and Group 3 includes species showing an increase in nominal catches in recent years.)

Group	Species (Common name)	Average nominal catch 1970-1972 (tons)	Percentage contribution to average 1970-72 catch
1	Angler	2,932	2.0
	Cusk	1,624	1.1
	King whiting	120	0.1
	Northern puffer	382	0.3
	Sea robins	1,843	1.3
	White hake	2,780	1.9
	Wolffish	246	0.2
	Bluefish	1,775	1.2
	Shad	2,004	1.4
	Misc., USA	11,725	8.0
	Groundfish (NS)	5,016	3.4
	Pelagic (NS)	415	0.3
	Other fish (NS)	31,232	21.3
2	Ocean pout	6,137	4.2
	Sculpin	5,156	3.5
	Scup	4,699	3.2
	Black sea bass	805	0.5
	Alewife	28,645	19.6
	Butterfish	8,400	5.7
3	Argentine	13,793	9.4
	Dogfish	10,367	7.1
	Skates	6,357	4.3
Total		146,453	100.0

Table 7. Nominal catches ('000 tons) of species groups (as defined in Table 6), 1963-1972.

	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972
Group 1	93	97	92	66	43	58	68	45	72	68
Group 2	54	40	50	64	64	85	125	66	59	37
Group 3	4	18	12	45	9	13	21	11	25	61
Total	151	155	154	167	114	152	206	117	156	166

5. Regulation of Additional Species in Subareas 2, 3 and 4

Canada has requested advice on allowable catches of a number of species listed in Comm.Doc. 74/1 and 2. Several of these species (e.g. Greenland halibut and American plaice) provide relatively small fisheries in the areas defined and very few biological or population data are available. Also the TAC for capelin has been established on a different basis from many other TACs agreed by the Commission, and, taking them together, the Commission should be aware that the TACs of these less well-known species have been suggested as practical figures to prevent an undesirable sudden expansion of fishing in SA 2, 3 and 4 as a whole, rather than to provide adequate management of the individual species.

These TACs will be reviewed as more data (e.g. discarding at sea) become available, and for some species it may be possible to increase the fishery, as the distribution of the stocks and the true potential catch from the area are better understood.

a) Redfish in Subarea 2 and Division 3K (Res.Doc. 74/5)

There was no fishery for redfish in SA 2 and Div. 3K prior to 1958. In that year a directed fishery commenced with catches reaching 150,000 tons. Catches were 187,000 tons in 1959 but decreased to 130,000 tons in 1960 and 55,000 tons in 1961; they were around 20,000 tons in 1962 and 1963 but increased to 56,000 tons in 1964. There was a steady decline to 20,000 tons by 1968 and catches up to 1972 remained remarkably stable at about this level. The 1973 provisional catch, however, was 40,000 tons.

Catch per day fished was at a high level of 40 tons in 1958 when the fleet fished the accumulated stock of old redfish. However, there was a very sharp decline to 13 tons per day by 1961. Some increase was evident in 1962 and 1963 (to 20 tons per day), but thereafter the catch per unit effort decreased to 12-15 tons per day during 1966 to 1971. In view of the stability of the catch per unit effort in the latter period, it is very likely that the increased catch in 1973 resulted from increased effort on the stock.

Standardized fishing effort, using 6-, 8-, and 10-year averaging periods, was used to construct a Schaefer-type yield curve. The best fitting relation, using a 10-year average of fishing effort, gave MSY at a fishing effort of some 2,000 standard days. Under equilibrium conditions this would give an MSY of 40,000 tons. At present the stock has been depressed below the MSY level by the heavy fishing on the accumulated stock in the late 1950s and early 1960s; at the current stock level a catch of about 25,000 tons in 1974 would enable the stock to recover towards the MSY level, and this is proposed as the TAC for 1974.

b) Greenland Halibut in Subarea 2 and Divisions 3K and 3L (Res.Doc. 74/2)

The general distribution of Greenland halibut in the Northwest Atlantic extends from Arctic regions to Georges Bank, but the only fishable concentrations are in SA 1 and 2 and in Div. 3K and 3L. During the 1950s and early 1960s the only real fishery for this species in SA 2 and 3 was by Canada in the inshore area. Between 1962 and 1966-67 the Canadian catch increased rapidly from about 600 tons to 16,600 tons. At the same time landings by other countries (mainly Poland, USSR and non-members) also increased, causing total landings to increase from 700 tons in 1962 to 27,000 tons by 1967 and 36,000 tons by 1969-70. Catches were somewhat lower in 1971 (24,000 tons) and 1972 (30,000 tons) and provisional figures for 1973 indicate the catch to be about 27,000 tons.

Returns from tagging programs tend to support the consideration that Greenland halibut in SA 2 and Div. 3K and 3L constitute a single stock. Since very few mature fish are taken in coastal waters, it is very likely that major spawning occurs in deeper water offshore areas.

No detailed assessment is at present possible for this stock. However, as part of the overall management regime, it is recommended that a 1974 TAC of 30,000 tons would be appropriate, this being close to the level of recent catches. As more knowledge of the distribution becomes available and detailed assessments are made, this level of catch may be adjusted in future.

c) Roundnose Grenadier in Subareas 2 and 3 (Res.Doc. 74/6)

The fishery for grenadiers (predominantly roundnose grenadier, *Macrourus rupestris*) is at present conducted mainly by USSR vessels fishing at depths of 600-1,200 m. It is a deep-water species whose availability to the fishery can vary sharply according to hydrographic conditions. Excepting an outstanding catch of 75,000 tons in 1971, catches have fluctuated around 20,000 tons since 1967, taking immature fish believed to be moving from shallow into deeper water.

Due to the slow growth rate of roundnose grenadier, annual production is expected to be only a small proportion of the biomass of the stock as a whole, but the data available are not adequate to establish what proportion of the total stock recent catches represent, because the distribution

of the species extends beyond the depth of recent trawling operations. However, the data do indicate that the fishery is taking the potential yield of that part of the stock which is at present being fished.

Preliminary estimates of sustainable yield indicate that this may be in the range of 24,000-37,000 tons. If a TAC for roundnose grenadier is to be set as part of a regime to regulate fishing in SA 2 and 3 as a whole, then a catch of 30,000 tons in 1974 is recommended. This would allow the fishery to be maintained at the average level of 1967-1973, and it would also allow some increase over the most usual level (20,000 tons), so that the fishery could be extended and, in being extended, provide a basis for better estimates of the potential catch.

d) American Plaice in Subareas 2 and 3 (Res.Doc. 74/3)

SA 2 and Div. 3K. From a knowledge of the extent of migration in Div. 3L and 3N it is quite probable that very little mixing occurs between adult plaice in Div. 3K and those to the south in Div. 3LNO. Research vessel cruises to SA 2 and Div. 3K do not indicate particularly large concentrations but rather a number of relatively small aggregates scattered throughout the area. Total catches from the stock increased from 300 tons in 1962 to a peak of 13,000 tons in 1970, but were lower in 1971 (5,348 tons) and 1972 (9,070 tons). Provisional statistics indicate the 1973 catch to be about 4,500 tons. No detailed assessment is available at present, but as part of an overall management regime aimed at preventing sudden diversion of effort to any unregulated stock, a 1974 TAC of 8,000 tons is recommended, which is about the average level of recent catches.

Div. 3M. This stock is distinct from the Grand Bank stock, as indicated by vertebral averages, age at sexual maturity and growth rate. The total stock is probably relatively small, and the only substantial landings reported were in 1965 and 1966 by the USSR which listed about 5,000 and 4,000 tons respectively of unspecified flounders, presumably plaice. No stock assessment was possible but, judging from recent catches, a TAC of 2,000 tons is recommended for 1974 to prevent diversion of fishing effort to this stock.

Subdiv. 3Ps. This stock is considered to be separate from the Grand Bank stock by the geographic separation of the latter area and also because no American plaice tagged on the Grand Bank were recovered on St. Pierre Bank or in adjacent localities. Except for relatively large catches taken in 1968 (8,350 tons) and 1969 (4,340 tons) by the USSR, the fishery has been mainly by Canada, with small quantities landed annually by the France (St. Pierre) fishery. Total catches increased from 1,000 tons in 1962 to 3,500 tons in 1967. The catches in 1968-72, however, ranged from 6,500 to 14,000 tons. Provisional figures for 1973 indicate a total catch of about 12,000 tons. No assessment was possible for this stock, but, to prevent sudden diversion of fishing effort to it, a TAC of 10,000 tons is recommended for 1974, close to the average catch for the past five years.

e) Argentine in Subareas 4 and 5 (Res.Doc. 74/21, 22, 23)

The fishery for argentine in the ICNAF Area began in 1963 with landings of 12,300 tons, increasing to 49,000 tons by 1966. In 1967-70 landings were lower, ranging from 5,500 to 8,100 tons, but then increased to 38,800 tons in 1972. Preliminary statistics indicate that 1973 nominal catches were low (about 5,000 tons). Almost all of these and earlier catches came from SA 4 and 5, with SA 4 catches in 1963-1972 averaging 6,300 tons and SA 5 catches averaging 10,800 tons. The USSR is the main country involved in this fishery, although Japan has taken significant quantities in recent years.

The argentine is distributed along the edge of the continental shelf, predominantly in depths of 100-300 fathoms. Stock separation studies indicate that there is a cline of stock units along the edge of the shelf with little inter-mixing among these, although there are areas of high concentration, particularly during the spawning season of March - May. The Fundian Channel area between Georges Bank (Subdiv. 5Ze) and Browns Bank (Div. 4X) is one such area which sustained high catches in 1972 (36,000 tons).

Argentine is a slow-growing, long-lived (20-30 years) species with a low fecundity and probably also a low natural mortality rate. Thus, the ratio of sustainable yield to biomass is low. Canadian research vessel surveys in 1958-68, a period when exploitation was low, give biomass estimates of 200,000-300,000 tons on the Scotian Shelf (Div. 4VWX). Yield per recruit curves are flat-topped with no F_{max}. Taking the alternative ($F_{0.1}$), Canadian estimates give $F_{0.1} = 0.20$ and the expected sustainable yield as slightly higher than 20,000 tons. Soviet analysis for the Fundian Channel area indicates a biomass of 100,000 tons in 1972 and an $F_{0.1} = 0.30$, implying a sustainable yield of 30,000 tons from this area. As exploitation rates have probably been low in most of the recent years, somewhat higher catches than the sustainable yield could be expected in the immediate future, by fishing at F_{opt}, until the accumulated stock is removed.

These estimates of yield are not directly comparable, because one refers to Div. 4VWX and the other to part of Div. 4X and part of SA 5. As there is no precise separation of stocks between SA 5 and Div. 4X and it is possible that some argentine catches in SA 5 are from Div. 4X stocks, it is not possible at this time to define the potential yield from SA 4 distinct from that of SA 5. Thus, it may be desirable to manage argentine, as for pollock, and combine SA 4 and 5 for management purposes. A suitable 1974 TAC would be 50,000 tons for the combined subareas, but if the fishery develops to this level and the accumulated stock is cropped, then it is likely that the TAC should be lowered. To prevent local over-exploitation, it would be appropriate to divide this TAC equally between Div. 4VWX and SA 5.

f) Squid in Subareas 3 and 4

Nominal catches of squid in SA 3 and 4 have so far been relatively small (less than 10,000 tons) and they are based mainly on *Illex illecebrosus*, a different species from *Loligo* which provides the fishery in SA 5 and 6. Some biological information concerning *Illex* has been presented to the Subcommittee, but nothing is yet known about the size of the stock or about its population dynamics, and no advice can yet be given to the Commission.

g) Partition of the 1974 TAC for Capelin in Subareas 2 and 3 (Res.Doc. 74/7, 12)

On the recommendation of the Assessments Subcommittee, the Commission at its 1973 Annual Meeting agreed to set a 1974 TAC of 250,000 tons for the capelin fishery in SA 2 and 3, recognizing at the time that the potential yield was perhaps substantially higher. To ensure rational development of the capelin fishery, particularly in view of the vital role played by capelin in the trophic ecology of the area, the Assessments Subcommittee in 1973 also recommended that future increases in the TAC should be related to the rate at which new information allowed the full potential of the resource to be assessed. Such an assessment should as far as possible take account of interactions between capelin and other species. Although recognizing that there was at least a partial separation of the capelin in the Southeast Shoal area (Div. 3NO) of Grand Bank from those further north, the Subcommittee did not recommend a division of the capelin quota, mainly because of the lack of definitive stock discrimination data.

The total catch of capelin in SA 2 and 3 was about 263,000 tons in 1973. New information on differences in growth rate of capelin in the Newfoundland - Labrador area (Res.Doc. 74/7), together with available data on seasonal distribution and probable migration patterns, suggest that a minimum stock breakdown of capelin would include Div. 2J-3K as one stock complex and Div. 3LNOPs as another. Total removals from the Div. 3LNOPs complex increased substantially in 1973 to about 130,000 tons, mainly from Div. 3NO. Since the capelin fishery in Div. 3NO occurs under conditions conducive to large catches and normally precedes the fishery in the northern area, the possibility exists that the MSY level of the Div. 3LNOPs stock complex may be reached in 1974, without the necessary data required to accurately assess its true potential. Thus it is considered desirable that the 1974 TAC for capelin be partitioned into two components corresponding to the two stock complexes defined above, with a maximum allocation of 150,000 tons for the Div. 3LNOPs stock complex. This level would allow some expansion in the Southeast Shoal fishery for new entrants. It is evident from the ecology of capelin that this species suffers heavy natural mortality after spawning, so that in terms of the effect of the fishery on the interaction between capelin and other species it may become desirable to allocate the potential catch between adult and juvenile fisheries as well as between areas.

h) Cod in Division 4T and Subdivision 4Vn

Components of at least three cod stocks spend part or all of the year in Sydney Bight (Subdiv. 4Vn). The large southern Gulf of St. Lawrence stock, which spends the summer months in Div. 4T, migrates in December to deep waters along the edge of the Laurentian Channel, particularly in Subdiv. 4Vn. The return migration occurs during April and May. The eastern Scotian Shelf cod (i.e. those from Sable Island - Banquereau area in Div. 4VsW) show some movement to the north in spring and summer, supporting a small otter trawl fishery in Subdiv. 4Vn in summer. Distinct local stocks support inshore longline, handline and gillnet fisheries around Cape Breton (Subdiv. 4Vn), also in the summer months. Nominal catches have been assigned to stocks by considering Div. 4T catches in all months and Subdiv. 4Vn catches in the months January - April inclusive as coming from the main southern Gulf of St. Lawrence stock. May to December catches were assigned to the offshore fishery if caught by otter trawl and to the inshore fishery if caught by other gears.

Div. 4TVn (spring) cod. Nominal catches from the southern Gulf of St. Lawrence stock declined from 70,000 tons in 1963 to 41,000 tons in 1967 and then increased to 68,000 tons in 1972. The catches in 1972 contained a large proportion of small fish aged 4 and 5, and the number (although not the weight) removed was the highest in the period studied (1960-72). Catches increased from 1967 with increasing stock abundance, but fishing mortality also increased in 1969 and 1970. Changes in catch and catch per effort did not vary proportionally in 1971 and 1972, suggesting

that effort, and thus mortality, was increasing. As F ranged from 0.4 to 0.5 in 1960-70 on fully recruited age-groups, it is unlikely that an increase would result in any substantial sustainable increase in yield. As F may well have been above this average in 1971 and 1972, catches in 1974 should not exceed the long-term average of 60,000 tons.

Subdiv. 4Vn (May - December) inshore cod. Catches from inshore stocks in Subdiv. 4Vn ranged from 4,200 tons to 6,200 tons in 1962-72, the average being 4,920 tons. This small population has been stable in the period 1960-68, with an average F of 0.35 on fully recruited age-groups. This F is probably close to that maximizing yield per recruit and a substantially larger sustained yield is unlikely to result from increasing F. Thus, 1974 removals should not exceed 5,000 tons.

Subdiv. 4Vn (May - December) offshore cod. The offshore summer fishery in Subdiv. 4Vn ranged from 2,200 tons to 6,600 tons in 1962-72, averaging 4,440 tons. Previous assessments of the Div. 4VsW stock did not take these fish into account in establishing a 1974 TAC of 60,00Q tons. The fishery in Subdiv. 4Vn is small in relation to that in Div. 4VsW, and inclusion in the analysis would not result in major changes in conclusions, in that the Div. 4VsW stock is fully exploited and perhaps over-exploited. Thus, catches from Subdiv. 4Vn of this stock should not be allowed to increase. Therefore, 1974 catches should not exceed 5,000 tons.

Conclusions. In total, the 1974 cod catches from all of Div. 4TVn should not exceed 70,000 tons. It should be noted that a single TAC for the entire area would not necessarily result in the optimum distribution of mortality on stocks. Over-exploitation of the southern Gulf of St. Lawrence stock in Subdiv. 4Vn in the spring could result, with subsequent under-exploitation of those stocks fished in Subdiv. 4Vn in summer. This would further result in dislocation of fisheries by Canadian inshore fishermen in Sydney Bight and the southern Gulf of St. Lawrence. However, this could be in part avoided by setting one TAC of 10,000 tons for Subdiv. 4Vn in May - December inclusive and another TAC of 60,000 tons for Subdiv. 4Vn in January - April inclusive plus Div. 4T.

i) Cod in Division 4X Offshore (Res.Doc. 74/25)

Cod on the offshore banks (Browns and LaHave) of Div. 4X belong to a discrete stock which mixes very little with the complex of inshore stocks around southwestern Nova Scotia and the Bay of Fundy. Catches from the offshore stock increased from 2,900 tons in 1962 to 19,000 tons in 1969 and then declined to 9,200 tons in 1970 and to 7,300 tons in 1972. Fishing mortality has been considerably above that giving maximum yield per recruit (F_{max} = 0.35), with a resultant decline in stock abundance. Given that the 1962-68 year-classes represent average recruitment to this stock, maximum sustainable yield is about 13,000 tons. However, with catches exceeding this in 1966-69, and indications from research vessel surveys that the stock continued to decline in 1970-72 and that mortality remained high, fishing at F_{max} would not give this high a yield in 1974. A decline in catches in 1970 corresponded to the imposition of the haddock quota regulations in this area, and as these fisheries are closely related, it is difficult to determine how much the decline in catch was due to lower cod abundance and how much to lower effort. However, there is sufficiently strong evidence of earlier over-exploitation to recommend that 1974 catches should not exceed the current level of about 8,000 tons.

6. Coordinated Groundfish Surveys

STACRES agreed that the Working Group on Coordinated Groundfish Surveys should include consideration of matters related to pelagic surveys and hydro-acoustic surveys. The Report of the Coordinated Surveys Working Group is at Appendix III, and a summary of the activities of this Group is given in Section III of the STACRES Report.

7. Review of TACs at the 1974 Annual Meeting

The Subcommittee will be required to review TACs for all groundfish species at the 1974 Annual Meeting. It is vital that this review should have at its disposal sampling data from national fisheries in 1973 and these should be available to scientists for revising their assessments before the meeting takes place. The Subcommittee therefore

recommends (1)

that all countries be requested to provide:

a) revised monthly catches in 1973 of each species stock under regulation; and

b) sampling data from 1973 pertaining to these catches.

These data should be airmailed to reach the Secretariat not later than 31 March 1974. Forms will be provided by the Secretariat for submission of these data and countries are urged to use them. The Secretariat will circulate the catch data and a list of the sampling data which will be available on request.

ANNEX 1 - REPORT OF THE AD HOC MACKEREL WORKING GROUP

Chairman: E. L. Cadima

Rapporteur: T. D. Iles

The Mackerel Working Group met at the Sea Fisheries Institute, Hamburg, Fed. Rep. Germany, during 7-9 January 1974 to evaluate the status of the mackerel stock in SA 5 and 6 based on the most recent data and information available. Participants were present from Canada (R.G. Halliday, T.D. Iles, W.T. Stobo, G.H. Winters), Fed.Rep. Germany (A. Schumacher, H. Dornheim, D. Schnack), Japan (F. Nagasaki), Poland (J. Popiel, A. Paciorkowski), USSR (A.S. Bogdanov, V.A. Richter, O.V. Bakarin), UK (D.J. Garrod, J.G. Pope), USA (B. Brown, V. Anthony, E.D. Anderson), and FAO (E.L. Cadima).

1. The Fishery in Subarea 5 and Statistical Area 6 in 1973

Provisional statistics reported to the January 1974 Special Meeting by countries fishing in SA 5 and 6 indicate that the total nominal catch in 1973 was about 366,000 tons (Table 1). This is substantially below the 1973 TAC of 450,000 tons and is less than the 1972 catch of 387,000 tons, the first decrease in catch since the fishery began to develop on a large scale in 1968. Young fish of age-groups 2 and 3 constituted 42% of the 1973 catch in numbers, with age-2 fish being the dominant group (26% by number) of all age-groups present.

Table 1. Nominal catches of mackerel from SA 5 and 6 in 1972 and 1973.

Country	Nominal catches (000 tons) 1972	1973[1]
Bulgaria	23.6	25.3
Canada	-	0.1
Fed.Rep. Germany	0.8	1.5
Italy	0.8	1.0
Japan	1.1	0.5
Poland	142.0	117.2
Romania	2.5	...
USSR	134.1	142.2
USA	2.0	1.9
German Dem.Rep.	80.5	76.7
Total	387.4	366.4

[1] Provisional data, as on 15 January 1974.

2. Stock Identity, Inter-relationships and Migrations

The assumption that the mackerel in the ICNAF Area are divided into two biologically distinct stocks (northern and southern) with some "mixing" in SA 5 and 6 during the winter was discussed on the basis of new information (Res.Doc. 74/8, 9). It was not possible to estimate the degree of mixing of these two spawning stocks, although it was accepted that mixing occurs. A tagging experiment on a substantial scale would be required if the problem is to be resolved, and it was recommended that this matter be discussed at the 1974 Annual Meeting.

3. Data and Parameters Used for Assessment

a) Catch Statistics for 1973

Based on preliminary information available on 7 January 1974, a 1973 catch of 372,000 tons of mackerel was estimated to have been taken, and this figure was used in the assessment. It consisted of catches (000 tons) by Bulgaria (27.9), Canada (0.1), Fed.Rep. Germany (1.5), German Dem.Rep. (80.7), Japan (0.5), Poland (117.2), USSR (142.0) and USA (1.9). However, reports available to the Secretariat later in the meeting gave the 1973 catches listed in Table 1.

b) Catch-per-effort Data, 1968-73

Various catch-per-effort data were considered with a view to analyzing trends in abundance of mackerel during 1968-73. Polish catch-per-day for B-18 trawlers showed an increase from 1971 to 1973, during a period when learning was not considered to be a factor affecting the catches. Taking the relative abundance indices for 1968-71 (catch-per-hour, with learning), as given in Res.Doc. 73/14 (see also *Redbook* 1973, Part I, page 88), and calculating values for 1972 and 1973 (assuming the proportionality between the catch-per-day and catch-per-hour values for 1971), a set of indices is obtained showing a continuous decrease from 1968 to 1971 followed by an increase to 1973 (Table 2). A second set of relative abundance indices (Res.Doc. 74/10) showed a continuous decline in catch-per-effort from 1968 to 1972, and a decline in abundance from 1972 to 1973 was indicated by the US spring bottom trawl survey. No agreement could be reached on trends in abundance, and the Group decided to take both sets of abundance indices for the assessments (Table 2).

Table 2. Mackerel catch per unit effort, 1968-73.

Year	Polish B-18 trawlers Catch/day (tons)	Res.Doc. 73/4 Catch/hr (tons) with learning	Res.Doc. 74/10 Catch/hr (tons) with learning
1968	25.6	1.80	1.96
1969	27.5	1.32	1.52
1970	32.7	1.05	1.07
1971	31.9	0.91	0.86
1972	32.1	0.97[1]	0.54
1973	35.1	1.06[1]	0.40[2]
		Hypothesis (2)	Hypothesis (1)

[1] Estimated from catch per day of Polish B-18 trawlers assuming proportionality of 1971 and learning factor equal to 1.
[2] Provisional estimate.

c) Growth Data

The Group decided to consider the following observed average weights by age-groups of mackerel in SA 4 (Res.Doc. 74/9) as more applicable to mackerel in SA 5 and 6 than those calculated from von Bertalanffy parameters, as had been done for the assessment at the 1973 Annual Meeting.

Age (yr)	1	2	3	4	5	6	7	8	9	10
Weight (g)	95	175	266	350	432	506	564	615	659	693

This particular set of weight data proved to be inconsistent with the age compositions adopted for the period 1968-73, and the results of the assessment were later corrected for this discrepancy (see Section 4 below).

d) Age Composition of Catches

The age composition data for the period 1968-73, accepted as the basis for assessment (Table 3), were prepared by scientists of Bulgaria, German Dem.Rep., Poland and USSR from sampling data collected during the period on commercial fishing vessels. Monthly age composition data were adjusted to monthly nominal catches and combined to give numbers caught in each year by age in Div. 5Z and SA 6.

e) Natural Mortality (M)

The range of values of the natural mortality coefficient (m) from 0.2 to 0.4, used at the 1973 Annual Meeting, was adopted for the assessment, and estimates of the population structures during 1968-73 were calculated for M = 0.2, 0.3 and 0.4. After comparing the results, the Group adopted M = 0.3 for use in the final calculations.

Table 3. Age composition of mackerel catches in Div. 5Z and SA 6 during the period 1968-1973.

Year	Numbers by age-group (millions)												Total number (10^6)	Catch (000 tons)	Mean weight (g)
	0	1	2	3	4	5	6	7	8	9	10	11+			
1968	2.1	63.7	90.8	49.8	9.9	9.1	4.3	0.8	0.4	0.1	+	-	231.0	59.6	258
1969	2.7	133.4	171.3	82.6	20.0	6.2	5.5	4.8	2.5	1.6	0.9	-	431.5	108.3	251
1970	2.9	131.3	28.9	349.4	174.0	39.7	13.9	12.5	19.6	18.0	9.0	-	799.2	199.8	250
1971	1.1	100.4	278.0	104.2	530.6	227.8	45.5	13.7	10.7	9.1	4.8	-	1325.9	348.7	263
1972	10.9	41.4	74.3	278.4	217.8	407.4	109.0	32.7	8.5	13.1	8.9	-	1202.4	386.0	321
1973	-	87.2	332.9	209.1	243.6	163.9	190.9	34.1	13.0	6.6	4.1	1.2	1286.6	371.8	289

f) Total Mortality (Z)

Depending on which set of catch-per-effort data was used, opinion varied on the best estimate of Z for 1973. The Group finally agreed to use two values (representing the extremes of opinion) for assessment purposes: 0.7 and 1.2 (for fully recruited age-groups).

g) Partial Recruitment

Two recruitment patterns were chosen to represent the two views on recruitment, as follows:

Age (years)		1	2	3	4	5+
Hypothesis (1)	%	25	50	90	100	100
Hypothesis (2)	%	10	30	40	60	100

4. Results of Assessments

The number of possible calculations (using cohort analysis techniques) implied by the ranges of individual parameters agreed on was reduced to four, characterized as follows:

Hypothesis[1]	M	Z (age 5 and over)	Partial recruitment (%) by age				
			1	2	3	4	5+
(1)	0.3	1.2	25	50	90	100	100
(1a)	0.3	1.2	10	30	40	60	100
(2)	0.3	0.7	10	30	40	60	100
(2a)	0.3	0.7	25	50	90	100	100

[1] Hypothesis (1) and (2) correspond to the two different opinions as to both the estimates of Z and the partial recruitment patterns, and give the extreme cases to be discussed.

Comparison of the initial results of the calculations (as catch in weight), i.e. using the mean weight-at-age data for SA 4 (Section 1(c) above), with the observed catches in the fishery indicated a discrepancy, as shown in Fig. 1. A linear relationship (correlation coefficient r = 0.996) is clearly demonstrated, and this was used to correct the catches and population biomasses. It was concluded that the Canadian mackerel samples in SA 4 were taken at a time of the year when condition factors were higher than the average in the SA 5 and 6 mackerel fishery.

The two hypotheses give widely different results in terms of population size and possible projected catches (Table 4), and there is no clear-cut evidence to allow a choice between the projected catches. Both cases indicate a decline in biomass in recent years. However, the yield-per-recruit curves derived from the calculations in Table 5, within the range of values of F for each of the hypotheses (F = 0.4 and F = 0.9), are very similar (Fig. 2). For Hypothesis (1) the fishery is fully exploited

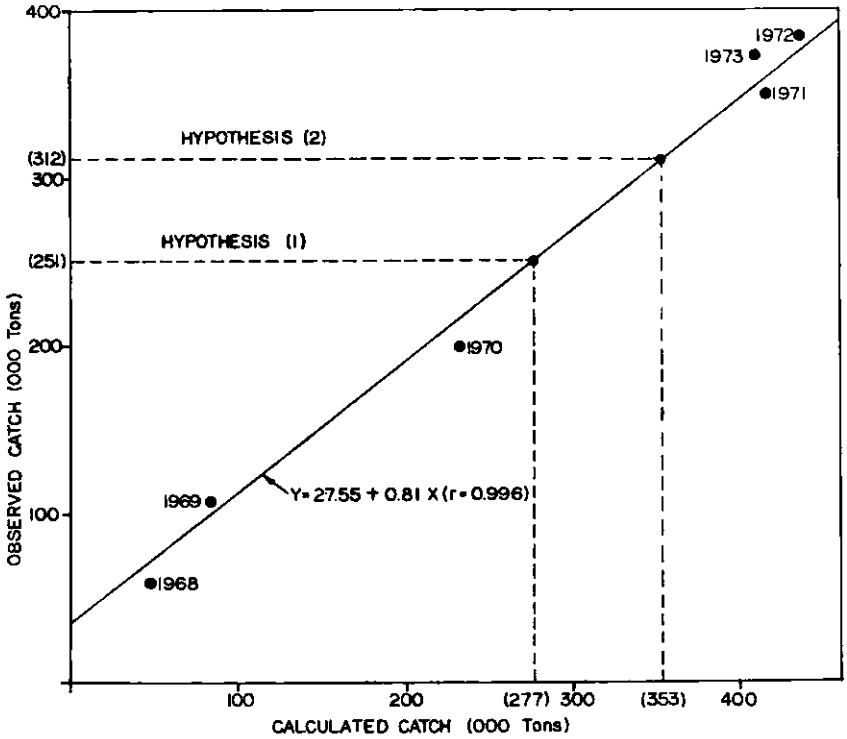


Fig. 1. Relationship between calculated and observed mackerel catches for the period 1968-73.

Table 4. Summary results of the mackerel stock assessment in Div. 5Z and SA 6.

Hypothesis	1973 F	% Recruitment to fishery by age				
		1	2	3	4	5+
(1)	0.9	25	50	90	100	100
(2)	0.4	10	30	40	60	100

	Year	Recruitment at age 1 (10^6)	F (100%) average of age-groups 5 to 9	Yield (000 tons)	Population biomass (age 2 and older) at end of year (000 tons)
Hypothesis (1)	1967				424
	1968	5801	0.028	60	756
	1969	2082	0.067	108	923
	1970	2322	0.42	200	959
	1971	1011	0.44	349	745
	1972	(1450)	0.73	386	520
	1973	(2320)	0.90	372	320
	1974	2320	0.90	251	283
Hypothesis (2)	1967				495
	1968	7146	0.028	60	897
	1969	2936	0.05	108	1134
	1970	4410	0.31	200	1313
	1971	3203	0.34	349	1262
	1972	(1790)	0.47	382	1260
	1973	(2860)	0.40	372	1068
	1974	2860	0.40	312	1021

( ) 1972: recruitment at age 1 = 25% of 1967 year-class.
( ) 1973: recruitment at age 1 = 40% of 1967 year-class.

at F = 0.9; for Hypothesis (2) the fishery is approaching full exploitation (about 86% of maximum sustainable yield). It follows that the amount of recruitment to the fishery at age 1 has much more influence on estimates of possible catch than the partial recruitment pattern. It also follows that significant increases in F will not produce significant increases in yield per recruit.

If no increase in effort is allowed in 1974, the projected catches are 251,000 tons by Hypothesis (1) (i.e. F = 0.9, recruitment complete at age 4) and 312,000 tons by Hypothesis (2) (i.e. F = 0.4, recruitment complete at age 5). Catches in 1974 significantly higher than these, in both instances, will be achieved only with large increases in F. There will be, again in both cases, a corresponding decline in the biomass for 1975, unless the size of incoming year-classes are larger than anticipated. There is no scientific basis for choosing between the two catch levels as a recommended TAC for 1974.

Table 5. Mackerel catches and population biomasses in SA 5 and 6 for a range of Fs under the two hypotheses considered, with M = 0.3.

Hypothesis	1973 F	% Recruitment to fishery by age				
		1	2	3	4	5+
(1)	0.9	25	50	90	100	100
(2)	0.4	10	30	40	60	100

	F	Z	1974 catch (000t)	Biomass (age 2 and over) at end of 1974 (000t)	Equilibrium catch, population biomass and yield per recruit		
					Catch (000t)	Biomass (age 2 and over) (000t)	Yield/Recruit (g)
HYPOTHESIS (1)	.1	.4	41	516	135	1350	58
	.2	.5	79	484	197	999	85
	.3	.6	114	454	228	786	98
	.4	.7	146	426	244	645	105
	.5	.8	176	401	253	545	109
	.6	.9	204	378	258	472	111
	.7	1.0	230	356	260	416	112
	.8	1.1	254	336	260	372	112
	.9	1.2	277	317	260	336	112
	1.0	1.3	298	300	260	306	112
	1.2	1.5	336	269	257	260	111
	1.5	1.8	385	230	253	211	109
	1.8	2.1	425	198	248	177	107
HYPOTHESIS (2)	.1	.4	98	1450	145	1826	51
	.2	.5	189	1373	217	1462	76
	.3	.6	274	1301	258	1227	90
	.4	.7	353	1233	283	1064	99
	.5	.8	427	1171	299	942	105
	.6	.9	497	1113	309	849	108
	.7	1.0	562	1058	316	774	110
	.8	1.1	623	1007	321	712	112
	.9	1.2	680	960	324	660	113
	1.0	1.3	734	915	326	616	114
	1.2	1.5	832	835	328	544	115
	1.5	1.8	960	731	328	463	115
	1.8	2.1	1130	596	325	372	114

Each of the possible levels for TAC is associated with a set of assumptions as to the level of F (i.e. a measure of the proportion actually being removed) and to a particular recruitment pattern which represents the availability of age-groups to the fishery. For those two different 1974 possible catches, the consequences in terms of biomass changes by 1975 of the two hypotheses are as follows:

1974 Catch	251	312
Hypothesis (1)	88	70
Hypothesis (2)	100	96

This gives the 1975 initial biomass as percent of 1974 initial biomass for two levels of 1974 catch under two sets of assumptions as to 1973 F (= 1974 F) and recruitment pattern.

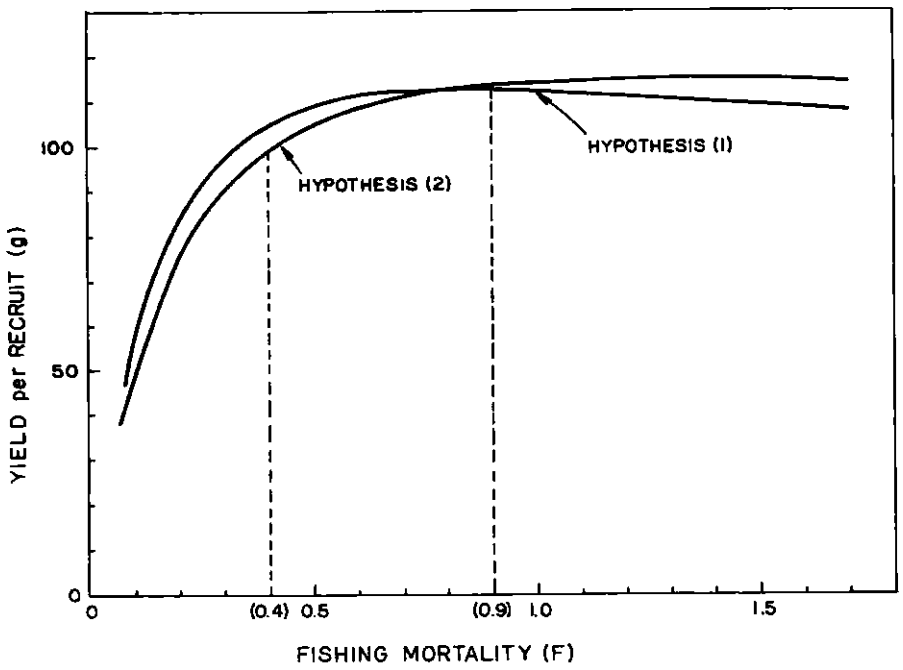


Fig. 2. Yield per recruit curves for mackerel in SA 5 and 6.

5. Age at First Capture and Size Limit Considerations

Assessments carried out at the 1973 Annual Meeting established that delaying the age at first capture of mackerel by avoiding the capture of very young fish (0, 1, and 2 years old) would improve yield per recruit and the biomass of the adult stock. Seasonal or area closure of the fishery could not achieve this, but research is in hand to determine whether it could best be achieved by regulation of mesh size or a minimum size limit and to estimate how the degree of benefit would vary according to the level at which a regulation might be set. For example, it may be appropriate to establish a minimum size limit close to the length at maturity (30 cm) similar to that imposed in the Norwegian national mackerel fishery in the North Sea for fishmeal.

It is reported that selectivity experiments are expected to give results that may be available for consideration at the 1975 Mid-term Meeting.

6. The Fishery in Subareas 3 and 4

Nominal catches of mackerel in SA 3 and 4 reached 37,000 tons in 1973. These were taken from a group of mackerel which spawn in a different area from the major stock in SA 5 and 6, but it is suspected that, if they are drawn from a separate stock, both stocks may be mixed together at the time of the fishery in SA 5 and 6. If this is so, it may influence the allocation of the existing TAC between subareas; if they are not mixing, it may be necessary to establish a separate TAC for mackerel in SA 3 and 4. The information is not yet sufficient to decide on the degree of mixing between mackerel in SA 5 and 6 on the one hand and in SA 3 and 4 on the other or to estimate the quantity of mackerel in SA 3 and 4, and therefore it is not yet possible to advise the Commission on a level of catch for mackerel which would be appropriate to the fishery in these northern areas.

It is urged that member countries should initiate research programs, giving special emphasis to those which can elucidate stock relationships, the mixing problem and estimates of potential recruitment.

ANNEX 2 - REPORT OF THE HERRING WORKING GROUP

Chairman: T. D. Iles Rapporteur: W. T. Stobo

The Herring Working Group met during 7-12 January 1974 at the Institute for Sea Fisheries, Hamburg, Fed. Rep. Germany, with representatives present from Canada, Fed. Rep. Germany, Japan, Poland, USSR, UK and USA. The main tasks of the Group were to revise the assessments made at the January 1973 Mid-term Meeting for the Nova Scotia (Div. 4XW(b)), Gulf of Maine (Div. 5Y), and Georges Bank (Div. 5Z + SA 6) herring stocks. The Group also reviewed recommendations in regard to ageing techniques and the current status of herring larval and juvenile surveys. The following research documents were reviewed: larval surveys (Res.Doc. 74/14, 15, 16, 17, 18); assessments (Res.Doc. 74/13).

1. Stock Identity, Relative Size and Inter-relationships

a) Juvenile Stage

The results of the 1973 herring juvenile surveys (Res.Doc. 73/84), updated by data of Fed.Rep. Germany survey samples, were reviewed as indicators of future recruitment potential. Fed.Rep. Germany age data showed that for the Georges Bank area and the area to the south and west the 1971 year-class made up only about 1% of the total numbers in survey hauls, whereas the 1970 year-class accounted for about 90%. This indicates that the 1971 year-class is much smaller than the 1970 year-class.

The coastal juvenile fisheries caught many fewer fish of the 1971 year-class in 1973 than of the 1970 year-class in 1972; for the New Brunswick (weir) fisheries the proportion was 34%, for Maine 50% and for Nova Scotia 22%. The Maine figures for 1973 included considerably greater amounts of purse-seine caught fish, which probably results in overestimating the relative size of the 1971 year-class. It was not possible to accept either set of estimates (i.e. from the juvenile surveys or the juvenile fisheries) as reliable quantitative indices of year-class size, but it was agreed that the 1971 year-class is relatively poor and that it can be accepted tentatively as being the same size as the 1969 year-class, the poorest on record. This will not affect estimates of total allowable catch for 1974 which will be dependent largely on the 1970 year-class, but it does have implications for TACs in 1975 and later years.

b) Larval Stage

The ICNAF larval herring survey program was continued in 1973. Offshore cruises with standardized sampling methods at the standard stations were carried out by Fed.Rep. Germany, Poland, USA and USSR. No stations were occupied in the coastal Gulf of Maine. The Canadian larval cruises were restricted to the Bay of Fundy and southwest Nova Scotia. Preliminary reports (Res.Doc. 74/14, 16, 17, 18), containing some qualitative and quantitative results, were presented. The results of the Canadian cruises were not available. In most areas larger concentrations of larvae, both large and small, were observed in 1973 than in 1972. The distribution of small larvae (<10 mm) delimited the same distinct spawning areas that had been observed previously in the areas surveyed, i.e. Georges Bank, Nantucket Shoals and off southwest Nova Scotia.

Georges Bank. The abundance of small larvae (<10 mm) in 1973 was about ten times greater than in 1972, indicating that larval production was an order of magnitude greater.

Nantucket Shoals. An increase in numbers of small larvae was recorded, compared to 1972, but to a much smaller degree than on Georges Bank (less than twofold).

Nova Scotia. Larval abundance was in the same range as in 1972. The significant increase in larval abundance in 1973 on the Georges Bank - Nantucket Shoals area indicates an increase in spawning stock size in 1973 relative to that in 1972.

The results of the 1971 and 1972 larval surveys were reviewed (Res.Doc. 74/15). It was agreed that larval surveys can provide much information on stock relationships. Concentrations of larvae less than 10 mm observed in 1971 and 1972 defined four main spawning areas: Georges Bank, Nantucket Shoals, the coastal Gulf of Maine, and southwest Nova Scotia. The distribution of larvae greater than 15 mm tend to overlap in the Georges Bank - Nantucket Shoals area, but the relative discreetness of the distribution between the areas of the three major stock complexes (Georges Bank - Nantucket Shoals, coastal Gulf of Maine, and southwest Nova Scotia) is maintained.

The value of larval surveys increases as analysis of data over an increasingly long time series becomes possible. Coupled with juvenile surveys, they may improve our knowledge of larval mortality and the size of the incoming year-classes. All participants agreed that the surveys

should be continued. The suggestion was made that larval sampling with Bongo nets should be made simultaneously with juvenile sampling, as the Fed.Rep. Germany will attempt to do in 1974.

2. Review of Ageing Techniques

The recommendations of a herring ageing workshop held in December 1972, with participants from Canada and USA (Res.Doc. 73/2), were discussed. It was agreed that they be adopted as the conventions for statistical and sampling reporting and are listed here.

a) That the generally accepted 1 January birthday for fishes of the Northwest Atlantic be adopted for herring.

b) The term age-group should be used instead of age because it is inclusive of both spring and autumn spawners. A fish is placed in age group 0 in the year of its birth; on 1 January of the year following its birth, it enters age-group 1 and progresses to subsequent age-groups in similar fashion. Arabic numerals should be substituted for the conventional Roman numerals for ease of tabulation; thus, age-group eight would be designated as 8-group rather than VIII-group.

c) Year-class designation of main importance for stock assessment purposes and age-composition data, should be reported to ICNAF on this basis.

d) The year-class is determined by subtracting the age-group from the year of sampling. If opaque zones are counted, an age-group is defined as:

i) for spring spawners: the number of completed opaque zones prior to 1 January of the sampling year;

ii) for autumn spawners: the number of completed opaque zones prior to 1 January of the sampling year plus one (1).

If hyaline zones are counted, the age-group is defined as:

i) for spring spawners: the number of completed hyaline zones prior to 1 January of the sampling year plus one (1);

ii) for autumn spawners: the number of completed hyaline zones prior to 1 January of the sampling year including the nucleus as the first zone.

In addition it was recommended that, in reporting to ICNAF, countries should indicate whether opaque or hyaline zones were used.

3. Fishery Trends

Table 1 lists the provisional herring catches by country and area for 1973. The total 1973 catch was 474,000 tons, 86% of the 1972 catch of 547,000 tons and 49% of the peak 1969 catch of 965,000 tons. Catches in the Gulf of St. Lawrence - Newfoundland stocks (SA 3 and Div. 4RST) in 1973 were 78,000 tons compared to 119,000 tons in 1972. This 35% decline is very largely accounted for by much smaller catches in the winter fishery of the south coast of Newfoundland. Catches from the Banquereau stock (Div. 4VW(a)) declined from 38,000 tons in 1972 to 28,000 tons in 1973. A TAC for this stock in 1974 of 45,000 tons was set by the Commission at its 1973 Annual Meeting.

Three stocks were under quota regulation in 1973. Individual quota allocations and catches are listed by country in Table 2. These catches include all herring caught, by all fisheries and gears, both inside and outside the Convention Area.

The total catch in Div. 4X and Div. 4W (south of 44°52'N) was 135,000 tons. This includes a purse seine catch of 20,860 tons taken near Grand Manan Island (at the entrance to the Bay of Fundy) during the summer in a fishing area which extends into Div. 5Y. This area is almost contiguous with the area fished during the Nova Scotia summer fishery, and from sampling information it could be assumed that the Nova Scotia stock was being exploited. A detailed breakdown of catches by area, fishery and gear is given in the section dealing with the assessment of this stock (see below).

Catches in the Gulf of Maine (Div. 5Y) were 32,454 tons compared with 62,416 tons in 1972. In the Georges Bank area (Div. 5Z and SA 6) the 1973 catch at 201,645 tons was about 16% higher than in 1972.

In all areas under quota regulation in 1973, the 1970 year-class made up at least a substantial proportion of the catches. The 1971 year-class, on evidence presently available, is expected to be relatively small.

Table 1. Provisional herring catches (tons) by country and area (stock) in 1973.

Country	Nfld-Gulf of St. Lawrence		Banquereau			Nova Scotia and Bay of Fundy					Gulf of Maine	Georges Bank		Total
	SA 3	4RST	4Vn	4Vs	4W(a)[1]	4W(b)[2]	4X(a)[3] ≥23 cm	4X(a)[3] <23 cm	4X(b)[4] ≥23 cm	4X(b)[4] <23 cm	5Y	5Z	SA 6	
Can(MQ)	-	34421	16800	-	5542	-	48626[5]	11951[5]	29442[5]	12195[5]	4110	5086	-	168173
Can(N)	16015	27218	3000	-	1000	-	-	-	-	-	-	-	-	47233
FRG	-	-	557	675	-	-	228	-	-	-	690[6]	31006	-	33156
Japan	-	-	-	108	-	32	1239	-	-	-	-	1219	21	2619
Poland	-	-	-	-	-	-	-	-	-	-	-	47071	2215	49286
Romania	-	-	-	-	-	-	-	-	-	-	-	1300[7]	-	1300
USSR	-	-	-	73	-	13153	17889	-	-	-	-	42241	10067	83423
USA	-	-	-	-	-	-	-	-	-	-	22370	4440	446	27256
Oth. Mem.	-	-	-	-	-	-	-	-	-	-	-	3254	19	3273
GDR	-	-	-	-	-	-	-	-	-	-	5284	52257	1003	58544
Total	16015	61639	20357	856	6542	13185	67982	11951	29442	12195	32454	187874	13771	474263
1972 Total	52025	66698	12388	2382	18002	15503	143771				62416	158549	15642	547375

[1] Div. 4W north of 44°52'N.
[2] Div. 4W south of 44°52'N.
[3] Div. 4X offshore and Nova Scotia inshore.
[4] New Brunswick side of Bay of Fundy.
[5] Catch partitioned into adults and juveniles using yearly length frequencies from Res.Doc. 74/13 and conversion values from Res.Doc. 73/91.
[6] 191 tons transferred to Div. 5Z for assessment purposes.
[7] No catch reported; assumed to be 1973 quota allocation.

Table 2. Herring catches and quota allocations (tons) for 1973.

Country	4XW(b) Catch	4XW(b) Quota	5Y Catch	5Y Quota	5Z + 6 Catch	5Z + 6 Quota
Canada	78,068 (102,214)[1]	57,000	3,833 (4,110)[1]	4,000	5,086	5,050
Fed.Rep. Germany	228	-[2]	690	1,000	31,006	31,600
Japan	1,271	1,350	-	-	1,240	1,200
Poland	-	-	-	-	49,286	49,400
Romania	-	-	-	-	1,300[3]	1,300
USSR	31,042	31,050	-	-	52,308	48,200
USA	-	-	16,234 (22,370)[1]	19,750	4,886	5,250
Others - Bul.	-	600	-	250	878[4]	8,000
- Fra.	-		-		2,395	
- GDR	-		5,284		53,260	
Totals	110,609 (134,755)[1]	90,000	26,041 (32,454)[1]	25,000	201,645	150,000

[1] Total catch including juveniles.
[2] No quota allocation; catch to be applied against quota allocation for "others".
[3] Catch data not available; assumed that quota was taken.
[4] Bulgarian data for Jan - Oct 1973.

4. Herring Assessments

a) Gulf of Maine (Div. 5Y)

Catch statistics. The total catch of herring in Div. 5Y by USA, Canada, Fed.Rep. Germany and German Dem.Rep. was 32,645 tons, 47% less than the amount caught in 1972. The catch by country, partitioned as adult and juvenile catches, are shown in Table 3.

Table 3. Catches in the Div. 5Y adult and juvenile herring fisheries in 1973.

Country		Catches (tons) Adult fishery	Juvenile fishery	Total
USA	- Ages 1-3	1,124	15,110	16,234
	- Age 4 and older	4,878	1,258	6,136
	Sub-total	6,002	16,368	22,370
Canada	- Ages 1-3	277	-	277
	- Age 4 and older	3,833	-	3,833
	Sub-total	4,110	-	4,110
FRG	Age compositions not yet reported	690	-	690
GDR		5,284	-	5,284
TOTAL		16,086	16,368	32,454

The catch in the adult herring fishery declined from 42,129 tons in 1972 to 16,085 tons in 1973 (this excludes 191 tons taken by the Fed.Rep. Germany in the southeast portion of Div. 5Y). There was some indication in 1973 that the unusual distribution of catches was due in part to changes in availability. All countries showed declines in catch, with the US catch of adults declining from 18,698 to 6,001 tons, the Canadian catch of adults from 11,637 to 4,110 tons, Fed.Rep. Germany catch from 2,936 to 690 tons and German Dem.Rep. catch from 8,898 to 5,284 tons; the Maine juvenile catch also declined from 19,513 tons in 1972 to 16,369 tons in 1973.

Year-class abundance and stock size. The catches in the Div. 5Y adult fishery (Table 4) show the continual decline in older fish and the great dependence of the fishery on the recruitment of the 1970 year-class. The good year-classes of 1960 to 1963 constituted 53%, 21%, 3% and 3% of the total catch (by weight) in the years 1970-73. The very poor year-classes of 1968 and 1969 constituted 2%, 13%, 23% and 42% of the total catch in the same years. The catch of the 1966 year-class (the strongest year-class between those of 1963 and 1970) declined from about 10,000 tons in 1972 to less than 4,000 tons in 1973. The size of the 1970 year-class is not known, but it appears large in the herring fisheries of Div. 5Z and 4X, and there has been some parallelism in year-class strength among the different fisheries. The catch of the 1970 year-class in the juvenile fishery at age 2 was about one-half of that of the 1966 year-class, although there are indications that the 1972 catch level may have been limited by plant capacities and not abundance.

Any large catch in 1974 must come substantially from the 1970 year-class, and the estimate of allowable catch in 1974 depends critically on the estimate of abundance of this year-class. The 1971 year-class appears to be poor, as judged from the catches of this year-class in the juvenile fishery in 1973. The age-2 herring catch of the 1971 year-class was larger than that of the 1969 year-class but less than that of the 1967 and 1968 year-classes.

Estimates of stock size in Div. 5Y for the years 1967-74 are given in Table 5. Following an accumulation of stock before 1968 from earlier strong year-classes, the adult (age 4 and older) stock size has steadily declined from 1968 to 1973. The estimated adult stock size (age 4 and older) at the beginning of 1973 was only 27% of that of 1967 and 1968. Under all three assumptions of recruitment in 1973 of the 1970 year-class, the 1974 stock size (age 4 and older) has increased (Table 5).

Table 4. Herring catches from the Div. 5Y adult fishery by age-group, 1967-73.

Year	Catch in numbers (000s) by age-group									Age 2 and older		Age 3 and older	
	2	3	4	5	6	7	8	9	9+	Number (000s)	Weight (tons)	Number (000s)	Weight (tons)
1967	21	317	2953	7410	13366	8197	585	343	493	33644	7807	33665	7805
1968	564	17734	17467	29458	29280	27974	18387	3166	4372	148402	31900	147838	31851
1969	1722	39044	6192	9850	22476	26618	21124	11028	4289	142343	32406	140621	32256
1970	3417	9327	26370	18350	26835	26943	23344	27993	16440	179021	40187	175602	39890
1971	634	23129	22676	33979	36750	26335	16011	11020	10588	181122	38575	180488	38520
1972	21243	16992	37487	39758	42449	27493	9347	1434	2072	199375	42169	178132	40321
1973[1]	1485	16559	6077	12923	15926	12631	6090	2113	1467	75271	15800	73786	15671

[1] The GDR catch in 1973 was not available when the calculations were made; a GDR catch of 5,000 tons was assumed with distribution over year-classes the same as for other countries.

Table 5. Stock sizes of adult herring in Div. 5Y, 1967-74.

Year	Stock sizes (millions) at beginning of year by age-groups								Age 3 and older		Age 4 and older	
	3	4	5	6	7	8	9	9+	Number (10^6)	Weight (000t)	Number (10^6)	Weight (000t)
1967	203	186	182	183	98	16	7	4	879	184	676	153
1968	239	166	147	135	124	64	11	7	893	191	654	154
1969	288	180	120	94	84	76	35	8	885	186	597	141
1970	192	200	142	89	56	45	43	22	798	169	597	139
1971	142	149	140	99	49	22	15	13	629	133	487	111
1972	59[1]	96	102	84	48	16	3	4	412	89	353	80
1973	288[2]								461	86		
	432[3]	26	45	48	31	15	5	3	605	109	173	42
	575[4]								748	131		
1974		221							371	73	312	64
	59	330	16[5]	25[5]	25[5]	14[5]	7[5]	4[5]	480	92	421	83
		457							607	115	548	106

[1] Assuming an F at age 2 in the juvenile fishery of 0.67 (the average over the 1966-68 year-classes).
[2] Recruitment assumed to be equal to 1966 year-class at age 3.
[3] Recruitment assumed to be 1.5 times 1966 year-class at age 3.
[4] Recruitment assumed to be 2.0 times 1966 year-class at age 3.
[5] From $N_i e^{-(F_i + 0.2)}$ where i refers to the year-classes in 1973, and F_i from cohort analysis.

Estimates of F in 1973 to give 1974 stock size (age 5 and older). Catches of the 1966 and the 1963 year-classes in the Maine juvenile fisheries as 2-year-olds were very similar, and it was assumed that these two year-classes were of the same size. In the cohort analysis of the adult fishery, using 1972 as the base year, estimates of the size of the 1963 year-class in 1968 as 5-year-olds would be expected to be relatively unbiased by the assumed starting Fs. This estimate was therefore used to give the size of the 1966 year-class in 1971 as 5-year-olds. This size was equivalent to an F = 0.8 for this year-class in 1972, which gave 1972 Fs for other year-classes by using proportions from 1970 and 1971 Fs. These Fs were applied to 1972 stock size by age-group to give the 1973 stock size by age-group. The 1973 stock size and 1973 catch then gave estimates of fishing mortalities for 1973 (Table 6). These 1973 Fs were used to give year-class size in 1973 for age 4 and older fish and in 1974 for age 5 and older fish.

Table 6. Estimates of fishing mortality (F) in the Div. 5Y adult herring fishery from cohort analysis, assuming M = 0.2.

	Fishing mortality (F) by age-group								Average F[1]	
Year	3	4	5	6	7	8	9	9+	Age 3 & older	Age 4 & older
1967	-	0.04	0.10	0.19	0.22	0.10	0.12	0.36	0.10	0.13
1968	0.09	0.12	0.25	0.27	0.29	0.38	0.37	1.07	0.24	0.26
1969	0.16	0.04	0.10	0.31	0.43	0.37	0.42	0.80	0.21	0.23
1970	0.06	0.16	0.15	0.40	0.75	0.87	1.27	1.63	0.35	0.44
1971	0.20	0.18	0.31	0.53	0.91	1.69	1.58	1.87	0.46	0.53
1972	0.42[2]	0.56	0.56	0.80	0.97	1.00	0.65	0.67	0.66	0.70
1973	0.065[3] 0.040[3] 0.030[3]	0.29[4]	0.38[4]	0.45[4]	0.59[4]	0.59[4]	0.65[4]	0.80[4]	0.21 0.16 0.13	0.45

[1] The average Fs are weighted over year-classes by stock size in numbers.

[2] From iteration of exploitation rate with N_3 determined from $N_2 e^{-(0.67 + 0.20)}$, where 0.67 is F averaged over 1966-68 year-classes in juvenile fishery.

[3] From assumption of 3 levels of recruitment relative to the strength of the 1966 year-class at age 3.

[4] From iteration of exploitation rate where N_i (for 1973) = $N_{i-1} e^{-Z_{i-1}}$.

Recruitment in 1974 of 3- and 4-year-old fish. Three levels of year-class size for the 1970 year-class, as 3-year-olds in 1973, were assumed, *viz.* 1.0, 1.5, and 2.0 times the size of the 1966 year-class. Comparison of the 1973 catch for each of the three assumptions gave three estimates of F for this year-class in 1973 and three estimates of year-class size in 1974. Recruitment of the 1971 year-class in 1974 was equated to that of the 1969 year-class in 1972. This 1969 year-class was the weakest yet recorded in the fishery. For each estimate of 1970 year-class size (in each case coupled to the same estimate for the 1971 year-class), a range of fishing mortality was applied to the 1974 stock size to generate a range of catches in 1974 and stock sizes for 1975 (Table 7). Recruitment in 1975 was assumed to be slightly less (27,000 tons) than the average observed in the adult fishery since 1967 and the same 1974 Fs were applied in 1975 to give 1976 stock size.

TAC level. The Commission in 1973 agreed that the Div. 5Y catch in 1974 must result in the restoration of the adult stock to at least 60,000 tons by the end of 1974, and in any event, the TAC for 1974 cannot exceed that of 1973 unless the adult stock size at the end of 1973 has reached a level which will provide the maximum sustainable yield by the end of 1974 (Special Commission Meeting, January 1973, Proc. No. 3, App. II). The level of stock size to give the optimum level of recruitment is considered to be 100,000-120,000 tons. Unless the stock size is approximately 110,000 tons or greater at the beginning of 1974, the catch in 1974 must not exceed 25,000 tons. Under all of the present assumptions of recruitment in 1973, the stock size at the end of 1973 is less than 110,000 tons and the TAC for 1974 cannot therefore exceed 25,000 tons. As can be inferred from Table 7, for a stock size of at least 60,000 tons at the beginning of 1975, the 1974 catch would have to be less than 1,000 tons under Option A (1970 year-class equal to 1966 year-class), less than 18,000 tons under Option B (1970 year-class equal to 1.5 times the 1966 year-class), and less than 37,000 tons under Option C (1970 year-class equal to 2.0 times the 1966 year-class).

Table 7 and Fig. 1 show the consequence of maintaining a TAC of 25,000 tons in 1974. If it is

assumed that the 1970 year-class is 200% of the 1966 year-class, a catch of 25,000 tons should result in a stock size at the beginning of 1975 of 72,000 tons. If the 1970 year-class is 150% of the 1966 year-class, a catch of 25,000 tons in 1974 would result in a stock size of 55,000 tons at the beginning of 1975. If the 1970 year-class is the same size as the 1966 year-class, a catch of 25,000 tons in 1974 would result in a stock size of 37,000 tons.

Table 7. Resultant stock sizes (age 4 and older) as a function of catches (age 3 and older) for the Div. 5Y adult herring fishery, assuming three sizes of the 1970 year-class and a range of fishing mortality rates in 1974.

1970 yc as % of 1966 yc	Stock size at start of 1974 (10^6)	Stock size at start of 1974 (000t)	F in 1974 (100%)	F on 1970 yc	Catch in 1974 (10^6)	Catch in 1974 (000t)	Stock 1975[1] (000t)	Catch 1975 (000t)	Stock 1976[1] (000t)
100% (A)	370	64	0.2	0.07	24.1	5.2	54.9[2]	6.2	69.4
			0.4	0.14	46.2	9.9	50.7	10.9	61.2
			0.6	0.21	66.5	14.2	46.8	14.3	54.5
			0.8	0.28	85.0	18.1	43.3	16.9	48.8
			1.0	0.35	102.1	21.7	40.2	18.8	44.2
			1.2	0.42	117.8	25.0	37.3	20.1	40.2
150% (B)	488	85	0.2	0.07	31.1	6.5	71.2	7.6	84.4
			0.4	0.14	59.6	12.4	65.9	13.4	74.1
			0.6	0.21	85.9	17.7	61.1[2]	17.7	65.6
			0.8	0.28	110.1	22.7	56.7	20.9	58.6
			0.9	0.32	121.5	25.0	55.0	21.9	55.0
			1.0	0.35	132.4	27.2	52.6	22.2	52.7
			1.2	0.42	152.9	31.3	49.0	24.8	47.7
200% (C)	606	106	0.2	0.07	38.1	7.7	87.3	9.2	99.1
			0.4	0.14	73.3	14.8	80.9	16.1	86.7
			0.6	0.21	105.7	21.3	75.1	21.3	76.4
			0.7	0.25	124.2	25.0	72.0	23.5	71.0
			0.8	0.28	135.7	27.3	69.7	25.2	67.8
			1.0	0.35	163.3	32.8	64.9[2]	28.0	60.6

[1] Stock sizes pertain to beginning of year.
[2] For a stock size greater than 60,000 tons at the beginning of 1975, 1974 catches would have to be <1,000 tons under Option (A), <18,000 tons under Option (B) and <37,000 tons under Option (C).

Under all three assumptions about the size of the 1970 year-class, if future recruitment is slightly less than the average for the years 1967 to 1972 and the fishing mortality remains the same, the 1976 stock size will remain at about the same level relative to 1975. It should be pointed out that high precision should not be placed on the exact values in Table 7, as imprecise weight-at-age data and assumptions concerning the estimates of fishing mortalities will affect the precision of the stock size, even if the correct recruitment level were known.

Traditionally the fishery for adult herring in Div. 5Y has been based on fish of age 4 and older, caught mainly during the spawning season, while the juvenile fishery exploited mainly age 2 herring during the summer months. During the last two years, the adult fishery extended throughout the year, catching both age 2 and age 3 herring, while the increased use of the purse seine in the juvenile fishery has allowed increased catches of age 3 and older fish. If these fisheries are catching herring from the same stock, future assessments will require more specific consideration of the total catch of age 3 and older herring from both fisheries.

b) Georges Bank Stock (Div. 5Z and SA 6)

For the Georges Bank stock, recommendations as to total allowable catch (TAC) for 1974 have to take into account the need to restore stock size (age 4 and older) at beginning of 1975 to a level of at least 225,000 tons (Special Commission Meeting, January 1973, Proc. No. 3, App. I). Also the 1974 TAC cannot be increased beyond that of 1973 unless the stock size at the beginning of 1974 (age 4 and older) exceeds 500,000 tons.

Recalculation of stock size and fishing mortalities by age-group. The previous assessment for this stock (*Redbook* 1973, Part I, p. 39) was corrected to include the actual catches by German Dem.Rep. in 1972 (40,016 tons), using Polish and Fed.Rep. Germany age data to assess catches in numbers. New estimates of stock size, catch, and fishing mortality were thus obtained (Table 8) to replace those given in *Redbook* 1973, Part I (Table 9, p. 40). This resulted in estimates of 1973 stock sizes for fish older than 5 years that were less than the 1973 catch of these age-groups. It was assumed that mortality coefficients estimated for 1972 were correct but that in 1973 there had been a change in fishing pattern, resulting in higher mortality on younger fish, particularly the abundant 1970 year-class. For each age-group a predicted 1973 catch in numbers was estimated, assuming that 1972 mortality rates applied. These were compared with the actual 1973 catches to give a rough measure of the change of distribution of F among the age-groups. This procedure suggested that Fs for older age-groups were one-half, or slightly less, in 1973 compared to 1972, and allowed the calculation of Fs by age-groups. The levels of assumed Fs in 1974 were partitioned among age-groups in the same proportions. This then implies that recruitment of the 1970 year-class to the fishery was complete at age 3.

Table 8. Georges Bank herring stock (Div. 5Z + SA 6): stock size and catch (millions) and fishing mortality, 1967-74. (This is a revision of Table 9 in *Redbook* 1973, Part I, page 40.)

		Numbers (millions) by age-group									Age 3 & older		Age 4 & older	
	Year	2	3	4	5	6	7	8	9	9+	Number (10^6)	Weight (000t)	Number (10^6)	Weight (000t)
Stock	1967[1]		1201	1402	973	1302	1100	133	23	20	6154	1322	4953	1136
	1968[1]		1454	977	1093	699	839	557	64	13	5696	1232	4242	1007
	1969[1]		1627	1143	735	591	361	295	152	47	4951	988	3324	736
	1970[1]		1012	1291	745	351	232	125	67	35	3858	761	2846	604
	1971[1]		565	715	649	365	177	106	56	43	2676	550	2111	462
	1972[1]	2010	559	239	333	238	142	53	41	33	1638	339	1079	253
	1973		1628[3] 2440[3] 3234[3]	431[1]	118[1]	119[1]	82[1]	45[1]	11[1]	25[1]	2459 3271 4065	433 558 681	831	180
	1974		559[4]	422[2] 1074[2] 1724[2]	118[2]	39[2]	68[2]	47[2]	26[2]	6[2]	1285 1937 2587	243 359 476	726 1378 2028	155 272 389
Catch	1967	2	7	61	108	251	379	49	11	10	876	219	869	
	1968	3	52	72	336	233	433	337	22	7	1492	373	1440	
	1969	-	46	210	277	278	189	191	110	24	1325	306	1279	
	1970	13	125	451	270	122	93	52	30	18	1161	247	1048	
	1971	13	333	276	285	176	104	50	14	22	1260	263	938	
	1972	28	35	110	214	158	100	45	29	21	712	174	677	
	1973	10	1026	266	64	33	23	12	3	5	1432	199	415	
F											Mean F[5]			
	1967	-	0.01	0.05	0.13	0.24	0.48	0.53	0.74	-	0.18			
	1968	-	0.04	0.08	0.41	0.46	0.85	1.10	0.46	-	0.40			
	1969	-	0.03	0.23	0.54	0.74	0.86	1.25	1.61	-	0.42			
	1970	-	0.15	0.49	0.51	0.48	0.58	0.60	0.63	-	0.41			
	1971	-	1.05	0.56	0.66	0.76	1.04	0.75	0.33	-	0.74			
	1972	0.01	0.86	0.51	0.83	0.87	0.95	1.37	0.33	-	0.80			
	1973	-	1.15 0.62 0.43	1.10	0.90	0.35	0.35	0.35	0.35	-	1.03 0.67 0.51			

[1] Stock size calculated from $\frac{CZ}{F(1-e^{-Z})}$.

[2] Stock size calculated from $N_{i+1} = N_i e^{-Z_i}$.

[3] Assumed to be 100%, 150% and 200% of the 1966 year-class at age 3.

[4] Assumed to be same as for 1972.

[5] Average Fs weighted over year-classes by stock size in number.

Recruitment of the 1970 year-class. It was reported that the catch per unit effort of the Fed. Rep. Germany fleet in 1973 was the highest recorded and that the effort was widely distributed; it was estimated that the 1970 year-class was twice the size of the 1966 year-class. Polish and USSR catch per unit effort information also suggested that the 1970 year-class was very large, but no quantitative data were given. The 1973 US spring and autumn surveys indicated an abundance increase of 1.5. It was decided to carry out catch projections assuming three different levels of size for the 1970 year-class, i.e. 1.0, 1.5, and 2.0 relative to the 1966 year-class.

Fishing mortality rates for 1973. The 1973 fishing mortality rates are indicated in Table 8.

Quota levels. The 1974 catches and population sizes for 1975 were calculated for a range of 1974 Fs, which included a level equal to the corresponding 1973 F and, in addition, values less than and greater than this. The results are given in Table 9 and Figure 2. The following points can be made:

i) The estimated stock size at the beginning of 1974 ranges from 155,000 tons to 389,000 tons for 1970 year-class size of 1.0 to 2.0 times that of 1966 year-class; the higher values are considerably less than the 500,000 ton level at which increase of the 1974 TAC relative to that of 1973 can be considered. It was agreed that the 1970 year-class was not large enough for the 1974 stock size to exceed 500,000 tons. Therefore the 1974 TAC should not exceed 150,000 tons.

ii) If the 1970 year-class is the same size as the 1966 year-class, the 1975 stock size will not reach 225,000 tons even with a 1974 TAC of zero. However, it was agreed that the 1973 F value of 1.14 for 3-year-olds associated with this assumption as to the size of the 1970 year-class is too high and Option A (Table 9) is highly unlikely.

Table 9. Georges Bank herring stock (Div. 5Z + SA 6): 1975 stock size as a function of 1974 catch for three assumed levels of the 1970 year-class and for a range of fishing mortality rates in 1974.

1970 yc as % of 1966 yc	1974 stock size at start of year		F by age-group				Weighted	1974 catch		1975 stock size at start of year	
	Number (10^6)	Weight (000t)	3	4	5	5+	$\bar{F}$	Number (10^6)	Weight (000t)	Number (10^6)	Weight (000t)
100% (A)	726	155	0.33	0.31	0.26	0.10	0.28	286	51	795	152
			0.66	0.63	0.51	0.20	0.55	501	89	604	118
			0.98	0.94	0.77	0.30	0.83	662	118	463	92
			1.14	1.05	0.90	0.35	0.97	726	130	407	82
			1.31	1.26	1.03	0.40	1.11	783	140	358	73
			1.64	1.57	1.29	0.50	1.39	876	157	280	59
			1.97	1.88	1.54	0.60	1.66	946	170	221	48
150% (B)	1378	272	0.18	0.31	0.26	0.10	0.24	387	70	1231	230
			0.35	0.63	0.51	0.20	0.49	685	124	993	182
			0.53	0.94	0.77	0.30	0.73	916	166	769	145
			0.62	1.05	0.90	0.35	0.85	1012	184	686	130
			0.71	1.26	1.03	0.40	0.92	1096	199	613	116
			0.89	1.57	1.29	0.50	1.21	1238	225	491	94
200% (C)	2028	389	0.12	0.31	0.26	0.10	0.25	522	95	1648	304
			0.25	0.63	0.51	0.20	0.49	921	168	1294	239
			0.37	0.94	0.77	0.30	0.74	1228	224	1024	190
			0.43	1.05	0.90	0.35	0.86	1354	247	914	170
			0.49	1.26	1.03	0.40	0.98	1465	267	818	152
			0.62	1.57	1.29	0.50	1.23	1650	301	660	123
			0.74	1.88	1.54	0.60	1.47	1705	328	538	101
			0.86	2.20	1.80	0.70	1.72	1911	349	442	83
			0.98	2.51	2.06	0.80	1.97	2004	366	366	69
200%			0.20	0.52	0.42	0.17	0.41	829	150	1375	255

It is not possible to determine with any certainty the size of the 1970 year-class on which the recommended TAC very largely depends. Some scientists considered Option C as realistic, with

the possibility that values even higher could have been assumed. Others maintained that the actual value probably lies between 1.50 and 2.00. If Option C is correct and the 1974 catch is 150,000 tons, the 1975 population size will be 255,000 tons, i.e. 30,000 tons more than the minimum stock size acceptable to the Commission.

c) Nova Scotia Stock (Div. 4XW(b))

Formal assessment of the Nova Scotia stock is made difficult because of the complexity of the fishery in that area. Because the same fishing areas in the Canadian fishery may contain juvenile, pre-spawning and spawning fish in proportions which vary from year to year and even from week to week within a fishing season, the problems of determining the numerical exploitation of individual year-classes are great. However recent analysis of the catch data (Res. Doc. 74/13) provides a better basis for future assessment.

Catch statistics. The total catch of herring in Div. 4XW(b) by Canada, Japan, USSR and Fed. Rep. Germany was about 135,000 tons. The Canadian catch amounted to 102,000 tons, of which about 38,000 tons were taken by fixed gear. The catch by gear, partitioned into components above and below 23 cm, is given in Table 10. The stock relationships are not well understood in Div. 4X, and it is assumed that fixed-gear catches and part of the purse-seine catches from New Brunswick are not from the same stock as that taken in Nova Scotia. However, the 20,860 tons of adult herring taken by purse seine were considered to be part of the Nova Scotia complex (see Res.Doc. 74/13). Therefore, for assessment purposes, the following components of the Canadian fishery were included: Nova Scotia purse-seine (and midwater trawl) catches; weir catches; the proportion of the gillnet catches in the area where the main stock is fished; as well as the Grand Manan purse-seine catches. Catch data for other countries involved in the fishery were incorporated for the period 1963-73.

Table 10. Herring catches in Div. 4XW(b) in 1973, partitioned into components above and below 23 cm.

Country	Gear	Area	Catch (tons)[1] ≥23 cm	Catch (tons)[1] <23 cm
Canada	Purse seine	4X(a)	36,209	5,458
		4X(b)	20,860	1,704
	Weir	4X(a)	5,757	6,493
		4X(b)	8,582	10,491
	Gillnets	4X(a)	5,715	
	Misc. gear		945	
Sub-total			78,068	24,146
Japan			1,271	
USSR			31,042	
FRG			228	
Sub-total			32,541	
Grand Total			110,609	24,146

[1] The Canadian catch is also partitioned by gear based on yearly length frequencies, presented in Res.Doc. 74/13, and converted from percentage by length to percentage by weight taken from Res.Doc. 73/91. Catches by other countries are assumed to be >23 cm.

TAC levels. Numbers removed at age in the period 1965-73 are summarized in Table 11. For 1973 the USSR catch in Div. 4W was apportioned by USSR sampling data. Few length frequencies were available for the USSR Div. 4X catch, and thus it was apportioned using Canadian Nova Scotia purse-seine sampling data for June, July and August.

Table 11. Age composition of catches from the Div. 4XW(b) herring stock, 1965-73.

Year	Catch in numbers (000) by age										Total
	1	2	3	4	5	6	7	8	9	10	
1965	30	210828	26072	233081	49129	10721	1591	476	16	11	531955
1966	616	45678	270055	56063	308471	44916	15006	7716	1689	215	750425
1967	4430	43234	68671	238403	109786	159205	57936	4497	409	-	686571
1968	13852	746145	78899	64045	267965	70183	87767	31258	15277	5635	1381026
1969	5	65549	325057	51952	115750	71446	48659	18837	6194	2789	706238
1970	448	83808	14819	188539	163076	89144	93908	32846	13428	7300	691312
1971	4626	11105	62611	46175	80192	41890	53092	21031	9732	4215	334669
1972	7732	647970	35408	82118	56397	58906	43546	39860	23034	9315	1004286
1973	215	27422	614700	137063	23449	21889	17655	14598	15955	6846	879792

It is apparent from these data that the fishery in 1973 was heavily dependent on the 1970 year-class, and this will also be true in 1974. Due to changes in the pattern of fishing in 1973 by both Canada and the USSR, no firm conclusion on the levels of F or the distribution of mortality among age-groups could be drawn. Thus it was not possible to base predictions of possible 1974 catch levels on a virtual population analysis. Rather, for ages 3 and 5 to 9, the mean ratio of catches at successive ages was used to estimate 1974 catches (Table 12), on the basis that mortality had, on the average, been close to the desirable level, as indicated by previous virtual population analysis which excluded 1973 catch data. Ratios for 2- and 10-year-olds were too variable to use this method. For age 2 fish, the 1974 estimated catch was taken as the equivalent of mean catches in average years (1966, 67, 69, 71, 73), giving an estimate of 1,500 tons. For 10-year-olds, the 1974 estimated catch was taken as equivalent to mean catches of 10-year-olds in 1968-73 (years for which ageing was considered to be sufficiently reliable), giving an estimate of 2,400 tons.

Table 12. Ratios used and calculations of the 1974 catch of age 3 and ages 5 and older, for the Div. 4XW(b) herring stock.

Ratio of year n to year n-1	Ratio of age n to age n-1					
	3/2	5/4	6/5	7/6	8/7	9/8
66/65	1.28	1.32	0.91	1.40	4.85	3.55
67/66	1.50	1.96	0.52	1.29	0.30	0.05
68/67	1.82	1.12	0.64	0.55	0.54	3.40
69/68	0.44	1.81	0.27	0.69	0.21	0.20
70/69	0.23	3.14	0.77	1.31	0.68	0.93
71/70	0.75	0.43	0.26	0.60	0.22	0.30
72/71	3.19	1.22	0.73	1.04	0.75	1.10
73/72	0.95	0.29	0.39	0.30	0.34	2.10
Mean ratio	1.27	1.41	0.56	0.90	0.43	1.45
Age	3	5	6	7	8	9
No. at age$_{N-1}$	27,422	137,063	23,449	21,889	17,655	14,598
No. at age$_{N}$	34,826	193,259	13,131	19,700	7,592	21,167
Mean wt. (kg)	0.112	0.223	0.268	0.294	0.331	0.357
Estimated catch by weight in 1974[1]	3,900	43,096	3,519	5,791	2,512	7,556

[1] Total weight contributed by fish aged 3 and 5-9 in 1974 catch = 66,374 tons.

This method gives an estimate of the 1974 catch for all ages (excluding 4-year-olds of the 1970 year-class) of about 70,000 tons. However, there is considerable doubt as to the strength of the 1969 year-class on which this figure is strongly dependent. It is not possible at this time to determine whether the high estimated catch in 1973 of the 1969 year-class as age 4 gives a true estimate of the strength of that year-class, as the earlier history of the year-class in the fishery implied it was a very poor one.

As was done for other areas, three assumptions were made as to the strength of the 1970 year-class, i.e. 1.0, 1.5, 2.0 times the size of the 1966 year-class. The strength of the 1966 year-class was estimated to be 2.4 billion fish at age 1, using virtual population analysis. (There is a sufficient series of data for this year-class that the assumption of a terminal F value has little influence on the population estimate). Using a 1974 value of F = 0.50, giving a yield per recruit close to the maximum, the contribution of the 1970 year-class to 1974 catches is 21,000 tons (1.0 x 1966 year-class), 64,000 tons (1.5 x 1966 year-class) and 108,000 (2.0 x 1966 year-class).

The Commission has in the past applied the TAC only to adults in the purse seine - midwater trawl fishery, whereas these calculations refer to the entire stock. Estimated catches by other gears of at least 20,000 tons must be removed to make these estimates comparable with previous TAC levels. Thus, the three assumptions on the strength of the 1970 year-class give estimated total catches of 70,000 tons, 114,000 tons and 158,000 tons. However, uncertainties about the strength of the 1969 year-class which, from catches at ages 1-3 could be as small as one-third of that implied by the catches at age 4, suggest that these are upper estimates and that catches could be as much as 30,000 tons lower. Given the uncertainties in these estimates which bracket the 1973 TAC of 90,000 tons, the Working Group concluded that the TAC for 1974 should remain at 90,000 tons.

5. ICNAF Herring Research Requirements

a) Tagging Experiment

Canada reported that a tagging experiment had been conducted in November and December 1973. Over 11,000 juvenile herring were tagged in the area around Grand Manan Island in the Bay of Fundy. External tags were used throughout. Recoveries are possible from SA 4 and 5 and should be sent to: Biological Station, St. Andrews, New Brunswick, Canada.

b) Larval Surveys

It was agreed that continuation of the ICNAF Herring Larval Survey Program is desirable, since data can provide information on spawning stock size.

c) Juvenile Surveys

It was agreed that the juvenile surveys should continue since the fishery is heavily dependent on incoming year-classes, for which few indices of abundance are at present available. For both larval and juvenile surveys, it was considered that the greatest importance was in providing information on future stock prospects but that preliminary estimates of mortality were also possible if both sets of data could be correlated. It was suggested that larval tows be incorporated in juvenile surveys carried out in the early months of the year. It was also recommended that STACRES organize the larval and juvenile surveys.

d) Sampling and Statistics

In order to provide increasingly precise advice for management, an improvement in the quality of the data is necessary. Catch statistics and sampling data are essential for both adult and juvenile fisheries. Also, in order to calculate weight of the catch relative to numbers derived from present assessment techniques, mean weights-at-age by month are necessary, especially since the fishery is dependent on young fast-growing fish. Analysis would proceed much more quickly if numbers of fish caught at age by month were also supplied by each country. These data should be made available for the 1975 Mid-term Meeting.

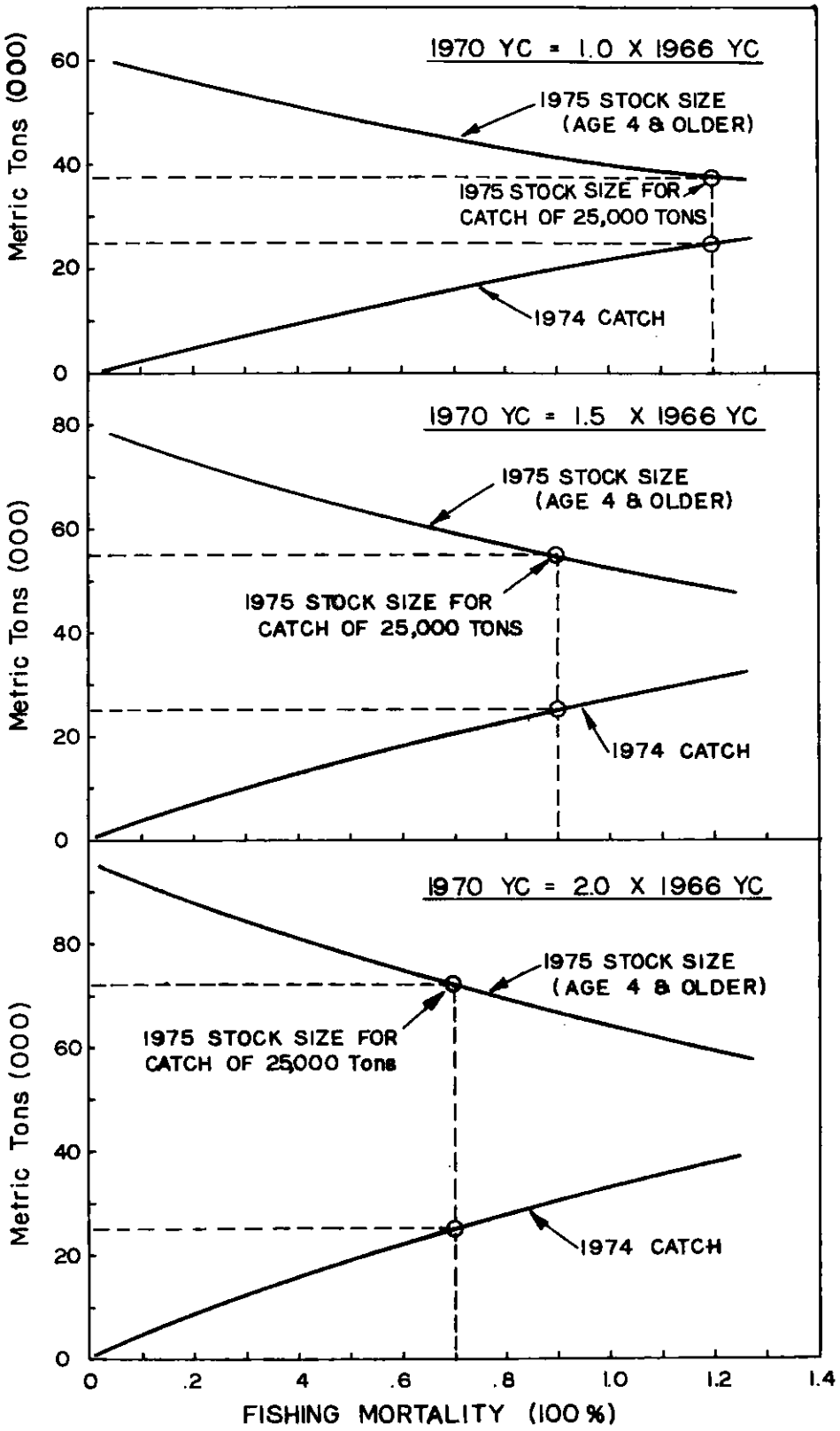


Fig. 1. Gulf of Maine (Div. 5Y) herring stock: 1975 stock size as a function of 1974 catch for a range of fishing mortalities and three assumptions about the 1970 year-class.

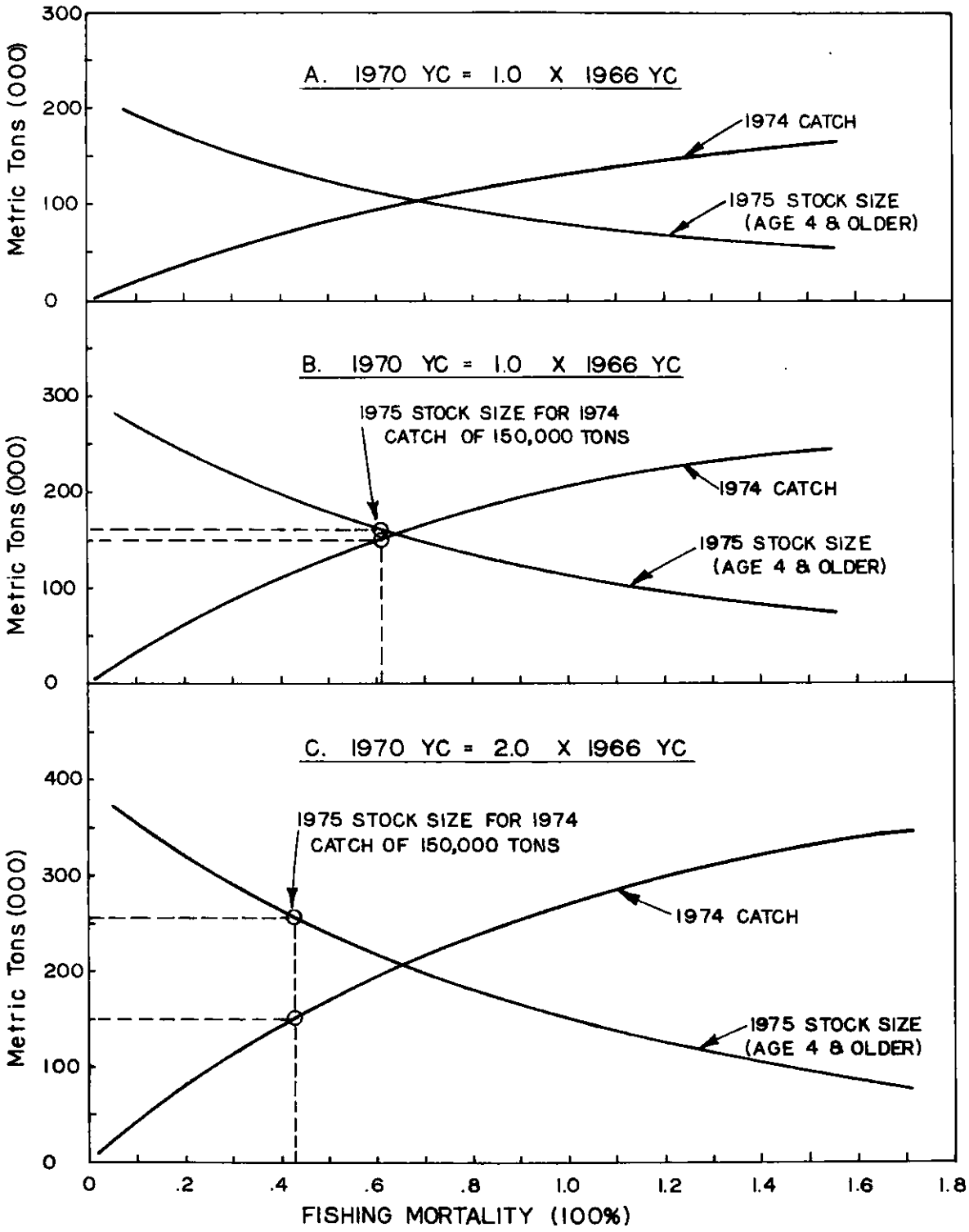


Fig. 2. Georges Bank (Div. 5Z + SA 6) herring stock: 1975 stock size as a function of 1974 catch for a range of fishing mortalities and three assumptions about the 1970 year-class.

APPENDIX II - REPORT OF SPECIAL WORKING GROUP ON ICNAF DATA BASE IMPROVEMENT

Acting Chairman: J. G. Pope

The Special Working Group on ICNAF Data Base Improvement met in several sessions during 15-18 January 1974 at FAO, Rome, Italy, with representatives present from 12 Member Countries and observers from FAO and the German Democratic Republic (Bulgaria, Iceland, Italy and Romania were not represented). In the absence of the Chairman, Mr R.C. Hennemuth (USA), Mr J.G. Pope (UK) was nominated to act as Chairman for this meeting.

1. The Special Working Group was established at the 1973 Annual Meeting to:

   a) formulate a detailed general plan for the finer breakdown of catch and effort statistics in the ICNAF Area;

   b) conduct a detailed study of the sampling methods used by member countries for estimating age-length compositions of catches, and document the sources and magnitude of sampling errors in past estimates of stock structure for major fisheries through analysis of past sampling; and

   c) investigate the advantages as well as costs of an expanded central data processing unit in the Secretariat with respect to processing more refined data on catch and effort, as well as providing increased capability for analysis of commercial and research sampling data.

   To make it possible for the Working Group to make specific recommendations to STACRES about the problems listed above, it is essential that further research work relevant to these topics be conducted and reported. Clearly, therefore, the primary objective of the Working Group at this meeting was to formulate the research work that was needed and to delegate this to member countries. The three following sections of this report are directed to this objective.

2. <u>The Finer Breakdown of Catch and Effort Statistics</u>

   The general feeling of the Working Group was that there was a genuine need for a finer breakdown of catch and effort data. In particular, it was felt that a finer breakdown of such data would provide additional inputs into the assessments of the mixed fishery problem and would assist in the assessment of species with geographical ranges which did not correspond with the current reporting areas (e.g. red hake in Div. 5Z). It was also felt that a finer division of catch and effort data would help to refine measures of fishing effort.

   It was noted that most countries currently collect data that would allow reporting of bi-weekly data on as fine a breakdown as 30-minute rectangles. It was clear, however, from the discussion that collecting catch and effort data in a breakdown as fine as this for all areas would involve everyone, particularly the ICNAF Secretariat, in a greatly increased workload. Consequently, it was decided to start with a pilot scheme on an experimental basis for one division. Div. 5Z was selected, for, in addition to supplying costing and logistic information for the Working Group, the data might well give valuable additional information for assessment of the red hake stocks in this area and for assessment of the mixed fishery problem. A protocol for the reporting of these data is given as Annex 1.

   The results of this pilot study should enable the Working Group to advise the Commission on the probable cost and problems of increasing the data base of catch and effort statistics in all ICNAF Areas. It was stressed that this was an experiment to produce information and not a final recommendation. The reporting of this additional information for Div. 5Z was essentially additional to the usual data reporting and should in no circumstances be regarded as a substitute for the routine data submissions.

   In order to formulate plans for analyses of these data, a task force, consisting of Dr B.E. Brown (USA), Dr F. Nagasaki (Japan), and Mr Ø. Ulltang (Norway), was requested to study and report on these problems. Their report is at Annex 2.

   The scale of the proposed pilot study will require that the Secretariat have additional facilities. Without a clear indication of the quantity of the data that will be involved in the Georges Bank pilot study, it is not possible to project with any degree of precision the cost of such a study to the Commission. An indication of the work involved and the estimated needs are as follows:

a)	Preparation of data for key-punching	Clerk (3-4 mo)	$2,000.00
b)	Key-punching and verifying	Contract	$2,000.00
c)	Programming	Contract	$1,000.00
d)	Computer costs (if work involves overtime for computer staff)		$1,000.00
e)	Duplication of computer plots		0
f)	Space	200 ft^2	0

The provision of funds for the Secretariat to carry out items (a) to (e) above must be considered in conjunction with the provisions of space suitably located near the Secretariat offices, so that the data-processing can be closely supervised. The space problem is the most critical of those listed, and, unless provision is made for suitable space, the other points become redundant.

The Working Group therefore recommends that STACRES present these requirements to the Commission.

3. Age and Length Sampling

The Working Group agreed that there was a need to establish guidelines for all kinds of biological sampling and, where possible, to develop standard methodology for sampling length and age distributions and other biological characteristics of the stocks. It was decided that there was a real need first to improve the accuracy and precision of sampling for length and age, and the hope was expressed that the Working Group would be able to recommend specific levels of precision that could be regarded as satisfactory.

In order that the Working Group will be able to give specific advice rather than to merely voice the usual sampling platitudes, it was recommended that individual countries should conduct investigations of some of their sampling schemes and to submit these results prior to the 1974 Annual Meeting. It was felt that it would be valuable to coordinate the separate national work, and a sub-group of specialists (Mr Pope, Miss Brennan, Dr Rikhter, Mr Nikolaev, Mr Kröncke, Mr Gulland, Dr Popiel and Dr Brown) was set up to provide the Working Group with specific advice.

The proposals of this sub-group were:

a) All member countries of ICNAF should produce a document, detailing their methods of sampling, and describing each major fishery in relation to the opportunities presented at sea and on shore for sampling catches and landings for length and age composition. A description should also be given of the current sampling program, including an outline of the costs (staff, etc.) involved. A suggested outline is:

Population sampled
Place sample taken
Method of collection (including preservation)
Size of sample and frequency of sampling
Staffing and/or cost
Reason for choice of method
Possible drawbacks to method
Constraints on sampling.

An example of the desired report is given as Annex 3. This information should be forwarded to the ICNAF Secretariat as soon as possible.

b) In order that the merits of the various sampling schemes currently used may be investigated objectively, it was recommended that all members of ICNAF should, if at all possible, conduct investigations into the accuracy of their current sampling methods with the objective of identifying any biases present. These investigations, and any others previously made but unpublished, should be reported to the 1974 Annual Meeting as research documents.

c) Since correct ageing is crucial to correct assessments, the Working Group recommends (i) that the Secretariat request national bibliographies of age validation studies already conducted on ICNAF stocks and advise on stocks where age reading was considered to a problem; and (ii) that STACRES then consider the need for initiating suitable studies.

d) Member countries were nominated to conduct statistical studies of stocks as follows:

Cod, haddock	USA, Spain
Flounders	USA, Canada
Redfish	USSR, Canada
Mackerel	Poland, GDR
Herring	USSR, FRG, Poland
Squid	Japan
Silver hake	USSR, UK (with US data)

and are requested to adopt as a format for presentation where applicable:

i) the figures and tables of Res.Doc. 74/29 using the methods proposed by Miss J. Brennan; and

ii) Fig. 1.10 of Gulland 1955 (Estimations of growth and mortality in commercial fish populations. *Fish. Invest.*, Lond., Ser. 2, 18(9)).

Advice on (i) may be obtained from Miss J. Brennan, Northeast Fisheries Center, NMFS, Woods Hole, Mass., USA, and on (ii) from J. Pope, Sea Fisheries Laboratory, Lowestoft, Suffolk, England.

Results should be reported as research documents for the 1974 Annual Meeting. Further useful references are given in Annex 4.

4. Expanded Central Data Base - Methods of Reporting and Processing

It was felt that an expanded central data-processing unit in the Secretariat might have considerable advantages in providing increased capability for analysis of commercial and research sampling data. However, the cost of such a unit would be impossible to define without results from the pilot study. The Working Group therefore decided to leave this question until these became available.

The Assistant Executive Secretary was requested to assess, before the 1974 Annual Meeting, the costs to the Commission of requiring the Secretariat to accomodate the reporting and processing of raw sampling data, assuming this was at the current level. The Working Group recommends that individual countries inform the Assistant Executive Secretary of the approximate number of length and age samples they make in one year at present.

5. The Working Group wishes to draw attention to the fact that sound advice to STACRES depends also on adequate biological sampling other than that giving age-length composition, as specified in the terms of reference; and the Working Group therefore recommends that the terms of reference of the Working Group be expanded to include all aspects of biological sampling of catches.

ANNEX 1 - PROTOCOL FOR THE REPORTING OF ADDITIONAL DATA FOR DIVISION 5Z

Reports should be made for the last 4 months of 1973, if at all possible, (to be reported by airmail to the Secretariat by 15 March 1974) and for the first 2 months of 1974 (to be brought to the 1974 Annual Meeting).

Reports should be made of the catch and effort by 30-minute rectangles (the Secretariat will circulate a chart showing the rectangles to be used as soon as possible) for each of the effort categories reported in STATLANT 21B or in more detail if this is available (e.g. discriminating between pelagic and bottom trawls). This information should be presented for each half month of the period - the first half of each month being defined as being from day 1 to day 15 and the second from day 16 to the end of the month. Effort data should be reported as currently requested, e.g. hours fished, days fished.

The species for which catch is to be detailed are cod, haddock, redfish, pollock, red hake, silver hake, yellowtail flounder, other flounders, squid, argentines, herring, mackerel, other fish.

Members are requested to complete a full breakdown of their statistics, but, if this is not possible, a stratified random sample of all vessel categories of at least 20% of their data should be analyzed. Information should be submitted to ICNAF on forms to be provided by the Secretariat.

ANNEX 2 - REPORT OF TASK FORCE ON ANALYSIS OF REFINED CATCH/EFFORT DATA

The following analyses are suggested to compare the 6-month refined time-area data with that currently being reported:

a) Plots of catches of the requested categories and total catch by 30-minute squares by two-week period.

b) Plots of effort by major gear and tonnage categories by 30-minute squares by two-week periods.

c) Comparison of seasonal trends catch per unit effort for selected species calculated for the refined data and with the currently available data.

d) Comparison of relative catchability coefficients between gear-tonnage classes calculated from the refined data and from the data currently available.

It is requested that the Secretariat be responsible for producing a computer file of the data and items (a) and (b), realizing that additional resources would be needed to do this. Items (c) and (d) should be done by scientists from the various countries (Japan will examine the squid data and USA will make a comparison of relative catchability coefficients using analysis of reviewed procedures). It is stressed that a significant amount of analysis must be available by the 1974 Annual Meeting. Therefore preliminary analyses on portions of the data should be reported to that Meeting. The Chairman of the Working Group will request other such studies by letter.

ANNEX 3 - EXAMPLE OF SAMPLING REPORT PROPOSED BY WORKING GROUP ON ICNAF DATA BASE IMPROVEMENT

Country - United States

Fishery - side trawlers making trips of about 14 days duration to Gulf of Maine, Georges Bank and Southern New England areas. Catches are landed at various New England ports.

Opportunities for Sampling - dockside sampling only. Sampling of discards is inadequate.

Current Sampling:

Population Sampled - yellowtail flounder landings from Georges Bank (Subdiv. 5Ze) by quarters.

Length Samples:

Place Sample Taken - dockside, at ports where the bulk of the species is landed.

Method of Collection - landings are sampled by market category and area in which catch was taken. A primary sampling unit consists of one 125 lb box of fish. The unit is separated into males and females and measured.

Size of Sample and Frequency of Collection - about 5 samples per month are taken, each consisting of about 100 fish.

Staffing and/or Cost - 5 port samplers.

Reason for Choice of Current Sampling Methods - with the logistic constraints listed below, the current scheme seems the most reasonable and direct such that unbiased estimates of percent at length can be made.

Drawbacks - the number of samples taken seems to be inadequate, although the number of fish measured per sample is adequate. Discards are not sampled.

Constraints - on-board sampling is not possible at present due to restrictions imposed by vessel captains, as well as lack of space on board for sampling and for sample storage.

Age Samples:

Place Sample Taken - dockside, at ports where the bulk of the species is landed.

Method of Collection - landings sampled for lengths (above) are subsampled for ageing, such that at least one fish is taken from each cm interval group by sex.

Size of Sample and Frequency of Collection - a total of 25 males and 25 females is typically collected for ageing from each sample taken for length measurements.

Staffing and/or Cost - 3 age readers, 5 port samplers.

Reason for Choice of Current Sampling Method - to get an unbiased estimate of percent of age at length (group).

Drawbacks - currently, both the numbers of samples taken and the number of fish per sample are inadequate to estimate the percent of age at length (group) precisely.

Constraints - the size of staff limits the workload (specifically ageing) that can be handled under specified time limits.

ANNEX 4 - SUGGESTED REFERENCES

Bazigos, G. P. 1973. Deck Sampling: An Assessment of a Pilot Trawling Survey at Lake Malawi (*UNDP/SF/MLW. 16*), FAO, Rome, Italy.[1]

Cochrane, W. G. 1963. Sampling Techniques. 2nd ed., John Wiley and Sons, Inc., New York, 413 p.

Gulland, J. A. 1966. A Manual of Sampling and Statistical Methods for Fisheries Biology, Part 1: Sampling Methods. FAO, Rome, Italy.

Pope, J. G. 1972. An Investigation of the Accuracy of Virtual Population Analysis Using Cohort Analysis. *Res. Bull. int. Comm. Northw. Atlant. Fish.*, No. 9, p. 65-74.

Pope, J. G. and D. J. Garrod. 1973. A Contribution to the Discussion of the Effects of Error on the Action of Catch Quotas and Effort Quotas. *Annu. meet. int. Comm. Northw. Atlant. Fish 1973*, Res.Doc. No. 110, Serial No. 3074 (mimeographed).

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[1] A contribution to the discussion of the effects of errors in sampling; limited distribution to participants of the Special Working Group on ICNAF Data Base Improvement.

APPENDIX III - REPORT OF WORKING GROUP ON COORDINATED SURVEYS

Chairman: J. Messtorff

Rapporteurs: R. G. Halliday
A. T. Pinhorn

The Coordinated Surveys Working Group met on 16-17 January 1974 at FAO, Rome, Italy, to consider various matters referred to it from STACRES. On the advice of the Chairman of STACRES, Dr A.W. May, the Group agreed to broaden the scope of its discussions to include all survey work, including hydro-acoustic surveys, on which a special session was held to discuss equipment and methodology.

1. Stratification Schemes for Groundfish Surveys

A revised stratification scheme for SA 2 and a proposed scheme for Div. 3K were presented by Dr Messtorff (Res.Doc. 74/4), who reported on the successful use of the stratified-random sampling design in these areas by Fed.Rep. Germany in 1973. It was noted that, in contrast, such a design was found impractical for use in SA 1.

Stratification schemes, which have been tested by use, are now available for almost all of SA 2 to 6, and it was suggested that these be brought together (including calculations of stratum sizes) for review and standardization at the Annual Meeting as a preliminary to production of a manual on methodology for groundfish surveys in the ICNAF Area. The Secretariat was requested to solicit information by Circular Letter and collate the material for presentation at the 1974 Annual Meeting. It was also proposed that the Secretariat produce working charts, showing the stratification schemes for all areas, and supply these to interested countries. It was thought that inclusion of the Baffin Island region in the stratification scheme would be useful, and countries with bathymetric charts of the area were requested to make these available at the 1974 Annual Meeting.

2. Review of Surveys Carried Out in 1973

Most countries indicated that the surveys scheduled for 1973, and summarized in a table in *Redbook* 1973, Part I, page 101, were carried out. However, details of surveys and results would not be available until the 1974 Annual Meeting.

3. Survey Plans and Coordination for 1974

Survey plans of most countries were not sufficiently firm for 1974 that a table setting out these plans could be produced as was done for 1973 at the 1973 Annual Meeting. However, most representatives could give general indications of their intentions, as follows:

Denmark will continue working selected trawling stations in SA 1 (20 hauls) and try to expand the number of stations in 1974.

Fed.Rep. Germany will, in 1974, repeat their surveys in SA 1 and 2 at levels similar to those of 1973. The young herring survey conducted in SA 5 and 6 in 1973 will also be repeated in 1974; this will be based on a stratified random sampling design and will include a comparison of catches between a bottom trawl, designed to catch pelagic species, and the standard bottom trawl used in USA surveys and also sampling with bongo nets for 1973 year-class herring.

German Dem.Rep. indicated that groundfish surveys would be conducted in SA 1, 2 and 3 from November 1974 to February 1975.

Canada hopes to conduct surveys at a level similar to that in 1973 and at similar times. In addition, a combined hydroacoustic and bottom trawling survey will be conducted on the Scotian Shelf between January and March, involving over 200 hauls if plans are successful.

USSR will conduct surveys in SA 2 and 3 in 1974 as in 1973, but no details were available. In SA 4, an October 1974 survey for silver hake in Emerald Basin will be conducted at a level similar to that in 1973 (20 hauls); the large-scale Scotian Shelf survey, which was not conducted in 1973, will be re-established in 1974, 120 trawl hauls being planned for August; in addition, a herring survey of 50 hauls is planned for Div. 4W-X in April. In SA 5 and 6 survey plans are the same for 1974 as for 1973, with the addition of a winter survey (February - March) for pelagics from Cape Hatteras to Georges Bank; this latter survey will include 120 hauls with a high opening bottom trawl, stations being chosen at random using the groundfish stratification scheme and will also include a hydro-acoustic survey.

France plans a survey in Div. 3P and Subdiv. 4Vn for cod during 15 January - 15 March and for scallops during 5-20 November. A herring survey will be conducted in Div. 5Z in September - October.

Poland will conduct a young herring and mackerel survey in SA 5 and 6 in March.

USA plans to conduct 1974 surveys at levels similar to those of 1973, but modified to include hydro-acoustic work in SA 4, 5 and 6. In addition, intensive surveys in shallow coastal waters will be conducted from the Bay of Fundy to Cape Hatteras in May. The USA is continuing to develop submarine surveys of resources of the continental slope mainly in SA 6, and in 1974 this will be done in July - August. Surface craft are also involved using techniques such as camera surveys. An invitation was extended for others to participate.

4. Hydro-acoustic Surveys

The potential importance of hydro-acoustic survey techniques for estimation of fish abundance was recognized and a special meeting of experts and interested biologists was held to discuss equipment and techniques following a presentation on methodology of hydro-acoustic equipment calibration by Mr J. Suomala (USA) (see Annex 1).

The Group concluded that the measurement of aquatic biomass by hydro-acoustic methods cannot, at this time, be considered to be a reliable information source for ICNAF deliberations and decisions. However, if properly developed and executed, hydro-acoustic experiments and subsequent surveys with properly calibrated equipment are performed, it is highly likely that additional information concerning the rate of change of pelagic fish abundance in the ICNAF Area may be obtained.

It was noted that cooperative arrangements have already been made for US, USSR and Polish research vessels to conduct hydro-acoustic experiments during the first half of 1974. Other countries are encouraged to participate in future arrangements of such experiments. US experts will prepare a manual for such proposed joint hydro-acoustic surveys.

5. Reporting of Survey Data (Res.Doc. 74/33, 34)

Summary information on the status of pre-recruit abundance estimates for the major species in SA 5 and 6 is given in Res.Doc. 74/33, and information on cost estimates for juvenile herring surveys at various levels of accuracy is presented in Res.Doc. 74/34.

The various procedures and techniques associated with the stratified-random groundfish surveys were discussed, and it was indicated that these originated from the experience of the US groundfish surveys over several years. They had been presented in various documents to previous ICNAF Meetings, and these together with previous discussions in the Working Group stimulated other countries to devise stratified-random schemes for the northern subareas. Dr Edwards (USA) indicated that all of the procedures and techniques used by the US scientists in their stratified-random surveys would be presented at the 1974 Annual Meeting as a single document, and the Working Group could then discuss the desirability and feasibility of including the material in the manual on surveys to be produced by the Secretariat as referred to in Section 1 above.

The Working Group discussed the desirability of obtaining data on the physical environment in time to be used in deliberations of STACRES. It was indicated that hydrographic observations at most trawling stations, as well as standard hydrographic sections, are carried out during surveys by some countries. It was further indicated that proposals will be forthcoming at the 1974 Annual Meeting concerning monitoring of the physical environment. The problem of procedures for handling such data was discussed. One suggestion was that a data bank might be established at the Secretariat. It was indicated that further discussion on this subject should take place at the next meeting of the Environmental Sub-committee.

The Chairman of STACRES suggested that the problem of coordinating all types of surveys should be discussed at the next meeting of the Steering and Publications Subcommittee.

6. Polish Government's Offer of the R/V *Professor Siedlecki* for Herring and Mackerel Research in Subarea 5 and Statistical Area 6

It was indicated that the R/V *Professor Siedlecki* would be available for a survey to provide biomass estimates of especially herring and mackerel in SA 5 and 6. The timing of the survey and the area to be covered were important considerations in planning the cruise. It was suggested that this might be part of a larger coordinated program involving other vessels. It was noted that, in addition to the Polish staff, there was accomodation for seven observers, and countries were invited to participate. In discussing the possibility of conducting herring and/or mackerel tagging with the Polish vessel, the type of gear used by the vessel was considered not suitable for taking these species in condition suitable for tagging.

7. Manual on ICNAF Groundfish Surveys

It was agreed that a comprehensive manual, setting out the methodology developed for quantitative

groundfish surveys in the ICNAF Area, would be most valuable in promoting standardization of techniques, now that stratification schemes are available for almost all of the fishing areas in SA 2 to 6. The presentation of data on survey methodology to the 1974 Annual Meeting, as requested in Section 1 above, will allow full consideration of data relevant to production of the manual. The Working Group therefore

recommends (3)

that a manual on ICNAF Coordinated Groundfish Surveys be produced subsequent to the 1974 Annual Meeting with format and content to be decided at that Meeting.

8. Other Matters

It was agreed that sufficient time be available in the STACRES timetable for the 1974 Annual Meeting for the Working Group to deal with matters requiring further consideration at that time.

ANNEX 1 - SUMMARY OF US PRESENTATION ON AND PLANS FOR HYDRO-ACOUSTIC SURVEYS

Mr Suomala (USA) presented a report on the methodology of hydro-acoustic equipment calibration, a summary of which follows:

The estimation of the density of fish by hydro-acoustic methods in an aggregation is dependent upon the knowledge of a number of parameters. These parameters are given in the following simplified basic expression:

$$\hat{P} = \frac{R^2 e^{2\alpha R}}{Io K^2 \frac{\sigma}{4\pi} \frac{c\tau}{2} \psi(\phi)} \tilde{V}^2_{RMS}$$

where:
- R - range to aggregation
- α - attenuation loss due to combined effects of scattering and absorption
- Io - acoustic source level
- K^2 - receiving voltage response
- σ - ratio of power scattered per unit solid angle to the incident intensity at target
- $\tilde{V}^2_{RMS}$ - root mean squared value of randomly varying received voltage
- c - propagation velocity of sound
- τ - time interval of transmitted acoustic carrier frequency
- $\psi(\phi)$ - integrated transducer directivity function

All of the above terms, except σ, are measurable with high precision and reasonable accuracy to allow practical density estimations of fish targets. The value of σ for the pelagic species of current interests in those parts of the ICNAF Area monitored by the National Marine Fisheries Service, Woods Hole, is not known at this time, and scientifically acceptable values of density cannot be obtained. Accordingly, the parameter σ is to be combined with the density estimate, $\hat{P}$, as a lumped parameter in the initial hydro-acoustical measurement experiments to be conducted in 1974.

The National Marine Fisheries Service, Woods Hole, plans to make available basic hydro-acoustical calibration, echo signal and other electronic measurement and data-recording equipment for deployment on cooperating survey vessels in order to normalize specific differences in vessel hydro-acoustic equipment. This measurement equipment will be operated by US personnel during the sea operations.

The gathering and reduction of all data obtained during the experiment will be accomplished with the active participation of ICNAF scientists, and the results of this data reduction activity will be in accordance with scientifically and technologically acceptable methods and procedures.

The National Marine Fisheries Service, Woods Hole, will provide the following instrumentation and equipment to verify the various operational parameters of the hydro-acoustical and echo signal processing equipment on participating vessels:

Tape recorder - Ampex FS1300
Oscilloscope - Tektronix 545
Camera - Type c12
Comparator amplifier - type 1A7A and type W
Counter - type 524L
Hydrophone - type LC-32
Digital computer - XDS 9300 and IBM 360/75
Analog computer - Beckman 2200
Miscellaneous voltmeters, oscillators, attenuators, megohmeter, computer peripheral equipment and electronic calculators.

APPENDIX IV - STATEMENT IN RESPONSE TO STACRES QUESTIONS REGARDING ADVICE TO THE COMMISSION ON HERRING

STACRES asked two questions of the Commission (STACRES Report, Section I, Subsection 3):

1) Identification of components of the (herring) fisheries and hence catch quantities on which assessments should be based in order to be related to the TAC?

2) Identification of adult as opposed to juvenile (herring) fisheries?

The following brief explanation deals with both of these points. The TACs developed by the Herring Working Group in 1972, 1973 and 1974 applied to the following stock components:

a) Div. 4WX. The adults caught in the Canadian purse seine fishery off southwestern Nova Scotia mainly in the summer and autumn. Adults caught by other nations offshore of the area fished by the Canadian fleet, including the overwintering concentrations found on the southern Scotian Shelf. (*Redbook* 1972, Part I, p. 43)

b) Div. 5Y. The adults caught in "(the) substantial adult fishery.....in the western portion of the Gulf of Maine.....concentrated on Jeffreys Ledge, Stillwagen Bank and adjacent areas" - this area being distinct from that of the "traditional USA juvenile herring fishery.....limited to the Maine coastline". (*Redbook* 1973, Part I, p. 48)

c) Div. 5Z and Statistical Area 6. The adults caught in the Div. 5Z and SA 6 mobile fleet fisheries.

At the Special Meeting in Rome in January 1972, adult stock size was formally defined "as that of age 4 and older at the beginning of the calendar year" (*Redbook* 1973, Part I, p. 34).

There has been a change in the pattern of recruitment to the adult stage and adult fisheries. In earlier years few 3-year-old fish were caught. In 1973 much and even most of the catch in all fisheries was made up of 3-year-old fish. Recruitment of 3-year-old fish during the year (assumptions as to the size of which now largely determine advice as to TAC) can be dealt with separately (see, for instance, Fig. 1, p. 38, *Redbook* 1973, Part I).

Assessment, therefore, has continued to deal with adult fish, adjusting the details to take into account the biological changes in the stocks, i.e., earlier age at maturity.

Assessments for 1973 and 1974 have been based on the expected catch of adult herring. This includes 3-year-old herring expected to mature during the year, which for administrative reasons, to allow monitoring of catches in the Canadian purse seine fishery, are taken to be fish greater than 23 cm.

T. D. Iles, Chairman
Herring Working Group

PART C

STACRES REPORT

MAY-JUNE 1974

C. REPORT OF STANDING COMMITTEE ON RESEARCH AND STATISTICS (STACRES)

Annual Meeting - May-June 1974

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C. REPORT OF STANDING COMMITTEE ON RESEARCH AND STATISTICS (STACRES)

Annual Meeting - May-June 1974

Chairman: A. W. May

Rapporteur: V. M. Hodder

Meetings of STACRES and its Subcommittees and Working Groups were held at Dartmouth, Canada, during 21-31 May and on 13 June 1974. These meetings were preceded on 20 May by a symposium on "Environmental Conditions in the Newfoundland Grand Bank Area in 1972 and their Effect on Fishery Trends". Since the 1973 Annual Meeting, meetings of STACRES were held in conjunction with Special Commission Meetings held in Ottawa, Canada, in October 1973 (this volume, Part A, page 5) and in Rome, Italy, in January 1974 (this volume, Part B, page 9). The ICES/ICNAF Joint Working Party on North Atlantic Salmon met at Copenhagen, Denmark, during 11-15 March 1974 and its report is given in Summ.Doc. 74/17.

The complete reports of the Subcommittees and Working Groups, as adopted by STACRES at this Annual Meeting, are given at Appendix I (Assessments), Appendix II (Coordinated Surveys), Appendix III (Statistics and Sampling), Appendix IV (Data Base Improvements), Appendix V (Environmental), Appendix VI (Gear and Selectivity), and Appendix VII (Steering and Publications). Brief summaries of these reports, together with other matters considered by STACRES, are given below. The STACRES Agenda and List of Scientific Participants are given in Part D of this volume.

I. ASSESSMENTS (APP. I)

1. Fishery Trends

The total catch of all species in the Convention Area and Statistical Area 6 (Summ.Doc. 74/38) remained at the same level as in 1972 (4.2 million tons)[1]. Major declines occurred in the fisheries for cod (231,000 tons), herring (65,000 tons) and shellfish (129,000 tons)[1]. These were offset by increases in the catch of hakes (192,000 tons) and capelin (199,000 tons). Catches declined in Subarea 1 (38,000 tons), Subarea 2 (60,000 tons) and Statistical Area 6 (281,000 tons)[1], and increased in Subarea 3 (36,000 tons), Subarea 4 (228,000 tons) and Subarea 5 (124,000 tons).

2. Assessments

The Assessments Subcommittee reviewed all assessments of stocks for which TACs[2] are in effect or proposed in order to recommend TAC levels for 1975. These assessments generally fall in one of four categories:

(1) analytical models based on analysis of age structure of a stock over time;
(2) general production models where stock size as a whole is known but age composition data are not available;
(3) general biological information;
(4) catch statistics alone.

In framing its recommendations the Subcommittee has kept in mind the general desirability of maintaining TAC levels that have already been agreed unless there is clear evidence to indicate adjustment for conservation reasons. Of more than 50 TACs reviewed, 35 are recommended to remain at the same level in 1975 as in 1974. Table 1 contains a summary of recommended TACs for the various stocks under regulation and for which regulation is proposed. Similar tables organized by subarea may be found within the Assessments Subcommittee Report (Appendix I).

3. Species Extending Outside Convention Area (Baffin Island)

In recent years fisheries have developed for Greenland halibut, roundnose grenadier and, to a small extent, for redfish in the area east of Baffin Island outside the Convention Area. In 1972 catches of Greenland halibut were about 10,000 tons and of roundnose grenadier about 6,000 tons in this area.

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[1] Editorial Note: After the preparation of Summ.Doc. 74/38, containing provisional nominal catches in the Northwest Atlantic in 1973, an additional 196,000 tons of oysters have been reported from Statistical Area 6 (see Summ.Doc. 74/38, revised 5 July 1974). Thus the total catch of all species in 1973 was 4.4 million tons, the catch of shellfish, etc. actually increased by 67,000 tons, and the total catch in Statistical Area 6 declined by only 85,000 tons.

[2] Total allowable catches.

Table 1. Recent catches and proposed TACs for stocks to be considered for regulation at this Commission Meeting.

Species	Stock area	Nominal catches (000 tons) 1971	1972	1973[1]	TACs (000 tons)[2] 1973	1974	1975	Assessment category
Cod	1	121	111	63	- (102)	107[3] (80)	(55)	1
	2GH	13	14	+	-	20[4] (20)	(20)	1
	2J+3KL	432	458	354	665.5 (650)	656.7[5] (650)	(550)	1
	3M	34	58	23	-	40 (35)	(40)	1
	3NO	126	103	80	103.5 (70)	101.1 (85)	(85)	1
	3Ps	64	44	53	70.5 (70)	70[6] (70)	(60)	1
	4Vn(Jan-Apr)+4T	57	68	51	-	63	(50)	1
	4Vn(May-Dec)	11	9	6	-	10[7] (70)	(10)	1
	4VsW	54	62	54	60.5 (60)	60 (60)	(60)	1
	4X(offshore)	9	7	7	-	- (8)	(5)	1
	5Y	8	7	6	10 (10)	10 (10)	(10)	4
	5Z	28	25	29	35 (35)	35 (35)	(35)	2
Haddock	4VW	13	5	4	4 (0)	0 (0)	(0)	1
	4X	18	13	13	9 (0)	0 (0)	(15)	1
	5	12	7	6	6 (0)	0 (0)	(0)	1
Redfish	2+3K	19	20	39	-	30 (25)	(30)	2
	3M	8	42	22	-	40 (-)	(16)	2
	3LN	34	29	34	-	28 (20)	(20)	2
	3O	20	16	9	-	16 (15)	(16)	2
	3P	28	26	18	-	25 (23)	(25)	2
	4VWX	62	50	40	-	40 (30)	(30)	4
	5	20	19	17	30 (30)	30 (30)	(25)	4
A. plaice	2+3K	5	9	5	-	10.5[8] (8)	(8)	1
	3M	1	1	1	-	2 (2)	(2)	4
	3LNO	68	59	53	60.5 (60)	60 (60)	(60)	1
	3Ps	7	7	15	-	11 (10)	(11)	4
Yellowtail	3LNO	37	39	33	50 (50)	40 (40)	(35)	1
	5(E69°)	24	30	26	16 (16)	16 (16)	(16)	2
	5(W69°)				10 (10)	10 (10)	(0)[9]	2
Witch	2J+3KL	16	17	24	-	22[10] (17)	(17)	1
	3NO	15	9	7	-	10 (10)	(10)	4
	3Ps	2	2	3	-	3 (3)	(3)	4
Flounders[11]	4VWX	34	24	28	-	32 (32)	(32)	4
Oth. flounders[12]	5+6	28	24	22	25 (25)	25 (25)	(25)	3
G. halibut	2+3KL	25	30	29	-	40[13] (30)	(40)	4
	1+Baffin I.	4	14	10	-	-		
Silver hake	4VWX	129	114	299	-	100 (50-100)	(120)	1
	5Y	8	7	9	10 (10)	10 (10)	(15)	3
	5Ze	72	78	62	80 (80)	80 (80)	(80)	3
	5Zw+6	28	31	61	80 (80)	80 (80)	(80)	3
Red hake	5Ze[14]	9	39	25	-	20 (20)	(20)	1
	5Zw+6[14]	31	36	42	40 (40)	50 (50-70)	(45)	1
Pollock	4VWX	12	20	30	50 (50)	55[15] (50)	(55)	4
	5	14	13	13				
Argentine	4VWX	7	6	1	-	25 (25)	(25)	3
	5	7	33	3	-	25 (25)	(25)	4
RN grenadier	1+Baffin I.	8	8	5	-	-		
	2+3	75	24	18	-	32 (30)	(32)	1
Capelin	2+3K	+	46	136	-	110[16] (250)	(300)	3
	3LNOPs	3	25	132	-	148[16]	(200)	3

Table 1. (Continued)

Species	Stock area	Nominal catches (000 tons) 1971	1972	1973[1]	TACs (000 tons)[2] 1973	1974	1975	Assessment category
Herring	4VW(a)	72	32	30	-	45 (45)	(45)	3
	4XW(b)	93	159	135				
	4XW(b)(adult)	70	75	91	90	90 (90)	(90)	1
	5Y	51	62	32				
	5Y(adult)	39	43	16	25	25 (25)	(25)	1
	5Z+6	267	174	202	150	150 (150)	(150)	1
Mackerel	4VWX	17	13	26	-	55 (-)		
	3+4	24	22	38	-	-	(70)	4
	5+6	349	387	381	450	304 (251-312)	(285)	1
Oth. finfish[17]	5+6	139	115	155	-	125 (125)	(125)	4
Squid(*Illex*)	3+4	9	2	10	-	-	(-)	3
" (*Illex*)	5+6	22	18	23	-	71 (-)	(-)	
" (*Loligo*)	5+6		31	34	-	(50-80)	(71)	2
Overall 2nd tier[18]	5+6	1136	1145	1156	-	923,9 (-)	850 (850)	

[1] Provisional statistics (Summ.Doc. 74/38).
[2] Quantities in brackets are TACs recommended by STACRES.
[3] Includes estimated 12,000 tons outside Convention Area.
[4] Includes estimated 1,000 tons outside Convention Area.
[5] Includes estimated 50,000 tons outside Convention Area.
[6] Includes estimated 20,000 tons outside Convention Area.
[7] Includes estimated 2,000 tons outside Convention Area.
[8] Includes estimated 2,500 tons outside Convention Area.
[9] Recommended TAC pertains to 5(W69°)+6.
[10] Includes estimated 2,500 tons outside Convention Area.
[11] American plaice, witch and yellowtail.
[12] All other flounders except yellowtail.
[13] Includes estimated 5,000 tons outside Convention Area.
[14] TACs pertain to 5Z(E69°) and to 5Z(W69°)+6 respectively.
[15] Each country to record its catch separately for Subareas 4 and 5, and note that Subarea 5 catch is applied against the second tier quota for Subarea 5 and Statistical Area 6.
[16] Countries without specific allocation may each take a total of 10,000 tons from the stocks, no more than 5,000 tons of which may be taken from Div. 3LNOPs.
[17] Excludes all TAC species and also menhaden, billfishes, tunas and large sharks.
[18] All finfish species (except menhaden, billfishes, tunas and large sharks) and squids.

It is possible that both Greenland halibut and roundnose grenadier exist as single stocks in Subareas 1-3 as well as the area east of Baffin Island. However, it was concluded that it would be desirable for management purposes to partition any TACs that might be agreed for these stocks. If the Commission wishes to implement precautionary quotas, initial levels of 20,000 tons are suggested for Greenland halibut in Subarea 1 plus the area east of Baffin Island, and 6,000 tons for roundnose grenadier in the same combined areas.

4. Proposal to Reduce TAC for Divisions 2J-3KL Cod

The TAC for cod in this area recommended for 1975 is 550,000 tons on the basis of most recent biological information. With reference to a proposal before the Commission to reduce the TAC below the level of biological MSY, it was concluded that if the catch is to be reduced to allow for increases in stock size, any desired reduction can only be ensured by reducing the TAC directly. Closure of the spawning area in Div. 2J would not necessarily achieve any significant catch reduction in the stock complex as a whole.

5. Seasonal Breakdown of TAC for Divisions 4VW(a) Herring

The TAC in effect for the 1974 calendar year is 45,000 tons and should not exceed this figure if a TAC is set for the calendar year 1975. However, if the Commission wishes to adopt a TAC for the period January-June 1975, it should be set at two-thirds the level suggested above, i.e. 30,000 tons.

6. Mackerel

The most recent data suggest that mackerel in Subareas 3 and 4 are either a migrating component of the mackerel fished in Subarea 5 and Statistical Area 6 or, if they form a separate biological unit, their distribution and fisheries on the two stocks overlap in Subarea 5 and Statistical Area 6 for part of the year. It is possible that the present TAC in Subarea 5 and Statistical Area 6 is appropriate for exploitation of mackerel throughout the ICNAF Area. It was not possible to complete a single assessment at this time for the ICNAF Area as a whole, and STACRES therefore

recommends (1)

i) that an overall assessment for mackerel in the ICNAF Area be carried out for the 1975 Annual Meeting,

ii) that a 1975 TAC be set in include all mackerel in Subareas 3 and 4, and

iii) that this TAC be 70,000 tons, being the level of catch expected in 1974 in these areas.

7. Two-tiered Quota System in Subarea 5 and Statistical Area 6

The overall TAC for finfish and squid in Subarea 5 and Statistical Area 6 has been set at 850,000 tons for 1975. Noting that this will be less than the summed TACs for individual components of the fishery, it is pointed out that, although the different individual species fisheries are of varied importance to the different overall national fisheries, there is no biological reason to expect that the ratio of the two tiers will be the same for all countries.

8. Research in 1974-75

While the processing of assessments is gradually being upgraded, further progress will be related to the research resources deployed and the quality and quantity of data available to ICNAF scientists. Particular areas that merit special attention in 1974-75 are:

a) stock differentiation and definition of management areas for capelin, mackerel and silver hake;

b) reassessment of silver hake in Div. 4VWX;

c) inclusion of juvenile herring fisheries in the appraisal of the overall effect of fishing on the herring resources as a whole; and

d) further analysis of species interaction and potential yield of a mixed fishery as a basis for review of the overall TAC for Subarea 5 and Statistical Area 6 at the next meeting.

II. COORDINATED SURVEYS (APP. II)

1. Reporting and Processing of Survey Data

It was concluded that the development and introduction of standard forms for computer processing could facilitate the handling of increasingly large amounts of survey data. Since not all national laboratories have adequate computer facilities, the proposed expansion of Secretariat facilities could assist in this respect if implemented.

2. Manual on ICNAF Coordinated Groundfish Surveys

It was agreed that the proposed manual should contain practical advice and instructions for planning, execution and analysis of data from groundfish surveys. Pertinent material will be prepared for presentation at the next meeting of the Group.

3. Hydroacoustic Surveys

The first joint hydroacoustic experiment was carried out in March-April 1974 by US and USSR research vessels. It was noted that an inventory of the results of hydroacoustic surveys over the past five years is being prepared by FAO. The complex stock mixture in parts of the ICNAF Area leads to problems in applying hydroacoustic methods, and further research is necessary before such methods can be used on a routine basis. In view of the potential importance of these techniques for fish abundance estimations, experimental work should be continued and Member Countries encouraged to participate.

III. STATISTICS AND SAMPLING (APP. III)

1. Participation in CWP

It was agreed that ICNAF participants to the Eight Session of CWP to be held in Paris in September should be the Assistant Executive Secretary, the Chairman of the Statistics and Sampling Subcommittee and one delegate and one observer from the USA.

2. Advance Monthly Statistics for Selected Species

It is important to have advance statistics for assessment purposes as early as possible before the Annual Meeting, and STACRES

recommends (2)

i) that countries be requested to compile preliminary monthly catch statistics for selected species in 1974 and forward the tables by Airmail to reach the Secretariat not later than 31 March 1975, and

ii) that the Secretariat compile the received statistics and circulate tables to assessment scientists as soon as possible after the deadline date.

3. Statistics of Industrial Fish

It was agreed that catches of industrial fish continue to be contained within nominal catch figures. However, in view of the usefulness of information on this subject, STACRES

recommends (3)

that National Research Reports should include any available information regarding quantities of fish, by species if possible, being used for industrial purposes.

4. ICNAF List of Vessels

It is proposed to issue amendments to the List of Vessels annually as a Summary Document, with a view to publishing the complete list every third year. STACRES

recommends (4)

that the ICNAF List of Vessels should be published for 1974 using the 1971 format. In future, national offices should be asked to amend annually their previous years' contribution to the List of Vessels, a copy of which will be sent to them by the Secretariat for this purpose.

5. Establishment of New Statistical Area

It was agreed that a new statistical area should be established in the Davis Strait area south of the Greenland-Canada Ridge and outside the Convention Area, and that this new statistical area would be named the "Baffin Island Area" and coded "0" (zero). STACRES therefore

recommends (5)

that a new statistical area be established with the marine boundary commencing on the east coast of Baffin Island at 66°15' latitude and running due east to the meridian 59°00'W; thence due south to latitude 61°00'N; thence due west to the meridian 65°00'W; thence in a northwesterly direction along a rhumb line to meet the southeast coast of Baffin Island at East Bluff (61°55'N, 66°20'W).

6. Requirements for Sampling Data

At the January 1974 Meeting STACRES recommended that all countries be requested to provide sampling data for 1973 pertinent to the 1973 catches of species for which TACs would be considered at the 1974 Annual Meeting. While advance reporting of sampling data as requested had been nearly complete, full use of these data had not been possible due to delay in obtaining preliminary catch statistics for 1973. Since advance reporting of sampling data was nevertheless highly valuable, STACRES

recommends (6)

that sampling data for species for which TACs are to be considered at the Annual Meeting in any year be airmailed to the ICNAF Secretariat to arrive not later than 31 March in that year.

7. Sampling Yearbook

The Sampling Yearbook series has played a fundamental role in the establishment of ICNAF sampling schemes. However, in view of the amount of work involved in issuing the Sampling Yearbook and the need to circulate requested data more quickly, STACRES

recommends (8)

i) that the issuing of Sampling Yearbooks be discontinued,

ii) that an annual list of commercial and research samples available for that year be incorporated in Redbook (Part I), and

iii) that the Secretariat supply the sampling data available, upon request, to Member Countries..

IV. DATA BASE IMPROVEMENTS (APP. IV)

The Special Working Group on ICNAF Data Base Improvements was organized at the 1973 Annual Meeting to consider a finer breakdown of catch and effort statistics, studies of sampling methods and bias, and expanded processing activities within the Secretariat. The Group met in January and May 1974.

1. Catch and Effort Statistics

It was noted that in many countries catch and effort data were already being worked in finer detail than that required for reporting to ICNAF. There was a consensus that for some fisheries more detailed data were required than the month by division reporting now in effect, and this was especially true in the southern subareas. A desirable degree of improvement in the accuracy of assessment and monitoring would be achieved if a more detailed statistical reporting system were generally adopted. STACRES

recommends (9)

that the Commission adopt a statistical reporting system based on 30 x 30 minute areas and twice-monthly time periods.

The time periods and areas proposed would be adjusted as necessary to be complete subsets of the present month and division strata. The STATLANT system would be changed only to the extent that

a) the STATLANT 21B forms would be changed to indicate the new time periods and areas, and

b) the Secretariat would process the more detailed data to arrive at the present Statistical Bulletin format, but would produce working reports in finer detail as required by STACRES. It was agreed FAO should assume the responsibility of distribution of the new STATLANT 21B forms and accompanying instructions.

The initial year for new reports could be set by the Commission after consideration of advice from Member Countries concerning their ability to adopt this system. The system could be phased in on the basis of subarea, e.g. Subarea 5 and Statistical Area 6 only in the first year, Subarea 4 in the second year and other subareas in later years as required. Necessary annual costs to the Secretariat would be about $70,000.00 (1974 Canadian dollars) to fully implement this system. This is an approximate total and depends to some extent on the Commission's implementation of increased funding currently requested. These additional costs would also be phased depending on the rapidity of implementation of the system.

2. Sampling

Statistical studies presented at this meeting provided valuable insights into the problem of bias and errors in sampling, and STACRES

recommends (10)

that statistical studies outlined in Summ.Doc. 74/8 be completed and reported to the next Annual Meeting and that the detailed data used be appended to such reports.

The studies available were not sufficient to provide precise advice on sampling requirements with regard to numbers sampled. However, the present ICNAF minimum sampling requirement was reviewed, and STACRES

recommends (11)

that an ICNAF sampling requirement should be specified at one sample per 1,000 tons of fish caught for each division, quarter of year, and gear. As an approximate guideline, such samples should consist of 200 fish from the entire length range for length composition and one fish per centimetre length group for age composition.

It was suggested that submission of individual length samples to the Secretariat for processing would be more useful than submission of adjusted data. It was agreed that a pilot project using individual samples in assessment of some major stocks would be valuable. STACRES therefore

recommends (12)

that individual length and age samples be submitted to the Secretariat for the years 1972 and 1973 for silver hake in Subareas 4 and 5 and Statistical Area 6, mackerel in Subareas 3-5 and Statistical Area 6, and cod in Div. 2J-3KL.

3. Future Work

STACRES noted that the Working Group still had some outstanding matters to be dealt with following the Annual Meeting, and agreed that these matters be pursued as follows:

a) all matters relevant to sampling will be considered by the Statistics and Sampling Subcommittee, and

b) all matters relevant to statistical studies, i.e. Georges Bank Pilot Study, will be considered by the new *ad hoc* Working Group on Fishing Effort Studies (see Other Matters, page 75).

V. ENVIRONMENTAL (APP. V)

1. Special Symposium on Environmental Conditions in the Grand Bank Area in 1972

Eleven papers were reviewed at the Symposium, which was held at the Bedford Institute of Oceanography on 20 May 1974. While 1972 was indicated as an unusually cold year in the Grand Bank area, associated with above-average transport of the Labrador Current, there was also evidence that the Atlantic Current was equal to or slightly above normal. Effects of these anomalous conditions on distribution and abundance of plankton and fish species were discussed. In view of the extensive coverage, and general consensus on conditions in 1972, STACRES

recommends (13)

that the papers presented at the Symposium on Environmental Conditions in the Grand Bank Area in 1972 be published in the ICNAF Special Publication series, together with significant points raised in discussion.

The volume would be edited by Mr H.W. Hill (UK), in collaboration with the Executive Secretary.

2. Environmental Conditions in 1973

At West Greenland the cold conditions prevalent since 1969 have persisted in late winter and spring, with some warming in the upper layers in summer and autumn. However, a 5-year running mean of sea surface temperature anomalies shows a decrease to the same low level of the 1900-1920 period. On the Labrador Shelf temperatures in the intermediate layers and deep slope water were unusually low. Over the western Grand Bank conditions were colder than at any time in the past 20 years.

3. Oceanographic Data

The former Canadian Oceanographic Data Centre (now renamed Marine Environmental Data Service) reported that initiatives now underway within that organization will facilitate the development of ICNAF-related data acquisition and data processing requirements.

4. Continuous Plankton Recorder Program

A paper was presented on behalf of the Institute of Marine Environmental Research, UK. STACRES is pleased to note the continuation of this program in the ICNAF Area and to acknowledge the reporting of results, which is now established as an annual feature.

5. Ice Conditions, Weather and Ice Reporting

STACRES wishes to draw the attention of the Commission to a recommendation made in 1973, which so far has had little response from Member Countries, and therefore

recommends (14)

that the Executive Secretary write to Member Countries, drawing their attention to the Commission's request of 1973 that fishing vessels operating off Greenland and Canada be encouraged to provide at least one weather report daily to coastal maritime radio stations when ice is in the vicinity.

It was noted that editing of papers on ice dynamics, presented at the 1973 Annual Meeting, was near completion.

6. Remote Sensing

A presentation on this subject was given by Mr P. Vandall of the Bedford Institute of Oceanography. Sensors mounted in aircraft and satellites have potential application for fish location, and some examples for tuna, menhaden and shrimp were reviewed.

7. IOC Resolution on Coordination of North Atlantic Oceanographic Investigations

STACRES endorsed the Environmental Subcommittee's conclusion that existing mechanisms for exchange of information between ICNAF, ICES and IOC were adequate for the present.

8. Coordinated Environmental Studies

A US proposal for an expanded ICNAF program of coordinated environmental research was discussed in some detail. The need for an expanded program and for better integration of existing data was agreed. However, there was no clear view of the optimum mix or level of effort needed for physical versus biological studies, or the best balance between widespread large-scale studies and intensive smaller-scale studies. STACRES endorsed the Environmental Subcommittee's conclusion that there is a need to

a) review the physical environmental research programs and the available data base in the ICNAF Area, and prepare a generalized circulation model based on current state of knowledge of major features of circulation and their driving forces;

b) establish a standard ICNAF data format for physical environmental data, and develop a plan for pooling such data from all Member Countries on an annual basis, through the Marine Environmental Data Service;

c) formulate hypotheses on environmental factors controlling fish production for selected regions within the ICNAF Area, in relation to the generalized circulation models; and

d) have a coordinated input from chemical, biological and physical oceanographers, as well as fisheries biologists, in order to deal effectively with such complex phenomena.

STACRES accordingly

recommends (15)

i) that an Environmental Working Group be established to prepare a comprehensive plan for coordinated environmental research in the ICNAF Area with the following terms of reference: "to suggest a proposal aimed at determining the factors involved in the production of good and poor year-classes in some of the main fisheries of the ICNAF Area";

ii) that work should begin urgently by correspondence and that the Working Group should meet in Copenhagen at the time of the next ICES meeting in early October; and

iii) that the Working Group incorporate the membership and duties of the two ad hoc Working Groups on Standardization of Hydrographic Sections (as indicated in Recommendation 17, Redbook 1973, Part I, p. 120).

It was agreed that Mr E.J. Sandeman (Canada) would act as Chairman of the Working Group.

VI. GEAR AND SELECTIVITY (APP. VI)

1. Uniform Minimum Mesh Size for Trawl Nets

STACRES considered the implications of the Canadian proposal (Comm.Doc. 74/18) regarding a uniform minimum mesh size for species subject to mesh regulations for trawl nets. It was recognized that the objective of the existing differentials is to attain uniform selectivity in fisheries pursued with materials having different selective properties. Results of selectivity experiments in the ICNAF Area indicate that polyamide nets have a higher selectivity than those of other synthetic materials (polyethylene and polypropylene) currently in use. Owing to the large number of factors affecting selectivity under commercial fishing conditions, the extent to which adoption of a uniform minimum mesh size would affect the attainment of uniform selectivity is uncertain.

Possible uniform minimum mesh sizes appear to be: 120, 125 and 130 mm. Adoption of either of these would alter the mean selection length (ℓ_c) for the Northwest Atlantic fisheries as a whole. An increase to a minimum mesh size of 130 mm for polyamides would increase the ℓ_c for nets made of this material by 8 to 10%. Similarly a decrease in the minimum mesh size of other synthetic materials to 120 mm would decrease the ℓ_c for nets made of these materials by 7-8%.

STACRES wishes to emphasize the continuing need to regulate the mean selection length (ℓ_c) for the regulated fisheries despite the adoption of other management measures (TACs) in recent years. It was noted that there have been indications of a decrease in ℓ_c for some demersal stocks in the Northwest Atlantic recently despite existing mesh regulations.

With respect to the Canadian proposal to eliminate existing differences between subareas in minimum mesh sizes for parts of the net other than the codend, it was noted that, since mesh selection takes place primarily in the codend, any change in mesh size in the forward parts of the net would have virtually no effect on overall selectivity.

VII. ICES/ICNAF JOINT WORKING PARTY ON NORTH ATLANTIC SALMON

The Report of the Meeting of the Working Party on North Atlantic Salmon (Summ.Doc. 74/17), held at Copenhagen in March 1974, was presented by its convener, Mr B.B. Parrish. Items of special relevance to ICNAF are summarized below.

1. West Greenland Fishery

Provisional statistics presented to the Working Party indicated a total West Greenland catch of 2,335 tons in 1973. This was 295 tons greater than in 1972 but 354 tons less than in 1971. The total catch comprised 1,574 tons taken by the fishery by Greenlandic vessels and 761 tons by the offshore drift-net fishery by Norwegian (212 tons), Faroes (164 tons) and Danish (385 tons) vessels. [Statistics subsequently reported by countries to the Commission (Summ.Doc. 74/38) indicate slightly higher catches for the Greenlandic fishery (1,585 tons) and Faroes drift-net fisheries (171 tons) than those given by the Working Party.] The increase in total catch in 1973 over 1972 was due mainly to a higher Greenlandic catch, the catch by the other fleets being approximately the same in the two years.

2. Length and Age Composition

The results of detailed length and age analyses of samples taken during the International Tagging Experiment in 1972 showed that, as in previous years, over 90% of the exploited stock at West Greenland in that year consisted of one sea-winter fish which, if surviving and returning to home water, would do so as two- or more sea-winter salmon. Although age analyses have not yet been made for material collected in 1973, length composition data suggest that the age composition of the exploited stock was similar to that in 1972 and previously. These results provide further confirmation of the conclusion that the direct effects of the West Greenland fishery on home-water stocks and fisheries will be confined to this two- or more sea-winter component.

3. Origin of Salmon at West Greenland

Further information was presented on the countries of origin of salmon in the West Greenland stock. Recaptures in home waters of salmon tagged at West Greenland in the International Tagging Experiment and further results of biochemical studies of blood serum proteins and analysis of scale characteristics indicated that the relative proportions of North American (mainly Canadian) and European (mainly British Isles) salmon in the exploited stock probably vary considerably from year to year. They suggest that in the years 1970-1972 the proportions of North American salmon probably ranged between 20-50%. Limited data for earlier years suggest that before 1970 the proportion may have been higher than 50%. It is

not known whether this change in proportions was due to a decrease in the abundance of North American salmon or to an increase in European salmon in the exploited stock.

4. Assessment of Effects of West Greenland Fishery on Home-Water Stocks

New assessments of the effects of the West Greenland fishery on home-water stocks and catches were made using the recapture data from the International Tagging Experiment. This gave a best estimate of the exploitation rate by the West Greenland fishery (i.e., the proportion of the salmon population present at the beginning of the season caught by the fishery) of 33%. The results of a simulation study using West Greenland exploitation rates around this value and a range of values of other parameters (i.e., growth and natural mortality rate between West Greenland and home waters, exploitation rate in home waters and the proportion of one-sea-winter salmon occurring outside the West Greenland area) indicated that the natural mortality rate between West Greenland and home waters probably lies in the range 15-40%. These values were used to provide revised upper and lower estimates of the direct effects of the West Greenland fishery on home-water stocks and catches. The results indicate that each 100 tons of catch at West Greenland results in a loss to the home-water stocks and catches for all countries combined of between 90-128 tons and 54-74 tons respectively. Thus, for a West Greenland catch of 2,000 tons, the approximate level of recent years, the losses to the stocks and catches amount to between 1,800-2,550 and 1,080-1,530 tons respectively. This range of losses is considerably narrower than that estimated previously.

The allocation of the losses between North American and European home-water stocks and fisheries will vary from year to year according to changes in their relative proportions in the exploited stock at West Greenland. In 1972 the estimated proportion of North American salmon in the stock probably lay in the range 20-35%, giving estimated losses to North American and European home-water catches from the West Greenland catch of 2,040 tons in that year of between 220-546 tons and 715-1,248 tons respectively. As pointed out in previous reports, these estimates refer to the immediate direct effects of the West Greenland fishery on home-water stocks and catches. They take no account of the possible longer-term effects on smolt production and recruitment through decreases in spawning stock size. Although, as previously reported, large decreases in spawning stock size and smolt production have taken place in recent years in some river systems, especially in Canada, which might be due in part to the West Greenland fishery, too few data are available on these parameters in other river systems for these longer-term effects to be assessed for the home-water stocks as a whole.

5. Home-Water Fisheries

Provisional catch statistics for the home-water salmon fisheries indicate that the catches of salmon and grilse combined was appreciably greater in 1973 than in 1972 in the main salmon producing countries. In most countries for which grilse and salmon catch data are reported separately, the catches of both components was higher in 1973, but the increase in the salmon component was particularly marked in Canada, Scotland and Norway.

6. Future Work

STACRES noted with approval the Working Party's plans to prepare a detailed scientific report on the 1972 West Greenland Tagging Experiment and associated studies, for publication as a special volume of the ICES *Rapports et Procès Verbaux*. STACRES was pleased to acknowledge the excellent cooperation of the commercial drift-net fishermen whose boats were used in the Experiment. It also endorsed the Working Party's recommendations regarding future research priorities relating to its assessment work.

While the scientific effort at Greenland has declined following the large tagging experiment in 1972, work on stock identification and distribution in continuing. STACRES requested that reports of this research be made available for review at later meetings of ICNAF.

VIII. COLLABORATION WITH OTHER ORGANIZATIONS

1. STACRES noted that the ICES/FAO/ICNAF Symposium on Acoustic Methods in Fisheries Research was held in Bergen, Norway, on 15-22 June 1973, and that ICNAF was represented by Mr K.A. Smith (Woods Hole, USA). ICNAF has committed financial support toward the cost of publication of the papers, which will appear in a volume of ICES *Rapports et Procès Verbaux*. It was noted that editing of the papers is well in hand.

2. STACRES took note of Summ.Doc. 74/14 (Extracts from resolutions passed at the 1973 ICES Meeting relevant to the research and statistical activities of ICNAF) and Summ.Doc. 74/13 (Report of the ICES Statistics Committee for 1973). The Assistant Executive Secretary attended the 61st Statutory Meeting of ICES at Lisbon, Portugal, in October 1973.

3. STACRES noted with appreciation the continuing interest of FAO in ICNAF activities by the active participation of FAO observers (Mr E. Cadima and Mr L. Butler) in the work of STACRES and its Subcommittees.

4. STACRES welcomed the Assistant Executive Secretary of ICSEAF (Dr B. Draganik) as an observer at its meetings, noting that ICSEAF is now a member of the CWP.

5. STACRES noted that ICES will be meeting at Montreal, Canada, in 1975, and suggested that scientists should use the occasion to collaborate on scientific matters of general interest to ICNAF and ICES at that meeting.

IX. STEERING AND PUBLICATIONS (APP. VII)

1. Organization of STACRES

Organization and operation of STACRES was reviewed. The only change suggested was the formation of a Biological Surveys Subcommittee, to incorporate the functions of the Working Group on Coordinated Groundfish Surveys, as well as other biological survey data.

2. Review of Publications

It was agreed that Redbook, Part II and Part III should be discontinued. Contents of Part II already appear as Summary Documents, while selected papers which formerly appeared in Part III should appear instead in the Research Bulletin, depending on their quality and content. The 1974 Research Documents were reviewed and 13 papers were recommended for publication in the Research Bulletin, subject to appropriate revision, refereeing and editing. It was noted that a bibliography of ICNAF scientific papers was in preparation by the Secretariat, and it was agreed that the Research Document and Summary Document series should be included in this bibliography.

3. Anniversary Publication

The Executive Secretary was requested to seek a volunteer to prepare a paper on the Commission's role in scientific investigation and management of fisheries in the Northwest Atlantic to mark the Commission's 25th year (1975). The paper would appear in the Research Bulletin.

X. OTHER MATTERS

1. Reporting of Tag Releases

Following the Fish Marking Symposium held at Woods Hole, USA, in 1961, STACRES recommended that details of tagging experiments conducted in the ICNAF Area be circulated to Member Countries, and at the 1962 Annual Meeting adopted the design for a postcard to be used by Member Countries for reporting tag releases to ICNAF. The system operated quite successfully for several years but the reporting to the Secretariat tapered off in the late 1960's. It was generally agreed that the system should be revitalized, and STACRES accordingly

recommends (18)

i) that Member Countries be requested to report promptly to the Secretariat details of tag releases in the Northwest Atlantic; and

ii) that the Secretariat promptly circulate the information to all Member Countries, and collate the information annually in a Summary Document for presentation to the Annual Meeting.

2. *Ad hoc* Working Group on Fishing Effort Studies

Noting the recommendation of STACREM that future technical studies relevant to the effort limitation concept should be continued under STACRES (*1974 Annu. Meet. Proc. 5*, para. 4), STACRES agreed to set up an *ad hoc* Working Group on Fishing Effort Studies with Mr R.C. Hennemuth (USA) as Convener.

XI. FUTURE MEETINGS

1. STACRES agreed that a mid-term meeting to consider the capelin stocks in Subareas 2 and 3 could only be arranged after the Commission's decision to hold a Special Meeting for this purpose is made known.

2. Noting that the deadline for the receipt of 1974 biostatistical data is 31 March 1975, considering the need to have the results of the stock assessments available for study prior to the Annual Meeting, and recognizing the necessity to meet at a place where computer facilities are readily available, STACRES agreed to meet during the second and third weeks of April 1975 (starting on Tuesday, 8 April) at Woods Hole, USA. This meeting would involve the work of the Assessments Subcommittee and related matters of the Biological Surveys Subcommittee.

3. STACRES agreed to meet during the week preceding the 1974 Annual Meeting of the Commission to consider all other matters not directly related to assessments.

XII. OFFICERS FOR 1974/75

1. Chairmen of STACRES and its Subcommittees were elected (or re-elected) as follows:

STACRES	- Dr A.W. May, Canada (re-elected)
Assessments Subcommittee	- Mr D.J. Garrod, UK (re-elected)
Statistics and Sampling Subcommittee	- Mr Sv.Aa. Horsted, Denmark (re-elected)
Environmental Subcommittee	- Mr H.W. Hill, UK (re-elected)
Biological Surveys Subcommittee	- Dr J. Messtorff, Fed.Rep. Germany (elected)

2. Members of the Steering and Publications Subcommittee were confirmed as follows:

Canada	- Mr S.N. Tibbo
Denmark, Fed.Rep. Germany, UK	- Mr Sv.Aa. Horsted (Denmark)
France, Portugal, Spain	- Mr R.H. Letaconnoux (France)
Iceland, Italy, Japan, Norway	- Mr Ø. Ulltang (Norway)
Bulgaria, German Dem.Rep., Poland, Romania, USSR	- Dr A.S. Bogdanov (USSR)
USA	- Mr R.C. Hennemuth
Ex officio Chairman	- Chairman of STACRES

XIII. APPRECIATION

The Chairman expressed his appreciation for the excellent work of participants during this Annual Meeting of STACRES, and adjourned the final session at 1045 hours on 13 June 1974.

CONDOLENCES

STACRES was informed of the recent deaths of two scientists who have for many years participated in research activities pertinent to ICNAF. A moment of silence was observed in memory of Mr J. Morice (Director of CRIP, ISTPM, St. Pierre and Miquelon) and Dr K. Schubert (Institute for Sea Fisheries, Hamburg, Federal Republic of Germany).

APPENDIX I - REPORT OF ASSESSMENTS SUBCOMMITTEE

Chairman: D. J. Garrod

The Subcommittee met at Dartmouth, Canada, on 22-27 May during the 1974 Annual Meeting of STACRES. Its task was to review all assessments of marine fish resources in the ICNAF Area and to recommend TAC levels for 1975. The results of these assessments are summarized by subarea, grouped in relation to the anticipated consideration of the Panels. The detailed report of the Herring Working Group is at Annex 1 and the *ad hoc* Mackerel Working Group at Annex 2.

The assessments themselves fall in one of four categories, *viz*

(1) analytical models based on detailed analysis of the age structure of a stock over time,
(2) production models where stock size as a whole is known but the age composition data are not available (these models incorporate to some degree trends in recruitment and interaction with other species that have been observed over time),
(3) general biological information, and
(4) catch statistics alone.

The type of assessment available is indicated in the summary tables for each subarea. In framing the advice the Subcommittee has kept in mind the general desirability of maintaining TAC levels that have already been agreed except where there is clear evidence that an adjustment is desirable for conservation reasons. In some instances where previous advice was based on average catch levels, and where the Commission reached agreement at a slightly different level but still in conformity with the advice, then the Subcommittee has adjusted its previous advice to conform to the already agreed level except where there is evidence that this is contrary to the biological objective of management. Of 54 TACs which have been reviewed, 35 are recommended to remain at the same level and four have been increased.

GENERAL FISHERY TRENDS (Table 1)

Table 1. Nominal catches (000 tons) in 1972 and 1973. (The symbol + indicates less than 500 tons.)

Species	SA 1		SA 2		SA 3		SA 4		SA 5		SA 6		Total	
	1972	1973	1972	1973	1972	1973	1972	1973	1972	1973	1972	1973	1972	1973
Cod	111	63	163	59	524	462	209	188	32	35	+	+	1039	808
Haddock	+	+	+	+	4	2	18	18	7	6	+	+	29	26
Redfish	3	3	10	12	124	111	131	170	19	17	+	+	286	313
Silver hake	-	-	-	-	+	-	114	299	107	120	8	12	230	431
Red hake	-	-	-	-	-	+	1	2	60	50	16	17	78	69
Pollock	+	+	+	+	1	+	20	30	13	13	+	+	34	44
Flounders	4	9	19	18	157	155	43	48	49	41	13	11	285	282
Other groundfish	7	10	5	8	33	23	24	33	22	32	12	9	103	115
Herring	+	+	1	+	52	17	259	233	221	220	16	14	549	485
Mackerel	-	-	-	+	2	3	21	36	201	315	187	66	410	420
Other pelagics	-	-	-	-	-	+	+	1	15	42	328	312	344	355
Other fish	4	6	21	62	60	217	33	36	85	51	41	50	245	422
Shellfish, etc.	10	10	-	+	2	4	38	46	108	121	416	265[1]	575	446[1]
All Species	139	101	220	160	958	994	911	1139	939	1063	1038	757[1]	4205	4216[1]

[1] Editorial note: After the compilation of 1973 provisional nominal catches in Summ.Doc. 74/38, an additional 196,000 tons of oysters were reported from Statistical Area 6 (see Summ.Doc. 74/38, revised 5 July 1974).

The total nominal catch of all finfish and shellfish remained steady at about 4.2 million tons (Table 1), with reductions in SA 1, 2 and 6 being offset by gains in SA 3, 4 and 5*. The changes in SA 1 and 2 reflect a continuing decline in the cod fishery in SA 1 and the effect of severe ice conditions in SA 2, which, when added to the smaller reductions in SA 3 and 4 add up to a reduction of 230,000 tons in the cod catch of the ICNAF Area as a whole. Nominal catches of silver hake increased, particularly in SA 4, but the catches of all other groundfish species remained fairly stable. Herring catches declined, but mackerel catches, which were regulated for the first time in part of the ICNAF Area in 1973, remained at the same level as in 1972. A significant increase occurred in the other fish category following the development of the capelin fishery in SA 3 during 1973.

SUBAREA 1

1. Fishery Trends

The total nominal catch of all species declined by about 34,000 tons to 101,000 tons in 1973, the lowest catch so far reported in ICNAF statistics for the Subarea. The decrease is due largely to a further drastic reduction in the cod catch from 111,000 tons in 1972 to 63,000 tons in 1973, a decrease which was far from being counterbalanced by increases in the catches of some other species.

Cod which formerly accounted for more than 90% of the total catch now accounts for only 60%. Shrimp catches have increased and are now the most important after cod with 13% of the total catch.

Total effort as well as catch-per-unit-effort in the cod fisheries by trawl has dropped further from the low 1972 level.

2. Species Review

Table 2 contains a summary of recent catches and TACs as well as the TACs recommended for 1975 for the stocks under consideration for management in SA 1.

Table 2. Subarea 1: summary of nominal catches (1966-73) and TACs (1973-75) by species and stock area.

Species	Stock area	MSY	Nominal catches (000 tons)				TACs (000 tons)[2]			Assessment category
			1966-70	1971	1972	1973[1]	1973	1974	1975	
Cod	SA 1	300	304	121	111	63	- (102)	107[3] (80)	(55)	1
G. halibut	1+BI[4]		2	4	14	10	-	-		
RN grenadier	1+BI[4]		2	8	8	5	-	-		

1 Preliminary statistics from Sum.Doc. 74/7 (revised).
2 Quantities in parentheses are TACs recommended by scientific advisers.
3 Includes 12,000 tons outside the Convention Area.
4 BI = Baffin Island area to west of Subarea 1.

a) Cod in Subarea 1 (Res.Doc. 74/86)

Since 1968 when the nominal catch of cod in SA 1 was close to 400,000 tons, catches have declined drastically to 111,000 tons in 1972; provisional figures for 1973 show a further steep decline to about 63,000 tons or only 20% of what was considered to be the MSY under the environmental and recruitment conditions prevailing in the 1950's and 1960's. This general decline is due promarily to the reduced stock size composed of many successive poor year-classes occurring since 1964, the only exception being the 1968 year-class which is of moderate size. The increasingly poor prospects for the fishery in the area has also resulted in a considerable decrease in most countries' fishing activity. This decreasing activity has, however, not been followed by a correspondingly great decrease in fishing mortality because trawl fishing has tended to concentrate in the best season, and probably also because the increasing gillnet fishery exploiting mainly large fish has meant that fishing mortality on older age-groups has been maintained at a relatively high level.

From 1972 to 1973 catch per effort seems to have decreased for most countries (Fed.Rep. Germany trawlers by about 30%, Norwegian trawlers by 37%, Greenland trawlers by 22%). All countries except Denmark (G) seem to have decreased their effort considerably in 1973, and, since there is no present indication [with the exception of Denmark (G)] of significantly increased activity in 1974, it does not seem likely that the 1974 catch will exceed the recommended TAC of 80,000 tons for 1974 (nor, of course, the TAC of 107,000 tons set by the Commission for 1973).

* Subareas 1 to 5 and Statistical Area 6 are hereinafter referred to in the text as SA 1 to 6.

Although under the present conditions fishing tends to be less attractive than in former years, the Subcommittee points out that under special circumstances, for example, if the 1968 year-class concentrates in accessible spawning schools in 1975 and following years which seems likely, a high input of concentrated effort may well lead to a fishing mortality rate on the spawning stock close to or above that providing the MSY[1].

The catch level in 1975 corresponding to $F_{0.1}$[2] is difficult to estimate at present because of some uncertainty as to the fishing mortality rate generated in 1973 as well as some uncertainty of the actual size of the newly recruited year-classes of 1968 and 1969 and year-classes to recruit in 1974 and onwards. Presuming that F in 1973 remained at the 1972 level, then the catch in 1975 corresponding to the $F_{0.1}$ level is estimated to be about 55,000 tons as compared with a nominal catch of 63,000 tons in 1973.

The Subcommittee, however, points out that the stock in the mid 1970's will consist to a very great extent of the 1968 year-class. After that time spawning stock is expected to decrease further because of the poor 1969-72 year-classes, possibly to a level where the stock/recruitment relationship becomes a critical factor, if this is not already so. Considering at the same time the great year-class fluctuations in this stock resulting from fluctuations in environmental conditions, the Subcommittee feels that, in order to ensure as far as possible a high enough spawning potential to produce a good year-class should environmental conditions be favourable in one of the years to come, fishing should be kept at the lowest practical level. This advice is, of course, based on the hope that an environmentally good year will occur while the spawning stock is not reduced considerably below its present size. The Subcommittee, however, is not in a position to give any advice on the probability of such a good year occurring in the near future.

Spawning stock size (biomass) which by 1968 was about 400,000 tons will inevitably decrease in the long term. By 1973 it is expected to be about 90,000 tons. It may increase temporarily in 1975-76 due to the maturation of the 1968 year-class but thereafter it will decrease further, the reduction in the spawning stock corresponding closely to the catch taken.

Spawning schools off East Greenland do to some extent supply recruits to the SA 1 stock; in some years even the major part of the recruits originate from spawning off East Greenland (e.g. the 1963 year-class). The 1968 year-class and therefore the spawning stock in the mid 1970's could be expected to spawn off East Greenland as well as off Southwest Greenland. The matter of managing the SA 1 cod fishery so as to take stock/recruitment relationship into account involves therefore, not only the fishery within the Subarea but also the fishery at East Greenland (in the NEAFC Area).

b) Greenland Halibut in Subarea 1

(See under Subarea 2, page 82.)

c) Roundnose Grenadier in Subarea 1

(See under Subarea 2, page 82.)

SUBAREA 2

1. Fishery Trends

Provisional statistics for 1973 indicate that the cod catch in SA 2 declined further from 163,500 tons in 1972 to 59,100 tons in 1973. This was caused by very severe ice conditions in the area causing the vessels to leave SA 2 earlier than before. Scarcely any cod were taken in Div. 2G and 2H and almost the entire SA 2 cod catch was taken in Div. 2J (58,900 tons compared to 150,000 tons in 1972). The cod catch in the small boat inshore fishery was 4,600 tons compared with 1,700 tons in 1972.

The redfish catch increased somewhat from 9,500 tons in 1972 to 11,500 tons in 1973. The catch of flounders remained approximately the same. The catch of other groundfish, mainly roundnose grenadier, increased from 5,400 tons in 1972 to 8,400 tons in 1973. The increase in the catch of other fish from 21,800 tons in 1972 to 62,500 tons in 1973 was due almost entirely to the increase in catches from the developing capelin fishery, which produced 59,800 tons in 1973 compared to 17,800 tons in 1972.

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[1] Maximum sustainable yield per recruit. Corresponding fishing mortality rate is F_{max}.

[2] $F_{0.1}$ is the value of fishing mortality rate at which the marginal yield per recruit is 10% of the catch-per-recruit-per-unit mortality in a very lightly exploited stock (*Redbook* 1972, Part I, p. 41 and *Redbook* 1973, Part I, p. 74).

2. Species Review

Table 3 contains a summary of recent catches and TACs as well as the TACs recommended for 1975 for stocks under consideration for management in SA 2 and also for those stock which extend into SA 3.

Table 3. Subarea 2 (and Subarea 3 for overlapping stocks): summary of nominal catches (1966-73) and TACs (1973-75) by species and stock area.

Species	Stock area	MSY	Nominal catches (000 tons) 1966-70	1971	1972	1973[1]	TACs (000 tons)[2] 1973	1974	1975	Assessment category
Cod	2GH	30	62	13	14	+	-	20.0[3](20)	(20)	1
Cod	2J+3KL	550	657	432	458	354	665.5 (650)	656.7[4](650)	(550)	1
Redfish	2+3K		25	19	20	39	-	30.0 (25)	(30)	2
A. plaice	2+3K		6	5	9	5	-	10.5[5](8)	(8)	1
Witch	2J+3KL		10	16	17	24	-	22.0[5](17)	(17)	1
G. halibut	2+3KL		30	25	30	29	-	40.0[6](30)	(40)	4
RN grenadier	2+3		22	75	24	18	-	32.0 (30)	(32)	1
Capelin	2+3K		1	+	46	136	-	110.0 (250)	(300)	3
Capelin	3LNOPs		2	3	25	132	-	148.0	(200)	3

[1] Preliminary statistics from Summ.Doc. 74/7 (revised).
[2] Quantities in parentheses are TACs recommended by scientific advisers.
[3] Includes 1,000 tons outside Convention Area.
[4] Includes 50,000 tons outside Convention Area.
[5] Includes 2,500 tons outside Convention Area.
[6] Includes 5,000 tons outside Convention Area.

a) Cod in Divisions 2G and 2H

The TAC advised for 1974 was based on the fact that abundance of old fish had decreased in recent years, and, although the MSY level was estimated to be 30,000 tons, the TAC was set at 20,000 tons to allow a rebuilding of the stock. No new data were available to suggest a change in this level of TAC and the TAC recommended for 1975 is 20,000 tons.

b) Cod in Divisions 2J, 3K and 3L

Consideration of 1975 TAC (Res.Doc. 74/89). Preliminary statistics indicate a catch of 354,000 tons in this area in 1973. Severe ice conditions hampered the 1973 fishery as in the preceding few years. Catches in Div. 2J were about 60% lower than in 1972, about 20% higher in Div. 3K and about 20% lower in Div. 3L.

Fishing mortality estimates derived by virtual population analysis including 1973 data show that the fishery in recent years may be taking relatively more fish of the younger ages than previously estimated. Estimation of the TAC for 1975 for this stock, as in the others, requires some expectation of the catch during 1974, and in this case the catch is expected to reach 450,000 tons. The incoming year-classes of 1969 and 1970 are estimated to be relatively poor and, added to the fact that more young cod are being caught than had been thought, the recommended catch at F_{max} in 1975 is 550,000 tons.

Advice related to Canadian proposal (Comm.Doc. 74/15; Res.Doc. 74/103, 104). ICNAF Comm.Doc. 74/15 proposes that the Commission at its 1974 Annual Meeting consider establishing a TAC for cod in Div. 2J+3KL for 1975 at a level substantially below the biological maximum sustainable yield to provide an increase in the economic yield per recruit. The Assessments Subcommittee decided to approach the problem by evaluating the effect of reduction in F on stock size assuming that increased stock size could give economic benefit.

Prior to 1960 the fishery in Div. 2J and to a large extent in Div. 3K was traditionally a small boat inshore fishery. However, in the 1960's otter trawl landings from Div. 2J rapidly increased from 39,000 tons in 1959 to 243,000 tons in 1961. Landings were 346,000 tons in 1968 and 357,000 tons in 1969. Landings have since decreased because of severe ice conditions to 148,000 tons in Div. 2J in 1972. Inshore landings in Div. 2J fluctuated between 14,800 tons and 27,700 tons in 1959-67, but decreased to 1,700 tons in 1972.

In the inshore fishery, the decrease in landings has been accompanied by a decline in the annual catch per man. In Labrador the annual catch per man has declined about 50% from the period 1959-72.

The corresponding decreases in Div. 3K and 3L were 11% and 15%. These declines have occurred during a period when larger boats and new types of fishing gear were being introduced into the inshore fisheries in an attempt to maintain productivity.

A major effect of the cod fishery in recent years in Div. 2J+3KL has been the reduction of the proportion of larger and older fish present in the stock. The number of mature fish present has declined substantially. The Labrador inshore fishery was traditionally dependent on post-spawning migration of older mature fish from Hamilton Inlet Bank. In the inshore trap fishery in Div. 2J the proportion of mature fish present in the catches and the average age have likewise declined substantially. These changes are not evident in Div. 3K but did occur in Div. 3L. In the offshore fisheries the average age of cod taken in the catches has declined in Div. 2J and 3L but has remained fairly stable in Div. 3K.

The Subcommittee therefore concluded that the development of the offshore fishery has resulted in a decrease in availability of cod to the inshore fishery, particularly in Div. 2J and to a lesser extent in Div. 3K and 3L. Additionally, the very low values of catch per man in Div. 2J in the years 1970-72 may be in part due to low water temperature prevailing in those years (see Report of Environmental Subcommittee).

The Subcommittee discussed ways in which fishing mortality might be reduced in order to achieve an increase in stock abundance. Since Comm.Doc. 74/15 suggests the closure of Hamilton Inlet Bank during the spawning season as one means of achieving this reduction, the effects of such a closure were evaluated. The effects could only be evaluated for Div. 2J as a whole since statistics are not available for Hamilton Inlet Bank *per se*.

The evidence on spawning period indicated that most of the fish had spawned by early April, and spawning was virtually complete by the end of that month. It was concluded that closure during February, March and April would cover the extent of the spawning season in Div. 2J. The effect of closure of the fishery in Div. 2J during February-April would likely result in immediate advantage to inshore fishermen in Div. 2J, since the inshore fishery is dependent on a post-spawning feeding migration to the inshore areas. However, the degree of benefit could not be quantified at present because of lack of suitable data.

After considerable discussion as to possible effects of closing the fishery in Div. 2J during February-April, it was concluded that, if the fishing effort released from such a closure was not diverted to the cod in Div. 3K and 3L but was removed completely from the stock complex, a decrease in catch in the offshore fishery in Div. 2J of 60% and in the whole of Div. 2J+3KL of 30% would result during those months, providing that the seasonal distribution of fishing remained the same as in the last five years. However, it is possible that the effort released by closing Div. 2J during the February-April period will simply be diverted to either Div. 3K or Div. 3L or both and would result in increases in fishing effort and hence mortality in these southern divisions. If this in fact took place, the reduction in catch below the 550,000 ton TAC recommended will be much less than that expected by the reduced catch in Div. 2J alone, since some of the reduction will be compensated for in the southern divisions.

The Subcommittee therefore concluded that if the catch in this stock complex is to be reduced to allow for increases in stock size, closure of Div. 2J during the spawning season will not necessarily result in a substantial reduction in catch and that any desired reduction can only be ensured by reducing the TAC directly.

Levels of TAC below 550,000 tons in 1975 would reduce fishing mortality in the stock and then could be expected to lead to long-term improvements in the stock in addition to any immediate benefit to inshore fisheries referred to earlier. These long-term improvements (5-10 years) would themselves be accompanied by some relative improvement in the catch as the fishery stablized at a new lower level of fishing mortality. The approximate magnitudes of such changes are given in Table 4.

Table 4. Effects of reduced TAC on long-term changes in MSY stock and catch for Div. 2J+3KL cod.

1975 TAC (000 tons)	1975 F	Long-term changes relative to 1975 (%)	
		% MSY Stock	% MSY Catch
550	0.35 (MSY)	100	100
471	0.30	117	99
330	0.20	173	96
172	0.10	189	82

c) Redfish in Subarea 2 and Division 3K (Res.Doc. 74/5, 54, 79)

Provisional catch statistics show a doubling of the nominal catch from 20,000 tons in 1972 to about 40,000 tons in 1973.

General production analyses indicate that this stock can sustain catches of 40,000-45,000 tons per year under equilibrium conditions but the stock is considered to be in a depressed condition at present. The 1972 catch of 20,000 tons, taken in 1,560 standard days fished, was well below the equilibrium curve as have been all catches since 1966. The 1972 catch per standard day fished (12.8 tons) was only slightly more than the 1971 catch per standard day fished of 11.7 tons and less than the 13.2 to 15.0 tons per day obtained during 1967-70.

Research surveys suggest the possibility of improved recruitment prospects over the next several years but the indications of greater numbers of relatively young fish (ages 8-11) present in 1973 research catches than in earlier years are somewhat inconclusive. The possibility of improved recruitment prospects, together with the doubling of the catch from 1972 to 1973, probably as a result of increased fishing effort directed toward these younger fish, provide reason to maintain the total allowable catch in 1975 at the level of the 1974 TAC of 30,000 tons to permit the stock to rebuild.

d) American Plaice in Subarea 2 and Division 3K (Res.Doc. 74/3, 69)

A TAC of 8,000 tons was recommended by the Subcommittee at the 1974 Mid-term Meeting, based on catch statistics only, and was established at that figure by the Commission, although this amount did not include a Canadian estimated catch of 2,500 tons outside the Convention Area. A new assessment indicates that to maintain the fishing mortality at the $F_{0.1}$ level not more than 8,000 tons annually should be removed from the total stock, including a Canadian estimated catch from outside the Convention Area.

e) Witch in Divisions 2J, 3K and 3L (Res.Doc. 74/48, 73)

Nominal catches of witch increased from about 800 tons in 1962 to 18,000 tons in 1970, and up to at least 24,000 tons in 1973. A preliminary TAC of 17,000 tons based on the recent catch levels was recommended by the Subcommittee for 1974 and established at 22,000 tons by the Commission.

A new assessment now available indicates that the average level of removals for 1963-71 of about 7,200 tons produced fishing mortalities just below the $F_{0.1}$ level. Until more current estimates of F are available, it is recommended that total removals from this stock in 1975 should not exceed 17,000 tons.

f) Greenland Halibut in Subareas 1, 2 and 3 (Comm.Doc. 74/21; Res.Doc. 74/2, 73, 84)

The possibility of a single Greenland halibut population in the Northwest Atlantic with recruitment from deep-water spawning in an area extending from the southern part of Davis Strait to off Labrador and Newfoundland was discussed. In 1972 approximately 10,000 tons of Greenland halibut were caught in the area east of Baffin Island outside the Convention Area. It was felt, while there might be a single stock for SA 1, 2 and part of 3, it would be better to partition this stock for management purposes. Therefore separate allocations should be made for (a) SA 1 including the area east of Baffin Island, and (b) SA 2 and Div. 3KL.

Subarea 1. A rough comparison of the area of the present fishery in SA 2 and 3 with ecologically similar areas in SA 1 suggest a potential catch for this area in the region of 20,000 tons. Since the 1973 catch in SA 1 was 7,500 tons, the Subcommittee considers 20,000 tons would be an appropriate initial level of catch for SA 1 and the area east of Baffin Island together, if the Commission should wish to implement a precautionary quota. There is a possibility also that the density of Greenland halibut in SA 1 may be higher than in SA 2 and Div. 3KL because of the proximity to known spawning grounds.

Subarea 2 and Divisions 3K and 3L (Res.Doc. 74/73). A TAC of 30,000 tons for 1974 proposed by the Subcommittee in January was increased to 40,000 tons by the Commission to take account of fish thought to be landed as incidental catch but not reported up to the present time. It is still not clear whether Greenland halibut are being landed as incidental catch and not reported, or whether they are being discarded at sea. It is proposed that the 40,000 tons TAC for the total stock be maintained in 1975, pending clarification of the discard/reporting practice and the provision of a more precise assessment.

g) Roundnose Grenadier in Subareas 1, 2 and 3 (Comm.Doc. 74/13; Res.Doc. 74/6)

At the Special Commission Meeting in January 1974 a precautionary quota for roundnose grenadier of 32,000 tons in SA 2 and 3 was adopted for 1974. In view of the fact that a developing fishery for

this species also takes place in the Baffin Island region outside the Convention Area, as well as in SA 1, and with regard to the possibility that the stocks in SA 1, 2 and 3 may form a joint population along the continental slope, Denmark has proposed that the fishery on roundnose grenadier within SA 1 also be regulated.

There is no evidence on the boundaries of the different stocks in this area of the Northwest Atlantic. The possibility exists that they form a single large stock but, if that is true, they would not be expected to migrate rapidly from one subarea to another, and, for practical purposes at the present time, the roundnose grenadier populations of the different areas will be regarded as separate stocks.

Subareas 2 and 3. The TAC for SA 2 + 3 is based on preliminary estimates of the sustainable yield in that part of the stock and should be maintained at the same level in 1975, i.e. 32,000 tons.

Subarea 1 and Baffin Island Area. Insufficient data are available to allow a corresponding estimate for the connecting region off Baffin Island or SA 1, and the Subcommittee can only advise that, if the Commission wishes to introduce a precautionary quota, it could be combined for both regions and set close to the level of catches in recent years (1971-73 average catch was about 6,000 tons for SA 1 and Baffin Island areas combined).

h) Capelin in Subareas 2 and 3 (Comm.Doc. 74/19; Res.Doc. 74/7, 12, 63, 76, 90)

The TAC of 250,000 tons established at the 1973 Annual Meeting was adjusted at the Mid-term Meeting and allocated in two parts to provide as nearly as possible for catches of 110,000 tons in SA 2 and Div. 3K and 148,000 tons in Div. 3LNOPs. Further evidence on the biological characteristics of these capelin resources in Div. 3LNOPs, and on the commercial catches in 1973 in that area, was available at the present meeting, together with observations on the effect of a fully developed capelin fishery on associated resources (e.g. cod and seals) and on comparisons with capelin fisheries elsewhere in the North Atlantic.

The biological data have established that the stocks in SA 3 mature at 3 to 4 years of age and suffer very heavy natural mortality after spawning. In these circumstances the greatest long-term yield would be taken by a very intensive fishery on mature capelin migrating to the spawning areas and during the spawning season. Such a fishery could be permitted to remove all except that fraction of the spawning stock necessary to ensure that future recruitment will not be impaired. This would itself ensure both the future of the capelin fishery and safeguard the continuing role of juvenile capelin in the ecosystem of the area. Development of a fishery on juvenile capelin should be avoided.

The size of such a fishery for adult capelin depends, of course, on the stock available and on the proportion which must be allowed to spawn. No new information is available to provide new estimates, but a review of the situation confirmed the opinion given last year that the potential catch of capelin throughout SA 2 and 3 could be 750,000 tons. Previous discussion had also indicated that expansion to this level should be carried out in a series of steps monitored to detect the effect on the stock, and the Subcommittee has no reason to change this advice. Since the major constraint on the proportion that may be caught is the proportion needed to ensure normal recruitment, then the expansion of the TAC should be phased to allow time for the effect of each step to be detected. This would be achieved by maintaining each new level of TAC for 3 years during which time appropriate research must be carried out to detect whether any changes in the resource should be attributed to the fishery. The view was also expressed that each step of the fishery should be substantially different from the previous one to improve the chance of detecting the effect.

Bearing in mind the view that the potential catch of capelin at the MSY level might be at least 750,000 tons, the Subcommittee concluded that the appropriate next adjustment of the TAC could be a catch of 500,000 tons, maintained for 3 years, coupled with (i) restriction of the fishery to mature capelin approaching and during the spawning season, and (ii) an undertaking that countries participating in the fishery should conduct surveys of both the adult and juvenile stock in order to monitor the effect of the fishery.

If the Commission adopts the advice to restrict the fishery to mature pre-spawning capelin, then the appropriate season for fishing would be June, July and August throughout SA 2 and 3.

The Subcommittee also considered the allocation of the catch between stock areas, so far as these are known, taking note of the development in 1974 of a fishery near the boundary between the area of allocation of the TAC for 1974. This is based on a component which is separate from the capelin that provided the fishery on the Southeast Shoal in Div. 3LNOPs in 1973. It is not yet clear how this spawning group of capelin relates to spawning groups elsewhere, or how capelin over the whole area recruit to one or other of the spawning groups. The Subcommittee therefore recognized the

existence of a new component in the fishery and considers that the existing rough estimate of allowable catch against the potential MSY should take this into account so that an appropriate split of a 500,000 tons TAC in 1975 would be 300,000 tons in SA 2 and Div. 3K and 200,000 tons in Div. 3LNOPs, noting in addition however that this would represent a very substantial rise in the 2+3K catch for which no additional data have been presented.

SUBAREA 3

1. Fishery Trends

Provisional statistics for 1973 indicate that the total groundfish catch was about 10% below the 1972 level (753,000 tons compared with 842,000 tons in 1972). The cod catch decreased by 12% from 524,000 tons in 1972 to 462,000 tons in 1973, the decline being almost solely accounted for by a decrease in the cod catch in Div. 3M (58,000 tons in 1972 compared with 22,600 tons in 1973) and Div. 3O (54,500 tons in 1972 and 34,900 tons in 1973). The haddock catch was only 2,400 tons against 3,800 tons in 1972. The redfish catch decreased somewhat from 124,000 tons in 1972 to 111,000 tons in 1973; the most marked change was in Div. 3M where the catch declined from 42,000 tons in 1972 to 22,400 tons in 1973. The flounder catch remained unchanged while the other groundfish catch decreased because of a decrease of 10,000 tons in the catch of roundnose grenadier.

The herring catch further declined from 52,000 tons in 1972 to 17,000 tons in 1973. This decrease may have been in part due to a decline in stock size, but some of it was related to extreme temperature conditions in 1973.

The total catch of other fish increased from 60,000 tons in 1972 to 217,000 tons in 1973 because of a dramatic increase in the catch of capelin in Div. 3K and 3N.

2. Species Review

Table 5 contains a summary of recent catches and TACs as well as the TACs recommended for 1975 for stocks under consideration for management in SA 3. (See Table 3, page 80, for those stocks which overlap parts of SA 2 and 3.)

Table 5. Subarea 3: summary of nominal catches (1966-73) and TACs (1973-75) by species and stock area.

Species	Stock area	MSY	Nominal catches (000 tons)				TACs (000 tons)[2]			Assessment category
			1966-70	1971	1972	1973[1]	1973	1974	1975	
Cod	3M	35	28	34	58	23	-	40.0 (35)	(40)	1
Cod	3NO	130	140	126	103	80	103.5 (70)	101.1 (85)	(85)	1
Cod	3Ps	60	66	64	44	53	70.5 (70)	70.0[3] (70)	(60)	1
Redfish	3M		4	8	42	22	-	40.0	(16)	2
Redfish	3LN		20	34	29	34	-	28.0 (20)	(20)	2
Redfish	3O		14	20	16	9	-	16.0 (15)	(16)	2
Redfish	3P		28	28	26	18	-	25.0 (23)	(25)	2
A. plaice	3M		1	1	1	1	-	2.0 (2)	(2)	4
A. plaice	3LNO		76	68	59	53	60.5 (60)	60.0 (60)	(60)	1
A. plaice	3Ps		8	7	7	15	-	11.0 (10)	(11)	4
Witch	3NO		8	15	9	7	-	10.0 (10)	(10)	4
Witch	3Ps		3	2	2	3	-	3.0 (3)	(3)	4
Yellowtail	3LNO		14	37	39	33	50.0 (50)	40.0 (40)	(35)	1
Capelin	2+3K		1	+	46	136	-	110.0 (250)	(300)	3
Capelin	3LNOPs		2	3	25	132	-	148.0 (250)	(200)	3

[1] Preliminary statistics from Summ.Doc. 74/7 (revised).
[2] Quantities in parentheses are TACs recommended by scientific advisers.
[3] Includes 20,000 tons outside Convention Area.

a) Cod in Division 3M (Res.Doc. 74/89)

The 1973 provisional catch in Div. 3M was 23,000 tons compared with 1971 and 1972 catches of 34,000 and 58,000 tons respectively.

The recommended TAC for 1974 of 35,000 tons was based on an estimate of long-term sustainable yield from virtual population analysis. Additional catch data which became available at the time of the

1973 Annual Meeting suggested that the numbers removed at age and hence stock size were underestimated in the analysis, and the TAC agreed to by the Commission was 40,000 tons. Subsequent analyses, incorporating these additional data, confirm that the MSY is in fact 40,000 tons and this is the TAC advised for 1975.

b) Cod in Divisions 3N and 3O (Res.Doc. 74/89)

The cod catch declined from 220,000 tons in 1967 to 102,000 tons in 1972. The 1973 provisional catch is 80,000 tons.

Fishing mortality estimates indicated that F in the 1960's was above F_{max} and during the period of peak catches (1967-68) was very high and remained much higher than F_{max} even after the catch had declined in 1969 and 1970. Estimates of F in 1971-72 are less certain because of lack of commercial sampling data during those years. The high fishing mortalities have resulted in a depressed stock which is very dependent on recruiting age-groups. Estimates of fishing mortalities from survey data indicate that F in 1972 was probably in the order of 0.5 but may have declined to 0.35 in 1973 with the declining catch. F_{max} for this stock is 0.2 (the lowest for any of the cod stocks), because of the growth characteristics of these cod. This essentially means that the stock should be fished at a low level of fishing mortality to obtain maximum benefit from this fast growth rate.

Commercial sampling data available in 1973 from the Spanish pair trawl fishery, which accounts for the major part of the catch in Div. 3NO, allowed for calculations of current stock size for 1973. These indicated a lower stock size in 1973 than previously estimated. Recruitment estimates indicate that the 1969-71 year-classes are poorer than the 1968 year-class. Assuming a catch in 1974 of about 80,000 tons and with recruitment to the fishery in 1974 and 1975 as predicted from surveys, fishing at F_{max} in 1975 implies a yield of 85,000 tons which is advised for 1975.

Samples of the type provided in 1973 are essential to understand the dynamics of this stock.

c) Cod in Subdivision 3Ps (Res.Doc. 74/89)

The cod catch decreased from 60,000 tons in 1971 to 46,000 tons in 1972 and provisional statistics indicate that the 1973 catch was 52,600 tons.

Previous assessments indicated fishing mortality in the 1960's to be about 0.4 to 0.5 and F values for 1969-70 were probably in this range also. Fishing mortalities are less certain for 1971-72 because of lack of offshore commercial sampling data for these years. Declines in catch in 1972 and 1973 indicated that F may have declined to 0.3 in this period. Assuming F = 0.3 in 1973, commercial sampling data from the offshore Spanish pair trawl fishery, which accounts for a major portion of the catch in the offshore area, allowed a calculation of current stock sizes in 1973. These calculations indicated lower stock sizes in 1973 than estimated previously. Recruitment estimates from survey data indicate that, although the 1971 year-class may be stronger than the 1969 and 1970 year-classes, all three year-classes are poorer than the 1968 year-class. If it is assumed that catches in 1974 will be 55,000 tons (i.e. close to the 1973 level) the yield at F_{max} (0.3) in 1975 will be 60,000 tons.

Samples of the type provided for 1973 are essential to understand the dynamics of this stock.

d) Redfish in Division 3M (Res.Doc. 74/54, 78)

At the 1973 Annual Meeting, the Commission established a precautionary catch quota for 1974 at 40,000 tons, approximately the level of catch in 1972, to prevent a further increase in fishing pressure on redfish in that area until such time as scientific information on the status of this stock became available.

A directed fishery for redfish in this area commenced in 1957 with a catch of about 32,000 tons. The catch increased to 54,000 tons in 1958, remained at about 52,000 tons in 1959 but then declined sharply to 8,000 tons in 1960. Catches remained less than 16,000 tons during 1961-64, increased to 29,000 tons in 1965 and subsequently declined to a very low level from 1966 to 1971 averaging 4,400 tons during that latter period. The catch increased dramatically from 8,000 tons in 1971 to approximately 42,000 tons in 1972 and apparently decreased again in 1973 to about 23,000 tons. Trends in fishing effort were similar to catch trends with peaks in fishing effort occurring in 1958, 1965 and 1972.

Maximum sustainable yield estimates of 13,000-17,000 tons were derived from a general production study of this stock. A yield-per-recruit analysis indicated an $F_{0.1}$ level of 0.2-0.3 and suggested that the average level of mortality during 1963-73, when catches averaged approximately 13,000 tons, may have been at or beyond $F_{0.1}$ for the average recruitment levels during this period. However,

commercial catch-per-unit-effort values point to an increase in recruitment in recent years.

The 1974 TAC of 40,000 tons appears to be considerably above the sustainable yield level for this stock. The history of the fishery indicates that it is highly unlikely that catch of this magnitude can be sustained without risking stock depletion. The Subcommittee recommends a TAC for 1975 of 16,000 tons, the level of the estimated maximum sustainable yield and approximately the level of the long-term average catch.

e) Redfish in Divisions 3L and 3N (Res.Doc. 74/54, 79)

Preliminary catch statistics indicate that the 1973 redfish catch from this stock was 34,000 tons, close to the 1971-72 average of 32,000 but considerably in excess of the estimated MSY level of 20,000 tons. The estimated 1972 fishing effort, which produced a total catch of about 29,000 tons, exceeded the level necessary to attain the MSY.

Virtually no commercial length or age data have been available for this stock since 1967, despite the increased catches of recent years, and this makes it impossible to determine the extent to which the recent increase in catches have been based upon the small redfish indicated by research surveys. It appears unlikely that catches from this stock can be sustained at either the 1971-73 level or at the 1974 TAC level of 28,000 tons. The Subcommittee therefore recommends that catches be limited to the level of the estimated MSY - 20,000 tons, until such time as adequate data become available.

f) Redfish in Division 3O (Res.Doc. 74/54, 79)

Catches from this stock declined from approximately 20,000 tons in 1971 to 16,000 tons in 1972 and preliminary statistics indicate a further decline to about 9,000 tons in 1973. The 1972 standard catch per hour of 0.83 tons was slightly above the catch rates of 1970 and 1971 but less than the 1.00 tons per hour obtained in 1969. Virtually no commercial length or age data have been available for this stock since 1968. In view of this the Subcommittee recommends that the TAC from this stock be limited to 16,000 tons, which is the level of estimated MSY, until such time as adequate data become available.

g) Redfish in Division 3P (Res.Doc. 74/54, 79)

Nominal catches of redfish from this stock have been at a relatively high level in recent years, averaging approximately 31,000 tons during 1969-72. A further assessment of this stock on the basis of a yield-per-recruit model indicates that the average level of fishing mortality during 1964-73, when catches averaged approximately 24,000 tons annually, was beyond or close to $F_{0.1}$, which suggests a sustainable yield at the $F_{0.1}$ level of less than 24,000 tons at the recruitment levels prevailing during that period. This confirms the MSY estimate of 23,000 tons derived previously from a general production study. The 1972 catch was only slightly less than that taken in 1971 (26,000 versus 27,500 tons), but according to preliminary statistics the catch declined to about 18,000 tons in 1973. Fishing effort declined from 44,000 standard hours fished in 1971 to 38,000 hours in 1972 and about 30,000 hours in 1973. Standard catch per hour fished was relatively stable from 1970 to 1973 at about 0.6-0.7 tons per hour.

Standardized commercial catch-per-unit-effort values point to an increase in redfish abundance in Div. 3P during the mid- and late-1960's. Recruitment to this stock was apparently higher during 1965-71 than during the 1959-64 period. Only about half as many redfish were caught in a 1973 research survey in this area as during a comparable survey in 1965 at the onset of the recent period of increased exploitation. Long-term prospects for the period when the 7- to 9-year-old fish dominant in 1973 research surveys will enter the fishery are for a recruitment level substantially lower than that which supported the Div. 3P fishery during 1965-73.

Since the fishery is apparently not yet exploiting these new year-classes, it is recommended that the TAC for 1975 be maintained at the level of the 1974 TAC - 25,000 tons. However, it should be noted that the prospects are for considerably diminished recruitment over the next several years and it is anticipated that the sustainable yield from this stock will be substantially less when the fishery becomes dependent upon these new year-classes.

h) American Plaice in Division 3M (Res.Doc. 74/3, 73)

A TAC of 2,000 tons, based on catch statistics, was established for 1974 at the January 1974 Special Commission Meeting. With catches remaining at a relatively low level, it is recommended that the TAC remain at the 2,000 tons level for 1975.

i) American Plaice in Divisions 3L, 3N and 3O (Res.Doc. 74/73)

Catches have declined generally from a peak of about 94,000 tons in 1967 to about 53,000 tons in 1973. A TAC of 60,000 tons was established for 1973 and again set at that level for 1974. The catch per hour appears to have stabilized since 1970; however, it should be pointed out that removals in 1973 fell short of the TAC by about 7,000 tons. The updated assessment indicates a removal level of about 47,000 tons for Div. 3LN and an additional amount of about 12,000 tons for Div. 3O; thus the 1975 TAC for Div. 3LNO as a whole should remain at the 1974 level of 60,000 tons. This assumes that recruitment will remain at the average level of the past 3 or 4 years.

j) American Plaice in Subdivision 3Ps (Res.Doc. 74/3, 73)

A TAC of 10,000 tons, based on catch statistics, was recommended by the Subcommittee and established at 11,000 tons by the Commission at the January 1974 Special Commission Meeting. No new assessment is available for this stock and the Subcommittee recommends that the 1975 TAC be maintained at the 1974 level of 11,000 tons.

k) Witch in Divisions 3N and 3O (Res.Doc. 74/73)

A TAC of 10,000 tons for 1974, based on current fishing levels, was established at the 1973 Annual Meeting. No new assessment is available for this stock, and the Subcommittee recommends that the 1974 TAC level of 10,000 tons be maintained for 1975, pending a proper assessment that will probably be available in 1975.

ℓ) Witch in Subdivision 3Ps (Res.Doc. 74/73)

A TAC of 3,000 tons for 1974, based on current fishing levels, was agreed to at the 1973 Annual Meeting. It is recommended that this TAC level be maintained for 1975.

m) Yellowtail in Divisions 3L, 3N and 3O (Res.Doc. 74/73)

A TAC of 50,000 tons for 1973 was established at the 1972 Annual Meeting, without a proper assessment but with the assumption that this stock was expanding. The 1974 TAC was set at 40,000 tons. Provisional statistics indicate a catch of 33,000 tons from this stock in 1973.

Catch-per-hour data indicate a fairly constant level in the past 2 or 3 years. However, the catch in 1973 contained a larger number of 4-, 5- and 6-year-olds than in previous years. These were mostly pre-spawning fish and made up a considerable proportion of the total numbers removed. This removal of more small fish changed the $F_{0.1}$ level from 0.7, as calculated from pre-1971 data, to 0.6. The updated assessment indicated that, if the catch in 1974 is similar to that in 1973, the TAC recommended for 1975 is 35,000 tons. However, if the total TAC of 40,000 tons is caught in 1974, this recommended TAC will result in fishing mortalities beyond $F_{0.1}$, and it must also be strongly emphasized that these predictions are based on very optimistic levels of recruitment which, if not realized, could considerably reduce the potential yield from this fishery in the immediate future.

n) Capelin in Divisions 3L, 3N, 3O and Subdivision 3Ps

(See under Subarea 2, page 83.)

SUBAREA 4

1. Fishery Trends

Preliminary statistics indicate that total catch from SA 4 increased in 1973 to 1.1 million tons from 0.9 million tons in 1972.

Silver hake catches increased 162% to 299,000 tons from 114,000 tons in 1972. Total redfish catches increased to 170,000 tons from 131,000 tons in 1972; Scotian Shelf redfish catches decreased to 40,000 tons whereas those from Div. 4RST increased substantially. Pollock and mackerel catches also increased - from 20,000 tons to 30,000 tons for pollock, and from 21,000 to 36,000 tons for mackerel. Flounder and haddock landings remained at 1972 levels (48,000 tons and 18,000 tons respectively). Herring and cod catches continued to decline, both being 10% lower in 1973. Herring catches in 1973 were 233,000 tons, with declines in all divisions except Div. 4R and Subdiv. 4Vn where some increase in catches occurred. Cod catches were 188,000 tons, the most substantial decline occurring in Div. 4T where landings declined from 42,000 tons to 26,000 tons in 1973. At least in part this was due to diversion of effort to redfish fishing.

2. Species Review

Table 6 contains a summary of recent catches and TACs, as well as the TACs recommended for 1975, for stocks under consideration for management in SA 4. Also included are stocks which overlap with SA 3 (mackerel and squids) and SA 5 (pollock).

Table 6. Subarea 4: summary of nominal catches (1966-73) and TACs (1973-75) by species and stock area.

Species	Stock area	MSY	Nominal catches (000 tons) 1966-70	1971	1972	1973[1]	TACs (000 tons)[2] 1973	1974	1975	Assessment category
Cod	4TVn(1)[3]		51	57	68	51	-	63 (70)	(50)	1
Cod	4Vn(2)[4]		9	11	9	6	-	10[5]	(10)	
Cod	4VsW		63	54	62	54	60.5 (60)	60 (60)	(60)	1
Cod	4X(offshore)		15	9	7	7	-	- (8)	(5)	1
Haddock	4VW	25	14	13	5	4	4 (0)	0 (0)	(0)	1
Haddock	4X	18	32	18	13	13	9 (0)	0 (0)	(15)	1
Redfish	4VWX		25	62	50	40	-	40 (30)	(30)	4
Silver hake	4VWX		26	129	114	299	-	100 (50-100)	(120)	1
Pollock	4VWX		17	12	20	30	50 (50)[6]	55 (50)	(55)	4
Pollock	5		9	14	13	13				
Flounders[7]	4VWX	32	32	34	24	28	-	32 (32)	(32)	4
Herring	4VW(a)		46	72	32	30	-	45 (45)	(45)	1
Herring(adult)	4XW(b)		...	70	75	91	90	90 (90)	(90)	1
Herring(total)			174	93	159	135				
Mackerel	4VWX		12	17	13	26	-	55 (-)		
Mackerel	4(+3)		17	24	22	38	-	-	(70)	4
Argentine	4VWX		6	7	6	1	-	25 (25)	(25)	3
Squids	4(+3)		3	9	2	10	-	-	(-)	3

1 Preliminary statistics from Summ.Doc. 74/7 (revised).
2 Quantities in parentheses are TACs recommended by scientific advisers.
3 4T (Jan-Dec) + 4Vn (Jan-Apr).
4 4Vn (May-Dec).
5 Includes 2,000 tons outside Convention Area.
6 TAC in 1973 pertained to 4X + 5.
7 American plaice, witch and yellowtail.

a) Cod in Subdivision 4Vn (Jan-Apr) and Division 4T (Res.Doc. 74/24, 92)

The cod stock which supports a summer fishery in Div. 4T migrates in December to deep waters along the edge of the Laurentian Channel with the major concentrations occurring in Subdiv. 4Vn. The return migration occurs during April-May. In setting a TAC for 1974 the Commission took account of this migratory pattern, applying the TAC to Div. 4T for the full year plus Subdiv. 4Vn for the period January-April inclusive.

The preliminary 1973 catch of 50,500 tons is below that of 1972 (68,000 tons). Recent catches have depended heavily on the good 1968 year-class which is comparable in strength to those of 1964 and 1965. Juvenile survey results imply that recruitment will be average through 1975, leading to a decline in relative stock abundance. Fishing mortality (F) in 1970-72 averaged 0.50 (the average catch was 64,000 tons) but declined to about 0.40 in 1973. If the 1974 TAC of 63,000 tons is taken, F will increase to 0.54 on age 5+ fish. While growth rate changes have prevented firm estimates of F_{max}, this is likely to lie between 0.40 and 0.50. To maintain F in this range implies catches around 50,000 tons in 1975.

b) Cod in Subdivision 4Vn (May-Dec) (Res.Doc. 74/24)

In the May to December period cod fisheries in Subdiv. 4Vn are based on local inshore stocks and also in part on some from the Div. 4VsW stock which moves north into Subdiv. 4Vn in summer. The preliminary estimate of the 1973 catch is approximately 6,000 tons. A TAC of 10,000 tons was set for these fisheries in 1974. No new data are available which modify the analysis on which the original recommendation was based. Thus, it is recommended that the 1975 TAC again be set at 10,000 tons.

c) Cod in Subdivision 4Vs and Division 4W

The preliminary 1973 nominal catch of 54,100 tons is lower than that of 1972 (61,600 tons). Improved sampling of commercial catches in the most recent years indicates that earlier assumptions on the age composition of unsampled catches were erroneous, considerably younger fish being taken. This raises uncertainties about the appropriateness of the previous management objective of maintaining F at 0.45 (associated with catches of 60,000 tons). It is likely that F_{max} is in fact lower and a TAC of 60,000 tons is at present too high. However, it will require several more years of improved data to adequately define an appropriate catch level. Historical catch data indicate that 60,000 tons is sustainable. Thus, assuming that recruitment will continue at past levels, a maximum of 60,000 tons is recommended for the 1975 TAC.

Continuing improvement in the sampling of this stock is urged to provide a sound basis for future recommendations.

d) Cod in Division 4X (offshore) (Res.Doc. 74/25)

The 1973 preliminary nominal catch was at a similar level to that in 1972 (approximately 7,000 tons). Despite lower catches in recent years, the fishing mortality (F = 0.75) has remained above the level giving maximum yield per recruit (F_{max} = 0.35). Research vessel surveys indicate that recruitment will not improve in the immediate future and continuation of present mortality rates will generate catches of about 7,000 tons. It is recommended that the 1975 catch should be reduced to 5,000 tons to bring F closer to F_{max}.

e) Haddock in Divisions 4V and 4W

The haddock catch of 4,300 tons in Div. 4VW in 1973 continues at the low level of 1972, and research vessel surveys indicate that mortality is still high (F = 0.70 on age 5+ fish). Pre-recruit year-classes are of low abundance and no improvement in stock abundance is foreseen. The Subcommittee therefore recommends that the TAC in 1975 continue to be zero.

It is important that by-catches be minimized. The effectiveness of closed area regulations during the spawning season was evaluated at previous meetings. While this would be likely to reduce incidental mortality on haddock, it has been reported that this would result in major dislocation of fisheries for other species, particularly for cod and silver hake.

f) Haddock in Division 4X (Comm.Doc. 74/23; Res.Doc. 74/91)

Div. 4X haddock sustained an average nominal catch of 17,000 tons in the period 1931-60 under stable fishery conditions. The catch increased in the early 1960's to reach 42,000 tons in 1966 and declined to 30,000 tons by 1969. Quotas and closed season-area regulations were imposed in 1970, under which catches declined still further to about 13,000 tons in 1973. A zero quota is in effect for 1974, but by-catches plus catches prior to 17 March, when the quota was put into effect, are expected to be substantial.

Stock abundance (in weight) declined in the late 1960's as the strong 1962 and 1963 year-classes passed through the fishery and were followed by a succession of very poor year-classes spawned in 1964-68. Research vessel surveys indicated that the 1969 year-class was stronger than those immediately preceeding it. This year-class, on entry into the offshore spring fishery at age 4, resulted in higher catches in early 1973, with resultant closure of the fishery in May. The 1971 year-class was predominant in haddock by-catches at age 2 in the summer of 1973. Research vessel surveys indicate that this year-class (1971) is twice as strong as that of 1969, and also that the 1972 year-class is as strong as that of 1969. However, the 1970 year-class is considerably weaker than even the poor year-classes of 1964-68, and first indications are that the 1973 year-class is also poor. Relating the strength of the 1969 year-class to that of 1963, as shown by research vessel surveys, indicates that it is 15% as strong, and leads to the following estimates of year-class strength (in millions of 2-year-old haddock): 1969 year-class - 25; 1970 - 1.5; 1971 - 50; 1972 - 25; 1973 - 1.5.

Fishing mortality (F) averaged 0.42 in 1962-70, slightly lower than that thought to maximise yield per recruit (F = 0.50). Most recent levels of F appear to have been lower, F = 0.19-0.40. Taking F = 0.40 in 1973 and the above recruitment estimates, stock size at the beginning of 1973 (age 2+) is calculated to be 69,000 tons. Assuming a 1974 catch of 13,000 tons, equivalent to F = 0.40, a stock size of 69,000 tons is obtained for 1975 also.

The implications of several 1975 catch levels were investigated (Table 7) in combination with fishing at F_{max} = 0.50 in 1976-77. A 1975 TAC of 20,000 tons would result in F exceeding F_{max} and reduced catches in 1976-77. A TAC set at 15,000 tons would be sustainable through 1977. However, although spawning stock (age 4+ fish) will increase in 1975 and 1976, by 1977 it will return to about the 1973-74 levels.

If recruitment is maintained at 1969-73 levels (i.e. at an average of 20 x 10^6 fish), average long-term yield fishing at F_{max} will be about 15,000 tons with average spawning stocks of about 40,000 tons.

Table 7. Division 4X haddock: stock and catch projections under different assumptions for 1975 catch.

	Stock size age 2 & older (tons)	Spawning stock age 4 & older (tons)	Catch (tons)	F for age 5+	No. of recruits at start of year (millions)	Assumptions
1973	69,000	42,000	13,000	0.40	50.0	
1974	74,000	32,000	13,000	0.40	25.0	
1975	69,000	54,000	20,000	0.54	1.5	
1976	65,000	54,000	19,000	0.50	20.0	1975 catch = 20,000 tons
1977	59,000	37,000	15,000	0.50	20.0	
1975	69,000	54,000	15,000	0.38	1.5	
1976	71,000	60,000	21,000	0.50	20.0	1975 catch = 15,000 tons
1977	63,000	40,000	17,000	0.50	20.0	
1975	69,000	54,000	10,000	0.24	1.5	
1976	77,000	66,000	23,000	0.50	20.0	1975 catch = 10,000 tons
1977	66,000	44,000	18,000	0.50	20.0	

The substantial decline in stock in the late 1960's resulted from recruitment failure and it is axiomatic that recovery of the fishery is dependent on recruitment returning to levels comparable to those pertaining in the 1950's and early 1960's. The year-classes of 1969-73, although better than those of 1964-68, are still weaker than pre-1963 year-classes, and the spawning stock is presently below historic levels. Fishing at F_{max} in 1975 implies catches of 19,000 tons but recovery of the spawning stock would be further encouraged by keeping catches to the lowest possible level. A TAC set at 15,000 tons would lead to a recovery of the spawning stock through 1976-77 but a decline thereafter, unless the improvement in recruitment continues in the immediate future. The Subcommittee noted that the effect of such a TAC would be enhanced by additional measures to reduce any incidental catches of small haddock that may be occurring.

The closed area in Div. 4X was reduced in size in 1972 (although the time of closure was extended to include May) to reduce interference in fisheries for argentine and silver hake. To reinstate the original closed area boundaries would give added protection to haddock stocks during the spawning season but would increase interference in argentine and silver hake fisheries. There is insufficient knowledge available at this time to predict the effects of prohibiting the use of all gears (except those used to catch crustaceans and scallops) in the closed area on the fisheries for pelagic species in Div. 4X.

g) Redfish in Divisions 4V, 4W and 4X

The preliminary 1973 nominal catch of redfish from the Scotian Shelf of 40,000 tons continues the decline in catch from the high level of 62,000 tons in 1971. Both Canadian and USA commercial catch rates, and Canadian research vessel surveys, show slight declines in abundance in 1973.

Commercial catch and research vessel length frequencies indicate that the recent high catches have been sustained by a good year-class (or several adjacent good year-classes) entering the fishery. This group of fish is now essentially fully recruited to the fishery. There is no indication of further new recruitment in the near future, few fish less than 20 cm occurring in research vessel catches.

It is unlikely that current catch levels can be maintained without increasing fishing mortality, and decreasing catch rates are anticipated. A TAC at the level of long-term average catches is recommended, i.e. 30,000 tons.

h) Silver Hake in Divisions 4V, 4W and 4X

In 1973 the silver hake catch from the Scotian Shelf more than doubled to 299,000 tons. While catch rates increased as the fishery exploited several extremely large year-classes, it is concluded that the exploitation rate was extremely high.

Both Soviet and Canadian research vessel surveys indicate the 1972 year-class to be strong, and Soviet data further indicates that the 1973 year-class is poor.

With a high natural mortality, fishing mortality associated with maximum yield per recruit is also high. Yield-per-recruit curves indicate, however, that little increase is to be gained by maintaining F much above 1.0. Given uncertainties in absolute recruitment levels and current exploitation rates, it is not possible to accurately associate F levels with catch levels. However, the Subcommittee agrees that a catch of 120,000 tons is likely to result in an F of about 1.0 and recommends this level (120,000 tons) as the 1975 TAC, although stressing that it does not take any account of the possible effect of the high exploitation rate upon future recruitment.

The USSR scientists agreed to present a detailed assessment of this stock at the 1975 Annual Meeting to resolve some of the uncertainties concerning the dynamics of this stock.

i) Pollock in Divisions 4V, 4W and 4X and Subarea 5

Catches from this resource have increased in recent years and reached 43,000 tons in 1973 (with an additional 297 tons in SA 6), compared to an average of 32,000 tons in the period 1960-72. The percentage of the total catch taken in SA 5 from 1960 to 1972 ranged from 16 to 54%, being highest in the period 1969-72, resulting from increased fishing in SA 5.

The pollock stock in Div. 4VWX and SA 5 is assessed as a unit, the TAC being based on examination of commercial catches and catch-per-unit-effort data combined with research survey catches. USA and Canadian commercial catch-per-unit-effort and survey cruise indices indicate that the population is not declining under current catch levels. This implies that fishing has not so far influenced the stock, but it would be preferable to maintain the TAC at its present level until such time as the effect of more prolonged fishing at the TAC level can be evaluated. It is therefore recommended that the TAC be maintained at 55,000 tons in 1975.

j) Flounders in Divisions 4V, 4W and 4X (Res.Doc. 74/56)

The flounder category in Div. 4VWX includes American plaice, witch and yellowtail. The combined catch of this group reached about 28,000 tons in 1973.

Although catch rates of Canadian otter trawlers continued to decline in 1973 as they have since 1965, research vessel survey abundance estimates did not change in the period 1970-73. Assessments presented in 1972 indicated that plaice and witch stocks were almost fully exploited, while yellowtail had been overexploited with resultant substantial decline in abundance. However, uncertainty in species breakdown of landings did not allow separate assessment of these species. A TAC of 32,000 tons was recommended for 1974, a level considered to give close to maximum yield per recruit under present conditions, and the Subcommittee recommends that the TAC be maintained at 32,000 tons for 1975, noting also that a breakdown of the flounder category by species is now becoming available and that it should become possible to assess these species separately in the near future.

k) Herring in Divisions 4V and 4W(a) (Banquereau) (Comm.Doc. 74/20; Res.Doc. 74/95) (Annex 1)

i) Review of fishery and TAC

Very little information on stock interrelationships for the Div. 4VW(a) stock complex is available. The current hypothesis that components of this complex are exploited in each of Subdiv. 4Vn, 4Vs and Div. 4W(a) therefore remains as the most reasonable basis for management. As well, the value of an analytical assessment of this stock complex will be questionable until more is known of stock identities.

The herring catches from this stock complex increased rapidly from less than 1,000 tons annually in 1965-67 to 146,000 tons in 1969, declined to 63,000 tons in 1970, increased slightly to 72,000 tons in 1971, and them declined to a level of 30,000 tons in 1972 and 1973.

The offshore fishery in Subdiv. 4Vs (Banquereau) has virtually collapsed, declining from a peak catch of 71,000 tons in 1969 to less than 2,500 tons since 1971. However, catches in Subdiv. 4Vn and Div. 4W(a) increased from 13,000 tons in 1969 to 64,000 tons in 1971 and declined to 28,000-30,000 tons in 1972 and 1973. The Canadian catch, which accounts for over 90% of the total catch in Subdiv. 4VnW(a) has, however, consistently been maintained above 25,000 tons since 1969.

The fishery in Subdiv. 4Vn has become more dependent on younger fish. In 1971-72 less than 20% of the catch was represented by herring less than age 5, but in 1973-74 the 1970 year-class alone accounted for 52% of the catch. Despite the fact that the 1973-74 catch com-

position suggests a large 1970 year-class, the catch-per-unit-effort has declined by 44% since 1971-72.

The fishery in Div. 4W(a) was started in 1968-69 and exploited only young fish. Canadian size limit regulations have restricted catches of fish less than 9 inches since 1973. In 1973-74, the catch in Div. 4W(a) was 27,500 tons, substantially higher than that of the previous year, with an accompanying increase in catch-per-unit-effort of 87% over the 1971-72 season. These increases were probably due to the recruitment of the large 1970 year-class which accounted for over 70% of the catch.

A greater dependency on younger fish and declining catch rates in Subdiv. 4Vn imply a decrease in adult abundance in the Div. 4VW(a) stock. The appearance of a good 1970 year-class in both Subdiv. 4Vn and Div. 4W(a) in 1973-74 and the increase in catch rates in Div. 4W(a) in 1973-74 suggest a future increase in abundance. If the fisheries are exploiting the same stock in Subdiv. 4Vn and Div. 4W(a), then in order to protect the future adult stock the exploitation of these younger fish should not be increased. The 1975 TAC for Div. 4VW(a) should not exceed 45,000 tons.

ii) Consideration of seasonal TAC (Comm.Doc. 74/20)

The Canadian herring fishery in Div. 4VW(a) extends from November to March and the small international fishery in Div. 4V mainly during the spring. Setting the Div. 4VW(a) TAC at the Annual Meeting would thus allow analysis of the data from the most recent fishing season; these data would not be available for consideration at mid-term meetings. It follows that a TAC for a 1 July-30 June period would be best suited for the management of this fishery. A TAC for the calendar year 1974 has already been agreed to by the Commission; a transition to a seasonal basis requires a recommendation for an interim TAC for the January-June 1975 period.

The total Div. 4VW(a) catches from 1971-73 have been partitioned before and after 30 June (Table 8). For the 3-year period 70% of the total catch and 68% of the Canadian catch were taken in the January-June period. In January-June 1974 the Canadian fishery took 26,680 tons which represents 67% of Canada's TAC allocation for Div. 4VW(a). These figures suggest that an interim TAC for the January-June period of two-thirds (30,000 tons) of the calendar year TAC would be appropriate. The Subcommittee accordingly recommends (1) that the TAC, if set for the 1975 calendar year, should not exceed 45,000 tons; (2) that the 1 July-30 June proposed management period be accepted and an interim TAC of two-thirds of the recommended 1975 calendar year TAC be set for the 1 January-30 June period.

Table 8. Division 4VW(a) herring catches (tons) for 1971-73 partitioned into January-June and July-December periods. (The Canadian portions of the catches are given in parentheses for 1971-74.)

Period	Year				Average	
	1971	1972	1973[1]	1974[1]	1971-73	%
Jan-Jun	57,800 (49,000)	21,500 (19,600)	12,600 (12,100)	... (26,680)	30,630 (26,900)	68
Jul-Dec	14,200 (4,500)	11,200 (10,700)	18,300 (16,400)		14,560 (10,530)	32
Total	72,000 (53,500)	32,700 (30,300)	30,900 (28,500)		45,200 (37,430)	100

[1] Preliminary statistics.

ℓ) Herring in Divisions 4X and 4W(b) (Annex 1)

The total catch from Div. 4XW(b) was 134,608 tons in 1973, a decline of 15% from 1972. Approximately 91,000 tons were applied against the 1973 TAC of 90,000 tons for the southwest Nova Scotia stock. The remaining 45,000 tons were taken by Canadian traditional juvenile and fixed gear fisheries and that portion of the purse seine catch under 9 inches.

It has been possible to complete an analytical assessment for this stock, comparable to those previously done for Div. 5Y and Div. 5Z + SA 6 herring stocks, which includes all catch and sampling data for 1973, and to project this analysis through 1975. The fishery on the Div. 4XW(b) stock is

defined as being comprised of the following fishery components: all non-Canadian catches in Div. 4XW(b), Canadian catches in the Nova Scotia purse seine, weir, trap and gillnet fisheries (excluding gillnet catches east of Shelburne, N.S.) and in the Grand Manan purse seine fishery.

Assumptions on the strengths of the 1969 and subsequent year-classes are critically important in projecting 1975 catches. Comparing year-class size at age 1 from cohort analysis with year-class performance in various fisheries, particularly with New Brunswick weir catches at age 2, indicates that the 1969 and 1971 year-classes are poor. No evidence is available on the size of the 1972 year-class which will contribute to the quota-controlled fishery in 1975. It was assumed that these year-classes are comparable in size to those of 1967 and 1968 (500×10^6 fish at age 1). (This recruitment is approximately equivalent to the conventional recruitment value of 300×10^6 fish at age 3 that was agreed by the Herring Working Group for this stock at this Annual Meeting.)

The 1970 year-class formed the bulk of the population biomass in 1973. The relationship between estimated population biomass (from cohort analysis) for 1966-70 and catch per effort in the Nova Scotia purse seine fishery was used to estimate total 1973 stock biomass. Biomass estimates for year-classes other than that of 1970, obtained under various assumptions of 1973 F, were subtracted from this estimate giving estimates of the 1970 year-class between 2 times and 2.5 times the strength of the 1966 year-class. (The 1966 year-class was previously the strongest to enter this fishery in the period of observation.) Given the likely direction of biases in this approach, it was considered that the 1970 year-class equals 2 times 1966 year-class was the more reasonable assumption. Other assumptions, which are described in the Herring Working Report (Annex 1) and in Res.Doc. 74/13, had only minor effects on the analysis.

A management option to obtain $F = 0.50$, the mortality thought to maximize yield-per-recruit implies a 1975 TAC in the order of 90,000 tons. (Immobile gear catches estimated at 15,000 tons were subtracted from projected 1975 catches to obtain the 1975 TAC value.) However, the fishery is currently largely dependent on the 1970 year-class, and, unless the 1972 or 1973 year-class is substantially larger than assumed (i.e. 300×10^6 fish at age 3), the 1976 TAC (if F is to be maintained at 0.50) will be substantially below 90,000 tons. This could be offset if the TAC in 1975 could be set lower than 90,000 tons.

Herring size limits (Comm.Doc. 74/16). The present 9-inch (22.7 cm) size limit provides for exemptions on an annual basis, but in principle this does enable vessels to mount a short-term but intensive fishery for undersized herring. From the point of view of conservation of the resources, it would be more effective if the exemption could be applied over short time intervals.

m) Mackerel in Subarea 4 (with 3) (Res.Doc. 74/8, 9, 94, 102) (Annex 2)

Data on the distribution of the fishery, on the biological characteristics of the fish, and some additional evidence from tagging on the range of migration of mackerel in SA 3 and 4 all indicate that these fish are either a migrating component of mackerel fished in SA 5 and 6, or, if they form a truly separate biological unit, then their distribution and the fisheries on the two stocks overlap in SA 5 and 6 during part of the year. The TAC appropriate to either situation and its allocation to subareas depends on the degree of this mixing. It is possible, for example, that the present TAC level for SA 5 and 6 is adequate for the exploitation of mackerel throughout the ICNAF Area, and it is even possible it may allow over-exploitation of any discrete component which migrates annually to SA 3 and 4. These possibilities cannot be resolved at present, nor is the Subcommittee optimistic that they can be resolved in the near future. (See Annex 2 for Report of the *ad hoc* Mackerel Working Group.)

Under the circumstances it might be most appropriate to include all mackerel within a single assessment, but, having regard for the already existing uncertainties for SA 5 and 6, the Subcommittee concluded that such an assessment was not possible at this meeting and strongly recommends that it be carried out for the 1975 Annual Meeting. Recognizing therefore that mackerel in SA 3 and 4 might be exposed to some additional risk, the Subcommittee recommends (i) that the 1975 regulation for mackerel in SA 4 be extended to include all mackerel in SA 3 and 4, and (ii) that in the first instance this TAC for 1975 be established at the 70,000 ton level of catch expected in 1974 to stabilize the known fishery (i.e. 15,000 tons in SA 3 + Div. 4RST and 55,000 tons in Div. 4VWX).

n) Argentine in Divisions 4V, 4W and 4X and in Subarea 5 (Res.Doc. 74/21, 22, 23)

The argentine stock has been judged on the basis of a combined stock in Div. 4VWX and SA 5 and apportioned equally between the two areas.

The 1974 TAC was set at 25,000 tons for each of the areas which, although thought to be above the long-term sustainable yield, reflects the higher yields expected during the development of the fishery as accumulated biomass is fished up. No new data are available which require a change in

this advice. Catches in 1973 were only 1,470 tons in Div. 4VWX and 2,512 tons in SA 5. Thus, it is recommended that the 1975 TAC again be set at 25,000 tons in each area, as in 1974.

o) Squids in Subarea 4 (with 3) (Res.Doc. 74/49, 50, 87)

Illex is the type of squid which predominates in SA 3 and 4. Shoals appear throughout the area during the summer months, but the range of their movement and the relationships between them and populations of *Illex* found farther south are not known. Although commercial catches are currently incidental and not taken in a directed fishery for *Illex*, studies based on the amount of *Illex* consumed by pilot whales suggest the potential catch could be substantial. It is not possible to suggest a TAC for this species.

SUBAREA 5 AND STATISTICAL AREA 6

1. Fishery Trends

a) Subarea 5

The total nominal catch of all species, including shellfish, increased from 939,000 tons in 1972 to 1,063,000 tons in 1973. For finfish (except menhaden) and squids the corresponding 1972 and 1973 catches are 847,000 and 947,000 tons.

Several species, which showed an increase in catches from 1971 to 1972, continued to show increasing catches from 1972 to 1973, notably silver hake (107,000 to 120,000 tons), mackerel (201,000 to 315,000 tons), menhaden (9,000 to 31,000 tons), and squids (26,000 to 36,000 tons). The catch of squids in SA 5 and 6 combined consists of both *Loligo* sp. and *Illex* sp., with *Loligo* estimated to have contributed 63 and 59% of the catch in 1972 and 1973 respectively. Other major species which showed increased from 1972 to 1973 include cod (32,000 to 34,700 tons), butterfish (2,100 to 7,800 tons).

Species, whose catches continued to decline since 1971, include haddock (6,700 to 5,900 tons from 1972 to 1973), flounders except yellowtail (19,000 to 15,400 tons), and alewife (8,700 to 5,600 tons). Those species that showed decreases in catches from 1972 to 1973 include redfish (19,100 to 17,300 tons), red hake (60,000 to 53,000 tons), yellowtail (29,600 to 25,500 tons), argentines (32,700 to 2,500 tons) and sharks (12,800[1] to 18 tons). Both haddock and yellowtail catches were restricted in 1972 and 1973 by imposed TAC levels.

The herring catch of 220,000 tons in 1973 was the same as that recorded for 1972.

b) Statistical Area 6

The total nominal catch of all finfish species decreased from 622,000 tons in 1972 to 492,000 tons in 1973, while the total shellfish catch increased from 416,000 to 461,000 tons. For finfish (except menhaden) plus squids, the corresponding 1972 and 1973 values are 324,000 and 213,000 tons.

Of the major species caught in SA 6 the catches of about one-half increased and the remainder decreased. Of those that increased from 1972 to 1973, butterfish (4,400 to 11,800 tons), red hake (16,100 to 16,900 tons), and summer flounder (3,100 to 4,000 tons) showed an increase from 1971 to 1972 as well. The most important of those that increased from 1972 to 1973 only was silver hake (8,400 to 12,400 tons).

For those species that showed a decrease from 1971 and 1972 and through 1973, the most striking was mackerel (232,000 to 187,000 and to 66,000 tons). However, as the mackerel stock overlaps SA 5 and 6, the marked decrease in SA 6 was offset by a corresponding increase in SA 5. Other species showing a decrease in 1973 catches included yellowtail (8,900 to 5,100 tons), herring (15,600 to 14,200 tons), menhaden (321,000 to 300,000 tons), and squids (22,600 to 20,500 tons). The catch of sea scallops also showed a decrease in 1973 (11,000 to 7,000 tons).

2. Species Review

Table 9 contains a summary of recent catches and TACs, as well as the TACs recommended for 1975, for stocks under consideration for management in SA 5 and 6.

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[1] Editorial Note: After the publication of *Statistical Bulletin*, Vol. 22 for the year 1972, USSR scientists informed the Secretariat that the USSR catch of 12,486 tons of sharks reported for 1972 should be classified as mostly dogfish.

Table 9. Subarea 5 and Statistical Area 6: summary of nominal catches (1966-73) and TACs (1973-75) by species and stock area.

Species	Stock area	MSY	Nominal catches (000 tons) 1966-70	1971	1972	1973[1]	TACs (000 tons)[2] 1973	1974	1975	Assessment category
Cod	5Y	10	7	8	7	6	10 (10)	10 (10)	(10)	4
Cod	5Z	35	39	28	25	29	35 (35)	35 (35)	(35)	2
Haddock	5		53	12	7	6	6 (0)	0 (0)	(0)	1
Redfish	5		11	20	19	17	30 (30)	30 (30)	(25)	4
Silver hake	5Y		17	8	7	9	10 (10)	10 (10)	(15)	3
Silver hake	5Ze	160	110	72	78	62	80 (80)	80 (80)	(80)	3
Silver hake	5Zw+6			28	31	61	80 (80)	80 (80)	(80)	3
Red hake	5Ze		52	9	38	25	-	20 (20)[3]	(20)[3]	1
Red hake	5Zw+6	40		31	36	42	40 (40)[4]	50 (50-70)[4]	(45)[4]	1
Pollock	4VWX+5		(See Pollock in Table 6 under SA 4)							
Yellowtail	5(E69°)		37	24	30	26	16 (16)	16 (16)	(16)	2
Yellowtail	5(W69°)						10 (10)	10 (10)	(0)[4]	2
Oth. flounders[5]	5+6		27	28	24	22	25 (25)	25 (25)	(25)	3
Herring(total)	5Y		45	51	62	32				
Herring(adults)	5Y		20	39	43	16	25	25 (25)	(25)	1
Herring	5Z+6		259	267	174	202	150	150 (150)	(150)	1
Mackerel	5+6		83	349	387	381	450	340 (251-312)	(285)	1
Argentine	5		8	7	33	3	-	25 (25)	(25)	4
Oth. finfish[6]	5+6		143	139	115	155	-	125 (125)	(125)	4
Squid(*Illex*)	5+6		7	22	18[7]	23[7]	-	71 (-)	(-)	
Squid(*Loligo*)	5+6				31	34	-	(50-80)	(71)	2
Overall 2nd tier[8]	5+6			1136	1145	1156	-	923.9 (-)	850 (850)	

1 Preliminary statistics from Summ.Doc. 74/7 (revised).
2 Quantities in parentheses are TACs recommended by scientific advisers.
3 TACs pertain to 5Z (east of 69°).
4 TACs pertain to 5Z (west of 69°) + 6.
5 All other flounders except yellowtail.
6 All other finfish except TAC regulated species and also except menhaden, billfishes, tunas and large sharks.
7 A complete separation of squids by *Illex* and *Loligo* is not available, but a breakdown has been estimated on the basis of seasonality differences in distribution and the reported identity of incidental catches.
8 Includes all finfish (except menhaden, billfishes, tunas and large sharks) and squids.

a) Cod in Division 5Y

The 1974 TAC for the Gulf of Maine stock was set at 10,000 tons based on historic catches. The preliminary 1973 catch was about 6,100 tons compared with an average of 5,800 tons for the period 1963-72. As assessment has yet to be completed for Div. 5Y cod, and in the absence of any new evidence concerning this stock the TAC recommended for 1975 is 10,000 tons.

b) Cod in Division 5Z

The 1974 TAC for the Georges Bank stock was set at 35,000 tons which is considered to be the MSY (Res.Doc. 72/117). The 1973 catch was about 28,500 tons. No new assessment of this stock has been completed, but commercial length frequencies for US landings suggest an increase in recruitment from the 1971 year-class. Likewise, survey estimates of pre-recruit abundance suggest an increase in commercial stock abundance will occur in 1975 and 1976. However, the 1972 assessment considered the level of fishing mortality associated with the MSY for the stock to have been exceeded during the high catches of the mid-1960's. Consequently, the current anticipated increase in recruitment is considered sufficient to indicate that removals at the current TAC level will result in a fishing mortality of the level associated with the MSY. A TAC of 35,000 tons is therefore recommended for 1975.

c) Haddock in Subarea 5

The haddock quota for 1973 was set at 6,000 tons. Preliminary statistics for 1973 indicate a catch of 5,890 tons. For several years the Assessments Subcommittee has been recommending that the removals be held to the lowest possible level. The TAC for 1974 was set at "zero" allowing for incidental catch only.

The 1963 year-class has supported the fishery since its recruitment to the fishery. This pattern has held true for the 1972 US fishery, with the 1963 year-class accounting for between 50 and 55% of the catch. The US autumn bottom trawl survey indices for 1973 indicate that the population remains at a low level relative to the early 1960's. The young-of-year index reflects another poor year-class. The estimates of available population and recruitment for SA 5 haddock are given in Table 10. At current levels of recruitment and removals, the haddock population would appear to be very gradually increasing. However, at this rate, it will take about 10 years for the stock to rebuild to the average level which existed during the period 1935-1960, unless recruitment improves and the by-catch of haddock can be reduced.

Table 10. Subarea 5 haddock: estimates of available population and recruitment, 1935-60 and 1968 to 1974.

	Average	Yearly estimates in millions of fish						
	1935-60	1968	1969	1970	1971	1972	1973	1974
Population (age 2+) including recruits	145	52	27	21	21	20	27	34
Removals: Total	63	33	15	9	9	4	4	
Fishing	41	28	12	6	6	3[1]	3[1]	
Natural	22	5	3	3	3	1	1	
Recruits (age 2)	54	16	8	9	9	8	11	15

[1] Under regulation; average weight 2 kg.

Any recruitment to the fishable stock is influenced by the incidental catch of small haddock, and incidental catches of haddock of all sizes at present account for all reported nominal catches. Therefore, the Assessments Subcommittee recommends that the TAC for 1975 remain at zero and that efforts be made to reduce incidental catches (particularly young fish of 0 and 1 age-groups) to the lowest possible level.

The proposal to extend the prohibition on fishing gear that may be used in closed season/areas would be a conservation measure to the extent that it would reduce the incidental catch, but data were not available to evaluate the reduction in by-catch including discard and industrial harvest that would occur with such an extension.

d) Redfish in Subarea 5

A comprehensive assessment of this stock has not yet been completed. Conclusions regarding its status were based on examination of long-term trends in catch and effort and recent trends in catch per tow of research vessel surveys.

The long-term commercial catch and effort series indicates a gradual recovery of the stock from rather low densities following the intensive fishery in the 1940's (up to 60,000 tons). Stock size increased steadily to the late 1960's in response to a markedly reduced fishery (down to 7,000 tons). The fishery began increasing again in 1969. Annual catches of 20,000 tons were recorded in 1971-72, and 17,000 tons were caught in 1973. Both commercial catch per day and survey catch per tow indicate declining abundance since 1969.

The 1974 TAC of 30,000 tons equals the estimate of MSY based on analysis of commercial catch and effort. This is not a precise estimate, but it is probable that the present catch and effort is below the MSY level. However, catches of 20,000 tons per year are approaching the MSY close enough, particularly because of the low productivity rate of redfish, so that the rate of increase in fishing effort should be kept small to prevent overshooting the MSY point and allowing time to assess effects of the increase. To accomplish this, the Subcommittee recommends a TAC for 1975 of 25,000 tons.

e) Silver Hake in Subarea 5 and Statistical Area 6 (Res.Doc. 74/100)

Stock identification. Three silver hake stocks are currently under management in SA 5 and 6: Div. 5Y, Subdiv. 5Ze, and Subdiv. 5Zw + SA 6. Earlier studies on the seasonal distribution and movement patterns of silver hake from US groundfish survey catches suggest the possibility that the fish in Div. 5Y and on the northern part of Georges Bank in Subdiv. 5Ze may constitute a single stock. The question was raised whether the available data could justify treating these two areas as a single stock for the purposes of assessment and management. USSR observations indicated that the stock on the northern part of Georges Bank was possibly separate from that in Div. 5Y. Therefore, it was agreed to continue to delineate the stocks as Div. 5Y, Subdiv. 5Ze and Subdiv. 5Zw + SA 6, until additional evidence can be brought to bear on this situation.

Division 5Y stock. The nominal catch in Div. 5Y increased from 6,700 tons in 1972 to 8,900 tons in 1973, but is still substantially below the 1955-66 mean of 28,500 tons. The 1974 TAC was set at 10,000 tons. The decline in catches after the mid-1960's is attributed to poor year-classes that were recruited to the stock during that time. Survey data have indicated good 1971-73 year-classes. As these year-classes recruit to the fishery, catches can be expected to improve. In order to allow for the gradual recovery of the stock to its former level, it is advisable to permit only a gradual increase in catch. To provide for this, the Subcommittee recommends that the TAC for Div. 5Y be increased to 15,000 tons for 1975.

Division 5Z and Statistical Area 6 stocks. A formal assessment was not available for these silver hake stocks. Survey data from 1974 spring cruises indicate that the relative abundance of the Subdiv. 5Ze and Subdiv. 5Zw + SA 6 stocks is at approximately the same level as in 1973. The nominal catch in 1973 was 62,000 tons in Subdiv. 5Ze and 61,000 tons in Subdiv. 5Zw + SA 6. The Subcommittee advises that the TACs for 1975 remain the same as those set for 1974: 80,000 tons for Subdiv. 5Ze and 80,000 tons for Subdiv. 5Zw + SA 6.

f) Red Hake in Subarea 5 and Statistical Area 6 (Res.Doc. 74/19, 64, 65, 100)

Stock identification. In its 1972 report the Assessments Subcommittee advised that the boundary between the Georges Bank (Subdiv. 5Ze) and Southern New England-Middle Atlantic (Subdiv. 5Zw + SA 6) red hake stocks should be the 69°W longitude line. However, USSR studies (Res.Doc. 70/39) indicate that the 70° line (present dividing line for Subdiv. 5Ze and 5Zw) conforms more closely to the actual stock boundary, although the area from 69°W to 70°W is an overlap region. It is intended that the assessments for the 1975 Annual Meeting should be carried out with the 70° line as the boundary between the two stocks, but for 1975 the recommended TACs will again be based on the 69°W longitude line as being the boundary.

Division 5Z (E of 69°) stock. The estimated nominal catch from the Georges Bank stock decreased from 29,200 tons in 1972 to 18,400 tons in 1973. A TAC of 20,000 tons was set for 1974. A USSR assessment based on virtual population analysis assuming M = 0.6 and F = 0.2 at age 2, and M = 0.4 and F = 0.7 at age 3+ indicates a 1975 TAC of 20,000 tons.

Division 5Z (W of 69°) and Statistical Area 6 stock. The nominal catch from the Southern New England-Middle Atlantic stock remained the same in 1973 as in 1972 at about 43,000 tons. A US assessment indicates a 50% decrease in stock size from 1973 to 1974 and suggests that the 1974 TAC should have been no larger than 40,000 tons assuming M = 0.4 and fishing mortality equalling

F_{max} = 0.75. This is confirmed by US 1974 spring survey data that indicate a further decline in stock size. The 1974 TAC of 50,000 tons was set based upon an earlier USSR assessment (Res.Doc. 73/27). A new USSR assessment employing the same techniques and assuming the same levels of M and F as used to assess the Georges Bank stock indicates a 1975 TAC of 45,000 tons and the Subcommittee recommends that the 1975 TAC be 45,000 tons.

g) Pollock in Subarea 5

(Review of pollock stock in SA 5 and Div. 4VWX is given under SA 4, page 91.)

h) Yellowtail in Subarea 5 (East of 69°W) (Res.Doc. 74/56, 99)

Stock structure studies (Res.Doc. 74/56) support the conclusion that yellowtail on Georges Bank is a separate stock from those off Nova Scotia. Res.Doc. 74/99 reviews the assessment of the Georges Bank stock. Removals, catch-per-effort values and catch-per-tow abundance indices have all stabilized under the quota management implemented since 1971. Landings per day at age data indicate a slight decrease in Z under removal restrictions which, for this stock, take account of the effect on the commercial fishery of discarding of young fish (age 3) in the catch. The TAC of 16,000 tons presently in effect has, therefore, served to maintain population size at current levels of recruitment. The measure seems adequate if successive years of poor recruitment do not occur, and thus the Subcommittee recommends a TAC for 1975 of 16,000 tons.

i) Yellowtail in Subarea 5 (West of 69°W) and Statistical Area 6

The SA 5 (W of 69°) part of this stock complex has been under quota management since 1971, and limitations on removals have reduced the catch from 24,103 tons in 1970 to 9,510 tons in 1973. The stock complex in the area consists of two stocks (Cape Cod and Southern New England) and a discussion of these, as well as the SA 6 stock, follows.

Cape Cod area. Preliminary 1973 statistics indicate a catch of 1,662 tons, an increase over the 1972 catch of 1,364 tons. Although landings per day remained the same, the estimated discards decreased, indicating perhaps a decline in abundance of small fish. The portion of the 1974 TAC applicable to this stock is 2,000 tons, based on historic catches, and this quantity was combined with that estimated for the Southern New England stock for management purposes. Considering the decline in catch per unit effort (stock abundance), the TAC for 1975 should be reduced to 1,600 tons.

Southern New England area. Although quota regulations greatly decreased removals since 1970, US commercial catch per day decreased significantly (46%) during the period. Age compositions of the US landings show an increase in the proportion of ages 2 and 3 fish and a decrease in older fish from 1970 to 1973, while, at the same time, US catch-per-tow indices from *Albatross IV* autumn research cruises for the Southern New England cruise strata indicate a drastic decrease in abundance of pre-recruit (age 1+) yellowtail. The catch per tow in numbers of pre-recruits has decreased 87% since 1969. Overall, the population appears to be still declining.

The pre-recruit (age 1+) indices have been used to project an index of abundance and weight for each age. Thus, for each year, an index for the total population is obtained by summing the indices for each age group (Res.Doc. 71/115). The index for 1975 has been computed assuming that the 1974 pre-recruit index is equal to that for 1973. The relationship between this weight abundance index and consequent catch at an F_{max} of 0.8 indicates a TAC of 2,600 tons.

Statistical Area 6. A first assessment for yellowtail in SA 6 was presented (Res.Doc. 74/99). *Albatross IV* survey data for cruise strata west and south of Subdiv. 5Zw were analyzed to estimate mortality rates. Estimates of total mortality coefficients (Z) for fish fully recruited to the commercial fishery (age 3 and older) indicate that mortality increased after 1970. The average coefficient for age 3 and older was 1.2 for the seven-year period 1963-70 and 1.8 for the period 1970-73. Natural mortality coefficient (M) was assumed to be 0.2, as for Div. 5Z yellowtail, giving F for the two periods of 1.0 and 1.6. The average Z for age 2 fish (the age at first entry into the fishery) was 0.6.

Yearly stock abundance indices were developed as was done for Southern New England based on annual autumn cruise pre-recruit (age 1+) catch-per-tow values. The mortality rates used were the averages for the two periods mentioned above. The abundance index for each year-class for each year in terms of weight was calculated by finding the product of the abundance index in numbers and weight at age. Weight at age data for SA 6 were not available so length at age at the beginning of the year was determined by a Bertalanffy growth equation for SA 5 and weight at age was then calculated from the length-weight equation given in Res.Doc. 71/14. The total abundance index for each year was then found by summing the abundance indices for all year-classes in the fishery (age 2-5) for that year. In order to calculate the 1975 abundance index, the pre-recruit value (1973 year-class) was assumed to be the same as the 1972 year-class. These stock abundance indices (Table 11) show a general decrease since 1970.

Table 11. Yellowtail in Statistical Area 6: abundance indices based on pre-recruit catch-per-tow data from US autumn research surveys, and nominal catches, 1967-73.

Year	Abundance index by weight[1]	Catch (tons)
1967	64.4	5,340
1968	67.3	3,272
1969	59.0	3,886
1970	36.8	4,168
1971	11.7	7,828
1972	22.4	8,891
1973	21.6	5,134[2]
1974	7.5[3]	
1975	3.8[3]	

[1] Z (age 2) = 0.60; Z (age ≥3) (1963-70) = 1.2; Z (age ≥3) (1970-73) = 1.8.
[2] Provisional catch from Summ.Doc. 74/7 (revised).
[3] Estimated.

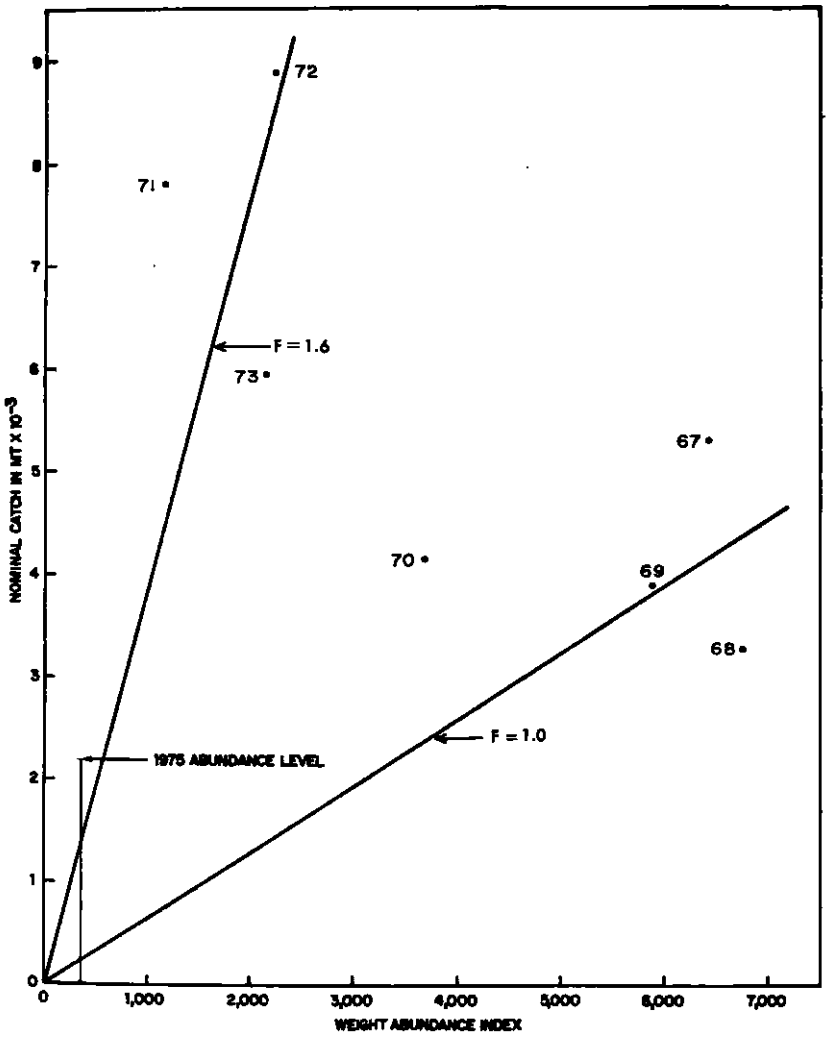

Fig. 1. The relationship between catches and abundance indices for Statistical Area 6 yellowtail flounder at two levels of fishing mortality and the 1975 abundance index point.

The plot of nominal catches and the weight abundance indices (Fig. 1) give two clusters of points, one for the period 1967-69 and one for 1971-73. Least squares fit of the relation between catch and stock abundance at the levels indicated for the two periods show the relationship that existed during the period 1967-73. The 1975 abundance index is extremely low, and it is reasonable to assume that further reductions in abundance are not desirable. A catch that would halt further decreases may be determined by computing the change in the weight abundance index that would occur during 1975 for year-classes in the fishery for different survival rates. If fishing in 1975 is set at the 1971-73 level, it is estimated that the catch would be about 1,300 tons, but stock abundance will be 20% less than the initial value after 1976 recruitment (if 1976 recruitment is at the 1974 level). Stock will be 10% less than the initial 1975 stock after recruitment in 1976, if fishing is set at the 1967-69 level to give a catch of 250 tons.

Therefore, if the 1973 and 1974 year-classes are assumed to be of the same abundance as the 1972 year-class, no directed yellowtail fishery can exist if the extremely low current stock size is to be maintained or increased.

Combined stocks in Division 5Z (west of 69°) and Statistical Area 6. All the available evidence indicates that the population of yellowtail, which provides the bulk of the catches in Southern New England and SA 6 comprise a single stock. Recently fishing has often taken place at or near the boundary line between the two areas. A single management regime for the total population in Div. 5Z (west of 69°) and SA 6 would take account of the overlap of distributions between SA 5 and SA 6. Accordingly the Subcommittee recommends a zero directed fishery for yellowtail in SA 5 (west of 69°) + 6. Incidental catches of yellowtail in the directed fisheries for other groundfish species would be expected to reach 4,000-5,000 tons, and clearly these should be held at the lowest possible level, particularly those taken in the fisheries to which the mesh regulations do not apply.

j) Flounders, Except Yellowtail, in Subarea 5 and Statistical Area 6

The TAC for this group of species was based on historic catches and research survey trends taking into account the general biology of these species. The average catch from 1963 to 1972 was 25,900 tons, the peak level being 30,000. The US and USSR joint survey cruises (Res.Doc. 73/8; *Redbook* 1973, Part I, Annex 3A) have shown declines in this group of species. There is no additional information to change the Subcommittee's previous recommendation for 1974, and it is advised that the TAC remain at 25,000 tons for 1975. It should be stressed, in view of the survey cruise trends, that all effort should be made to reduce by-catch, particularly of small fish below the age at maturity whose yield per recruit is considerably below their potential.

k) Herring in Division 5Y (See also Annex 1)

Additional information since the January 1974 assessment consists of catch and sample data for the first four months of 1974. The US catch of herring from January to May 1974 was greater than 3,000 tons, or about 2½ times the US catch for the same period in 1973. The bulk of the catch was from the 1970 year-class as expected. These data do not alter the assumptions of year-class strength made in the January assessment.

Assumptions. The assessment of the Div. 5Y herring stock to set a TAC for 1975 was made with the following assumptions:

(1) The 1974 TAC of 25,000 tons will be fully taken.
(2) The size of the 1970 year-class at age 3 is 150-200% that of the 1966 year-class. No new information is available on the precise size of the 1970 year-class, but the indications are that it is probably within this range and possibly closer to the upper part of the range.
(3) The 1971 year-class at age 3 is equal in size to the 1969 year-class, the poorest year-class observed in the fishery. The catch of the 1971 year-class at age 2 was the second lowest recorded in the Div. 5Y juvenile fishery.
(4) The 1972 year-class is taken to be 150 million fish (23,250 tons), approximately one-half of the size of the 1966 year-class at age 3. This is a conventional level of abundance for age 3 herring recruiting to the regulated fishery in Div. 5Y. The average year-class size of age 3 herring over year-classes 1964-69 was 192 million fish (29,800 tons) and over the poorer year-classes of 1967-69 was 138 million fish (21,400 tons). The conventional level of 150 million fish was chosen to be less than the long-term average (192 million) in order to be conservative.

TAC level for 1975. According to the constraints provided by the Commission (Summ.Doc. 74/9, Proceedings No. 7, Appendix II, p. 59), the TAC in 1975 cannot exceed 25,000 tons unless the adult stock size (age 4 and older) at the end of 1974 will be at a minimum of 110,000 tons. Under the most optimistic assumption on the abundance of the 1970 year-class (twice the size of the 1966 year-class at age 3), the adult stock at the end of 1974 cannot reach 110,000 tons and the TAC for 1975 cannot, therefore, exceed 25,000 tons. The other constraint provided by the Commission

requires that an adult stock size of at least 60,000 tons be maintained at the beginning of 1976. If the 1970 year-class is 200% of the 1966 year-class, and assuming that the 1974 TAC is taken, then the adult stock size at the beginning of 1975 will be 79,000 tons. A catch of 25,000 tons in 1975 will decrease this stock size to 69,000 tons at the beginning of 1976. If the 1970 year-class is 150% of the 1966 year-class, and assuming that the 1974 TAC is taken, then the stock size at the beginning of 1975 will be 58,000 tons. A catch of 25,000 tons in 1975 will decrease this stock size to 49,000 tons at the beginning of 1976. While a catch of 25,000 tons in 1975 will probably result in a stock size at the beginning of 1976 of 60,000 tons or more, it does not take advantage of the good 1970 year-class for rebuilding the stock. Establishing a TAC of 20,000 tons for this fishery would provide a better opportunity for stock rebuilding and some insurance against TAC reduction in 1976, if the recruitment assumptions prove to be too optimistic.

ℓ) Herring in Division 5Z and Statistical Area 6 (See also Annex 1)

Additional information since the January 1974 assessment consists of preliminary results from the spring juvenile herring survey on Georges Bank and the US spring groundfish survey. The juvenile survey confirmed that the 1971 year-class was very poor relative to the 1970 year-class. There are indications that the size of the 1972 year-class may be similar to that of the 1971 year-class but the reliability of the abundance index for the 1972 year-class is less certain than for the 1971 or 1970 year-classes. Further details of the juvenile herring surveys are given in the Report of the Herring Working Group (Annex 1). Indices of abundance for herring in the US spring groundfish survey averaged 4.1 fish per tow in 1973-74 compared to 37.6 per tow in the period 1968-70 in the Southern New England and Middle Atlantic area. The reliability of these data is uncertain due to the small numbers of herring caught.

Assumptions. The assessment of the Div. 5Z + SA 6 herring stock to set a TAC for 1975 was made with the following assumptions:

(1) The 1974 TAC of 150,000 tons will be fully taken.
(2) The size of the 1970 year-class at age 3 is equal to 200% that of the 1966 year-class. Preliminary analyses of the age composition of samples obtained from the 1974 juvenile survey on Georges Bank suggest that at least 90% of the herring taken were of the 1970 year-class. This suggests that the 1970 year-class is equal to the larger of the two assumptions (150% and 200% of the 1966 year-class) made at the January 1974 Meeting.
(3) The size of the 1971 year-class at age 3 is equal to that of the poorest year-class observed in the fishery, i.e. the 1969 year-class. Estimates of the size of the 1971 year-class are available from both the 1973 and 1974 juvenile surveys. Both estimates indicate that this year-class is very poor. This year-class did not appear in the adult fishery as age 2 fish in 1973 as was observed for the 1970 year-class in 1972.
(4) The 1972 year-class is equal to 800 million fish (124,000 tons) at age 3, or approximately one-half the size of the 1966 year-class. The size of this year-class was chosen at a conventional level, as the information on the abundance of this year-class is very limited. The average year-class size at age 3 herring over year-classes 1964-69 was 1,070 million fish (166,000 tons) and over the 3 poor year-classes of 1967-69 was 712 million fish (110,000 tons). While this level of recruitment (800 million) may be conservative over a long period it may be equal to or a slight overestimate of present levels of recruitment.

TAC level for 1975. The two constraints (Summ.Doc. 74/9, Proceedings No. 7, Appendix II, p. 59) provided by the Commission specify that an adult stock of at least 225,000 tons be maintained to the beginning of 1976, and the 1974 TAC of 150,000 tons can only be increased if the adult stock size at the end of 1974 will reach a level (500,000 tons) that will provide the maximum sustainable yield by the end of 1975. This level of 500,000 tons cannot be reached by the end of 1974 and the TAC for 1975 cannot therefore be advised to exceed 150,000 tons. Under the present assumptions on recruitment, a catch in 1975 of 150,000 tons would leave an adult stock size at the beginning of 1976 of 237,000 tons, thus meeting the constraint of the required minimum stock size in 1976. Such a catch in 1975, however, would continue the adult stock decline of previous years that was interrupted sharply in 1974 with the addition of the 1970 year-class to the adult stock. In 1974 the adult stock size was 389,000 tons, a large increase over the 180,000 tons at the beginning of 1973. With a catch of 150,000 tons in 1974, the stock will decline to 301,000 tons at the beginning of 1975 and to 237,000 tons by the beginning of 1976 under present assumptions. The adult stock size of 237,000 tons will be the second lowest stock size observed in the fishery, and, with no indication of improved recruitment from the 1971 and 1972 year-classes, a catch in 1975 of 150,000 tons could probably result in a very low TAC for 1976, if the minimum stock level constraint is to be maintained.

m) Mackerel in Subarea 5 and Statistical Area 6 (See Annex 2)

A reassessment of mackerel is given in the Report of the *ad hoc* Mackerel Working Group at Annex 2. Comparisons of estimates of year-class strength derived from mortality studies with those derived

from the composition of catches have made it possible to resolve differences between the two hypotheses used as a basis for advice at the January 1974 Mid-term Meeting. It is now evident that in recent years mackerel have recruited to the fishery at a comparatively early age but that fishing mortality is now at a more generally acceptable level. Recruitment prospects are reasonable, if not particularly encouraging, and it is estimated that a TAC of 285,000 tons in 1975 will maintain both fishing mortality and stock size close to the 1973 and 1974 levels.

It was however noted that catches in 1975 are likely to contain a quantity of 1-year-old mackerel. It is generally undesirable to catch such young fish because of the waste of growth potential, but it was also noted that since 1-year-old mackerel tend to shoal separately from the older fish it is also conceivable that a fishery could develop specifically on this age-group within this quota. Such a possibility would be discouraged by a minimum size limit of 25 cm total length, and, even though the Subcommittee recognized that it might be impossible to avoid some small catch of undersized fish with certain gears (e.g. trawl), it was considered to be a useful additional precautionary measure that should be implemented while further surveys are undertaken to establish the degree of separation of 1-year-old from older mackerel. If such a limit could be totally effective in 1975, it implies that the expected catch of 1-year-old mackerel would not be taken. This amounts to some 31,000 tons within the total TAC of 285,000 tons. If the size limit were implemented and a 285,000 ton TAC were taken from the older age-groups only, it would imply an increase in fishing mortality from 0.6 to 0.7 in 1975 on the age-groups concerned. The Subcommittee considers this to be a marginal increase of F on the older age-groups, which would not significantly change the state of the stock in one year, although it would have to be taken into account in setting a TAC for 1976.

n) Argentine in Subarea 5

(See under Subarea 4 for discussion of argentine in Division 4VWX and Subarea 5, page 93.)

o) Other Finfish in Subarea 5 and Statistical Area 6

A TAC for other finfish of 125,000 tons was established for 1974. This was based on the historic catches which averaged 140,000 tons during the period 1963 to 1972 combined with the observed decline in groundfish biomass during the same period of an order of magnitude of over 50% (Res. Doc. 73/8; *Redbook* 1973, Part I, Annex 3A).

This TAC is made up of numerous species which have not been examined individually or in groups. However, a preliminary assessment was presented on spiny dogfish (Res.Doc. 74/30) indicating an MSY of 40,000 tons. The recommendation of the Subcommittee is that the 1975 TAC for the "other finfish" group of species should remain at 125,000 tons.

p) Squids in Subarea 5 and Statistical Area 6

There are two types of squid of commercial importance in the ICNAF Area, *Loligo* and *Illex*. *Loligo* has the more southerly distribution of the two, but both occur in SA 5 at different times of the year. The directed fishery for squid has so far been aimed at *Loligo* and the advice on which the 1974 TAC was based (i.e. 50,000-80,000 tons) related to that species alone. The two types should therefore be distinguished in the statistics, especially since a directed fishery for *Illex* is now being developed in addition to existing incidental catches of *Illex*. Although the separation is not yet available in the statistics, some idea of the quantities involved has been obtained based on differences in the seasonality of the two species and the reported identity of incidental catches. These are given in Table 9.

It may become necessary to establish a TAC for *Illex* at some future date, but at present there are no data to indicate what the potential catch might be. New information is becoming available for *Loligo* which will provide a new assessment in 1975, but at the moment there is no new information on which to revise the 71,000-ton TAC for squid (*Loligo*).

q) Second Tier Overall TAC in Subarea 5 and Statistical Area 6

Under the agreement reached at the Special Commission Meeting held at Ottawa in October 1973 the overall TAC for all finfish and squid in SA 5 and 6 was set at 850,000 tons for 1975. The Subcommittee has no additional advice on the level of this TAC, but, noting that it will be less than the summed TAC for individual components of the fishery, wishes to point out that, because of the varies importance of different individual species fisheries to the different overall national fisheries, there is no biological reason to expect that the ratio of the two tiers be constant for all countries.

RESEARCH REQUIREMENTS

Full assessments are being brought forward for stocks for which advice has hitherto had to be based on catch statistics alone, and the precision of all assessments is gradually being upgraded. Progress will be related to the resources deployed in statistical sampling and research, and in this regard there must be a commitment to expanded and on-going survey programs as described elsewhere in the Report of the Standing Committee on Research and Statistics. Some further advance has also been made at a theoretical level but, in addition to the perennial problems of estimating recruitment, discussions at this present meeting have indicated particular points that merit special attention in 1974/75. These are (but not in order of priority):

a) Stock differentiation and definition of management areas for capelin, mackerel and silver hake.

b) Reassessment of silver hake in Div. 4VWX.

c) Inclusion of mackerel in SA 3 and 4 into the mackerel assessment for SA 5 and 6 if the research on stock differentiation confirms the need.

d) Inclusion of juvenile herring fisheries in the appraisal of the overall effect of fishing on the herring resources as a whole.

e) Further analysis of the species interaction and potential yield of a mixed fishery as a basis for review of the overall catch quota for SA 5 and 6 at the next regular meeting of the Subcommittee.

ANNEX 1 - REPORT OF HERRING WORKING GROUP

Chairman: T. D. Iles

Rapporteurs: W. T. Stobo, V. C. Anthony

The Herring Working Group met on several occasions during the course of the Assessments Subcommittee meetings, with representatives present from most of the countries exploiting the herring stocks in the ICNAF Area. The main objective of the meetings was to assess the available data and advise on TACs for 1975.

1. Advice on Preparation and Implementation of ICNAF Regulatory Measures (Comm.Doc. 74/22)

The 1972, 1973 and 1974 TACs for the Nova Scotia (Div. 4XW(b)), Georges Bank (Div. 5Z), and Gulf of Maine (Div. 5Y) herring stocks were agreed to at Special Meetings held in the January of the calendar year in which they applied. It has been proposed (Comm.Doc. 74/22) that TACs for all herring stocks be set at the Annual Meeting in June for the following calendar year. Therefore, advice on TACs for 1975 for these three stocks may be required at the present meeting.

It was recognized in the proposal that a loss of precision in scientific advice was likely; this was dealt with in general terms at the last Annual Meeting (*Redbook* 1973, Part I, page 85), and has been considered at this Meeting in so far as it affects the value of advice for setting the 1975 TACs. The loss in precision is related primarily to the estimates of the sizes of the 1970, 1971 and 1972 year-classes. Data on the 1970 year-class (5-year-old fish in 1975) are available from the 1973 adult fishery, the 1972 juvenile fishery and from observations on its distribution and relative abundance offshore from juvenile surveys of 1973 and 1974. The 1970 year-class is relatively large and its size has been estimated to be 1.5 to 2.0 times the size of the 1966 year-class at age 3. The 1971 year-class has not yet appeared in the adult fisheries, but the 1973 juvenile fisheries and the juvenile surveys of 1973 and 1974 indicate that it is a poor one, possibly as small as any on record. No information is available for the 1972 year-class from either the adult or the juvenile fisheries. Estimates of the 1972 year-class from the 1974 juvenile surveys suggest that this year-class is also a poor one. It was agreed to assign an arbitrary size to the 1972 year-class, the calculation of which is dealt with in the individual stock assessments. The adoption of a conventional and conservative size for the year-class recruiting as 3-year-old fish in the TAC year (in this case the 1972 year-class) would mean that the probability of over-exploitation of the recruiting year-class would be reduced.

It was also agreed that, if TACs for these stocks for the following calendar years are to be regularly set at Annual Meetings, this convention for 3-year-old recruitment to the fishery in the TAC year be routinely followed. This will have to be done until such time as the results of juvenile surveys are reliable enough to generate year-class estimates with which a reasonable level of precision can be associated. It will, however, require a few more years of accumulated data before there can be an adequate evaluation of the pre-recruit surveys for estimation of year-class strength.

The following assessments deal with the four major herring stocks under consideration for quota regulation in 1975.

2. Herring in Divisions 4V and 4W(a) (Banquereau Stock)

a) Catch statistics

The fishery in this area has been a relatively recent one, with large catches first occurring in 1968-69. It has variously been assumed that this stock complex has three components, one in each of the ICNAF Subdiv. 4Vn, 4Vs and Div. 4W(a). There is, however, little biological evidence to confirm this hypothesis.

The fishery in Subdiv. 4Vs has virtually collapsed, with catches declining from 70,000 tons in 1968-69 to less than 2,500 tons since 1971. However, the Canadian fishery closer to shore in Subdiv. 4Vn and Div. 4W(a) has consistently taken catches greater than 25,000 tons since it began in 1968. Table 1 gives the Canadian catch statistics by month for Subdiv. 4Vn and Div. 4W(a). These data are presented on the basis of 1 July-30 June fishing season. The data have been revised and differ somewhat from figures previously reported.

b) Catch Composition and Catch per Unit Effort

Catches of Subdiv. 4Vn adult herring increased between 1968 and 1972. Since then the fishery has become more dependent on younger fish (Table 2). In 1970-71 and 1971-72 fish less than 5 years old accounted for less than 20% of the catches; but in 1972-73 fish less than 5 years old accounted for almost 40% of the catch and in 1973-74 the 1970 year-class alone accounted for 52% of the catch. Despite the fact that the 1973-74 catch composition suggests a large 1970 year-class, a 44% decrease in the catch per unit effort occurred between 1971-72 and 1973-74 (Table 3).

The Div. 4W(a) fishery began in 1968-69 as a juvenile fishery. This difference between the Div. 4W(a) and Subdiv. 4Vn fisheries (juvenile *vs* adult) may account for the difference in the catch compositions prior to 1973. Canadian size limit regulations instituted in 1973 have restricted exploitation of juveniles, and thus the Div. 4W(a) fishery is now directed towards adults. In 1973-74 the catch and catch per unit effort in Div. 4W(a) increased by 87% over that of the 1971-72 season (Table 3). This increase was probably due to the large 1970 year-class which accounted for over 70% of the catch.

Table 1. Canadian monthly herring catches (tons) in Subdiv. 4Vn and Div. 4W(a) for the period 1968-74. (Fishing season is based on a 1 July-30 June period.)

Area	Month	1968/69	1969/70	1970/71	1971/72	1972/73	1973/74
4Vn	Jul	56	42	13	5	28	18
	Aug	-	7	-	545	10	3
	Sep	-	-	10	8	3	-
	Oct	271	-	-	318	-	20
	Nov	-	-	8	953	5,084	3,988
	Dec	102	-	1	4,311	7,683	10,965
	Jan	136	1,431	1,569	3,991	1,434	363
	Feb	687	1,624	1,348	-	54	-
	Mar	848	-	-	-	-	-
	Apr	25	1,834	16	370	624	
	May	100	11	56	60	2,165	
	Jun	51	43	44	101	94	
	Total	2,276	4,992	3,065	10,662	17,179	15,347
4W(a)	Jul	126	96	59	28	-	12
	Aug	60	62	19	28	-	16
	Sep	2	-	1	2	-	27
	Oct	1	-	6	15	-	9
	Nov	-	-	-	119	42	164
	Dec	-	2,033	3,629	4,200	164	1,243
	Jan	3,729	5,504	14,676	10,788	7,248	16,697
	Feb	10,920	6,773	13,965	4,051	392	9,623
	Mar	8,169	6,667	13,535	5,905	-	-
	Apr	2,016	5,919	6,571	449	17	
	May	26	11	40	53	43	
	Jun	63	42	34	18	15	
	Total	25,112	27,107	52,535	25,656	7,921	27,791
Total (4Vn+4W(a))		27,388	32,099	55,600	36,318	25,100	43,138

Table 2. Year-class composition of the Subdiv. 4Vn and Div. 4W(a) fisheries in the 1969-74 seasons. [The 1973-74 composition was derived from the calculated numbers at age; the compositions for earlier years were derived from weighted age-length distributions (Stobo *et al*, Res.Doc. 73/94).]

Area	Fishing season	Year-class composition (%)												
		1972	1971	1970	1969	1968	1967	1966	1965	1964	1963	1962	1961	1960+
4W(a)	1969-70	-	-	-	1.4	14.3	22.8	35.1	9.9	10.0	3.5	1.8	1.2	0.1
	1970-71	-	-	0.4	25.6	22.1	10.4	15.3	7.7	10.1	4.5	1.8	1.0	1.2
	1971-72	-	-	2.6	11.0	33.7	11.8	15.3	10.8	8.6	3.6	1.4	1.3	-
	1972-73	-	10.7	28.4	31.9	8.1	5.1	7.1	2.8	2.1	2.0	1.2	0.5	0.1
	1973-74	1.6	5.4	70.4	10.8	2.6	2.1	1.6	2.0	1.8	0.3	1.0	-	0.4
4Vn	1970-71	-	-	-	-	0.7	5.8	12.3	14.7	13.9	19.5	5.4	12.4	15.3
	1971-72	-	-	-	1.5	4.7	3.5	8.6	9.4	17.0	14.3	17.2	18.7	5.1
	1972-73	-	0.1	5.9	14.5	19.2	9.0	8.5	5.8	15.0	11.0	6.5	2.0	2.5
	1973-74	0.1	4.6	51.9	16.9	5.3	3.5	3.8	3.4	4.6	3.1	1.7	0.6	0.5

Table 3. Canadian monthly catch per unit effort (tons) for large herring purse seiners in Subdiv. 4Vn and Div. 4W(a) during the 1971-72 to 1973-74 fishing seasons.

Area	Month	Fishing season 1971-72	1972-73	1973-74
4Vn	Nov	100.3	80.8	61.6
	Dec	106.9	99.5	88.8
	Jan	154.0	122.9	51.9
4W(a)	Nov	-	14.0	-
	Dec	70.6	81.9	165.2
	Jan	78.6	74.6	133.1
	Feb	79.7	97.1	128.4
	Mar	68.2	-	-
	Apr	57.2	-	-

c) TAC for 1975

The collapse of the Subdiv. 4Vs adult fishery, the trend toward a greater dependency on younger fish in Subdiv. 4Vn, and the declining catch rates in Subdiv. 4Vn imply a substantial reduction in adult abundance in the Div. 4W(a) stock complex.

The appearance of a large 1970 year-class in both Subdiv. 4Vn and Div. 4W(a) and the substantial increase in the catch per unit effort in Subdiv. 4W(a) suggest a future increase in adult abundance. If the fisheries are exploiting the same stock in Subdiv. 4Vn and Div. 4W(a), however, then the exploitation of these younger fish should not be increased in order to protect the future adult stock. An increased 1975 TAC therefore is not advisable.

d) TAC Based on Fishing Season 1 July-30 June (Comm.Doc. 74/20)

The Canadian fishery in Div. 4VW(a) extends from November to March. The small international fishery in Div. 4V occurs mainly during the spring. Setting the TAC at the Annual Meeting would thus allow analysis of the data from the most recent fishing season; these data would not be available for a mid-term meeting. It follows that a TAC for a 1 July-30 June period would be best suited for the management of this fishery. A TAC for the calendar year 1974 has already been agreed to by the Commission; a transition to a seasonal basis requires a recommendation for an interim TAC for the January-June 1975 period.

The total Div. 4VW(a) catches from 1971-73 have been partitioned into January-June and July-December periods (Table 4). For the 3-year period 68% of the total catch and 70% of the Canadian catch was taken in the January-June period. In January-June 1974 the Canadian fishery took 26,683 tons which represents 67% of Canada's Div. 4VW(a) 1974 quota. These figures suggest that an interim TAC for the January to June period of two-thirds of the calendar year TAC would be appropriate. The Working Group therefore advises (i) that the TAC, if set for the 1975 calendar year, should not exceed 45,000 tons; (ii) that the 1 July-30 June proposed management period be accepted, and an interim TAC of two-thirds of the suggested 1975 calendar year TAC be set for the 1 January-30 June 1975 period (i.e. 30,000 tons).

Table 4. Div. 4VW(a) catches (metric tons) from 1971-73 partitioned into January-June and July-December periods. The Canadian portion of the catch is given in parentheses for 1971-74.

Period	Year 1971	1972	1973	1974	Average 1971-73	%
Jan-Jun	57,800 (49,000)	21,500 (19,600)	12,600 (12,100)	... (26,680)	30,630 (26,900)	68
Jul-Dec	14,200 (4,500)	11,200 (10,700)	18,300 (16,400)		14,560 (10,530)	32
Total	72,000 (53,500)	32,700 (30,300)	30,900 (28,500)		45,200 (37,430)	100

3. Herring in Divisions 4X and 4W(b) (Nova Scotia Stock)

a) Catch Composition, Mortality and Recruitment

All catch and sampling data up to 1973 are now available for this stock and the catches, expressed as numbers at age for the period 1965-73 (Table 5) have been updated from those presented at the January 1974 Mid-term Meeting.

Table 5. Catch composition (numbers x 10^{-3}) for the southwest Nova Scotia stock (Div. 4XW(b)), 1965-73.

Age	1965	1966	1967	1968	1969	1970	1971	1972	1973
1	30	616	4,430	13,852	5	448	4,626	7,732	1
2	210,828	45,678	43,234	746,145	65,549	83,808	11,105	647,970	20,505
3	26,072	270,055	68,671	78,899	325,057	14,819	62,611	35,408	650,221
4	233,081	56,063	238,403	64,045	51,952	188,539	46,175	82,118	57,480
5	49,129	308,471	109,786	267,965	115,750	163,076	80,192	56,397	21,127
6	10,721	44,916	159,205	70,183	71,446	89,144	41,890	58,906	17,996
7	1,591	15,006	57,936	87,767	48,659	93,908	53,092	43,546	16,102
8	476	7,716	4,497	31,258	18,837	32,846	21,031	39,860	13,155
9	16	1,689	409	15,277	6,194	13,428	9,732	23,034	11,901
10	11	215	296	5,635	2,789	7,300	4,215	9,315	5,520

These numbers were used in a cohort analysis using F = 0.5 for the terminal F for each year-class. Initially average F values for each age-group for the period 1965-72 were used as starting F's in 1973. High F-values are associated with strong year-classes and thus the average over a period of years is not necessarily applicable to a specific year; therefore the following method of estimating the starting F's in 1973 was used. The 1972 F-values for the 1968 and older year-classes calculated from the cohort analysis were used to calculate selection factors using the 1966 year-class as a standard. Three values of F = 0.4, 0.5 and 0.6 were assumed for the 1966 year-class in 1973 and values for the other year-classes (1968 and older) were adjusted proportionally. Estimates of the size and hence of 1973 F's for the year-classes of 1969 and 1971 were made from a comparison of weir catches at age 2 from the New Brunswick weir fishery and population sizes at age 1 from the southwest Nova Scotia stock as follows:

Year-class	1963	1964	1965	1966	1967	1968	1969	1970	1971
New Brunswick weir catch at age 2 (10^{-6})	775	139	160	694	351	313	165	615	212
Pop. at age 1 in SW Nova Scotia stock (10^{-9})	2.7	1.3	1.1	2.4	0.5	0.5	-	-	-

Without implying stock relationships between populations, the correspondence between the New Brunswick weir catch at age 2 and the population size at age 1 on the southwest Nova Scotia stock suggest that the 1969 and 1971 year-classes are poor, while the 1970 year-class is large. This correspondence is only useful in suggesting that the 1970 year-class is good but does not relate to its size relative to the 1966 or 1963 year-classes as the catch from the weir fishery has an upper limit imposed by the processing capabilities of the food industry. No evidence is available to indicate the size of the 1972 year-class which will recruit to the Nova Scotia fishery in 1974. It is assumed then that the 1969, 1971 and 1972 year-classes are similar in size at age 1 to those of 1967 and 1968 (500 x 10^6). The stock sizes for these year-classes at age 1 used in the assessment (Res.Doc. 74/13) are as follows:

Year-class	1969	1971	1972
No. at age 1	500 x 10^6	483 x 10^6	670 x 10^6

At the 1974 Annual Meeting it was agreed by the Working Group to use a conventional recruitment value for any new year-classes for which no data were available on their relative size. It was agreed that for the Div. 4XW(b) stock this value should be one-third the size of the 1966 year-class at age 3 (i.e. 300 x 10^6). This would result in slightly lower assumed values at age 1 for the 1971, 1972 and 1973 year-classes, and a 2,000-ton decrease in the recommended TAC for 1975. This decrease was not considered significant due to the wide range of variables within the assessment.

The 1970 year-class was the dominant year-class in the population in 1973 and formed the major part of the biomass. Thus differing assumptions of the size of the 1970 year-class predominantly affect the total calculated stock biomass in 1973.

b) Stock Biomass and Catch Predictions

Stock biomass of age 2 and older fish were calculated for the period 1966 to 1971 from calculated population numbers. These were plotted against annual catch per unit effort for the southwest Nova Scotia purse seine fishery and are shown in Fig. 1.

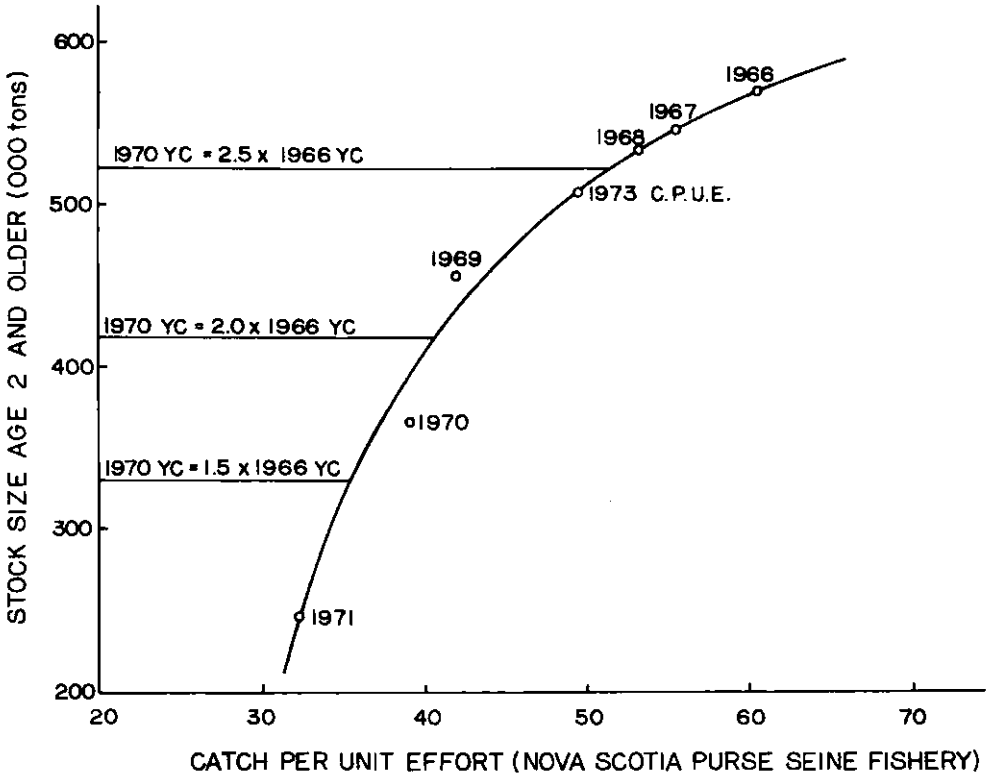

Fig. 1. Relationship between stock size and catch per unit effort in the Nova Scotia purse seine fishery.

The catch per unit effort in 1973 was 49.1 tons per boat night, which corresponds to a stock size on the curve of 505,000 tons. Biomass of year-classes other than 1970, using assumptions of year-class size as listed earlier, is 122,000 tons. Using these assumptions the 1973 catch per unit effort indicated that the 1970 year-class is between 2.0 and 2.5 times the strength of the 1966 year-class at age 3. Thus, three assumptions were used on the size of the 1970 year-class in making 1975 catch predictions: 1.5, 2.0 and 2.5 times the 1966 year-class. The proportions of year-classes in the 1974 catch were assumed to be the same as those in the 1973 catch. Catch in 1975 was calculated using assumed F-values of 0.03, 0.13, and 0.25 on ages 2, 3 and 4, respectively, which fitted the recruitment patterns of a poor year-class to the fishery. An F = 0.5 was used on age 5 and older fish which corresponds to the maximum yield per recruit when age at recruitment is greater than 2.5.

Nine options on 1975 catches and stock sizes were calculated, using the three assumptions on size of the 1970 year-class and three values of F in 1973 on age 5 and older fish.

The nine calculated values for 1975 TACs (i.e. total catches minus estimated catches by immobile gears of 12,000, 15,000 and 17,000 tons for assumptions that the 1970 year-class was 1.5, 2.0 and 2.5 times the 1966 year-class) are shown in Table 6. It was considered that 2.0 x 1966 year-class was the most reasonable assumption on the size of the 1970 year-class implying a 1975 TAC in the order of 90,000 tons. However, it is stressed that, unless the 1972 and 1973 year-classes are substantially stronger than assumed (i.e. 300 x 10^6 fish at age 3), the 1976 TAC will be very substantially below 90,000 tons if F is maintained at 0.50. This could be offset if the TAC for 1975 could be set lower than 90,000 tons. Thus, it is not possible to recommend any increase in the size of the 1975 TAC from 90,000 tons. In fact, to help offset the effects of possible poor recruitment of the 1972 year-class, it should be set lower than 90,000 tons to reduce the possibility that the 1976 TAC will be very substantially reduced.

Table 6. Resultant stock sizes (age 4 and older) as a function of catches (age 3 and older) for the Div. 4XW(b) herring fishery, assuming three sizes of the 1970 year-class and a range of fishing mortality rates in 1974. (F's in 1975 were set to correspond to maximum yield per recruit.)

1970 year-class	Stock size at start of 1974 (10^6)	Stock size at start of 1974 (000 tons)	Average F in 1974 (age 3 and older)	1975 stock (000 tons)	1975 TAC (000 tons)	1976 stock (000 tons)
150%	1,214	229	.49	157	43.5	149
	1,179	218	.63	149	40.5	145
	1,150	209	.88	141	38.0	142
200%	1,870	334	.43	278	85.0	220
	1,835	322	.56	270	82.0	217
	1,806	313	.83	263	79.0	214
250%	2,600	449	.41	413	131.0	300
	2,564	438	.56	405	128.0	297
	2,535	429	.81	398	126.0	294

4. Herring in Division 5Y (Gulf of Maine Stock)

Additional information since the January 1974 assessment consists of catch and sample data for the first four months of 1974. The US catch of herring from January to May 1974 was more than 3,000 tons or about 2.5 times the US catch for the same period in 1973. The bulk of the catch was from the 1970 year-class as expected. These data do not affect the assumptions of year-class strength made in the January 1974 assessment.

The adult stock size (age 4 and older) has steadily decreased from the level of 152,000 tons in 1968 to a low of 46,000 tons in 1972. The recruitment of the 1970 year-class to the adult stock (age 4 and older) increased the stock size in 1974 to 78,000-100,000 tons. If the TAC for 1974 is fully taken, the adult stock will decrease to 58,000-79,000 tons at the beginning of 1975.

a) Assumptions

The assessment of the Div. 5Y herring stock to set a TAC for 1975 was made with the following assumptions:

(1) The TAC for 1974 (25,000 tons) will be fully taken.

(2) The size of the 1970 year-class at age 3 is 150-200% that of the 1966 year-class. No new information is available on the precise size of the 1970 year-class, but the indications are that it is probably within this range and possibly closer to the larger of the two values.

(3) The 1971 year-class at age 3 is equal in size to the 1969 year-class, the poorest year-class observed in the fishery. The catch of the 1971 year-class at age 2 was the second lowest recorded in the Div. 5Y juvenile fishery. Juvenile surveys in Div. 5Z and SA 6 indicate that this year-class is much smaller than the 1970 year-class and strengths of year-classes in the Div. 5Z and SA 6 fishery tend to correspond to the strengths of year-classes in the Div. 5Y juvenile fishery.

(4) The 1972 year-class is taken to be 150 million fish (23,250 tons), approximately half of the size of the 1966 year-class at age 3. This is a conventional level of abundance at age 3 for newly recruiting year-classes. The average year-class size at age 3 for year-classes 1964-69 was 192 million fish (29,800 tons); for the poor year-classes of 1967-69 it was 138 million fish (21,400 tons). The conventional level of 150 million fish was conservatively chosen as less than the long-term average (192 million fish), because of the uncertainties about the size of this year-class. Lower levels of exploitation of herring at age 3 should result in an increase in yield if they are caught at age 4.

b) TAC Level for 1975

In January 1974 the Commission (Summ.Doc. 74/9, Proc. No. 7, Appendix II, p. 59) agreed that the Div. 5Y catch in 1975 should be set at a level which will maintain the adult stock at least at 60,000 tons at the end of 1975. It was also agreed that the level of catch for 1975 will not be increased above that for 1974 unless the adult stock size at the end of 1974 has reached a level (110,000 tons) which will provide the maximum sustainable yield by the end of 1975. The level of 110,000 tons cannot be reached at the end of 1974 even with a very small catch in 1974 and assuming the upper level for the 1970 year-class. A TAC in excess of 25,000 tons cannot, therefore, be recommended for 1975.

Fig. 2 and Table 7 compares the catch (age 3 and older) for 1975 with the stock size (age 4 and older) at the beginning of 1976 for the assumed levels of the 1972 and 1971 year-classes and for two levels of this 1970 year-class. Assuming this 1970 year-class to be 200% of the 1966 year-class, catches of 20,000 tons and 25,000 tons in 1975 would result in stock sizes in 1976 of 74,000 tons and 69,000 tons respectively. A catch of about 16,000 tons is required to maintain the 1975 stock level of 79,000 tons. Assuming the 1970 year-class to be 150% of the 1966 year-class, catches of 20,000 or 25,000 tons in 1975 would result in stock sizes (age 4 and older) of 54,000 and 49,000 tons respectively at the beginning of 1976. The lowest stock size in the history of the fishery was 46,000 tons in 1973.

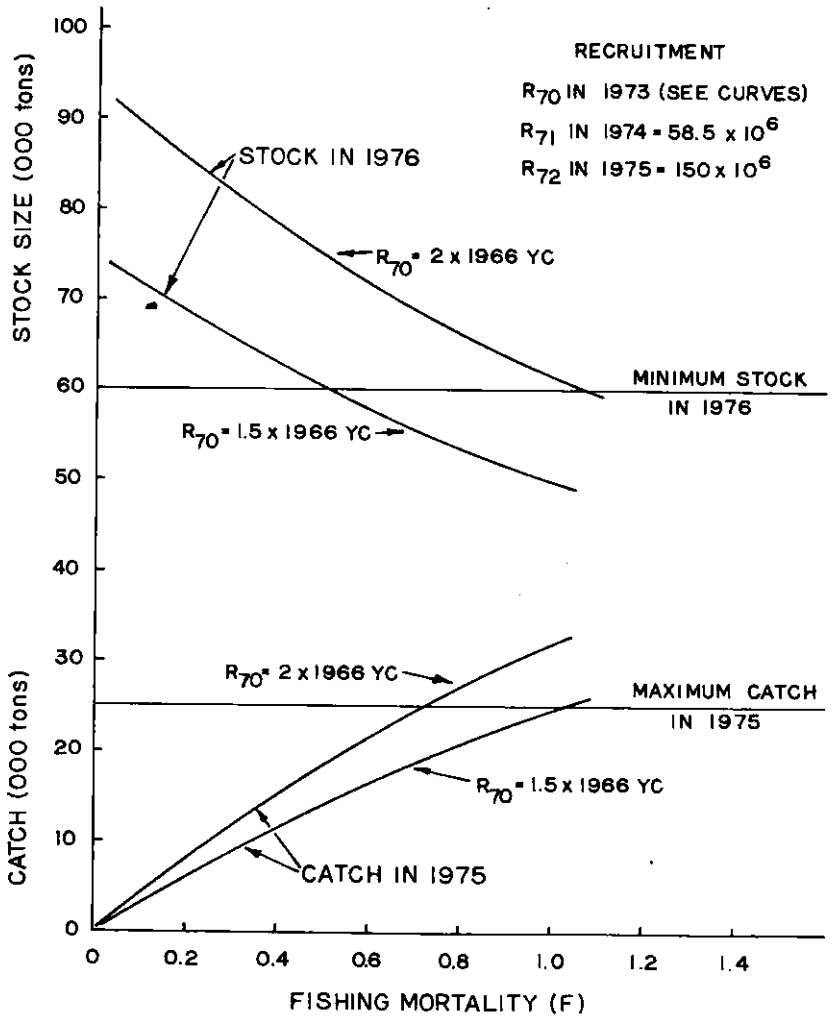

Fig. 2. Comparison of catch for 1975 with stock size (age 4 and older) in 1976.

Table 7. Resultant stock sizes (age 4 and older) as a function of catches (age 3 and older) for the Div. 5Y adult herring fishery, assuming two sizes of the 1970 year-class and a range of fishing mortalities in 1975.

1970 year-class as % of 1966 year-class	Stock size at start of 1974 (10^6)	Stock size at start of 1974 (000 tons)	Catch in 1974 (000 tons)	Stock size at start of 1975 (10^6)	Stock size at start of 1975 (000 tons)	1975 F (100 %)	Catch in 1975 (000 tons)	Stock size at start of 1975
150	387	79	25 (assumed)	256	58	0.2	6.2	68.1
						0.4	11.2	62.7
						0.6	16.5	57.9
						0.8	20.8	53.7
						1.0	24.7	49.8
							25.0	49.0
200	508	100	25 (assumed)	351	79	0.2	8.0	85.3
						0.4	15.1	78.3
						0.6	18.4	75.1
							25.0	69.0
						0.8	27.1	66.5
						1.0	32.2	61.6

While a catch of 25,000 tons in 1975 will probably result in a stock size at the beginning of 1976 of 60,000 tons or more, it does not take advantage of the good 1970 year-class to rebuild the stock. Establishing a TAC of 20,000 tons for this fishery would provide a better opportunity for stock rebuilding and some insurance against TAC reductions in 1976, if the recruitment assumptions prove to be too optimistic.

5. Herring in Division 5Z and Statistical Area 6 (Georges Bank Stock)

Additional information concerning this stock since January 1974 consists of preliminary results from the spring juvenile herring survey on Georges Bank and from the US spring groundfish survey. The juvenile survey confirmed that the 1971 year-class was very poor relative to the 1970 year-class. There are indications that the size of the 1972 year-class may be similar to that of the 1971 year-class, but the reliability of the abundance index for the 1972 year-class is less certain than for the 1971 or 1970 year-classes. Abundance indices for herring in the US spring groundfish survey averaged 4.1 fish per tow in 1973-74 compared to 37.6 per tow in the period 1968-70 in the Southern New England and Middle Atlantic area. The reliability of these data is uncertain due to small numbers of herring caught.

a) Assumptions

Assessment of the Div. 5Z + SA 6 herring stock to advise a TAC for 1975 was made with the following assumptions:

(1) The TAC for 1974 (150,000 tons) will be fully taken.
(2) The size of the 1970 year-class at age 3 is 200% of that of the 1966 year-class. Preliminary analyses of the age composition of samples obtained from the 1974 juvenile survey on Georges Bank suggest that at least 90% of the herring taken were of the 1970 year-class. This indicates that the 1970 year-class is equal to the larger of the two assumptions (150% and 200% of the 1966 year-class) used in the January 1974 assessment.
(3) The 1971 year-class size at age 3 is equal to that of the poorest year-class observed in the fishery, the 1969 year-class. Estimates of the size of the 1971 year-class are available from both the 1973 and 1974 juvenile surveys. Both estimates indicate that this year-class is very poor. This year-class did not appear in the adult fishery as age 2 fish in 1973 as was observed for the 1970 year-class in 1972.
(4) The 1972 year-class is equal to 800 million fish (124,000 tons) or approximately half the size of the 1966 year-class at age 3. The size of this year-class was chosen at a conventional level as the information on the abundance of this year-class is very limited. The average year-class size of age 3 herring over year-classes 1964-69 was 1,070 million fish (166,000 tons) and over the 3 year-classes of 1967-69 was 712 million fish (110,000 tons). While this level of recruitment (800 million) may be slightly conservative over a long period it may be equal to or a slight overestimate of present levels of recruitment.

b) TAC Level for 1975

The two constraints (Summ.Doc. 74/9, Proc. No. 7, Appendix II, p. 59) provided by the Commission specify that an adult stock of at least 225,000 tons should be maintained at the end of 1975 and that the 1974 TAC of 150,000 tons can only be increased if the adult stock size at the end of 1974 has reached a level (500,000 tons) that will provide the maximum sustainable yield by the end of

1975. This level of 500,000 tons cannot be reached by the end of 1974 and the TAC for 1975 cannot therefore be advised to exceed 150,000 tons. Under the present assumptions for recruitment, a catch in 1975 of 150,000 tons would leave an adult stock size at the beginning of 1976 of 237,000 tons (Fig. 3), thus meeting the constraint of the required minimum stock size at the beginning of 1976. Such a catch in 1975, however, would continue the adult stock decline of previous years that was interrupted sharply in 1974 with the addition to the adult stock of the 1970 year-class.

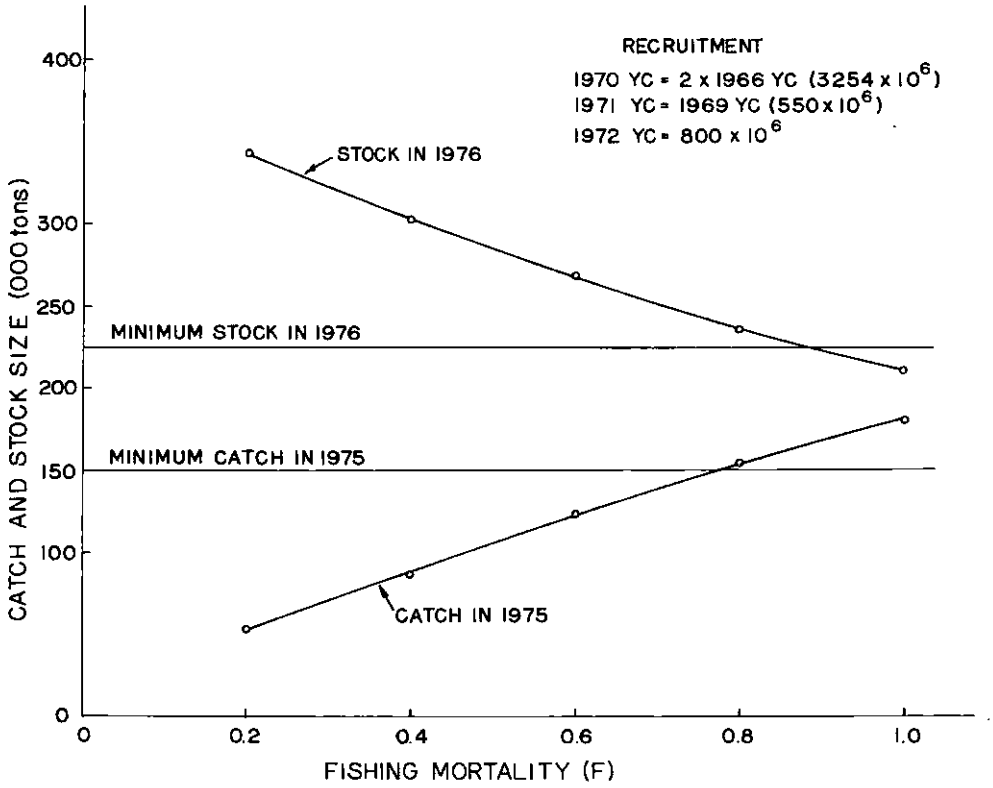

Fig. 3. Div. 5Z + SA 6 herring catch (age 3 and older) in 1975 and stock (age 4 and older) in 1976.

In 1974 the adult stock size was 389,000 tons, a large increase over the 180,000 tons at the beginning of 1973. With a catch of 150,000 tons in 1974, the stock will decline to 301,000 tons at the beginning of 1975 and to 237,000 tons by the beginning of 1976 under present assumptions. The adult stock size of 237,000 tons will be the second lowest stock size observed in the fishery. With no indication of improved recruitment from the 1971 and 1972 year-classes, a catch in 1975 of 150,000 tons could result in a very low recommended TAC for 1976 to maintain the minimum stock level constraint.

6. Herring Size Limits (Comm.Doc. 74/16)

The present 9-inch (22.7 cm) size limit regulation provides for tolerances on exemptions on an annual basis. This allows vessels to mount an intensive short-term effort on under-sized herring under the assumption that enough large herring will be caught in the rest of the year to comply with the tolerance levels allowed by the regulation.

If the minimum size regulation were to apply to all herring on board the vessel at the time of inspection, rather than on an annual basis, the exploitation of young fish would be reduced. The Working Group, therefore, advises that it would be biologically advantageous that the regulation be amended so that the tolerance levels associated with the size limit regulation apply at the time of inspection.

7. Results of 1973 Surveys

a) Larval Surveys

Reports on the 1973 larval herring surveys are presented in Res.Doc. 74/14, 16, 17, 18, 57, 72, and a summary report is given in Res.Doc. 74/105. The general pattern of spawning in 1973 appeared broadly similar to 1971 and 1972 in that the two main spawning areas again occurred on north-eastern Georges Bank and Nantucket Shoals. Spawning was earlier and less extensive off south-

western Nova Scotia and western Gulf of Maine. Detailed comparisons with 1971 and 1972 are not possible for these areas because the inshore areas of the western Gulf of Maine were not sampled in 1973, and the samples from the inshore areas off western Nova Scotia and Bay of Fundy are not yet analyzed.

In the Georges Bank area (including Nantucket Shoals) total production of larvae was in the order of 10 times greater than in the previous two years. This increase is believed to be the result of significant recruitment to the spawning stock from the large 1970 year-class. In addition to the much greater production of larvae in 1973, it was noted that larvae of all sizes were distributed over a much wider area. The wider distribution of small larvae (<10 mm) suggests that spawning may have occurred over a somewhat wider area. Warmer water temperatures were observed over much of Georges Bank in 1973, but the duration and timing of spawning appeared to be roughly comparable to that in previous years, with peak abundance of small larvae (<10 mm) occurring from mid- to late October and relatively few small larvae found in December. However, mortality during autumn seemed to be higher in 1973 than in the previous years, since by December, when hatching had mainly finished, total abundance of larvae on Georges Bank including Nantucket Shoals was only about four times as high in 1973 as in 1972 and 1971 compared to a 10-fold difference in larval production. On a survey in February 1974 the catches of larvae on Georges Bank had dropped to only about 1/10 the abundance level seen in December 1973, and, in addition, the February 1974 catches were considerably less than those of December 1972, a year of much smaller larval production. This indicates that substantial mortality probably continues throughout the winter, since the larvae are believed to be too small to emigrate out of the area or escape the survey gear.

The Working Group agreed that a longer time series of larval surveys was needed and particularly a continuation of the spring larval surveys in order to investigate more fully the question of the magnitude and timing of winter mortality. In addition, 0-group midwater trawl surveys in late spring or early summer may be required to complete the picture of the first year of life, and it was noted that Canada has already begun such surveys in the Bay of Fundy. It was also agreed that it is very important to continue sampling throughout the Gulf of Maine, including the inshore areas, the Bay of Fundy, and the shoal areas around Nantucket, in order to fully document the distribution of herring spawning and to better define the extent of mixing of larvae among spawning sites and the amount of inshore movement. Continued hydrographic sampling of temperatures and salinity at least is considered necessary to relate spawning and larval dispersal to the major features of circulation and temperature changes.

In view of the great differences between the larval production of 1973 and the previous two years, there will be a unique opportunity to observe whether the strength of these year-classes is at all related to the production of larvae. However, it seems clear that true insight into the causes of mortality will require further studies on the feeding and food supply of larvae and related production indices such as are reported in Res.Doc. 74/14 and 74/68, and perhaps also indices of nutrient levels. The Working Group felt that these studies should be expanded providing that the areal and seasonal coverage of larval sampling is not jeopardized. Finally, the Working Group noted the need for a more comprehensive analysis of the total composition and biomass of the plankton samples, and urged all Member Countries to carefully preserve intact at least the 0.333-mm samples until a standard protocol for such analysis can be established. The resources for processing these samples are increasing, particularly with establishment of the sorting center in Poland.

b) Juvenile Surveys

Bottom trawl surveys for juvenile herring were conducted in the spring (March-April) of 1973 in SA 5 and 6 by the research vessels *Walther Herwig* (Fed.Rep. Germany) and *Wieczno* (Poland), and the surveys were repeated in 1974 by the *Walther Herwig* and *Kronometer* (USSR). Each research vessel used a herring-type bottom trawl similar to the gear used by commercial vessels from its own fleet. The *Wieczno* (1973) and *Kronometer* (1974) surveys were carried out primarily in SA 6, whereas the *Walther Herwig* (1973 and 1974) covered Div. 5Z (Georges Bank and Southern New England) and a small portion of Div. 4X (Browns Bank). The surveys in Div. 5Z by *Walther Herwig* provide the best available measures of juvenile herring abundance because they were the most intensive, and, in both years, they used the same trawl in the same area with sampling designs which could be compared. In addition to the special herring surveys, the *Albatross IV* (USA) conducted the regular spring groundfish survey covering the entire area of SA 5 and 6 with the standard stratified random design.

Results of the surveys in SA 5 by the *Walther Herwig* indicate that the 1971 year-class is considerably weaker than the 1970 year-class, and that the 1972 year-class may be even weaker than the 1971 year-class. An approximate measure of the abundance of the 1971 year-class (relative to the 1970 year-class) was obtained by comparing the mean number per haul of 3-year-old fish in the 1973 and 1974 surveys on Georges Bank. Since no age-length key is yet available for the spring 1974, the estimate is based on a comparison of the stratified mean number per haul of fish from 19-25 cm total length (the approximate size range of 3-year-old herring in March 1973). The ratio

of the 1973 to 1974 catches of this size group (corresponding to the ratio of the 1970 to 1971 year-classes at age 2) was approximately 10:1, suggesting that the 1971 year-class is substantially smaller than the 1970 year-class. The best available measure of the relative strength of the 1972 year-class is based on a comparison of the catches of 2-year-old herring (largely fish <19 cm). Less than 2% of the catch on Georges Bank (by number) in 1973 were <19 cm (1971 year-class) but no herring <19 cm (1972 year-class) were caught at all in 1974, suggesting that the 1972 year-class may be even weaker than the 1971 year-class.

Results of the 1973 and 1974 spring trawl surveys by *Albatross IV* in Southern New England and Mid-Atlantic areas, suggest that the 1971 and 1972 year-classes may be of the same order of magnitude. Only a very small number of juvenile herring (<19 cm) were caught in these areas by *Albatross IV* in either 1973 or 1974; for Southern New England the catch of the 1972 year-class at age 2 (1974 survey) was only 0.7 fish per haul as compared with 0.6 fish per haul of the 1971 year-class at age 2 (1973 survey). Comparable figures for the mid-Atlantic area were 0.2 fish per haul for the 1972 year-class in 1974 and no fish of the 1971 year-class were taken in 1973. Although there were very small numbers of juvenile herring in the *Albatross IV* catches with the Yankee #41 trawl, it should be noted that the length frequencies of the *Albatross IV* herring catches in both 1973 and 1974 were quite comparable with those of the other research vessels (*Walther Herwig, Wieczno,* and *Kronometer*) which used much larger herring-type trawls (Res.Doc. 73/84, Addendum 2). The scarcity of 1972 year-class fish in the Southern New England and Mid-Atlantic areas in 1974 was also confirmed by the USSR research vessel *Kronometer* which caught no fish <20 cm in 33 bottom trawl hauls during April.

The pre-recruit estimates of the 1971 year-class and especially the 1972 year-class based on these surveys still must be viewed as preliminary, since we are not yet sure as to what degree the 2-year-old herring are available to the spring bottom trawl surveys. In particular, there is some question whether juvenile herring may be aggregated in shoal areas inaccessible to the trawls. In any case, however, the available data all point to the fact that the 1971 year-class is substantially smaller than the 1970 year-class, and that the 1972 year-class appears to be of the same order of magnitude as the 1971 year-class.

8. Otolith Exchange and Age Reading Techniques (Res.Doc. 74/77; 73/2)

Results of the 1972 otolith exchange are now complete and include readings by Canada, Fed.Rep. Germany, Poland, USSR and USA. Considerable variation in age estimates, particularly for large fish, was evident between and within countries with an overall agreement of less than 50%, but the general conclusion reached was that further exchanges would be of questionable benefit. Nevertheless, it was recognized that some attempt to reduce differences in age estimates should be considered. At an ageing workshop held in St. Andrews, Canada, in December 1972 (Res.Doc. 73/2) ageing techniques and conventions for assigning year-classes were agreed to by North American scientists. In January 1974 the Herring Working Group accepted these conventions, and it is again recommended they be followed when reporting age data. In addition, the expanding use of otoliths for back calculation of length at age and their use for stock identification purposes increases the need for standardization of techniques. It was also recommended that multiple readings within laboratories be instituted by all countries to ensure consistent estimates of age.

9. Program of Research for 1974-75

a) Larval Surveys

The Working Group recommends that the larval herring survey be continued in the autumn of 1974 and extended into the spring of 1975. A proposed time schedule is given in Table 8. An outline of basic sampling procedures, including the standard cruise track and data formats for 1974 and suggestions for supplementary sampling, will be issued in a Circular Letter following the 1974 Annual Meeting.

Table 8. Proposed schedule for 1974 ICNAF larval herring survey.

Country	Dates	Area of Survey
France	7-24 September	Standard Cruise Track
Poland	30 September-20 October	" " "
USSR	15-30 October	" " "
Fed.Rep. Germany	1-20 November	" " "
USA	1-20 December	" " "
USA	3-21 February (1975)	" " "
Fed.Rep. Germany	5-25 March (1975)	Division 5Z
Canada	September-December monthly cruises	Bay of Fundy
USA	September-December monthly cruises	Coastal Gulf of Maine and Nantucket Shoals

b) Juvenile Herring Survey

Noting that definitive evaluation of the spring juvenile herring surveys will require a longer time series, the Working Group urges continuation of the program in 1975 using the same stratified random bottom trawl survey plan which was recommended for 1974 (*Redbook* 1973, Part I, p. 98). Additional concurrent hydroacoustic work (e.g. USSR-USA experiments in April 1974) is encouraged to explore possibilities of improved survey methods for juvenile pelagic species such as herring and mackerel. Also preliminary midwater trawl sampling for post-larval herring (0-group) is planned for Div. 4X (Bay of Fundy) in April to October 1974 and possibly for Georges Bank and Gulf of Maine in May of 1975 to further delineate distributional patterns of young herring. A tentative schedule of proposed surveys directed toward juvenile herring and mackerel is given in Table 9. The Working Group noted the need for more comprehensive analysis of 1974 survey results prior to the next Annual Meeting to allow better evaluation of pre-recruit measures of the 1972 and 1973 year-classes.

Table 9. Proposed pelagic and demersal trawl surveys in the ICNAF Area in the spring of 1975.

Country	Vessel	Area	Proposed sampling strata	Approximate period and/or number of vessel days	No. of hauls	Type trawl	Nature of sampling
FRG	*Walther Herwig*	Div. 5Z	5-25 (ICNAF)	March (20 days)	80	Bottom (herring)	Stratified random
Poland	*Wiecsno*	SA 6	61-76, 1-9 (ICNAF)	March (20 days)	90	Bottom (herring)	Stratified random
USSR	*Kronometer*	Div. 5Z & SA 6	Experimental plan to be developed	March-April (30 days)	?	Midwater	Hydroacoustic[1] and trawling
USA	*Albatross IV*	SA 5, 6 & Div. 4X	1-49, 61-76 (ICNAF)	3 March-30 April (45 days)	320	Bottom (groundfish)	Stratified random

[1] The primary purpose of the *Kronometer* cruise is to continue experiments on hydroacoustic techniques of estimating biomass of pelagic species, with trawling directed toward identification of acoustic targets.

c) Stock Identity Studies

The Working Group noted the need for more definitive information on the interrelationships of the Subdiv. 4Vs, 4Vn and Div. 4W(a) components of the herring stock complex in Div. 4VW(a) as a necessary input for assessment. A tagging experiment is proposed for Subdiv. 4Vn in November 1974 and in Div. 4W(a) in February 1975. In addition plans are in progress for tagging herring (adults and juveniles) in Div. 4X in the New Brunswick weir fishery from July to September 1974, covering the region from Grand Manan Island to Point Lepreau; and tagging of spawning adults will also be attempted in the Trinity-Lurcher Shoal area in August-September 1974.

More detailed studies of the juvenile herring fisheries in the Bay of Fundy and the Gulf of Maine are urgently required to provide data on which an assessment of their effect on catches in the adult fisheries can be based.

It was noted that an analysis of catch and age composition of the New Brunswick weir fisheries will be made to determine their value as indices of year-class strength.

d) Age-Growth-Maturity Studies

An apparent change in growth rate of the 1970 year-class necessitates a review of mean weights at age currently being used in assessment studies.

The low level of agreement observed in the otolith exchange program poses serious problems in comparing and combining data for assessments. All countries should follow the agreed conventions for reading herring otoliths (Res.Doc. 73/2) and a workshop should be considered in the future to evaluate the effects of these conventions on improving the accuracy of age reading.

The Working Group noted the available data on maturity stages of spawning herring obtained during the course of the herring fisheries on Georges Bank over the past years, and urges all Member Countries to summarize these data for comparison with results of the larval surveys to improve information on the timing and location of spawning.

ANNEX 2 - REPORT OF AD HOC MACKEREL WORKING GROUP

Chairman: E. L. Cadima

Rapporteur: T. D. Iles

The Mackerel Working Group met on 22-23 May 1974 during the Annual Meeting of the Assessments Subcommittee to evaluate the state of the mackerel stock in SA 5 and 6 based on the most recent data and information available. Participants were: Ø. Ulltang (Norway), A. Paciorkowski (Poland), E.D. Anderson (USA), A. Schumacher (Fed.Rep. Germany), T.D. Iles (Canada) and E.L. Cadima (FAO).

1. Modification of Parameters and Assumptions Used at the January 1974 Mid-term Meeting in the Assessment of Mackerel Stocks in Subarea 5 and Statistical Area 6

a) Sizes of 1972 and 1973 Year-classes

Table 1 lists the percentage age composition for fish 2 years of age and over for the years 1973 and 1974 from data from surveys on the one hand and from commercial fleet sampling on the other. No other data for 1973-74 are available to extend the bases for comparison. Both sets of data indicate that the 1971 and 1972 year-classes are of comparable size as age 2 fish. Therefore, these year-classes were taken to be the same size for assessment purposes.

The 1974 spring survey by *Albatross IV* suggested that the 1973 year-class is stronger than the 1971 and 1972 year-classes. It was agreed to accept the assumption, made at the January 1974 Mid-term Meeting (this volume, Part B, page 31), that the size of the 1973 year-class is 1.6 times that of the 1972 year-class.

Table 1. Percent age composition of number/tow of mackerel (age 2 and over) from *Albatross IV* spring surveys in 1973 and 1974 and of Polish mackerel catches in 1973 and January 1974.

Year-class	Age	*Albatross IV* spring survey		Polish commercial fleet	
		1973	1974	1973	1974
1971	2	9.6	13.3	29.5	27.4
1970	3	14.3	27.1	4.6	25.7
1969	4	26.0	3.0	26.1	8.2
1968	5	5.6	10.4	14.2	10.1
1967	6	29.4	6.2	15.1	7.6
1966	7	8.9	24.9	3.9	15.9
1965	8	5.0	9.2	3.9	3.6
1964	9	0.4	4.7	1.6	1.2
1963+	10+	0.8	1.0	0.9	0.0

b) Pattern of Recruitment to the Fishery

Two different hypotheses relating to the pattern of recruitment were used at the Mid-term Meeting (Summ.Doc. 74/8). It is confirmed that the 1967 year-class is very large even after 6 years of exploitation (Table 1). Assuming Hypothesis (2) used in January 1974 as to the recruitment pattern and with F assumed to be 0.4, calculations indicate that the 1971 year-class was as large as 65% of the 1967 year-class size. Accepting Hypothesis (1) gives an estimate of 25% of the 1967 year-class size, which corresponds to the best estimate now available. Therefore, the pattern of recruitment of Hypothesis (1) was agreed for assessment purposes.

c) Total Mortality (Z) Values

Z values were revised for both hypotheses using the most recent available data. At the January 1974 Meeting catch-per-effort data were available from 1968 to 1972 only and 1973 values could be estimated only by extrapolation. A 1973 value for catch per effort of 75% of that of 1972 was assumed which generated a Z value of 1.20. Catch-per-effort data for 1973 from the US commercial fleet are now available and indicate a decline from 1972 to 1973. Results of the US spring survey indicated a decline in overall abundance which supports the commercial data (Res.Doc. 74/10). However, catch per effort for Polish B-18 trawlers showed an increase in 1973 to the highest level yet recorded. It was concluded that an overall decline in catch/effort had occurred but that its

magnitude was smaller than indicated by the US data alone. If catch per effort had remained the same in 1973 as in 1972, a Z value of 0.8 would be implied, and this was accepted as the low limit.

In addition, estimates of Z for 1971-72 calculated from the data on 4-year-old and older fish in 1971 and 5-year-old and older in 1972, using catch-per-effort data from Res.Doc. 74/10, gave a value of Z = 1.0. It was accepted, therefore, that a Z = 0.9 was the most appropriate and this was incorporated into the analysis. This value is equivalent to a 10% decline in abundance.

These procedures resulted in a single agreed hypothesis with a single set of assumptions pertaining to the recruitment pattern, mortality (Z), and estimates of year-class strength (i.e. partial recruitment of 25% at age 1, 50% at age 2, 90% at age 3; a Z value of 0.9 with M = 0.3; and the 1972 year-class equal to the 1971 year-class and the 1973 year-class equal to 1.6 times the 1972 (or 1971) year-class).

2. Results of Mackerel Assessment

The results of the assessment (Table 2) indicate the following:

a) The 1974 TAC of 304,000 tons would be obtained at F = 0.6 (i.e. with no increase in F from that of 1973).

b) If in 1975 the F is maintained at 0.6, the 1975 catch would be 285,000 tons.

c) If age 1 fish (less than 25 cm total length) are not caught in 1975, a catch of 285,000 tons can be expected with F = 0.71, but if F is maintained at 0.6 the expected 1975 catch would be 255,000 tons.

d) The 1976 stock size would be of the same order of magnitude as that of 1975.

Table 2. Results of mackerel assessment for Subarea 5 and Statistical Area 6.

	Age group	Mean weight[1] (kg)	Partial recruitment	Age composition of stock and catch (x 10^6) 1969	1970	1971	1972	1973	1974	1975	1976
Stock	0			3603	1765	2547	-	-	-	-	-
	1	.095	.25	2433	2705	1286	2059	(2059)	(3294)	(3294)	(3294)
	2	.175	.50	4649	1683	1886	866	1490	1313	2100	2100
	3	.266	.90	1450	3296	1222	1160	578	818	721	1153
	4	.350	.100	386	1001	2128	815	622	250	353	311
	5	.432	↓	139	268	586	1125	418	253	102	144
	6	.506		121	97	163	242	487	170	103	41
	7	.564		91	84	60	82	87	198	69	42
	8	.615		54	63	51	33	33	35	81	28
	9	.659		34	38	29	29	17	13	14	33
	10	.693		2	24	12	14	10	7	5	6
	11+	.693		-	-	-	-	3	5	3	2
	Number (x 10^6)[2]			9359	9259	7423	6425	5804	6356	6845	7154
	Weight (000 tons)[3]			1482	1705	1607	1360	1117	994	996	1038
Catch	0			2.8	3.0	1.1	10.9	-	-	-	
	1			139.4	137.7	100.4	41.6	88.1	397.9	397.9	
	2			179.0	30.3	278.0	74.6	326.2	296.2	473.8	
	3			86.3	366.5	104.2	279.4	211.2	298.8	263.3	
	4			20.9	182.5	530.6	218.6	246.0	98.9	139.7	
	5			6.5	41.6	227.8	408.9	165.5	100.1	40.2	
	6			5.7	14.6	45.5	109.4	192.8	67.3	40.7	
	7			5.0	13.1	13.7	32.8	34.4	78.3	27.3	
	8			2.6	20.6	10.7	8.5	13.1	13.8	31.8	
	9			1.7	18.9	9.1	13.1	6.7	5.1	5.6	
	10			0.9	9.4	4.8	8.9	4.1	2.8	2.1	
	11+			-	-	-	-	1.2	2.0	1.1	
	Number (x 10^6)			451.0	838.2	1325.9	1206.7	1299.3	1361.3	1423.6	
	Weight (000 tons)			113.2	209.6	348.7	387.4	375.5	303.3	285.6	
Fishing mortality (F)				0.06	0.35	0.39	0.55	0.60	0.60	0.60	
TAC				-	-	-	-	450	304		

[1] Provisional values requiring correction on estimated catches as in Summ.Doc. 74/8, Fig. 1, p. 26.
[2] Numbers for age 1 and older.
[3] Weights adjusted as in Summ.Doc. 74/8, Fig. 1, p. 26.

These results depend very largely on the assumption used regarding the size of the 1974 and 1975 year-classes for which no estimates are available. If the size of the 1974 and 1975 year-classes is set conventionally at conservative levels (i.e. equal to the 1971 or 1972 year-classes), the 1975 catch for F = 0.6 would be 274,000 tons.

Equilibrium catches, biomass and yield per recruit are listed in Table 3. A separate assessment (Res. Doc. 74/108) gave results similar to those obtained by the Working Group for natural mortality coefficient and $F_{0.1}$ estimates.

Table 3. Mackerel catch and population biomass (age 2 and over) in Subarea 5 and Statistical Area 6 for a range of F's and M = 0.3.

		Equilibrium catch, population biomass and yield per recruit		
Fishing mortality (F)	Total mortality (Z)	Catch for recruitment of 3294 x 10^6 (000 tons)	Biomass for age 2 and over (000 tons)	Yield per recruit (g)
0.1	0.4	182	1,820	58
0.2	0.5	254	1,288	85
0.3	0.6	289	996	98
0.4	0.7	308	814	105
0.5	0.8	318	685	109
0.6	0.9	324	593	111
0.7	1.0	326	522	112
0.8	1.1	326	466	112
0.9	1.2	326	421	112
1.0	1.3	326	384	112
1.2	1.5	324	328	111
1.5	1.8	318	265	119
1.8	2.1	313	223	107

For a constant year-class size at age 1 such as 3,294 million fish, the equilibrium catch at F_{max} (0.9) would be 326,000 tons and at $F_{0.1}$ (0.3) would be 289,000 tons. Equilibrium catches at the same levels of year-class size, F = 0.6, and a series of assumptions regarding the percentage recruitment to the fishery at ages 1, 2, and 3 are as follows:

Age	Recruitment (%)	Equilibrium catch (000 tons)	Recruitment (%)	Equilibrium catch (000 tons)	Recruitment (%)	Equilibrium catch (000 tons)
1	0		0		0	
2	50	338	100	336	0	341
3	100		100		100	

All of the assessment was carried out assuming that the stock is restricted to SA 5 and 6.

3. Mackerel Research Requirements

There is urgent need of further research to determine the relationship between mackerel in SA 5 and 6 on the one hand and those in SA 3 and 4 on the other.

A small *ad hoc* working group considered a proposal to conduct large scale tagging experiments to determine the degree of intermixing and the relative contributions of northern and southern components to the winter mackerel fishery in SA 5 and 6. Tagging winter concentrations, when the components are mixed, would present technical difficulties. Furthermore, differences in catch levels in winter and summer fisheries would require very large numbers of fish to be tagged, if meaningful numbers of recaptures in summer inshore fisheries are to occur. It was concluded that the likelihood of meaningful results was not sufficiently high to justify the substantial expenses that would be involved.

Inshore tagging experiments in SA 3 to 6 in summer to determine intermixing of components in winter fisheries would also have to be on a wide scale (and hence expensive) to have much liklihood of success.

It is unlikely that sufficiently extensive experiments could be mounted especially in SA 5 and 6. However, small-scale tagging could give some useful qualitative information on mackerel movements, and it is recommended that countries undertake such experiments.

Other methods of resolving the question of mixing between SA 5+6 and SA 3+4 were also considered. It is suggested that historical data from egg and larval surveys should be reviewed to determine whether order of magnitude estimates of spawning stock sizes in different geographical areas can be obtained.

As spawning periods of southern and northern mackerel are different, with spawning occurring earlier in the south, progression of maturity stages of fish caught in the winter fishery may indicate the spawning component to which they are likely to recruit. It is recommended that a standard definition of maturity stages be adopted and observations be made routinely during commercial sampling of catches.

It is suggested that parasite infestation be investigated as a possible means of separating stock components.

APPENDIX II - REPORT OF WORKING GROUP ON COORDINATED SURVEYS

Chairman: J. Messtorff

Rapporteur: R. Wells

The Working Group met on three occasions during 22-29 May 1974 in conjunction with the Annual Meeting of STACRES to consider a number of agenda items referred to it by STACRES.

1. Review of Survey Results Relevant to Assessments

Results of recent surveys relevant to stock assessments were reviewed (Res.Doc. 74/33, 50, 54, 55, 61, 66, 75, 79, 86, 92 and National Research Reports). Information on results of larval herring surveys (Res.Doc. 74/14, 15, 16, 17, 18, 57, 72, 105) and juvenile herring surveys (Res.Doc. 74/115) were also presented, and these are summarized in the Report of the Herring Working Group (Appendix I, Annex 1).

2. Review of Survey Activities in ICNAF Area in 1973

At the January 1974 Mid-term Meeting the Group had agreed to include in its discussions all ICNAF survey work. Surveys carried out by Member Countries in 1973 are listed in Table 1.

Table 1. Inventory of surveys conducted in the ICNAF Area during 1973 and to April 1974.

Month	SA 1	SA 2	SA 3	SA 4	SA 5	SA 6
Jan	-	-	-	50/RVn(FRA) ? (CAN)	-	-
Feb	3/C (DEN) 3/D (DEN)	-	42/P (CAN) 50/Pn (FRA)	-	-	-
Mar	-	-	59/Ps (CAN)	50/Vs (FRA) 6/X (FRG)	46/YZ(FRG) 30/Z (POL) 165/Z (USA)	24/ (FRG) 15/ (POL) 85/ (USA)
Apr	3/D (DEN)	-	65/LNO(CAN)	74/RS (CAN) 70/X (CAN)	-	-
May	-	60/J (USSR)	60/LNO(CAN) 60/K-P(USSR)	-	-	-
Jun	2/B (DEN)	60/J (USSR)	60/K-P(USSR)	-	-	-
Jul	-	-	-	146/VWX(CAN)	-	-
Aug	5/A (DEN)	-	-	-	-	-
Sep	5/F (DEN)	26/J (CAN)	27/KLM(CAN)	?/T (CAN) 40/X (FRA)	70/Z (USSR) 80/Z (USA) 76/YZ(FRA)	80/ (USA)
Oct	?/C (USSR) 2/D (DEN)	-	50/NO (FRA) 23/K (CAN)	40/R (FRA) 20/WX (USSR) 23/R (CAN) 20/X (POL) 19/X (USSR)	165/YZ(USA) 117/YZ(POL 100/YZ(USSR)	60/ (USSR)
Nov	18/C-F(UK)	58/G-J(FRG)	26/K (FRG)	70/X (USA) 47/RS (CAN) 20/X (FRG)	106/YZ(FRG)	-
Dec	27/B-F(FRG)	-	-	-	115/YZ(USA)	-
1974 Mar/Apr	-	-	-	7/X (FRG) 70/X (USA)	66/YZ(FRG) ?/YZ(USSR) 165/YZ(USA)	74/ (USSR) 85/ (USA)
Total hauls	68+	204	522	772+	1301+	423

Most of the surveys listed were groundfish surveys, except for (a) juvenile herring surveys in March 1973 in Div. 5Z and SA 6 and in March/April 1974 in Div. 4X, 5Z and SA 6; (b) larval herring surveys in Div. 4X, 5Y and 5Z in September (France), October (Poland and USSR), November (Fed.Rep. Germany) and December (USA); and (c) shrimp surveys in Div. 4R in October (Canada). Most of the Danish groundfish surveys in SA 1 include shrimp.

Compared with recent years, the surveys have increased in most, if not all, subareas and provided better seasonal coverage. It was noted, however, that a further intensification was especially desirable in the northern part of the ICNAF Area. Note was taken of the plans for 1974 surveys in SA 2 and 3 by the German Dem.Rep. In SA 2 and Div. 3K a random stratified groundfish survey based on a revised stratification scheme was successfully conducted for the first time by Fed.Rep. Germany.

3. Survey Plans and Coordination for 1974

Surveys already undertaken in early 1974 are listed at the bottom of Table 1. Planned survey activities of Member Countries are summarized in Table 2.

Table 2. Proposed biological surveys in the ICNAF Area in 1974.

Country	Type of survey	Area	Month
Canada	Groundfish	2J-3K	Mar-Apr
	"	3LNOPs	Apr-Jun
	"	3P	Sep
	"	4RST	Oct-Nov
	"	4TVn	Jan-Sep
	"	4VWX	Jul
	"	4	Jul-Aug
	Herring	3KL	Jun-Jul
	"	4RS	May,Oct
	" (eggs,larvae)	4T	Aug
	" (juveniles)	4T	Jun-Sep
	" (larvae)	4VWX	Oct-Nov
	" (juveniles)	4X	Oct-Nov
	" (eggs,larvae)	4	Oct-Nov
	Mackerel	4RS	Oct
	Tuna	5+6	Jul-Aug
	Capelin	2J	Oct
	"	4RS	May,Oct
	Shrimp	2J	Nov-Dec
	Scallop	4R	Jun-Jul
	Euphausiids	4T	May
	"	4X	Aug
	Eggs,larvae,post larvae	4	Jun
	Acoustics	4RS	Sep
	"	4VsWX	Jun-Sep
Denmark	Groundfish	1C-D	Jan-Dec
	"	Davis St.	Jul-Aug
	Capelin	Inshore	Apr-Nov
	Shrimp	A-F	Apr-Oct
	Plankton	1B-E	Jun-Jul
Poland	Herring(larvae)	5YZ	Sep-Oct
Fed.Rep. Germany	Groundfish	1+2	Dec
	Herring larvae	5YZ	Nov
France	Groundfish	3P	Jan-Mar
	"	4R-T	Jan-Mar
	"	4VW	Jan-Mar
	Cod	4R	Nov
	Herring	4R-T	Mar
	"	4VsW	Mar
	"	5YZ	Sep-Oct
	Scallop	3Ps	Dec
German Dem.Rep.	Groundfish	2+3	Jan
	"	2+Baffin I.	Aug-Sep
	"	2+3	Aug-Sep
	"	2+3	Dec-Feb
Norway	Groundfish	?	Apr-Oct
	Capelin	1	May-Jul
USSR	All species	?	Jun-Nov
	Groundfish	3K-P	May-Jul
	Eggs & larvae	2J+3	Mar-Jun
	Herring	4-6	Feb-May
	Mackerel	4-6	Feb-May
	Herring(larvae)	5	Oct
USA	Groundfish(3)		Mar-May
	" (3)		Sep-Nov
	"		Sep
	Juveniles		Jul
	Herring(larvae)		Dec
	Benthic		Aug

Member Countries agreed that, where feasible, the random stratified survey schemes would be used for groundfish surveys. In Div. 4X, where both the USA and Canada have stratification schemes, it was suggested that other Member Countries employ the Canadian scheme. For the joint larval herring surveys to be conducted again in the autumn of 1974, a tentative schedule for the participating countries was set up as follows:

France	- 7-24 September
Poland	- 30 September-20 October
USSR	- 15-30 October
Fed.Rep. Germany	- 1-20 November
USA	- 1-20 December

In addition to the above schedule for larval herring surveys, tentative plans were made for juvenile herring surveys in the spring of 1975 (the third in the series) with the proposed schedule as given in Table 3.

Table 3. Proposed schedule for juvenile herring survey in spring 1975.

Country[1]	Area	ICNAF sampling strata	Month (no. vessel days)	No. of hauls	Trawl type	Type of sampling
FRG	5Z	5-25	March (20 days)	80	Bottom (herring)	Stratified random
POL	6	1-9, 61-76	March (20 days)	90	Bottom (herring)	Stratified random
USSR	5Z+6	Plan to be developed	March-April (30 days)	?	Midwater	Hydroacoustic and trawling[2]
USA	4X,5+6	1-49, 61-76	March-April (45 days)	320	Bottom (groundfish)	Stratified random

[1] Research vessels involved are *Walther Herwig* (Fed.Rep. Germany), *Wieczno* (Poland), *Kronometer* (USSR) and *Albatross IV* (USA).

[2] The primary purpose of the *Kronometer* cruise is to continue experiments on hydroacoustic techniques of estimating biomass of pelagic species, with trawling directed toward identification of acoustic targets.

4. Reporting and Processing of Survey Data

The Working Group discussed the need for standardization of recording survey data. It was felt that, especially for groundfish surveys, the development and introduction of standard forms suitable for computer processing could facilitate both comparisons of results between surveys of different countries and also the handling of increasingly large amounts of data. In this connection it was stated that not all national laboratories have at present adequate computer facilities to enable prompt analysis of survey data. It was therefore suggested that, where the need existed, the computer facilities of the ICNAF Secretariat be made available. The establishment of an ICNAF Data Base could provide this service in the future.

5. Manual on ICNAF Coordinated Groundfish Surveys

It was recommended by STACRES at the January 1974 Mid-term Meeting that a manual on ICNAF coordinated groundfish surveys be produced. At its present meeting, the Working Group agreed that such a manual should contain practical advice and instructions for planning, executing and analyzing groundfish surveys. The major sections would deal with:

I. Description and objectives of ICNAF groundfish survey program
II. Sampling design
III. General requirements for vessels and trawl gear
IV. Data collection
V. Data analysis
VI. Usefulness of groundfish surveys in stock assessments

In order to proceed the following representatives were asked to prepare pertinent material for presentation at the next meeting of the Group:

J. Messtorff - compilation of revised strata charts for SA 2-5, listing of strata sizes, and design of stratification scheme for the Baffin Island area;
M.D. Grosslein - outline of major elements of trawl survey methods;
A.T. Pinhorn and/or R.G. Halliday - summary of appropriate length conventions.

6. Hydroacoustic Surveys (Res.Doc. 74/113)

The first joint US-USSR hydroacoustic experiment proposed at the January 1974 Meeting was successfully carried out in the ICNAF Area in March/April 1974. An account of this experiment was presented to the Working Group by Mr J.B. Suomala (USA). The objectives of the joint hydroacoustical experiment were:

- to establish and implement standard calibration methods and procedures for all hydroacoustical equipment to be employed for aquatic biomass measurements;

- to obtain hydroacoustical echo signals and other *in situ* data in raw, unfiltered form from aquatic animals (fishes) and the surrounding environment; these data are to be used to begin to understand and evaluate the feasibility and potential usefulness of hydroacoustical methods to obtain pelagic aquatic biomass estimations in the ICNAF Area.

The results of manually processing fifty photographs and applying the appropriate statistical methods, assuming that the target distribution was uniform, showed that the estimate of target density would be within a factor of two with a confidence interval of 99%. Further manual processing of an additional fifty CRT photographs reproduced from the analog data tape at a later date showed no significant change from the original density estimate. A standard procedural document to formalize hydroacoustical equipment calibration procedures and tests is being prepared.

Following Mr Suomala's report, the Group discussed in general the practicability of hydroacoustic techniques in obtaining stock abundance estimates of individual species as well as of total biomass. Mr B.B. Parrish (UK) noted that in recent years hydroacoustic surveys differing in sophistication and automation have been carried out, particularly in the Northeast Atlantic. These have been most promising for pelagic species and in areas where no great mixture of species occurred. In this connection Dr D.H. Cushing (UK) reported on a joint hydroacoustic survey carried out for blue whiting along the continental slope off the British Isles. An inventory of the results of hydroacoustic surveys over the last five years is being prepared by FAO.

The Working Group reached the conclusion that the complex stock mixture in certain ICNAF areas leads to major problems in applying hydroacoustic methods and that further research by experts would be necessary before such methods could be used on a routine basis.

In view of the potential importance of hydroacoustic techniques for fish abundance estimation, the Working Group concluded that experimental work should be continued and that Member Countries be encouraged to participate. The Working Group also expressed its regret that the Polish R/V *Professor Siedlecki* was unable to participate as proposed at the January meeting, but it was hoped that the vessel might be made available for future cooperative work in the ICNAF Area.

7. Data on Physical Environment Obtained on Biological Surveys

Problems of collecting and processing data on the physical environment routinely obtained on biological surveys should be included in the terms of reference of the proposed Environmental Working Group.

8. Other Matters

It was noted that expanded studies of plankton communities are desirable in the ICNAF Area but additional resources are required to process plankton samples. The proposed establishment of a plankton sorting center in Poland was welcomed by the Working Group.

APPENDIX III - REPORT OF STATISTICS AND SAMPLING SUBCOMMITTEE

Chairman: Sv. Aa. Horsted

Rapporteur: L. Butler

The Subcommittee met on 30 May 1974 to consider matters referred to it by STACRES. Matters relevant to improvements in the ICNAF data base were referred to the Working Group on Data Base Improvements, and it was agreed that the Report of this Working Group (App. IV) be considered directly by STACRES. The following documents were reviewed in relation to the various agenda items: Summ.Doc. 74/13, 14, 15, 16, 20, 23, 34, 38, 39, and Res.Doc. 74/114.

1. ICNAF Statistical Activities Report, 1973/74

a) The Assistant Executive Secretary introduced his report (Summ.Doc. 74/20). In particular, he emphasized that at present the Statistical Bulletin can be issued within four to six weeks of the receipt from national offices of completed sets of STATLANT Form 21B. It was, therefore, stressed that Member Countries should strive to ensure that their completed forms are submitted to ICNAF before the deadline date (30 June) and that the material is sent by airmail. Particular attention was drawn to the need for placing the recognized airmail labels on envelopes.

b) The Subcommittee noted with pleasure the provision of updated statistics for the various flounder species for 1963-72 (Summ.Doc. 74/34) and agreed that these be published in the next issue of Statistical Bulletin.

2. CWP Activities Relevant to ICNAF

The CWP representative presented two documents, Summ.Doc. 74/15 and 74/39. The following points emerged from the discussion:

a) ICNAF participants to the 8th Session of CWP to be held in Paris during 12 (or 13) to 21 September 1974 would be the Assistant Executive Secretary, the Chairman of the Statistics and Sampling Subcommittee, and one delegate and one observer from the USA.

b) National offices which had not yet commented on the paper, "Notes on the Improvement of the Definition for the Fishing Effort Concept, 'Days on Ground'" (dated 11 March 1974), prepared and circulated by the Secretary of CWP, should do so as soon as possible, so that a working document could be prepared by the CWP Secretary for the 8th Session of CWP.

c) The 8th Session of CWP should discuss the problem of measuring effort in gillnet fisheries.

d) It was thought the 8th Session of CWP need not discuss the question of statistics on discards (see Section 6 below).

3. Statistical Activities of Other Regional Agencies

The Subcommittee took note of the information contained in Summ.Doc. 74/13 (Report of the ICES Statistics Committee) and Summ.Doc. 74/14 (Extracts from resolutions passed at 1973 ICES Meeting). The observer from ICSEAF (Dr B. Draganik) commented briefly on the statistical activities of ICSEAF.

4. *Statistical Bulletin*, Vol. 22 for 1972

Following the Assistant Executive Secretary's comments on *Statistical Bulletin*, Vol. 22, which has been reorganized in the light of recommendations from the 1973 Annual Meeting, the following points emerged with a view to improving future issues:

a) The historical series in Part I should in future issues continue to cover the most recent 15 years for TAC species.

b) The historical series for "flounders" should be discontinued, and separate historical tables be introduced for American plaice, witch, yellowtail and Greenland halibut.

c) The Secretariat will attempt to complete the historical series for squids, and, in due course when data for sufficient years become available, separate tables for *Loligo* spp. and *Illex* spp. should be introduced.

d) The rightmost column in Table 1 (Part II) headed "ICES Area" should be deleted and the space taken for listing the ICNAF Statistical Area catches for the previous year.

e) It was agreed that, in all tables in which the term occurs, the group title "Shellfish" should be

replaced by the more general title "Invertebrates".

f) Since there have not as yet been any catches reported for Stat. Div. 6E and 6F, the space occupied by these columns could, if necessary, be taken for recording the catches from any new statistical areas that might in future be introduced. Any future catches from Stat. Div. 6E and 6F could be included under Stat. Div. 6D and suitably footnoted.

g) The species included on any page of Table 4 should be clearly indicated at the top of the page.

5. Advance Monthly Statistics for Selected Species

A first attempt to obtain advance monthly statistics for use at the Mid-term Meeting in January 1974 and a second attempt to obtain similar data by March 1974 to facilitate the work of the Assessments Subcommittee, by supplying the scientists concerned with tabular material prior to the meeting, were not very successful. It was hoped that future attempts to obtain advance statistics would be more successful and it was stressed that, where catch statistics were not available, estimates by the pertinent national offices should be made.

Considering the importance of these advance statistics for assessment purposes prior to the Annual Meeting, the Subcommittee

recommends (2)

i) that countries be requested to compile preliminary monthly catch statistics for selected species in 1974 and forward the tables by airmail to reach the Secretariat not later than 31 March 1975; and

ii) that the Secretariat compile the received statistics and circulate the produced tables to assessment scientists as soon as possible after the deadline date.

6. Statistics on Discards

It was agreed that the form, as presented by the Assistant Executive Secretary in Summ.Doc. 74/20, Appendix A, should be used for the reporting of statistics on discards with the addition of Greenland halibut in the list of species. It was proposed that "Sampling Rate" should normally indicate the percentage of nominal catch sampled. If another estimation procedure is employed, this should be reported.

Since STACRES has decided to discontinue the publication of Redbook, Part III, in which the statistics on discards were previously published, the Subcommittee agreed that, in future, statistics on discards should appear in the Statistical Bulletin.

7. Statistics of Fish Used for Industrial Purposes

It was agreed that, while the catch of industrial fish should continue to be included in nominal catches, the ICNAF Secretariat should not attempt to collect separate statistics for industrial fish. However, in view of the usefulness of information on this subject, the Subcommittee

recommends (3)

that National Research Reports should include any available information regarding quantities of fish, by species if possible, being used for industrial purposes.

8. Adequacy of National Reporting on STATLANT Forms

The Secretariat reported that, although some improvement had been noted in the submission of STATLANT statistics, the 1973 STATLANT 21B returns for several countries were received as late as five months after the deadline of 30 June. Once again the Subcommittee urged that Member Countries make every attempt to respect the deadline for the submission of STATLANT 21A (15 April) to facilitate the production of preliminary statistics for use at Annual Meetings and STATLANT 21B (30 June) to facilitate the early production and issuing of the Statistical Bulletin.

9. Review of STATLANT Forms

a) Since carbon copies of completed STATLANT forms are no longer automatically produced, FAO should be asked to consider whether copies of completed STATLANT Form 21B should still be submitted to that organization.

b) Catches of *Gadus ogac* (Greenland cod) should be listed separately and placed in the "other groundfish" group.

10. ICNAF List of Vessels

Noting that the 1971 *List of Vessels* was produced from computer printout, the Subcommittee agreed that, while a complete list should continue to be published triennially as in the past, amendments to the most recently published list could be compiled as a Summary Document for the intervening years. To reduce the workload of national offices when compiling the required information, the Secretariat will supply each country with a copy of the previous year's list for amendment.

The Subcommittee agreed that no change was necessary in format, and accordingly

recommends (4)

that the 1974 List of Vessels be published using the 1971 format.

11. New Statistical Area off Baffin Island

In view of the possible extension to the area off Baffin Island of some stocks under regulation in the Convention Area, the Subcommittee

recommends (5)

i) that a new statistical area in the Davis Strait south of the Greenland/Canada Ridge and outside the Convention Area be established; and

ii) that the statistical area be called the Baffin Island Area with the code "0" (zero).

The marine boundary (Fig. 1) would commence on the east coast of Baffin Island at 66°15'N latitude and run due east to the meridian 59°00'W; thence due south to the parallel 61°00'N; thence due west to the meridian 65°00'W; thence in a northwesterly direction along a rhumb line to meet the southeast coast of Baffin Island at East Bluff (61°55'N, 66°20'W). Further division of the proposed new statistical area was thought unnecessary.

12. Requirements for Sampling Data

At the January 1974 Meeting, STACRES recommended that all countries be requested to provide sampling data for 1973 pertinent to the 1973 catches of species for which a quota would be considered at the 1974 Annual Meeting.

The Subcommittee noted with great appreciation that the advance reporting of sampling data as requested had been nearly complete, but at the same time was concerned about the fact that the full use of these data in up-to-date assessments had not been possible due to the aforementioned failure by many countries (see Section 5 above) to supply at the same time the requested advance catch statistics for 1973.

It was felt, however, that the advance reporting of sampling data for the TAC species was highly valuable, and the Subcommittee accordingly

recommends (6)

that sampling data for species, for which a quota is to be considered at the Annual Meeting in any year, be airmailed to reach the Secretariat not later than 31 March of that year.

The Secretariat will continue to provide the appropriate forms and circulate a list of the sampling data received, and upon request will supply the individual scientists and laboratories with the sampling data requested by them.

For sampling data not requested by the above mentioned early reporting, the deadline would still be 31 July. The Secretariat would, therefore, shortly after the Annual Meeting circulate a letter to Member Countries reminding them of the request to report samples not already submitted.

The Subcommittee stressed the importance of countries providing details on their sampling methods in the annual updating of Notes to Sampling Data.

13. Review of Sampling Forms

The Subcommittee reviewed the present forms used for reporting sampling data. It was noted that some countries continue to report their sampling data on the older forms. Since this creates some difficulties in data-processing at the Secretariat, the Subcommittee stressed the importance of the new forms to be used by Member Countries in accordance with the instructions supplied with the forms.

Minor changes in the forms were proposed. Mid-points of 2- and 3-cm grouping should be substituted by the lowest value of the proper length range (e.g. 18.5 for the group 18-19 and 19 for the group 18-20 should both be substituted by 18-). Countries should indicate on the form their method of measuring (cm below or nearest cm).

With regard to the reporting of the various species by length groups, the Subcommittee

recommends (7)

that the following length groupings be used, and that some species as indicated be reported by sex (male and female separately):

Cod, pollock, white hake, cusk	*3 cm*
Haddock, red hake	*2 cm*
Herring, mackerel, butterfish, squids	*1 cm*
Roundnose grenadier	*3 cm by sex*
Silver hake, American plaice, witch, Greenland halibut, yellowtail (SA 3-4)	*2 cm by sex*
Redfish, yellowtail (SA 5-6)	*1 cm by sex*
Capelin	*½ cm by sex, if possible.*

14. Sampling Yearbook

The Subcommittee reviewed the latest issue of *Sampling Yearbook*, Vol. 17 for the year 1972. It was noted that the Sampling Yearbook, besides data on samples from commercial catches, also contained some research and exploratory samples mainly selected to fill gaps in the commercial sampling scheme. Also included in Vol. 17 was a list of research samples available in the Secretariat.

It was noted with appreciation that sampling was gradually increasing although far from being satisfactory. The new minimum sampling requirements (see Rec. 11) if met, would mean a considerable increase in the volume of the Sampling Yearbook, probably to an extent that more than one volume per year would become necessary. Since only part of the information in the Sampling Yearbook is normally used by individual workers or laboratories, it was felt that, although the Sampling Yearbook has been extremely useful and has played a fundamental role in the establishment of ICNAF sampling schemes, the present need for speedy availability to individual scientists of sampling data, and the great amount of work involved in issuing the Sampling Yearbook, made it desirable to circulate data on request instead of in a bulky volume. The Subcommittee, therefore,

recommends (8)

i) that the issuing of Sampling Yearbook be discontinued;

ii) that an annual list of commercial and research samples available for that year be incorporated in Redbook (Part I); and

iii) that the Secretariat supply the sampling data available upon request to Member Countries.

15. Other Matters

The Subcommittee took note of Res.Doc. 74/114 describing the Canadian Atlantic fishery statistical system. It was noted that the introduction of a grid system (not larger than 1° square) was being planned.

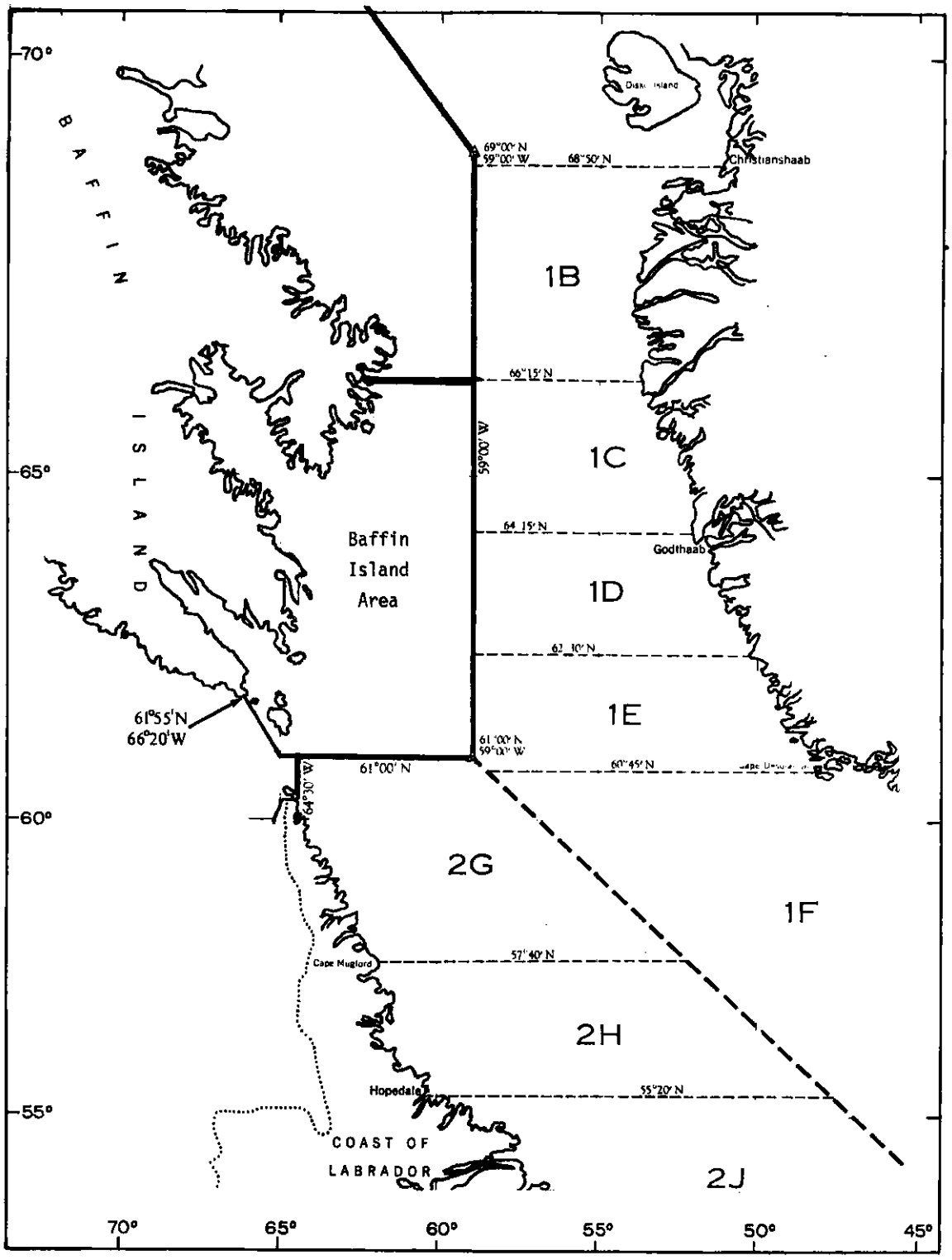

Fig. 1. Map of northern part of the ICNAF Convention Area, showing the boundaries for the Baffin Island Area (Statistical Area 0).

APPENDIX IV - REPORT OF SPECIAL WORKING GROUP ON ICNAF DATA BASE

Chairman: R. C. Hennemuth

The Working Group was set up at the 1973 Annual Meeting to consider (a) finer breakdown of catch and effort statistics, (b) studies of sampling methods and bias, and (c) expanded processing facilities within the Secretariat. The Group first met during the January 1974 Mid-term Meeting, the report of which is contained in Summ.Doc. 74/8 (see also Report of January 1974 Meeting of STACRES, Appendix II, this volume). Several recommendations were adopted relating to further work to be completed in time for the 1975 Annual Meeting. During the present STACRES Meeting, the Working Group met to review progress on these projects and to consider further the problem of improving the ICNAF data base.

1. Catch and Effort Statistics

Few data for the Div. 5Z Pilot Study were available prior to the meeting. Some reports were made available at the meeting and others were reported to be in the mail. It was decided that the Secretariat incorporate in a document all available data within a month after the meeting, together with plots of the catches and effort as described in Summ.Doc. 74/8, and circulate this to Member Countries for study.

The Group again discussed the necessity and desirability of obtaining catch and effort data in finer detail. It was noted that many countries' fisheries were already recording data on a finer basis than that required for reporting to ICNAF, and that the Commission's regulations require daily observations of catch and effort. Several countries noted improvements in their fisheries for more detailed recording, although further development was required. There was a consensus for some fisheries that more detailed data were required than the month by division now in effect, whereas for some others implementation of present requirements would be satisfactory. It was noted that the need for more detailed data was especially true in the southern subareas where the mixed species fishery problem was greatest, but that, even in single species fisheries, a desirable degree of improvement in the accuracy of assessment and monitoring would be achieved.

This need is related to the goals of the Commission and the accuracy of assessments necessary to achieve them. These factors are, however, difficult to express and evaluate in cold, hard facts. The assessment scientists strive to provide the most precise answers possible. In general, the present level can be improved significantly by just the full compliance with present guidelines and requirements. However, there are several major problems facing the scientists which do require the recommended statistics. The silver hake, red hake, herring and mackerel fisheries in SA 4, 5 and 6 are examples of such a need that have been discussed and brought forward to the Commission over the past several years (*Redbooks*, Part I, 1968-73). The assessment of the total finfish regulation in SA 5 and 6 is another example where estimation of the overall fishing mortality to the desired degree of accuracy requires a time-area breakdown of at least the detail recommended (Res.Doc. 74/101). Other specific examples, some in SA 3, have also been discussed.

In reality, it is the judgement of the scientists, who are actively involved in assessments, that must be relied upon. The collective judgement indicates, without much doubt, the need to have the improved statistics to provide the desired confidence in the advice given. This need was expressed at the 1973 Annual Meeting, when the Commissioners, in considering the scientific basis of decision, advised that Member Countries should begin immediately to improve their national resources for ICNAF work. The Group's recommendation is a specific need to which the general advice applied. In consideration of this need, the Working Group

recommends (9)

that the Commission adopt a statistical reporting system based on 30 x 30 minute areas and twice-monthly time periods in accordance with the following specifications:

a) the time periods and areas proposed are adjusted as necessary to be complete subsets of the present month and division strata;

b) the STATLANT system would be changed only to the extent that (i) the 21B Forms would indicate the new time and area periods, (ii) the Secretariat would process the more detailed data to produce the present Statistical Bulletin format, but would also produce working reports of the finer detail as required by STACRES in its scientific endeavors, and (iii) FAO would assume the responsibility of distribution of the new 21B STATLANT Forms with accompanying instructions.

c) the initial year for new reports should be set by the Commission upon consideration of national problems;

d) the necessary annual cost to the Secretariat of about $70.000.00 (1974 Canadian dollars) are provided for upgrading staff and facilities.

With regard to specification (b) of the recommendation, no change is suggested for the other categories of classification (e.g. gear, tonnage class) or in the time schedule of reporting.

With regard to specification (c), the Group points out that the new reporting system could be phased in on the basis of subarea, e.g. SA 5 and 6 only in the first year; SA 4 in the second year; and detailed reporting for SA 1, 2 and 3 could be postponed, if necessary, for a period because there is less urgency and need, although it would be beneficial to have the improved data base for the ICNAF Area as a whole.

With regard to specification (d), it is estimated that, if the new reports are due first in year X, the increased costs would be phased in approximately as follows: $41,000.00 in year X-2, $54,000.00 in year X-1, and $70,000.00 in year X. These costs are approximate and depend to some extent on the Commission's implementation of increased funding for maintaining the present operations.

Varying degrees of difficulty for nations in implementing this recommendation were postulated. It was not possible to fully evaluate these, and, indeed, the Working Group did not consider this in their purview. Compliance is really a matter of commitment by the Member Countries for the resources to do the job. There is the danger that, if this is not adequate, the attempt to meet the new requirements may be only partially successful, and timely reporting may suffer a temporary set-back. The Group can only point out the obvious inference that, if the improved data is not available, the biological basis of decisions will not improve to the level, in many cases, which scientists have judged to be necessary.

2. Sampling Methods

A number of statistical studies had been completed and were reviewed (Res.Doc. 81, 83, 106, 109, 112). These studies stressed the need for developing as rigorous a design and analysis for collecting samples as was possible, with particular attention paid to probability sampling. It was also noted that the variability in age and length compositions should be studies in relation to other factors of variability in the analytical models which utilize such data, e.g. virtual population analyses. It was agreed that the statistical studies provided valuable insights into the problem of bias and errors in sampling, and the Group

recommends (10)

that the studies outlined in the January Report (Summ.Doc. 74/8) be completed and reported to the 1975 Annual Meeting, and that the detailed data be appended to such reports.

Advice on methods of analysis is available from J. Brennan (USA), J. Pope (UK), and W. Doubleday (Canada).

The studies available were not sufficient to provide a precise set of sampling requirements with regard to numbers sampled. However, an *ad hoc* Working Party reviewed the present ICNAF minimum sampling requirement with respect to its formulation and adequacy (Annex 1). Relative to the problem of minimum levels, the Working Group

recommends (11)

that the minimum level should be one sample per 1,000 tons of fish caught for each division, quarter of year, and gear. (Sample size was considered to be largely a practical problem of sampling unit but 200 fish from the entire length range for length composition and one fish per cm length group for age composition was chosen as an appropriate 'rule of thumb'.)

With regard to desirable levels of sampling, it was considered that a level leading to a 10% coefficient of variation, if associated with the estimated numbers caught at each age, would probably form the most appropriate objective. There is, however, a need for further research into the variability of national sampling schemes to assess the likely increase in effort needed to achieve this level. There is also a need for further research into effects of sampling errors on assessment errors with a view to specify the optimum standard for sampling.

All Member Countries present provided documentation on the sampling methods employed to take length and age samples (Summ.Doc. 74/35 with Addenda 1-7). In general the methods and problems associated with dockside sampling and at-sea sampling were common to all countries utilizing one or the other approach. The primary sampling unit on a vessel at sea was the individual trawl haul, while ashore it was commonly a container or bin of fish, often containing only one of a number of market size categories. None of the reported sampling methods provided adequate samples of fish discarded at sea; the sampling at sea was from the catch taken on board while on shore it was from part of the catch retained for marketing. The number of fish per sample varied widely (100-1,000), depending on circumstances. The subsamples from the primary sampling unit were mostly grab samples, except that the Fed.Rep. Germany had studied bias and developed a systematic method to minimize it, and dock-side samples usually included all fish within the container. Almost all countries stratified the age samples by length groups. The level of

sampling in many major categories was expressly inadequate. The by-catches were not sampled, except in a few instances, either for length and age or species composition.

The practice of sampling from scouting vessel fishing within the fleet was routine for some countries and the samples used, in some cases, for estimating age and length of commercial catches. The possibility of bias was discussed, and it was agreed that this should be specifically noted in any analyses based on such samples.

The limitations on age reading were in many cases more restrictive than the collection limitations.

Many countries had special forms for recording samples, but the identifying information and the procedures for handling such data varied widely.

3. Reporting and Processing Samples

The matter of differences arising in final age and length composition, by using different analytical procedures, was noted as one of major importance. The submission of individual length samples to the Secretariat for processing was suggested in order to provide for more uniform analysis and provide a more adequate data base for assessments. Several problems were raised - for example, the varied and haphazard sampling methods sometimes employed required knowledge of the conditions of sampling when processing so that invalid summaries were not obtained. It was noted that uniform (in terms of principles) and systematic sampling methods would alleviate some of the difficulties, but could not be expected to be maintained under difficult conditions sometimes encountered.

It was suggested that a pilot study - using individual samples in assessment of some major stocks - would be valuable. The Group accordingly

recommends (12)

that individual length and age samples be submitted to the Secretariat for the years 1972 and 1973 for the stocks listed below, so that they would be available for species assessments at the 1975 Annual Meeting:

Silver hake in SA 4, 5 and 6 (three stocks)
Mackerel in SA 3-6 (one stock)
Cod in Div. 2J+3KL (one stock)

The Secretariat will prepare a circular letter with details of submission requirements.

4. Estimated Costs of Secretariat Processing

The additional costs required for the Secretariat to process both the more detailed catch and effort statistics and the individual age samples were estimated on the basis of extrapolation from existing processing. Items included were personnel (four additional positions - $30,000.00), leased computer hardward (read-write terminal - $15,000.00), programming and keypunching ($10,000.00), computer time (15,000.00). The total of these costs is $70,000.00 per year (1974 Canadian dollars).

It was noted by the Secretariat that a request for additional funds and facilities to take care of present work was pending. The costs above are in addition to this, but include anticipated savings in intergration of activities of the expanded Secretariat.

5. Age Validations

Two documents (Res.Doc. 74/110 and 111) were presented which listed bibliographies of validation studies and pointed out major problems in some species. The Group encouraged the continuation of such studies by expressing the need to have a validation study for every stock for which age compositions are utilized in assessments. Cooperative studies among countries ageing fish from the same stock would be most desirable. Otolith exchanges had indicated important differences in ageing for many stocks, but follow-up activities to rectify these differences had not been pursued.

ANNEX 1 - REPORT OF WORKING PARTY ON MINIMUM AND DESIRABLE LEVELS OF SAMPLING

1. Minimum Sampling Levels

The sampling requirement that a minimum of 200 fish be measured for every 1,000 tons taken per quarter was considered. Suggested improvements in this procedure included the following:

a) The emphasis in sampling should henceforth be on the number of samples taken rather than on the number of fish sampled. There was a consensus that, as a general rule, at least 200 fish be taken in each sample of the full length range. However, it was felt that practical consideration of sampling unit (i.e. box, fish pound, etc.) would determine sample size in many sampling situations.

b) The number and distribution of samples for each species should be such that all gears and ICNAF divisions fished in a quarter of the year be represented in the sampling procedures. It is, therefore, suggested that a minimum of at least one length and age sample per 1,000 tons caught in each division for each gear and quarter of year be taken.

c) The age sampling should be such that at least one otolith or scale sample per cm length group be aged for each length sample taken.

The above advice was viewed as providing a minimal level of sampling and was not to supersede sampling procedures developed on the basis of studies of variance components of stock sampling.

2. What would be a desirable level of sampling?

The levels of sampling suggested in the previous section were designed to ensure that at least a minimum of sampling was carried out and are not meant to suggest the desired levels.

The level to be desired is of course related to the question of what the results are to be used for. For example, when virtual population analysis is used, it seems probable that the precision with which fishing mortalities are estimated are similar to the precision of the catch at age data. This suggests that a sampling scheme, producing catch at age data which have a similar coefficient of variation at each age, would be most appropriate. Other uses (catch curves) might be better served by sampling schemes giving a greater precision to the numbers at age of the older ages. The feeling of the Group was that sampling schemes, which generated coefficients of variation for the numbers caught at age that were approximately the same for all the important ages of fish (i.e. those which contribute significantly to the catch), would probably be most generally desirable, since, apart from being most appropriate to virtual population analysis, it would also ensure that all ages were sampled to an acceptable level of accuracy. The magnitude of the coefficient of variation of numbers at age which should be set is a question of the accuracy required for assessments of particular stocks. Tentatively, however, it could be stated that 20% would be too large and 10% probably of the order which would be moderately satisfactory.

The adoption of this level of accuracy, as being desirable, would not, of course, imply that this level should be achieved by all contributing sampling schemes; but it would imply that a nation, catching a proportion (q) of the fish from a particular stock, would need to sample such that the coefficient of variation of its catch at age data was approximately $10\sqrt{1/q}$ %. Thus a country catching a quarter of the quota from a particular stock would be expected to achieve a coefficient of variation of approximately 20% for the catch numbers at each age. It is therefore suggested that:

a) Countries continue to carry out more statistical studies of their sampling schemes so that the level of precision they are currently achieving can be established. It would be particularly helpful if studies of important stocks such as cod, herring and mackerel could be made.

b) Research into the relationship between sampling error and assessment error be continued.

APPENDIX V - REPORT OF ENVIRONMENTAL SUBCOMMITTEE

Chairman: H. W. Hill

Rapporteur: M. D. Grosslein

The Environmental Subcommittee met on 21 May 1974. The following documents were reviewed in relation to the various agenda items: Res.Doc. 74/14, 50, 51, 52, 57, 61, 67, 70, 71, 74, 82; Summ. Doc. 74/10, 21, 22, 24, 26, 30, 31, 32 and 33.

1. Special Symposium on Environmental Conditions on the Newfoundland Grand Bank Area in 1972

Nine invited papers were presented at the Symposium on "Environmental Conditions in the Newfoundland Grand Bank Area, 1972, and their Effect on Fishery Trends", and two formal papers, presented as 1974 Research Documents which were relevant to environmental conditions in 1972 and the previous decade, were reviewed during the discussion periods.

1972 was clearly indicated as an unusually cold year in the waters of the Grand Bank Area, the transport of the Labrador Current being above average during the spring and reaching a peak during late April and May, when estimates by several contributors suggested that it was 50%-100% above the norm. It was suggested that the increase in the Labrador Current was associated with a sustained anomalously low air pressure system causing an increase in northwesterly winds and below normal air temperatures over the eastern seaboard of Canada during the first half of 1972. However, there was also evidence that the Atlantic Current was equal to or slightly above normal, and higher than normal bottom layer temperatures were reported from the southern Georges Bank and Cabot Strait during this period. Phytoplankton was more abundant than usual in the Labrador Current and to the east and southeast of Grand Bank, but the spring outbreak was late and persisted until July. The outbreak of copepods was also later than usual, numbers being particularly low over the Grand Bank. It was suggested that the increase in young herring on the Nova Scotian Shelf and Georges Bank in the winter of 1972 might be associated with the increase of southerly advection of cold water in the 0-100 m layer, and that the distribution of cod on the western slope of Grand Bank and in the Avalon Channel could have been affected by the unusually cold bottom temperatures.

Two of the papers presented, concerned with the general circulation of the area, tended to lend support to Mann's hypothesis concerning the derivation of the Atlantic Current to the southeast of Grand Bank.

In view of the extensive cover and general consensus of agreement on the 1972 environmental conditions among the papers presented, and in the discussion periods, the Subcommittee

recommends (13)

that the papers presented at the Special Symposium on Environmental Conditions on the Newfoundland Grand Bank Area in 1972, after suitable editing by the Convener, in conjunction with the Executive Secretary, be published in the ICNAF Special Publication series together with the significant points raised in the discussion periods.

2. Environmental Conditions in 1973

a) West Greenland

The cold conditions prevalent since 1969 in West Greenland waters have persisted in late winter and spring but some improvement has occurred in the upper layers in the summer and autumn. In August, temperatures in the Irminger component of the West Greenland Current were lower than usual and did not reach 4°C below 300 m, but in October an inflow of warmer water was noted in the deeper layers. However, the strength of the Irminger component at the end of 1973 was less than in 1972. The 5-year running mean of sea surface temperature anomalies has now decreased to the same low level as before the 1920's.

b) Labrador Shelf and Grand Bank

On the Labrador Shelf surface temperatures were above average in July-August but in the intermediate layer were lower than the 1951-71 mean, although not as low as in 1972. In the deep slope water east of Hamilton Inlet Bank temperatures were lower than in 1972 and in the deepest layer comparable with or lower than the lowest over the last 20 years. The same trend of hydrographic conditions were also observed in November.

On the Grand Bank to Flemish Cap area surface temperatures were above average (1951-71) but were below normal over the southern part of the Bank. Bottom temperatures on the western Grand Bank and in the Avalon Channel were lower and very cold water, below -1.5°C, covered a greater area of the bottom than in any previous year of the period. The Atlantic Current to the south of Grand

Bank was reported by the USCG to be 40 miles further north than average and directly along the Tail of the Bank, forcing the Labrador Current, which generally appeared to be weaker than normal in the period April-July, up onto the Bank itself.

c) Nova Scotian Shelf and Georges Bank

Surface water temperatures over Georges Bank were between 15-16°C in September reducing to 14-15°C in November with salinities near 32‰. On the Nova Scotian Shelf colder (11-13°C) and more saline water was found. The near bottom temperatures on Georges Bank were between 7-17°C depending on depth in September reducing to 7-15°C in November.

3. Standardization of Hydrographic Stations, Sections and Base Periods for Temperature and Salinity

It was reported that Dr Hermann had agreed to act as convener for the West Greenland area and Dr. Schlitz for the Canadian East Shelf area. The Subcommittee noted the proposals submitted by Dr Hermann (Res. Doc. 74/82) and referred these to the new Environmental Working Group (see Item 11).

4. Canadian Oceanographic Data Centre Report

Dr Wilson reported that CODC had been renamed the Marine Environmental Data Service and had incorporated three existing data services. The reorganization had meant they had made little progress processing data for the ICNAF Area. Two major programs underway included a system of plot programs, which should be operational shortly, and which would facilitate the production of horizontal contoured maps, and the acquisition of a Data Management System which will greatly facilitate the development of new computer programs and modification of existing programs, and will help the development of ICNAF-related data acquisition and data processing requirements.

5. Presentation of Continuous Plankton Recorder Results for 1973

A paper was presented on behalf of the Institute of Marine Environmental Research, UK, which indicated that in 1973 phytoplankton was below average in every month in Subarea 1, although the spring peak occurred at the usual time. It was scarce in the first half of the year in Subarea 2 but particularly abundant in October and December. Numbers were low in April in Subarea 3 but above average in May and June. Total copepods were low in Subarea 3 except in June and August but they were unusually abundant in Subarea 4 in January and February and in Subarea 5 in October. Young stages of *Sebastes* were also well above normal in May in Subareas 2 and 3, in June in Subarea 4, and especially so in July in Subarea 1.

6. Plankton Sorting Centre at Gdynia

It was reported that work had not yet begun but Dr Sherman would be visiting the Sorting Centre in Szczecin shortly to finalize plans. The major objectives of the Sorting Centre will be to provide logistic support to:

a) long-term monitoring of the plankton community along the lines recommended in the proposal for a coordinated ICNAF environmental research program (Res.Doc. 74/70);

b) specific stock-recruitment studies with the initial focus on spawning areas to investigate community composition, plankton succession, abundance, and distribution.

Sample and processing protocols have been detailed in the documents for the MARMAP program of the US National Marine Fisheries Service (NOAA) and will include the use of density gradient sorting methods. Initial samples for processing will include the zooplankton collected during the ICNAF Joint Survey of Herring Larvae to support stock-recruitment studies for this species. The lont-term monitoring series to be examined will include the plankton samples obtained on groundfish surveys from the Gulf of Maine to Georges Bank during autumn and spring surveys.

7. Ice Conditions and Weather and Ice Reporting

Following the severe ice years of 1969-72, 1973 had been more normal off the West Greenland coast. In 1973 polar ice did not pass north of Frederikshaab (approximately 62°N). Off Labrador at the end of 1972, there was unusually large quantities of drift ice. By comparison, at the same time in 1973, the area was entirely free of ice, and during the 1973 winter and spring of 1974, ice conditions were less severe than in the winter 1972/73.

The Chairman asked about the implementation of Recommendation 20 (*Redbook* 1973, Part I, page 122), and, since it appeared that there had been no significant increase in reporting from fishing vessels, the Subcommittee

recommends (14)

that the Executive Secretary write to Member Countries drawing their attention to the Commission's request of 1973 that fishing vessels operating off Greenland and Canada be encouraged to provide at least one weather report per day to coastal maritime radio stations when ice is in the vicinity.

8. Publication of Papers on Ice Dynamics Presented at the 1973 Annual Meeting

The Executive Secretary reported that the preparation of the papers for publication was continuing and it was hoped that the editing would be completed in about two months. It was planned to publish the papers in the ICNAF Special Publication series.

9. Presentation on Remote Sensing and its Use in Fisheries

Dr Vandall of the Bedford Institute of Oceanography gave a presentation on remote sensing techniques. He indicated that remote sensing is essentially the technique of using instruments on an aircraft or in a satellite to determine the characteristics of the surface of the earth through its emission or reflection of electromagnetic radiation. Using radiometers, scanners, cameras and special devices the ultraviolet, visible, infra-red and microwave region may be used with ground control measurements to determine the characteristics of objects and their environment. In terms of fish the detection can be either direct or indirect. The latter method involves sensing physical phenomena known to be characteristic of an organism's habitat or sensing physical phenomena that are created as a result of the organism's presence. Phenomena like the character of sea surface (temperature, salinity, colour, turbidity and currents), front location, thermocline depth, food availability as determined by upwelling, location, internal waves, etc., fish oil secretions and bioluminescence are representative of the indirect approach.

Largely under the National Marine Fisheries Service (NOAA) at Pascagoula, Mississippi, the following results have been brought forth: tuna catch locations have been correlated with thermal front locations using IR radiometer data from aircraft and satellites, turbidity interfaces have been correlated with catch locations of menhaden and shrimp using visible data from aircraft and satellites, fish oils appear to be distinguishable using an optical correlation spectrometer in the UV and IR bands; temperature variations of 1°C have been observed in the IR over fish oil films, fish school tonnages may be estimated from image enhancement of bioluminescence by low light level TV at night, and in some circumstances, species identification should be possible with a multispectral scanning system.

Problems with this type of sensing arise with the intervening atmosphere which alters the magnitude of radiation coming from an object and going to a sensor. Only radiation in the microwave band seems relatively free of this. This limits schedules for sensing operations and limits detection capability to 'clear' days and makes the gathering of ground truth information mandatory. The other preblem is the fact that only sea surface sensing can take place. This may be overcome to some extent by discovering how subsurface features are reflected in those processes observed at the surface.

10. IOC Resolution on Coordination of North Atlantic Oceanographic Investigations

The Chairman outlined the present procedure for the exchange of information between ICNAF, ICES and IOC, by means of meetings of the Joint Coordinating Group consisting of the Secretaries of the three bodies, together with the Chairman of the ICES Hydrography Committee and ICNAF Environmental Subcommittee. He informed the Subcommittee of the next biennial meeting of the Group, which would be held in Copenhagen in September 1974, and would include presentations by the main international marine research programs in the North Atlantic.

The Subcommittee noted with pleasure the existing mechanism for the exchange of information between the three bodies but felt that there was no advantage to be gained by extending this liaison to include cosponsorship or joint planning of projects.

11. Proposal for Coordinated Environmental Studies

The Subcommittee reviewed a US proposal for a significantly expanded ICNAF program of coordinated environmental research (Circular Letter 74/23 and Res.Doc. 74/70). The proposal involves comprehensive and coordinated studies of both physical and biological processes controlling organic production on the continental shelf, including long-term synoptic monitoring of large-scale (annual and seasonal) anomalies in environmental factors and marine organisms, as well as intensive short-term studies in selected key areas to determine the smaller-scale (within season) dynamics of processes controlling fish production. There was general agreement among the Subcommittee members as to the need for expanded study of the dynamics of circulation on the continental shelf, treating the entire ICNAF Area as a system, and for more detailed studies of factors controlling production in planktonic communities, particularly those related to survival of fish larvae. Further, it was agreed that it was essential to better integrate the available environmental data by establishing standard data formats and pooling information from all ICNAF countries. However, there was no clear view as to the optimum mix or level of effort needed for physical *vs.* biological studies, or the best balance of large-scale *vs.* small-scale studies.

A majority did favour better coordination of long-term studies and consideration of more intensive studies restricted in time and space. It was generally felt that any significant new effort should be preceded by careful study of the cost and expected benefits in terms of improved understanding of mechanisms controlling year-class strengths of fish.

The Subcommittee noted the need to: (a) review the physical environmental research programs and the available data base in the ICNAF Area, and prepare a generalized circulation model based on current state of knowledge of major features of circulation and their driving forces; (b) establish a standard ICNAF data format for physical environmental data, and develop a plan for pooling such data from all Member Countries on an annual basis, through the Marine Environmental Data Service; (c) formulate hypotheses on environmental factors controlling fish production for selected regions within the ICNAF Area, in relation to the generalized circulation models; and (d) have a coordinated input from chemical, biological and physical oceanographers, as well as fisheries biologists, in order to deal effectively with such complex phenomena. In view of their comprehensive and continuous work in the area, it was also thought to be highly desirable to encourage closer cooperation and coordination with the research program of the USCG Oceanographic Unit. The Subcommittee therefore

recommends (15)

i) that, bearing in mind the guidelines outlined in (a) to (d) above, an Environmental Working Group be established to prepare a comprehensive plan for coordinated environmental research in the ICNAF Area with the following terms of reference: "to suggest a proposal aimed at determining the factors involved in the production of good and poor year-classes in some of the main fisheries of the ICNAF Area";

ii) that work should begin urgently by correspondence and that the Working Group should meet in Copenhagen at the time of the next ICES meeting in early October 1974;

iii) that the Working Group incorporate the membership and duties of the two ad hoc Working Groups on Standardization of Hydrographic Sections (as indicated in Recommendation 17, Redbook 1973, Part I, p. 120), and that the composition of the new Working Group should then include the following representation:

Canada	*- R.W. Trites, E.J. Sandeman (Chairman), A.W. White, J.R. Wilson*
Denmark	*- F. Hermann*
France	*- C.H. Allain (ISTPM, Nantes), J.P. Minet (St. Pierre and Miquelon)*
Fed.Rep. Germany	*- J. Messtorff (M. Stein)*
German Dem.Rep.	*- Representative from Rostock Sea Fisheries Institute*
Norway	*- Representative from the Fisheries Institute in Bergen*
Poland	*- Representative from Sea Fisheries Institute, Gdynia*
Portugal	*- Representative from the Fisheries or Hydrographic Office in Lisbon*
Spain	*- Representative from the Fisheries Office in Madrid*
USSR	*- V.V. Burmakin, V.A. Bryantsev, I.K. Sigaev*
UK	*- H.W. Hill*
USA	*- R.J. Schlitz, M.D. Grosslein, Representative from US Coast Guard*

The Chairman of the Subcommittee on Biological Surveys should serve on the Working Group as an ex officio member.

APPENDIX VI - REPORT OF AD HOC WORKING GROUP ON GEAR AND SELECTIVITY

Chairman: H. Bohl

Rapporteur: L. S. Parsons

The Working Group met on 29 May 1974 with representatives present from Canada, France, Fed.Rep. Germany, German Dem.Rep., Japan, Norway, Poland, Portugal, Spain, USSR, UK, USA and an observer from ICSEAF. The following documents were reviewed in relation to the various agenda items; Comm.Doc. 74/18, Summ.Doc. 74/18, and Res.Doc. 74/41.

1. Uniform Minimum Mesh Size

The Working Group considered the implications of the Canadian proposal (Comm.Doc. 74/18) regarding a uniform minimum mesh size for species subject to mesh regulations for trawl nets. The nature and extent of the enforcement problem was outlined, and, after considerable discussion, it was generally agreed that a uniform minimum mesh size would facilitate enforcement at least for some countries. However, it was recognized that the objective of the existing differentials is to attain uniform selectivity in fisheries pursued with materials having different selective properties. Results of selectivity experiments indicate that polyamide nets have a higher selectivity than those of other synthetic materials (polyethylene and polypropylene) currently in use, but, owing to the large number of factors affecting selectivity under commercial fishing conditions, the extent to which the adoption of a uniform minimum mesh size would affect the attainment of uniform selectivity is uncertain.

Possible uniform minimum mesh sizes appear to be: 120, 125 and 130 mm. Adoption of either of these would alter the mean selection length (ℓ_c) for the Northwest Atlantic fisheries as a whole. An increase to a minimum mesh size of 130 mm for polyamides would increase the ℓ_c for nets made of this material by 8 to 10%. Similarly a decrease in the minimum mesh size of other synthetic materials to 120 mm would decrease the ℓ_c for nets made of these materials by 7-8%.

The Working Group wishes to emphasize the continuing need to regulate the mean selection length (ℓ_c) for the regulated fisheries despite the adoption of other management measures (catch quotas) in recent years. It noted that there have been indications of a decrease in ℓ_c for some demersal stocks in the Northwest Atlantic recently despite existing mesh regulations.

With respect to the Canadian proposal to eliminate existing differences between subareas in minimum mesh sizes for parts of the net other than the codend, it was noted that, since mesh selection takes place primarily in the codend, any change in mesh size in the forward parts of the net would have virtually no effect on overall selectivity.

2. Recent Selectivity Experiments

The Fed.Rep. Germany has conducted selection experiments with different kinds of polyamides (i.e. standard elongations of 23.8% and 50.1%). These yielded selection factors for cod of 3.36 for the polyamide standard and 3.44 for capron but these differences were not significant.

The Group noted Res.Doc. 74/41, which describes selectivity and relative efficiency of salmon drift nets in research cruises in the West Greenland-Labrador Sea area.

3. Recent Developments in Fishing Gear Research

The Fed.Rep. Germany has recently engaged in experimental deep-water trawling to depths of 2,200 m in the area between the eastern Grand Bank and Flemish Cap. Catches of commercial magnitude of grenadiers, Greenland halibut and smoothheads were obtained at 800 and 1,200 m. At greater depths catches were too small to be of commercial interest.

The Fed.Rep. Germany has recently tested the so-called "JAGER" net for both midwater and bottom fishing. Results obtained so far are encouraging. Towing resistance is much less than for other types of trawls.

Dr Treschev (USSR) reported on the adoption of the 'swept volume' method of measuring fishing effort in USSR fisheries. The Group urges countries to pursue studies and assessments of this method.

4. Summary of Trawl and Mesh Size Sampling (Summ.Doc. 74/18)

The Group wishes to reiterate the desirability of avoiding the use of topside chafers which reduce selectivity.

5. Report on the Gear and Behaviour Committee of ICES

The Chairman reported on recent activities of the Gear and Behaviour Committee of ICES and noted the

establishment of five working groups of this Committee:

a) reaction of fish to fishing operations;

b) research on engineering aspects of fishing gear, vessels and equipment;

c) data collection and processing in fish capture research;

d) standardization of scientific methods for comparing the catching performance of different fishing gear; and

e) research on sound and vibration in relation to fish capture.

APPENDIX VII - REPORT OF STEERING AND PUBLICATIONS SUBCOMMITTEE

Chairman: A. W. May

1. Organization and Operation of STACRES

The Steering and Publications Subcommittee reviewed the organization and operation of STACRES with particular reference to the Subcommittee and Working Group structure. It was concluded that the Working Group on Coordinated Groundfish Surveys should be reconstituted as a Subcommittee of STACRES, and the Subcommittee accordingly

recommends (16)

that STACRES establish a new subcommittee to be named the "Biological Surveys Subcommittee", whose terms of reference will incorporate those of the present Working Group on Coordinated Groundfish Surveys, as well as coordination and review of information from all other biological surveys.

The Chairman of this Subcommittee, for purposes of necessary liaison, would also serve as an *ex officio* member of the Working Group on Coordinated Environmental Research.

No further organizational changes were considered necessary. However, the necessity of a flexible organizational structure within STACRES was reaffirmed. In this connection it was noted that while the Subcommittee structure was intended to deal with requirements in the longer term, Working Groups would be established from time to time to deal with *ad hoc* issues of a shorter term nature or issues requiring detailed consideration by small groups of experts. The establishment and organization of working groups should be at the discretion of the various Subcommittees, through their Chairmen, and working groups would normally report through the Subcommittees. In accordance with the normal practice within STACRES the Chairmanship and terms of reference of working groups of a continuing nature should be reviewed within the Subcommittees at least once every three years.

2. Review of Status of Redbook, Parts I, II and III

The content, use and distribution of the various parts of the Redbook series were discussed. It was concluded that the national research reports received adequate distribution as summary documents, and that selected papers of high quality and particular interest from the research document series should be published in the Research Bulletin. Publication of Redbook, Part III, was of questionable value. Accordingly the Subcommittee

recommends (17)

i) that Redbook, Part I, be continued as the Report of the Standing Committee on Research and Statistics, with the simple title "Redbook", followed by the appropriate year; and

ii) that Redbook, Parts II and III, be discontinued in 1974.

In further discussion the Subcommittee confirmed the suggestion from the January 1974 Meeting in Rome, i.e. that the Secretariat ask the heads of Institutes concerned with research related to ICNAF for comments on the question of guidelines for selection, editing and refereeing of papers for the Research Bulletin. These replies should be consolidated for discussion at the next Annual Meeting.

3. Review of Other Publications and Documents

After review of the newly emerged "Working Paper" series within STACRES, the Subcommittee concluded that these should be regarded as data records of an *ad hoc* nature, and not given serial numbers. Therefore they would not be catalogued in the normal way. Material of continuing interest should be submitted as research documents or consolidated as a research document (e.g. possibly stock record sheets).

The Secretariat's initiative in beginning the compilation of a bibliography of ICNAF publications was welcomed. The Subcommittee concluded that this bibliography should include research documents and summary documents, as well as Research Bulletins, Special Publications, and Redbooks. It was noted that the annual "Guide to ICNAF papers" would continue to be issued.

4. Publication of Meeting Documents

The following 1974 Research Documents have been recommended for publication in the Research Bulletin, subject to appropriate revision, refereeing and editing: 1 (Fukuda), 13 (Miller and Halliday), 20 (Pope), 24 and 25 combined (Halliday), 29 (Brennan), 31 (Reeves), 34 (Reeves), 49 (Mercer), 64 (Rikhter), 75 (Pinhorn and Pitt), 89 (Pinhorn and Wells), 91 (Halliday), 105 (Schnack).

5. Anniversary Publication

After discussion of various possibilities for a publication to mark the 25th Anniversary of ICNAF in 1975, it was concluded that a paper for the Research Bulletin which would review the Commission's role in scientific investigation and management of fisheries in the Northwest Atlantic since 1950 would be most appropriate. The Executive Secretary was requested to search for a volunteer, familiar with the subject, to undertake such a paper.

PART D

STACRES AGENDA

LIST OF RECOMMENDATIONS

LISTS OF DOCUMENTS

AGENDA FOR STACRES MEETING - MAY-JUNE 1974

1. OPENING

   a) Appointment of Rapporteurs
   b) Adoption of Agenda
   c) Plan of work of STACRES

2. ASSESSMENTS (Chairman: D.J. Garrod)

   a) Review of catch statistics and fishing activity in 1973
   b) Review of abundance indices from coordinated surveys in 1973
   c) Stock assessments (*Redbook* 1973, Part I; Sum.Doc. 74/1, 8; Com.Doc. 74/13, 15, 16, 19, 20, 21, 22, 23)
      i) Cod [1, 2GH, 2J+3KL, 3M, 3NO, 3Ps, 4Vn(Jan-Apr)+4T, 4Vn(May-Dec), 4VsW, 4X(offshore), 5Y, 5Z]
      ii) Haddock [4VW, 4X, 5]
      iii) Redfish [2+3K, 3M, 3LN, 3O, 3P, 4VWX, 5]
      iv) American plaice [2+3K, 3LNO, 3M, 3Ps]
      v) Yellowtail [3LNO, 5(E69°), 5(W69°)]
      vi) Witch [2J+3KL, 3NO, 3Ps]
      vii) Greenland halibut [1+Baffin I., 2+3KL]
      viii) Flounders [4VWX]
      ix) Flounders except yellowtail [5+6]
      x) Silver hake [4VWX, 5Y, 5Ze, 5Zw+6]
      xi) Red hake [5Z(E69°), 5Z(W69°)+6]
      xii) Pollock [4VWX, 5]
      xiii) Roundnose grenadier [1+Baffin I., 2+3]
      xiv) Argentine [4VWX, 5]
      xv) Capelin [2+3K, 3LNOPs]
      xvi) Squids [3+4, 5+6]
      xvii) Herring [4VW(a), 4XW(b), 5Y, 5Z+6]
      xviii) Mackerel [3+4, 5+6]
      xix) Other finfish [5+6]
      xx) Overall TAC for finfish + squids [5+6]
   d) Other matters

3. STATISTICS AND SAMPLING (Chairman: Sv.Aa. Horsted)

   a) Reports on statistical activities
      i) ICNAF statistical report, 1973/74 (Sum.Doc. 74/20)
      ii) CWP activities as they pertain to ICNAF (Sum.Doc. 74/15)
      iii) Statistical activities of other regional agencies for 1973 (Sum.Doc. 74/13, 14)
   b) Fishery statistics
      i) *Statistical Bulletin*, Vol. 22 for 1972
      ii) Advance monthly statistics for selected species, 1973 (Circ.Letter 74/11)
      iii) Statistics of discards (Sum.Doc. 74/16)
      iv) Statistics of fish used for industrial purposes (Sum.Doc. 74/16)
      v) Adequacy of national reporting on STATLANT forms
      vi) Review of STATLANT and other forms used to solicit fishery statistics, including deadlines
      vii) List of Vessels: requirements for 1974 and subsequent years
   c) Sampling data
      i) *Sampling Yearbook*, Vol. 17 for 1972
      ii) Early requirements for sampling data (Circ.Letter 74/7)
      iii) Adequacy of sampling and/or reporting of national sampling data
      iv) Reporting and processing of research vessel sampling data
      v) Review of sampling forms and deadlines
   d) ICNAF data base improvement (Working Group Chairman: R.C. Hennemuth)
      i) Report of first meeting in January 1974 (Sum.Doc. 74/8)
      ii) Report on data submission for 5Z pilot study and other requirements (Circ.Letter 74/12)
      iii) Future considerations (Com.Doc. 74/22)
   e) Other matters

4. COORDINATED SURVEYS (Chairman: J. Messtorff)

   a) Review of report of January 1974 meeting (Sum.Doc. 74/8)
   b) Review of groundfish and pelagic fish survey activity in 1973, including results relevant to assessments (see Item 2(b) above)
   c) Proposed survey activity in 1974

d) Reporting and processing of survey data
e) Participation in and plans for herring and mackerel research in SA 5 and 6 on cruise of Polish R/V *Professor Siedlecki*
f) Review and standardization of stratification schemes, including Baffin Island area
g) Manual for ICNAF surveys
h) Hydroacoustic surveys
i) Availability of data on physical environment obtained in recent survey cruises in time to be used in deliberations of STACRES and its Subcommittees
j) Other matters

5. ENVIRONMENTAL (Chairman: H.W. Hill)

a) Special session: Hydrography of the Newfoundland-Grand Bank area in 1972 and effects on fishing trends (*Redbook* 1973, Part I, p. 119)
b) Review of environmental conditions in 1973
c) Standardization of hydrographic stations, sections and base periods for temperature and salinity anomalies (*Redbook* 1973, Part I, p. 120): (i) West Greenland (SA 1); (ii) Canadian eastern shelf (SA 2, 3 and 4)
d) Progress report by Canadian Oceanographic Data Centre (CODC) on processing and exchange of ICNAF Area data (*Redbook* 1973, Part I, p. 121)
e) Presentation by representative from UK Institute for Marine Environmental Research on plankton studies in the ICNAF Area in 1972 (*Redbook* 1973, Part I, p. 121)
f) Report on techniques adopted by the Gdynia Institute for the sorting of plankton samples (*Redbook* 1973, Part I, p. 121)
g) Review of weather and ice reporting (*Redbook* 1973, Part I, p. 122)
h) Publication of papers on ice dynamics presented at the 1973 Annual Meeting
i) Introduction to remote-sensing techniques by representative of Bedford Institute of Oceanography
j) IOC resolution re coordination on North Atlantic oceanographic investigation (Sum.Doc. 74/10)
k) Other matters

6. GEAR AND SELECTIVITY

a) Trawl material and mesh size sampling for 1972 (Sum.Doc. 74/18) and provisional data for 1973
b) Consideration of any recent selectivity experiments
c) Consideration of any recent developments in fishing gear research
d) Other matters

7. AGEING TECHNIQUES AND VALIDATION STUDIES

a) Herring scale otolith exchange program, 1972 (completion of report)
b) Need for further otolith exchange programs and/or workshops (e.g. mackerel)
c) Inventory of age validation studies in ICNAF Area (Circ.Letter 74/12)

8. COOPERATIVE RESEARCH PROJECTS

a) Review of Report of ICES/ICNAF Joint Working Party on North Atlantic Salmon, Copenhagen, 11-15 March 1974 (Sum.Doc. 74/17; see also Com.Doc. 74/14)
b) Symposium on Acoustic Methods in Fishery Research, Bergen, 19-22 June 1973 (Sum.Doc. 74/14)
c) IOC Resolution VIII-13, re coordination on North Atlantic oceanographic investigations (Sum.Doc. 74/10)

9. STEERING AND PUBLICATIONS

a) Organization and operation of STACRES (refer also to Com.Doc. 74/11)
b) Review of meeting agenda and timetable
c) Review of status of Redbook, Part I, II and III
d) Review of other ICNAF publications relating to research and statistics
e) Review of distribution of publications and meeting documents
f) Recommendations for publication of relevant meeting documents
g) Anniversary publication
h) Other matters

10. MID-YEAR MEETINGS (Com.Doc. 74/22)

11. ARRANGEMENTS FOR 1975 MEETING

12. ELECTION OF OFFICERS

13. OTHER MATTERS

LIST OF RECOMMENDATIONS

LISTS OF RESEARCH AND SUMMARY DOCUMENTS - 1974

1. Research Documents

Res.Doc. No.	Serial No.	Authors and Titles
74/1	3142	Fukuda, Y. A note on yield allocation in multi-species fisheries (10 pages)
74/2	3144	Pitt, T.K. The Greenland halibut fishery in Subarea 2 and Divisions 3K and 3L (4 pages)
74/3	3145	Pitt, T.K. Status of the American plaice fishery in Subarea 2-Division 3K, Division 3M and Subdivision 3Ps (3 pages)
74/4 (Rev.)	3147	Messtorff, J. Revised stratification scheme for groundfish surveys in Subarea 2 and Division 3K (5 pages)
74/5	3148	Pinhorn, A.T., and L.S. Parsons. Status of the redfish fishery in ICNAF Subarea 2 and Division 3K (5 pages)
74/6	3149	Pinhorn, A.T. Preliminary estimates of sustainable yield for roundnose grenadier (*Macrourus rupestris*) in ICNAF Subareas 2 and 3 (5 pages)
74/7 (Rev.)	3150	Winters, G.H. Back-calculation of the growth of capelin (*Mallotus villosus*) in the Newfoundland area (16 pages)
74/8 (Rev.)	3154	Moores, J.A., G.H. Winters and L.S. Parsons. Some biological characteristics of mackerel (*Scomber scombrus*) in Newfoundland waters (17 pages)
74/9	3155	Stobo, W.T., and J.J. Hunt. Mackerel biology and history of the fishery in Subarea 4 (23 pages)
74/10 (Rev.)	3156	Anderson, E.D. Relative abundance of Atlantic mackerel in ICNAF Subarea 5 and Statistical Area 6 (14 pages)
74/11		Document withdrawn
74/12	3158	Winters, G.H. Rationale for partition of capelin quota in Subareas 2 and 3 (2 pages)
74/13 (Rev.)	3159	Miller, D.S., and R.G. Halliday. An assessment of the 4X-4W(b) herring stock (38 pages)
74/14	3160	Balkovoy, V.A., V.A. Sushin and I.K. Sigaev. Preliminary results of herring larval survey on Georges Bank, 15 October-1 November 1973 (10 pages)
74/15	3161	Schnack, D. Notes on ICNAF Joint Larval Herring Surveys in Georges Bank-Gulf of Maine areas in 1971 and 1972 (10 pages)
74/16 (Rev.)	3162	Schnack, D., and G. Joakimsson. Report of ICNAF larval herring cruise, *Walther Herwig*, October-November 1973 in Georges Bank-Gulf of Maine areas (14 pages)
74/17	3163	Au, D.W.K. Preliminary report of ICNAF larval herring (*Clupea harengus*) survey in the Gulf of Maine and on Georges Bank during December 1973 (5 pages)
74/18	3164	Grimm, Stefan. Larval herring distribution in the Gulf of Maine and on Georges Bank, 29 September-20 October 1973 (6 pages)
74/19 (Rev.)	3165	Anderson, E.D. Assessment of red hake in ICNAF Subarea 5 and Statistical Area 6 (27 pages)
74/20 (Rev.)	3166	Pope, J.G. A possible alternative method to virtual population analysis for the calculation of fishing mortality from catch at age data (16 pages) + Addendum I (1 page)
74/21	3168	Halliday, R.G. A review of the biology of the Atlantic argentine with particular reference to the Scotian Shelf (20 pages)

Res.Doc. No.	Serial No.	Authors and Titles
74/22	3169	Shevchuk, L.I. Assessment of total and natural mortality of argentine (*Argentina silus* Ascanius) in the Browns Bank area (4 pages)
74/23	3170	Shevchuk, L.I. The optimum level of exploitation and an approximate assessment of argentine stocks (*Argentina silus* Ascanius) in the Browns Bank area (7 pages)
74/24	3171	Halliday, R.G. The cod stocks of the southern Gulf of St. Lawrence and Sydney Bight (ICNAF Div. 4T-4Vn) (16 pages)
74/25	3172	Halliday, R.G. A virtual population assessment of the Div. 4X offshore cod stock (9 pages)
74/26	3173	Doubleday, W.G. Bias in two length frequency formulae (6 pages)
74/27	3174	Halliday, R.G. A description of Canadian fisheries in Subarea 5 and Statistical Area 6, 1969-72 (9 pages)
74/28	3175	Carrothers, P.J.G. Descriptions of trawl-gear used for demersal species by the Canadian fleet in Subarea 5 and Statistical Area 6 during the period 1969 through 1972 (12 pages)
74/29 (Rev.)	3176	Brennan, J.A. Preliminary evaluation of the present USA sampling scheme of yellowtail flounder for estimating the number at age in the landed catch (15 pages)
74/30	3177	Grosslein, M.D. A first approximation of MSY for spiny dogfish in Subareas 5 and 6 and Division 4X (1 page)
74/31 (Rev.)	3178	Reeves, J.E. Comparisons of long-term yields from catch quotas and effort quotas under conditions of variable recruitment (16 pages)
74/32	3179	Bowman, E.W., and K.A. Smith. A summary description of US fisheries in Subarea 5 and Statistical Area 6 for the period 1969-72 (21 pages)
74/33 (Rev.)	3180	Heyerdahl, E.G., and M.D. Grosslein. Status of pre-recruit abundance estimates for major species in Subareas 5 and 6 (2 pages)
74/34 (Rev.)	3181	Reeves, J.E. Costs of surveying recruits to the Georges Bank herring fishery (9 pages)
74/35	3221	Chalmers, R.J., and W.R. Munro. Trends in Scottish salmon and grilse catches, 1952-71 (4 pages)
74/36	3222	Swain, A. A report on the smolt tagging carried out in European countries, with particular reference to recaptures made off Greenland in 1972 and comparable home-water recaptures (14 pages)
74/37	3223	Swain, A. Further report on the analysis of age, length and weight data collected during the International Salmon Tagging Experiment, 1972 (8 pages)
74/38	3224	Ruggles, C.P., J. Ritter and R. Harger. Some preliminary tables and graphs summarizing North American smolt tagging experiments, prepared for the March 1974 Meeting of ICES/ICNAF Joint Working Party of North Atlantic Salmon (10 pages)
74/39	3225	Ruggles, C.P. Abundance of Atlantic salmon in New Brunswick rivers in 1973 (6 pages)
74/40	3226	Lear, W.H., and E.J. Sandeman. Use of scale characters and a discriminant function for identifying continental origin of Atlantic salmon (12 pages)
74/41	3227	Lear, W.H., and O. Christensen. Selectivity and relative efficiency of salmon drift nets (9 pages)
74/42	3228	Pippy, J.H.C. The value of parasites as biological tags in Atlantic salmon at West Greenland (9 pages)
74/43	3229	Christensen, O., and W.H. Lear. Distribution and abundance of salmon at West Greenland (23 pages)

Res.Doc. No.	Serial No.	Authors and Titles
74/44	3230	Christensen, O., and W.H. Lear. By-catches in salmon drift nets at West Greenland in 1972 (27 pages)
74/45	3231	Jensen, J. Møller. Report on recaptures from the International Salmon Tagging Experiment at West Greenland, 1972; analysis of smolts tagged in home waters and recaptured at West Greenland, 1972 (22 pages)
74/46	3232	Smed, Jens. The temperature of the waters off Southwest Greenland during the International Salmon Tagging Experiment in 1972 (15 pages)
74/47	3253	Pippy, J.H.C., and Paul van Banning. Identification of *Anisakis* larva (I) as *Anisakis simplex* (Rud., 1809, det. Krabbe, 1878) (Nematoda: Ascaridata) (5 pages)
74/48	3255	Bowering, W.R., and T.K. Pitt. An assessment of witch (*Glyptocephalus cynoglossus*) for ICNAF Divisions 2J-3KL (6 pages) + Addendum I (1 page)
74/49	3256	Mercer, M.C. Modified Leslie-DeLury assessments of the northern pilot whale (*Globicephala melaena*) and annual production of the short-finned squid (*Illex illecebrosus*) based upon their interaction at Newfoundland (14 pages)
74/50	3259	Paulmier, G. Preliminary observations on commercial squids (*Loligo pealei* LeSueur and *Illex illecebrosus* LeSueur) on Georges Bank, R/V *Cryos* cruise, September-October 1973 (14 pages)
74/51	3260	Sigaev, I.K. Characteristic features of the hydrological conditions on the Nova Scotia Shelf and Georges Bank, 1972 (6 pages)
74/52	3261	Bryantsev, V.A. Water temperatures in the Nova Scotia Shelf and Georges Bank areas, 1960-68 (14 pages)
74/53	3262	Kovalyov, S.M., and V.V. Sokhnov. Results of Soviet investigations on sand eel on Newfoundland Grand Bank and near West Greenland in 1971-73 (4 pages)
74/54	3263	Chekhova, V.A. Groundfish trawl survey in the Newfoundland area in 1973 (6 pages)
74/55	3264	Postolaky, A.I. Distribution of cod eggs in the south Labrador and north Newfoundland areas in 1973 (4 pages)
74/56	3269	Berthome, J.P. Comparative study of the stock distribution of yellowtail (*Limanda ferruginea* Storer 1839) on Nova Scotia and Georges Banks (9 pages)
74/57	3270	Minet, J.P., G. Paulmier and J.C. Poulard. Distribution of larval herring on Georges Bank and off southern Nova Scotia, September 1973 (18 pages)
74/58	3271	Decamps, Ph., and D. Briand. Results of studies on herring of the Gulf of St. Lawrence, and Banquereau and Georges Banks (12 pages)
74/59	3273	Messieh, S.N. Problems of ageing Atlantic herring (*Clupea harengus* L.) in the ICNAF Area (6 pages)
74/60	3274	Messieh, S.N. Growth of the otoliths of young herring (*Clupea harengus* L.) in the Bay of Fundy (ICNAF Div. 4X) (7 pages)
74/61	3275	Rau, N. Eggs and larvae of cod and haddock on Browns Bank, Georges Bank, and Nantucket Shoals, 26 February-11 March 1973 (7 pages)
74/62	3278	Document withdrawn
74/63	3283	Dommasnes, A., T. Monstad and G. Sangolt. The Norwegian capelin fishery on Grand Banks, Newfoundland, 1973 (The *Nordglobal* Expedition) (4 pages)
74/64	3284	Rikhter, V.A. A forecasting method and an approximate estimate of total allowable catch of red hake from Southern New England in 1974-75 (9 pages)
74/65	3285	Rikhter, V.A. The estimation of total allowable catch of red hake from the Georges Bank for 1975 (8 pages)

Res.Doc. No.	Serial No.	Authors and Titles
74/66	3288	Halliday, R.G. A note on research vessel survey biomass estimates for the Scotian Shelf (3 pages)
74/67	3292	Robinson, G.A., J.M. Colebrook and G.A. Cooper. The Continuous Plankton Recorder Surveys: plankton in the ICNAF Area in 1973 (6 pages)
74/68	3293	Damkaer, D.M., and D.W.K. Au. A preliminary investigation of the food of larval herring from Georges Bank (5 pages)
74/69	3299	Pitt, T.K. Assessment of American plaice from Subarea 2 and Division 3K (6 pages)
74/70	3303	Schlitz, R.J., and M.D. Grosslein. Proposal for a coordinated ICNAF environmental research program (10 pages)
74/71	3304	Templeman, W. Temperatures and salinities in the eastern Newfoundland area in 1973 (13 pages)
74/72	3305	Au, D.W.K., and T.L. Morris. Report of larval herring surveys in the Gulf of Maine and on Georges Bank during December 1973 and February 1974 conducted by R/V *Albatross IV* (31 pages)
74/73	3306	Pitt, T.K. Updated estimates of total allowable catches of several flatfish stocks for Subareas 2 and 3 (10 pages)
74/74	3307	Hermann, F. Hydrographic conditions off West Greenland during 1973 (8 pages)
74/75	3308	Pinhorn, A.T., and T.K. Pitt. Results of groundfish surveys on Grand Bank and St. Pierre Bank, 1971-73 (14 pages)
74/76	3309	Winters, G.H., and J.S. Campbell. Some biological aspects and population parameters of Grand Bank capelin (23 pages)
74/77	3310	Winters, G.H. Supplementary report on ICNAF Herring Otolith Exchange, 1971-72 (ICNAF Res.Doc. 72/92) (16 pages)
74/78	3311	Parsons, L.S., and D.G. Parsons. An evaluation of the status of Flemish Cap redfish (18 pages)
74/79	3312	Parsons, L.S., and D.G. Parsons. Some observations on Subarea 2 + Division 3K, Divisions 3L-N and Division 3O redfish (16 pages)
74/80	3313	Parsons, L.S., and D.G. Parsons. Yield per recruit assessment of ICNAF Division 3P redfish (11 pages)
74/81	3316	Giedz, M. The size of sample in calculating the length composition of herring in Polish commercial catches on Georges Bank during the period from August to October 1973 (5 pages)
74/82	3318	Hermann, F. Proposal for standard hydrographic sections in the West Greenland area (3 pages)
74/83	3319	Pope, J.G. Contribution to the problem of designing length sampling schemes for the New England silver hake (3 pages)
74/84	3320	Smidt, Erik. Notes on the distribution of Greenland halibut in the Northwest Atlantic (4 pages)
74/85	3321	Kapel, F.O. New data on hunting for hooded seals and age composition of catches in South Greenland (8 pages)
74/86	3322	Horsted, Sv.Aa. Subarea 1 cod: estimates of yield 1974-76 (15 pages)
74/87	3323	Mercer, M.C., and G. Paulmier. Distribution and biological characteristics of the short-finned squid (*Illex illecebrosus*) on the continental shelf of Subareas 3 and 4 in May-June 1973 (11 pages)

Res.Doc. No.	Serial No.	Authors and Titles
74/88	3324	López-Veiga, E.C., and A. Vázquez. Some observations on board two Spanish pair trawlers (7 pages)
74/89	3325	Pinhorn, A.T., and R. Wells. Calculation of total allowable catches (TACs) for 1975 for cod stocks in Subareas 2 and 3 (16 pages)
74/90	3326	Ulltang, Ø. On management of a capelin fishery (7 pages)
74/91	3327	Halliday, R.G. Current status of the ICNAF Division 4X haddock stock (24 pages)
74/92	3328	Hare, G.M., and A.C. Kohler. Pre-recruit indices of abundance and predicted numbers of recruits in the southern Gulf of St. Lawrence cod stock (3 pages)
74/93	3329	Hunt, J.J. Comparison of the otolith length/width ratio of herring in ICNAF Subareas 4 and 5 (7 pages)
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74/1	3134	ICNAF. Report of Standing Committee on Research and Statistics (STACRES), Ottawa, Canada, 15-19 October 1973 (4 pages)
74/2	3135	ICNAF. Proceedings of Special Commission Meeting, Ottawa, Canada, 15-19 October 1973 (30 pages)
74/3 (Rev.)	3143	ICNAF Secretariat. Nominal catches in Statistical Area 6 for 1963-65, and amended catch and effort data for Bulgaria in 1969-70 and for Japan in 1967-69 (5 pages)
74/4	3141	ICNAF Secretariat. Nominal catches of finfish and squids in Subarea 5 and Statistical Area 6, 1963-1972 (8 pages)
74/5	3151	ICNAF Secretariat. Nominal catches of certain stocks in Subareas 2, 3 and 4 proposed for regulation at the Special Commission Meeting, January 1974 (6 pages)
74/6	3152	ICNAF Secretariat. Summary of nominal catches (1966-72) and TACs (1972-74) by species and stock area (2 pages)
74/7 (Rev.)	3183	ICNAF Secretariat. Nominal catches by country and stock area for TAC species, 1973 (8 pages)
74/8	3208	ICNAF. Report of Standing Committee on Research and Statistics (STACRES), Fourth Special Commission Meeting, January 1974 (53 pages)
74/9	3207	ICNAF. Proceedings of the Fourth Special Commission Meeting, FAO, Rome, Italy, 22-30 January 1974 (71 pages)
74/10	3213	IOC. Resolution of Intergovernmental Oceanographic Commission (IOC) relating to coordination of North Atlantic investigations (1 page)
74/11	3219	ICNAF Secretariat. ICNAF catch quota proposals as at 1 April 1974 (5 pages)

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74/12	3220	NEAFC. Northeast Atlantic Fisheries Commission Special Meeting on herring: press notice (1 page)
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74/14	3234	ICES. Extracts from resolutions passed at the 1973 ICES Meeting relevant to the research and statisticsl activities of ICNAF (2 pages)
74/15	3236	FAO. Report of meetings between international agency Secretariats and national fishery statistical offices, 26 September-2 October 1973 (7 pages)
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