

ICES Advisory Committee on Fishery Management
ICES CM 2004/ACFM:25

Report of the North Western Working Group

27 April – 6 May 2004
ICES, Copenhagen

This report is not to be quoted without prior consultation with the General Secretary. The document is a report of an Expert Group under the auspices of the International Council for the Exploration of the Sea and does not necessarily represent the views of the Council.

International Council for the Exploration of the Sea
Conseil International pour l'Exploration de la Mer

Palægade 2-4 DK-1261 Copenhagen K Denmark
Telephone + 45 33 15 42 25 · Telefax +45 33 93 42 15
www.ices.dk · info@ices.dk

Contents

1	INTRODUCTION.....	1
1.1	Participants.....	1
1.2	Terms of reference	1
1.3	Stocks assessed by NWWG	2
2	DEMERSAL STOCKS IN THE FAROE AREA (DIVISION VB AND SUBDIVISION IIA4)	5
2.1	Overview.....	5
2.1.1	Fisheries.....	5
2.1.2	Fisheries and management measures	6
2.1.3	The marine environment.....	8
2.1.4	Catchability analysis.....	8
2.1.5	Summary of the 2004 assessment of Faroe Plateau cod, haddock and saithe (figure 2.1.7).....	9
2.1.6	References:	9
2.2	Faroe Plateau Cod	15
2.2.1	Stock definition.....	15
2.2.2	Trends in landings.....	15
2.2.3	Catch-at-age.....	15
2.2.4	Mean weight-at-age	16
2.2.5	Maturity-at-age	16
2.2.6	Groundfish surveys.....	16
2.2.7	Stock assessment	17
2.2.7.1	Tuning and estimates of fishing mortality	17
2.2.7.2	Stock estimates and recruitment	18
2.2.8	Predictions of catch and biomass.....	19
2.2.8.1	Short-term prediction.....	19
2.2.8.2	Biological reference points	19
2.2.8.3	Medium-term prediction.....	19
2.2.8.4	Long-term prediction	19
2.2.9	Management considerations	19
2.2.10	Comment on the assessment	20
2.2.10.1	References	20
2.3	Faroe Bank Cod	57
2.3.1	Trends in landings and effort.....	57
2.3.2	Stock assessment	57
2.3.2.1	Comment on the assessment.....	58
2.3.3	Reference points	58
2.3.4	Management considerations	58
2.4	Faroe Haddock.....	64
2.4.1	Introduction	64
2.4.2	Trends in landings and fisheries	64
2.4.3	Catch-at-age.....	64
2.4.4	Weight-at-age	65
2.4.5	Maturity-at-age.....	65
2.4.6	Assessment	65
2.4.6.1	Tuning and estimates of fishing mortality	65
2.4.6.2	Stock estimates and recruitment	66
2.4.7	Prediction of catch and biomass	66
2.4.7.1	Input data	66
2.4.7.1.1	Short-term prediction.....	66
2.4.7.1.2	Long-term Prediction.....	67
2.4.7.2	Biological reference points	67
2.4.7.3	Projections of catch and biomass.....	67
2.4.7.3.1	Short-term prediction.....	67
2.4.8	Medium-term projections	67
2.4.9	Management considerations	67
2.4.10	Comments on the assessment	67
2.5	Faroe Saithe	114
2.5.1	Landings and trends in the fishery	114
2.5.2	Catch at age	114

2.5.3	Weight at age	114
2.5.4	Maturity at age	114
2.5.5	Stock assessment	115
2.5.5.1	Tuning and estimation of fishing mortality	115
2.5.5.2	Stock estimates and recruitment	115
2.5.6	Prediction of catch and biomass	115
2.5.6.1	Input data	115
2.5.6.2	Biological reference points	116
2.5.6.3	Projection of catch and biomass	116
2.5.7	Management considerations	116
2.5.8	Comments on the assessment	117
2.5.9	Annex	117
3	DEMERSAL STOCKS AT ICELAND (DIVISION VA)	150
3.1	Overview of the dynamics in the fishery in ICES division Va	150
3.1.1	The fishery	150
3.1.1.1	Pelagic fishery	150
3.1.1.2	Demersal fishery	151
3.1.2	Mixed fisheries	151
3.1.3	Management	152
3.1.3.1	Adoption of a Harvest Control Rule for the Icelandic cod stock in 1995	152
3.1.4	Comments	153
3.1.5	References	153
3.2	Saithe in Icelandic waters	163
3.2.1	Trends in landings	163
3.2.2	Fleets and fishing grounds	163
3.2.3	Catch at age	163
3.2.4	Mean weight at age	164
3.2.5	Maturity at age	164
3.2.6	Migration of saithe	164
3.2.7	Stock Assessment	165
3.2.7.1	Tuning input	165
3.2.7.1.1	Commercial fleets	165
3.2.7.1.2	Survey	165
3.2.7.2	Estimates of fishing mortality	165
3.2.7.3	Spawning stock and recruitment	167
3.2.8	Prediction of catch and biomass	168
3.2.8.1	Input data	168
3.2.8.2	Biological reference points	168
3.2.8.3	Medium term projections	168
3.2.9	Management considerations	168
3.2.10	Comments on the assessment	168
3.3	Icelandic cod (Division Va)	208
3.3.1	Stock definition	208
3.3.2	Data	208
3.3.2.1	Fishery dependent data	208
3.3.2.1.1	Landings	208
3.3.2.1.2	Sampling intensity	208
3.3.2.1.3	Catch in numbers at age	209
3.3.2.1.4	Mean weight at age in the landings	209
3.3.2.1.5	CPUE	209
3.3.2.2	Fishery independent data	210
3.3.2.2.1	Survey abundance indices	210
3.3.2.2.2	Mean weight and maturity at age in survey	210
3.3.3	Stock Assessment	210
3.3.3.1	Estimates of fishing mortality	210
3.3.3.2	The selection of a final run	211
3.3.3.3	Stock and recruitment estimates	211
3.3.4	Biological and technical interactions	211
3.3.5	Prediction of catch and biomass	212
3.3.5.1	Input data to the short-term prediction	212
3.3.5.2	Short term prediction results	213

	3.3.5.3	Input data to the long-term prediction	213
	3.3.5.4	Long-term prediction results and biological reference points.....	213
	3.3.6	Medium term simulation.....	213
	3.3.7	Management considerations	214
	3.3.8	Comments on the assessment	214
3.4		Icelandic haddock	269
	3.4.1	Introductory comment	269
	3.4.2	Trends in landings and fisheries	269
	3.4.3	Catch at age	269
	3.4.4	Weight and maturity at age.....	270
	3.4.5	Survey and cpue data.....	270
	3.4.6	Stock Assessment	271
	3.4.7	Recruitment estimates.....	273
	3.4.8	Prediction of catch and biomass	274
		3.4.8.1 Input data	274
		3.4.8.2 Biological reference points.....	274
		3.4.8.3 Projection of catch and biomass	275
	3.4.9	Management considerations	275
	3.4.10	Comments on the assessment	275
4		OVERVIEW ON FISHERIES AND THEIR MANAGEMENT IN GREENLAND WATERS	310
	4.1	Description of the fisheries	310
		4.1.1 Inshore fleets;	310
		4.1.2 Offshore fleets	311
	4.2	Overview of resources	311
	4.3	Description of the most important commercial fishery resources - except mammals.....	311
		4.3.1 Shrimp	311
		4.3.2 Snow crab	311
		4.3.3 Scallops.....	312
		4.3.4 Squids	312
		4.3.5 Cod	312
		4.3.6 Redfish.....	312
		4.3.7 Greenland halibut.....	312
		4.3.8 Lump sucker	312
		4.3.9 Capelin.....	312
	4.4	Advice on demersal fisheries	312
5		COD STOCKS IN THE GREENLAND AREA (NAFO AREA 1 AND ICES SUBDIVISION XIVB).....	315
	5.1	Stock definition.....	315
		5.1.1 Cod off Greenland (offshore component).....	315
		5.1.1.1 Trends in landings and fisheries (offshore component).....	316
		5.1.2 Surveys (offshore component).....	316
		5.1.2.1 Results of the German groundfish survey off West and East Greenland.....	316
		5.1.2.1.1 Stock abundance indices.....	316
		5.1.2.1.2 Age composition.....	317
		5.1.2.1.3 Mean length at age.....	317
		5.1.2.2 Results of the Greenland groundfish survey off West Greenland.....	317
		5.1.2.2.1 Stock abundance indices.....	317
		5.1.2.2.2 Age composition.....	318
		5.1.3 Biological sampling of commercial catches	318
		5.1.4 State of the stock.....	318
		5.1.5 Management considerations	318
		5.1.6 Comments on the assessment	318
	5.2	Inshore cod stock off Greenland	334
		5.2.1 Trends in Landings and Effort.....	334
		5.2.2 West Greenland young cod survey	334
		5.2.3 Assessment of the stocks	335
		5.2.4 Status of the stock.....	335
		5.2.5 Biological reference points.....	335
		5.2.6 Management Considerations.....	335
6		GREENLAND HALIBUT IN SUBAREAS V AND XIV.....	339
	6.1	Landings, Fisheries, Fleet and Stock Perception.....	339

6.2	Trends in Effort and CPUE.....	340
6.3	Catch-at-age.....	341
6.4	Weight-at-age.....	342
6.5	Maturity-at-age.....	342
6.6	Survey information.....	342
6.7	Stock Assessment.....	343
6.7.1	Age-based assessment.....	343
6.7.2	Stock production model.....	343
6.7.3	Summary of the various observation data.....	344
6.7.4	State of the stock.....	344
6.7.5	Stock projection.....	344
6.7.6	Biological reference points.....	345
6.8	Management Considerations.....	345
6.9	Comments on the Assessment.....	345
7	REDFISH IN SUBAREAS V, VI, XII AND XIV.....	369
7.1	Problems regarding stock identity of <i>S. mentella</i>	369
7.2	Nominal landings and splitting of the landings into stocks.....	370
7.3	Abundance and distribution of 0-group and juvenile redfish.....	370
7.4	Discards and by-catch of small redfish.....	370
7.5	Special Requests.....	370
8	SEBASTES MARINUS.....	379
8.1	Trends in landings.....	379
8.1.1	Biological data form the fishery.....	379
8.2	Assessment data.....	380
8.2.1	CPUE.....	380
8.2.2	Survey data.....	380
8.2.3	Assessment by use of BORMICON model.....	381
8.2.4	State of the stock.....	382
8.2.5	Catch projections and management considerations.....	382
8.2.5.1	Short term projection.....	382
8.2.5.2	Medium term projection.....	383
8.3	Biological reference points.....	383
8.4	Comment on the assessment.....	383
9	DEEP-SEA <i>SEBASTES MENTELLA</i> ON THE CONTINENTAL SHELF.....	404
9.1	Landings and Trends in the Fisheries.....	404
9.2	Trends in CPUE and survey indices.....	405
9.3	Catch projections.....	405
9.4	Biological reference points.....	406
9.5	Management considerations.....	406
10	PELAGIC <i>SEBASTES MENTELLA</i>	422
10.1	Fishery.....	422
10.1.1	Summary of the development of the fishery.....	422
10.1.2	Description on the fishery of various fleet.....	423
10.1.2.1	Faroes.....	423
10.1.2.2	Germany.....	423
10.1.2.3	Greenland.....	423
10.1.2.4	Iceland.....	423
10.1.2.5	Norway.....	424
10.1.2.6	Russia.....	424
10.1.2.7	Spain.....	425
10.1.2.8	Portugal.....	425
10.1.2.9	Other nations.....	425
10.1.3	Discards.....	425
10.1.4	Illegal Unregulated and Unreported Fishing (IUU).....	426
10.1.5	Trends in landings.....	426
10.1.6	Biological sampling from the fishery.....	426
10.2	Trends in survey and CPUE indices.....	427
10.2.1	Acoustic data.....	427
10.2.2	Trawl estimate.....	427

10.2.3 CPUE.....	428
10.2.4 Ichthyoplankton assessment	428
10.2.5 State of the stock.....	428
10.3 Management considerations.....	428
10.4 Pelagic Surveys on <i>S.mentella</i>	429
11 Working documents	447
Annex 1 - Technical Minutes.....	448

1 INTRODUCTION

1.1 Participants

Einar Hjörleifsson (chair)	Iceland
Jesper Boje	Greenland
Höskuldur Björnsson	Iceland
Jolyon Chesworth	JRC, Italy (part time)
Luis Ridao Cruz	Faroe Islands (part time)
Sigurður Jónsson	Iceland
Kristján Kristinsson	Iceland
Jean-Jacques Maguire	Faroe Islands
Sergei Melnikov	Russia
Lise Helen Ofstad	Faroe Islands
Kay Panten	Germany
Marie Storr-Paulsen	Greenland
Hans Joachim Rät	Germany
Jákup Reinert	Faroe Islands
Torsteinn Sigurdsson	Iceland
Bjorn Ævarr Steinarrsson	Iceland
Petur Steingrund	Faroe Island

1.2 Terms of reference

The North-Western Working Group [NWWG] (Chair: E. Hjörleifsson, Iceland) will meet at ICES Headquarters from 27 April–6 May 2004 to

- a) assess the status of and provide catch options for 2005 for the stocks of redfish in Subareas V, XII and XIV, Greenland halibut in Subareas V and XIV, cod in Subarea XIV, NAFO Subarea 1, and Division Va, saithe in Division Va and haddock in Division Va;
- b) assess the status of and provide effort options and expected corresponding catches for 2005 for cod, haddock, and saithe in Division Vb as these stocks are under effort control;
- c) update survey and fishery information on the stocks of redfish in Subareas V, VI, XII and XIV. In particular, update information on the development of the pelagic fishery for redfish with respect to seasonal and area distribution to allow NEAFC to further consider the appropriateness of area and seasonal closures;
- d) consider further possibilities for the incorporation of biological interactions into the assessments of capelin, herring, and cod stocks in Division Va;
- e) update information on the stock composition, distribution and migration of the redfish stocks in Subareas V and XIV, and consider the report of SGSIMUR with regard to implications for assessment and advice on pelagic “deep-sea” *Sebastes mentella* and the *Sebastes mentella* fished in demersal fisheries on the continental shelf and slope;
- f) provide information on the horizontal and vertical distribution of pelagic redfish stock components in the Irminger Sea as well as seasonal and interannual changes in distribution;
- g) provide specific information on possible deficiencies in the 2004 assessments including, at least, any major inadequacies in the data on catches, effort or discards; any major inadequacies in research vessel surveys data, and any major difficulties in model formulation, including inadequacies in available software. The consequences of these deficiencies for the assessment of the status of the stocks and for the projection should be clarified;
- h) comment on this meeting’s assessments compared to the last assessment of the same stock, for stocks for which a full or update assessment is presented;

- i) document fully the methods to be applied in subsequent update assessments and list factors that would warrant reconsideration of doing an update, and consider doing a benchmark ahead of schedule, for stocks for which benchmark assessments are done.

In addition to the ToR from ICES the NWWG is asked to address the NEAFC request to ICES on the following issues:

*“Regarding redfish stocks: a) submit new information on stock identity of the components of redfish such as "pelagic deep-sea" *Sebastes mentella*, "oceanic" *Sebastes mentella* fished in the pelagic fisheries and the "deep-sea" *Sebastes mentella* fished in demersal fisheries on the continental shelf and slope. NEAFC requests ICES to include in its advice all relevant information, including the outcome of the ICES Study Group on Stock Identity and Management Units of Redfishes, planned in August 2004;”*

Since SGSIMUR (ICES ToR-e above) will not meet until the fall and since the advice by ACFM on *S. mentella* will not be until the fall 2004 (after a special NWWG fall meeting), the work on *S. mentella* during the current meeting related only to updating informations on catches and the fisheries (ToR c and f). A full stock assessment is however provided for the *S. marinus* since it is the understanding of the working group that ACFM will provide advice on that stock this spring.

Although ToR d, has been part of the ToR of this working group for a number of years, it has not been considered by the working group during this meeting.

No systematic attempt were made to identify possible deficiencies in the inadequacies of the observables and model formulations (ToR g) beyond that what is provided in the individual chapters. The inadequacies of available ICES software has been commentented on in earliar reports of this working group.

In last years report it was noted that changes in the structure of the report (Annex, "Quality Control") needed intersessional work. Since this work was not done prior to this meeting it was decided to keep the current format of the report. Full documentation of methods to be applied in subsequent update assessment (ToR i) is thus only available as specified in individual assessments. Part of the reasons is that the working group has in addition to focusing on providing a point numbers for advisory purpose been exploring tools that may help in understanding better the limitation of the observables as well as influence on various model assumptions.

1.3 Stocks assessed by NWWG

Introduction

The stocks dealt with by NWWG can be divided into two classes: those for which data are sufficient to allow an age-based analytical assessment, and those for which either the data is limited or for which the quality of the data is questionable, impeding analytical assessments. All gadoid stocks are in the first class except for Faroe Bank cod, where a short time-series and incomplete biological sampling of the landings inhibit standard ICES analytical assessment, and the offshore cod in Greenland, where a ceased fishery prevents a VPA. In the second class are most of the redfish management units as well as Greenland halibut. One redfish stock, *S. marinus*, sits in the middle of these two extremes, being assessed by a length-based model (Bormicon).

Age-based analytical assesements

For most of the stocks for which age-based analytical assessments were carried out, the terminal fishing mortality was estimated by tuning aged catch data with selected fleet age-disaggregated commercial or survey indices. In the final run only the Faroe saithe was based on a commercial tuning series since no reliable survey index is available for that stock. Overview of the observables, models and principal assumptions used for the gadoid stocks that are analytically assessed by the NWWG are shown in table 1.1.1, including a comparison with last year's settings.

Faroe stocks

In the last two years two survey indices have been made available as a tuning fleet to the catch at age data of cod and haddock. In last years assessment the tuning of the cod was only based on the autumn survey. Post-stratification of the spring survey, that was done this year, resulted in that series being used in addition to the autumn survey in the final assessment of the cod (a benchmark assessment). As last year, both the spring and the summer survey were used in the assessment of the haddock, an updated assessment based on SPALY settings. Since the saithe assessment was an update it was assessed using, with some minor modifications, the commercial cuba tuning fleet.

The assessment on the Faroese stocks has historically been based on the Lowestoft software. This year the working group experimented with the ADAPT as implemented in the NOAA Fisheries Toolbox (<http://nft.nefsc.noaa.gov>) in particular since it provides some indication of the noise in the observables through easily executable bootstrapping. The working group thought this tool was of great value to judge the quality of the assessment although point estimators used as the basis of forward projections were still based on the XSA.

Icelandic stocks

The results from the studies indicate that the input data for the cod is not very sensitive to the model assumptions made. The point estimator for forward projection of the cod was based on the same assumption and settings as last year since point estimators from other models were not considered statistically different from that. As indicated in last years assessment the 2003 spring survey for the haddock can be considered as an outlier. It still influences to quite extent the terminal estimators which in addition to very high observed indices in recent year (outside historical experience) make terminal estimates of the haddock more uncertain than experienced in the past. Although the haddock is considered an update assessment some minor changes were made to last years settings to reduce the influence of inertia terms (shrinkage). The saithe was not assessed by ICES last year. The point estimators in the adopted run was based on the model assumption as was run in last years domestic assessment at MRI, Reykjavik.

In recent years icelandic cod, haddock and saithe have been assessed by using various software packages. The reason for the use of different software is a result of the preference and expertise of the individual user that does the assessment. All the models are based on catch-at-age analysis (i.e. using the stock and the catch equation) using survey information as additional information. Various different assumptions are then explored by the different individuals running the different software – the final choice of settings is based on personal judgement (sometimes referred to as expert opinion).

Stock	Assessment year	Assessment model	Name of tuning fleets	Year range for tuning	Age range for tuning	Time series weights	Power model	q plateau	shrinkage year range	shrinkage age range	S.E. for shrinkage	min S.E. for fleet estimates	selectivity plateau	Selectivity	Selectivity functions	F constraints
Faroe cod	2003	XSA	Summer survey	1996-2002	2-8	None	2	6+	5	5	2.0	0.3				
	2004	XSA	Summer survey Spring survey	1996-2003 1994-2004	2-8 2-9	None	2	6+	5	5	2.0	0.3				
Faroe haddock	2003	XSA	Summer survey	1996-2002	1-8	None	2	6+	5	5	0.5	0.3				
	2004	XSA	Spring survey Summer survey Spring survey	1994-2003 1996-2003 1994-2004	1-5 1-8 1-5	None	2	6+	5	5	0.5	0.3				
Faroe saithe	2003	XSA	Cuba logbooks	1985-2002	3,5-11	Yes	5	9+	5	3	0.5	0.3				
	2004	XSA	Cuba logbooks	1985-2003	3-11	Yes	5	9+	5	3	0.5	0.3				
Icelandic saithe	2003*	CAMERA	March survey	1985-2003	2-8	None	None	6+					8+	fixed	non parametric	None
	2004	CAMERA	March survey	1985-2004	2-8	None	None	6+					8+	fixed	non parametric	None
Icelandic cod	2003	ADCAM	March survey	1985-2003	1-10	None	1-5	None					None	RW	non parametric	RW
	2004	ADCAM	March survey	1985-2004	1-10	None	1-5	None					None	RW	non parametric	RW
Icelandic haddock	2003	ADCAM	March survey	1985-2003	1-9	None	None	None							non parametric	RW
	2004	ADCAM	March survey	1985-2004	1-9	None	None	None							non parametric	RW**

* Not assessed by ICES in 2003. Setting of the domestic assessment at MRI, Reykjavik

** The inertia term was reduced

RW: Random walk

Table 1.1.1. Overview of the observables, models and principal assumptions used for the gadoid stocks that are analytically assessed by the NWWG. Comparisons in settings are made between the present assessment year and 2003. Changes in settings between years are shown as underlined and bold.