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Report of the Study Group for Long Term Advice

23–27 February 2004
ICES, Copenhagen

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1 Introduction

The SGLTA (23-27 February 2004) TORs were:

A **Study Group for Long-Term Advice** [SGLTA] (Chair: P. Degnbol, Denmark) will be established and will meet at ICES Headquarters from 23–27 February 2004 to:

review the approach presented by the Working Group on Methods of Fish Stock Assessments regarding conservation limits and long term reference points and plan implementation by the Assessment Working Groups;

review developments in stock assessment methodology in relation to the implementation in the Assessment Working Groups;

review and plan implementation of long-term management simulations and evaluations of recovery plans and harvest control rules as presented by the Working Group on Methods of Fish Stock Assessments;

review progress made by the Study Group on the Development of Fishery-based Forecasts and plan implementation of fisheries-based advice by the Assessment Working Groups;

respond to feedback from meeting to be held by NSCFP in October 2003.

The TORs focus on the output from SGDFP and the Methods WG. However, the changes to be introduced in the advisory process in 2004 are such that it was relevant to review these changes based on the MCAP report as well. The meeting also served as a forum to discuss various issues regarding the work of assessment working groups in 2004.

1.1 Participants

Poul Degnbol (Chair)

Yuri Efimov (ACFM member)

Steve Flatman (chair WGSSDS)

Asta Gudmundsdottir (chair WGNPBW)

Lawrence Kell (WGMG member)

Ciaran Kelly (chair WGMHSA)

Yuri Kovalev (chair AFWG)

Paul Marchal (chair SGDFP)

Sten Munch-Petersen (chair WGPAND)

Carl O'Brien (Chair WGMG)

Rick Officer (chair WGNSSDS)

Else Torstensen (chair HAWG)

Valentin Trujillo (chair WGHMM)

Morten Vinther (ACFM member)

The chairs of NWWG, WGBFAS and WGNSSK were unable to attend the SG.

1.2 Documentation

The SG discussions were based on the reports of the Study Group for the Development of Fisheries Based Forecasts 2003 and 2004 (Anon 2003a and Anon 2004a) and a draft report for the Methods Working Group 2004 (Anon 2004b) which finalised its meeting just prior to this SG.

The SG furthermore made reference to documents regarding the ICES advisory process including MoU's with client commissions and a draft format of the integrated ICES advice as discussed by MCAP, see list below

Doc. No	
1	Agenda and workplan
2	Draft Report Layout
3	SGLTA TOR
4	ACFM action plan 2003
5	Letter from J. Holmquist 17 February 2004
6	Proposal for format for integrated advice
7	Draft SGDFE 2004 report
8	SGAWWP 2003 (Executive Summary)
9	Draft of relevant sections from WGMG 2004 report
10	MCAP January 2004
11	Burden of Proof (Paper for MCAP-WGCOOP)
12	Report from NSCFP October 2003
13	Draft Report from SGFI (Feb 2004 Extract)
14	Quality Issues
15	MOU EC-ICES 2004

2 Long term reference points and long-term management simulations

The identification of reference points which will provide long-term high yield while maintaining stock reproductive capacity should be based on long-term simulations of outcomes of various reference point choices. Terms of Reference a) and c) are therefore seen as closely interlinked and are discussed in concert.

2.1 The reference point framework

The pa framework which has been the basis for ICES advice in recent years suffers from serious problems in estimating biomass limit reference points which are the basis of the framework. The Study Group on Precautionary Reference Points for Advice in Fisheries Management 2003 (Anon 2003b) found that limit reference points could only be estimated using an analytic approach for less than 25% of the stocks for which advice is given. The WGMG (Anon 2004b) has therefore proposed to use an estimate of F_{crash} (for instance estimated through concave regression, CONCR, as described in Anon 2004b) instead, which would apply to all stocks for which stock-recruitment data are available. WGMG found that the F_{lim} used for various stocks by ICES seem appropriate based on a CONCR analysis for most stocks. This would imply a move away from biomass reference points altogether. This is considered sensible for many reasons including the difficulties in estimating such reference points from historical data, the need for such reference points to reflect production regimes and a requirement to identify regime shifts and the problems involved in estimating present biomasses. However, there is a need to consider the transition carefully and to evaluate the communication aspects of a move from a biomass based to a fishing mortality based framework.

Long-term reference points are understood as targets in the sense they are used in international soft law such as the FAO Code of Conduct for Responsible Fisheries. The term 'target reference point' is therefore used here as synonymous with 'long term reference points'. Long-term reference points relate to objectives and should thus be identified in a dialogue between managers and scientists where managers identify overall objectives and scientists propose candidate target reference points which will relate to these objectives. It has been indicated by client commissions that 'high long-term yield and achieving low risk of depleting the productive potential of the stock' (Memorandum of Understanding between ICES and client commissions 2004) would be a relevant objective to be considered for target reference points. Various proposals for recovery plans and management agreements also indicate that it may be an objective to limit the inter-year variations in TAC or effort. ICES can propose candidate target reference points and harvest control rules with these properties but the further development of these until decisions are made must take place in a close interaction between scientists and managers.

Target reference points relating to high long-term yield can only be estimated on a single stock basis when interactions with other stocks are considered negligible. For stocks with important biological interactions a set of target reference points must be developed for the stock assemblage. There will not be one set of reference points which provides the highest long-term yield. The choice will be between many possible sets and the decision between these will depend on the priority given to yield from specific stocks. This will relate to societal considerations such as overall value or the importance of the various stocks for various fleets, fishing communities or nations. The choice between the various sets of target reference points can thus not be made by science.

A number of candidate reference points relating to high long-term yield are available. Some of these are based on some extension of the F_{max} concept by including the S/R relationship (F_{MSY}) or by choosing a reduction in marginal gain from increasing F in order to make estimates more robust ($F_{0.1}$). A less analytic but more robust approach when data on stock-recruitment relationships do not exist or are inconclusive is to identify a target reference point from the historical time series (F_{hist}). The target reference point should in that case be similar to what prevailed in a historic period where the stock produced high yields for an extended period.

The identification of target reference points will be sensitive to a range of conditions which should be checked:

Multispecies aspects – if biological interactions with other exploited stocks are considered important target reference points should be identified for the stock assemblage in concert.

Multi-fleet aspects. If technical interactions are considered important the target reference points of the stocks which are exploited simultaneously will be coupled.

Density dependent growth and maturity has been found to be important in some stocks and should be included in reference point estimation

Discard practices may be related to the fishing mortality in certain management regimes. It is for instance expected that discarding will increase in mixed fisheries when TAC's are very restrictive for one or a few stock.

2.2 Approach to target reference point decision

Long-term reference points with the properties implied would be sensitive to biological interactions between stocks and to technical interactions. For stocks where such interactions are important candidate reference points can thus only be evaluated in a framework which includes such interactions. In most ICES areas the present stock situation is remote from what would be the case when long-term target points are approached. It is therefore not possible to evaluate the numerical value of candidate reference points by extension of the present situation and it is not realistic to simulate and predict the multiple interactions in such a situation with any realism. The most realistic approach is therefore that some initial rough estimates of candidate target reference points are used as a basis for management decisions to start the process of rebuilding towards the situation which would apply when targets are achieved, monitor the situation and adapt the target reference points according to the outcomes. Target reference points in a multifleet and –species context should thus be estimated in an adaptive framework. However, for stocks which are exploited in single-stock fisheries and where biological interactions with other exploited stocks are negligible it may be possible to provide initial estimates of candidate target reference points which are reasonably realistic from the outset.

In 2004 it will thus be possible to suggest candidate long-term targets relating to high long-term yield with low risk of depleting the reproductive potential of the stock for some stocks which are harvested by single-stock fisheries with insignificant discarding, where productivity is relatively stable and where biological interactions are considered of less importance. For these stocks simulations of harvest control rules should be used as a means to evaluate the properties of candidate target points in relation to the implied objectives. Such stocks were suggested by the WGMG (Anon 2004b):

NE Atlantic mackerel,
Herring, North Sea, Irish Sea, and Celtic Sea,
Saithe North Sea,
NE Arctic cod
NE Arctic saithe

It is also suggested to attempt an evaluation of management plans (recovery plans, management agreements, rebuilding plans) where such have been agreed or proposed. This would include cod in North Sea, West of Scotland and Irish Sea, and Northern hake. However, for these stocks, where technical and biological interactions and discarding is important, it will not be possible in the short term to propose candidates for long-term target reference points, such points must be estimated through and adaptive learning framework.

At the present meeting the WG Chairs identified stocks for which options for management plan evaluations could be attempted by the WGs this year (Table 2.1), either because they are considered to be subject to minimal interactions or because management plans have been agreed or proposed.

The working groups should also identify those stocks which can be candidates for multi-annual TACs. The ICES Study Group On Multiannual Assessment Procedures (Anon 1999) dealt with this issue, and the issue has been developed further by WGMG (Anon 2004b) and others. The Study Group On Multiannual Assessment Procedures identified mackerel as a candidate for multi-annual TAC's.

2.3 The tools available and their implementation

Several tools have been developed over time to deal with harvest control rule simulations. These were discussed by the WGMG (Anon 2004b) and include the WGMTERM, ICP, STPR, and CS4/5. There are more comprehensive evaluation tools under development which will not only make medium term forecasts under a range of HCR conditions but will include an evaluation of the management procedure. A full management procedure evaluation is required for evaluation

of reference points and HCR's. However, in the absence of a management evaluation tool it is suggested that existing simulation software is modified to incorporate those HCR options which have been included in existing management plan agreements or proposals.

Of the existing simulation tools CS5 includes most options in relation to HCR's from the outset and is therefore suggested as the tool to be used as the default presently for simple simulations. For some stocks specific software has been developed to deal with the properties of those stocks and such software should still be used for these stocks.

A range of necessary modifications to the CS5 software were identified for the software to be adequate to deal with the candidate stocks:

2.3.1 Methods/implementation issues:

A range of issues in the present implementation of simulations were identified:

The CS5 assumes an SSB in the starting year without uncertainty and this should be corrected.

The SSB in the starting year is given as an input. This may not be consistent with the N matrix. The SSB in year -1 should instead be backcalculated from the N matrix.

The link to the assessment and the traditional short-term forecasts must be consistent.

The CVs on population numbers, M and maturity are not included in the present version, this should be included. 1000 simulations is probably not enough to converge results and to achieve reasonable estimates of marginal fractiles. The decision on number of simulations should be done at runtime on a case by case basis.

The CS5 seems to stop after 10 years if the %biomass option is used. This may make sense if the simulations are only to evaluate recovery plans but there is no reason to hardwire the time span of simulations – this should be a choice by the user.

There is a need for documentation of CS5 - a F_{low} chart is needed as is a user guide.

The 4 parameters for the S-R model needs to be clarified.

The units used in the S-R as well in other parts of the calculations needs to be specified in the User's Guide.

The priority of HCR rules in the CS5 needs to be stated more transparently.

R has to be age 0 or 1. A canonical artificial correction (calling age 3 for age 1 for instance) for this gives problems with the S-R model as lag in years cannot be included.

More S-R models needs to be included. An example is an option for bootstrapping within a specified historical period.

Inclusion of discards would be very useful but could be difficult to program.

2.3.2 HCR variants to be included:

The variants of HCRs to be evaluated are listed in table 2.1. The needs are summarized as:

HCR options:

Possibilities for two age dependent ranges for F. The fleet structure for Nsea herring with HCRs including separate F_s for juveniles and adults cannot be handled in the present setup.

Priorities in elements in the HCR – the hierarchy of decision rules should be flexible and transparent;

F based HCR including the speed to reach the safe/target level; This is required for simulations in relation to long term targets.

Recovery plan and the time after: when recovery plans are agreed the assumption must be that another HCR will be used once the goals of the recovery plan have been achieved

Options for rules for what to do when the stock gets below a certain B level, like for Baltic cod it is stated that 'ensure and rapid' should be taken to rebuild the stock and it should be possible to simulate the outcomes of various decision rules in that case.

Options 5 and 6 may be generalized to two step HCRs with two trigger points as are presently agreed in several cases (example Baltic sprat). For instance of the type $F=0$ until B_{lim} , F =increasing linearly until B_{pa} , and then $F=F_{pa}$ at and above B_{pa} .

Options for a HCR with stable catches for some years like the Mackerel case with 3-year stable catches.

Options for HCR with a change window both in terms of TAC percentage and absolute TAC. An example is Icelandic cod where a 30 000 t variation in TACs from year to year needs to be possible as an option. NEA cod is also a case here.

The exploitation pattern to change over time; in the present setup of the software the exploitation pattern can be changed from year 1, but thereafter it remains fixed. Fishing management is not expected to happen this way

Possibilities for simulating in-year decisions as used for capelin, anchovy and Sandeel. This should include presentation of distributional issues when relevant (Anchovy where the split between first and second half year is also a split between two national fleets);

2.3.3 Output modifications:

The output needs to be modified to be more informative:

- Presentation of foregone yield - a graph of one HCR compared to a default HCR (which has to be defined);

- S-R plot needed for quality control;

- Plot of actual catch change from year to year;

- Counts of how often the various segments of a HCR was activated or an indication of which rule was decisive in each year;

2.4 Implementation plan

It was decided that WGs in 2004 should

- Present candidate target reference points (high long-term yield, low risk of reduced stock productivity) for stocks with minimal technical or biological interactions

- Present HCR simulations for stocks with low technical interactions with other stocks and for stocks where management plans are agreed or proposed.

In 2005 there should be interaction with clients on basis of the outcomes of the process in 2004 in order to refine the proposals for target reference points. There should be agreement on desired properties and a shared evaluation of the proposals in relation to these properties. There is also a need to develop a learning framework for stocks where multispecies effects are important.

The relevant stocks are listed in Table 2.1

Table 2.1 Stocks for which management plans exist or are proposed and stocks which are considered suitable candidates for harvest control rule evaluation in a single stock context.

WG	Stock	Rationale	Existing or proposed management Plans	Approach
WGNEPH	Iberian peninsula Nephrops stocks	Recovery plans	<p>Rebuilding plan: A meeting of the Subgroup on management Objectives of STECF took place in 2003 to develop a stock recovery plan for southern hake and <i>Nephrops</i> in VIIIc and IXa (SGMOS 2003). The recovery plan is yet to be implemented, but ICES will reconsider its advice in the light of its evaluation.</p> <p>Proposed plan: gradual F reductions (10% p.a.) to achieve $F_{0.1}$ for hake of 0.15 over a recovery time of 5-10 years. Closure of the fishery in five areas around the Iberian peninsula.</p>	An effort control scheme was considered to represent the best overall management scheme for the fisheries for southern hake and Iberian <i>Nephrops</i> , but account needs to be taken of the problems associated with defining and regulating effort in artisanal fleets. For <i>Nephrops</i> annual reductions in F were proposed based on the strategy for hake – gradual F reductions (10% p.a.) to achieve $F_{0.1}$ for hake of 0.15 over a recovery time of 5-10 years. Since this was deemed insufficient to allow effective recovery of <i>Nephrops</i> stocks, closures of some areas of high <i>Nephrops</i> were also recommended. Only limited scope for the use of gear regulations was identified, given the mixed nature of the fisheries, but some minor changes were suggested.
WGBFAS	East and west Baltic cod	Target F and B	<p>Management objectives: In resolution XX, in June 2003, the IBSFC agreed to implement the following management plan for the two cod stocks, Eastern and Western Stocks in the Baltic:</p> <p>“IBSFC agrees to implement the following management plan for the two cod stocks, Eastern and Western Stocks, which is consistent with the precautionary approach, ensures sustainable exploitation and provides for stable and high yield. This management plan replaces IBSFC resolutions X and XVII.</p> <p>1. Management targets The management targets are to maintain the Spawning Stock Biomass (SSB) at levels greater than 23,000 tonnes for the Western stock and 240,000 tonnes for the Eastern stock.</p> <p>2. Management areas The Contracting Parties agree to implement two management areas, one for the Western cod stock and one for the Eastern cod stock.</p>	

			<p>3. Setting total allowable catches</p> <p>a) <i>IBSFC shall only adopt TACs that are predicted by ICES to generate an annual fishing mortality rate not exceeding 0.6 for the Eastern stock and 1.0 for the Western stock.</i></p> <p>b) <i>Where the SSB is estimated by ICES to be greater than or equal to the target levels defined in chapter 1, the TACs shall not exceed a level which, according to ICES, will result in the SSB being below the target levels at the end of the year of the application of the TACs.</i></p> <p>Within the constraints laid down in paragraph 3a, the TACs shall not be set at levels which are more than 15% less or 15% greater than the TACs of the preceding year.</p> <p>c) <i>Where the SSB is estimated by ICES to be less than the target levels defined in chapter 1 but above 9,000 tonnes for the Western stock and 160,000 tonnes for the Eastern stock, the following rules shall apply:</i></p> <p>i) <i>the TAC shall be fixed at a level which, according to ICES, will result in an increase of at least 30% in the SSB or in a SSB greater than the target levels, defined in chapter 1, at the end of the year of the application of the TAC;</i></p> <p>ii) <i>where it will not be possible, according to ICES, to achieve the increase in the SSB indicated in paragraph 3a, the TAC shall be set at the lowest possible level.</i></p> <p><i>Within the constraints laid down in paragraph 3a, the TACs shall not be set at levels, which are more than 15% less or 15% greater than the TACs of the preceding year.</i></p> <p>d) <i>Where the SSB is estimated by ICES to be less than 9,000 tonnes for the Western stock or 160,000 tonnes for the Eastern stock, the following rules shall apply:</i></p> <p>i) <i>the TAC shall be fixed at a level which, according to ICES, will result in the SSB being above these levels at the end of the year of the application of the TAC and will give an increase of at least 30% in the SSB;</i></p> <p>ii) <i>where it will not be possible, according to ICES, to increase</i></p>	
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			<p><i>the SSB to 9,000 tonnes for the Western stock or 160,000 tonnes for the Eastern stock within one year, the TAC shall be set at the lowest possible level.</i></p> <p>4. Technical measures limiting fishing effort and mortality</p> <p><i>a) IBSFC shall provide for consistency between gear selectivity and the minimum landing size for cod, in order to reduce discards and fishing mortality on juvenile cod.</i></p> <p><i>b) The minimum landing size of 38 cm for cod shall be kept under regular review. In accordance with the development in the stocks and the selectivity in the fisheries, the minimum landing size shall be revised no later than 2005 with a view to adopting an increase to apply from 2006.</i></p> <p><i>c) IBSFC shall, for all fisheries targeting cod, from 2003 keep under regular review the development in the fishing activities, including the impact of closed areas and seasons, and gear regulations in terms of control, conservation and sustainable exploitation objectives. On the basis of scientific advice and any review carried out, IBSFC shall adopt, where appropriate, adjustments to the fishery rules.</i></p> <p>5. Control and enforcement</p> <p>The Contracting Parties of IBSFC shall continue their co-operation on control and enforcement with the aim of establishing a comprehensive and efficient Control and Enforcement Scheme, which supports this management plan and ensures compliance with IBSFC recommendations and Fishery Rules.</p> <p>6. Review of the management plan</p> <p><i>This management plan shall be reviewed as necessary, on the basis on scientific information and advice, not later than 2006.”</i></p>	
	Baltic sprat		<p>Management objectives: In Resolution XIII, September 2000, the IBSFC agreed to implement a long-term management plan for sprat in the Baltic:</p> <p><i>“The IBSFC agreed to implement a long-term management plan for the sprat stock</i></p>	

			<p><i>which is consistent with a precautionary approach and designed to ensure a rational exploitation pattern and provide for stable and high yields. This plan shall consist of the following elements:</i></p> <ol style="list-style-type: none"> <i>1. Every effort shall be made to maintain a level of spawning stock biomass (SSB) greater than 200 000 t.</i> <i>2. A long-term management plan, by which annual quotas shall be set for the fishery, reflecting a fishing mortality rate of 0.4 for relevant age groups as defined by ICES shall be implemented.</i> <i>3. Should the SSB fall below a reference point of 275 000 t, the fishing mortality rate referred to under paragraph 2 will be adapted in the light of scientific estimates of the conditions then prevailing, to ensure safe and rapid recovery of the spawning stock biomass to levels in excess of 275 000 t.</i> <i>4. The IBSFC shall, as appropriate, adjust management measures and elements of the plan on the basis of any new advice provided by ICES.</i> <p><i>A review of this arrangement shall take place not later than in the year 2003.”</i></p>	
WGSSDS	Biscay sole	Proposed management plan (ACFM).	Management objectives: There are no explicit management objectives for this stock.	WG ₂₀₀₄ to evaluate using modified CS5 software.
	Sole VIIe	Proposed management plan (WG).	Management objectives: There are no explicit management objectives for this stock	WG ₂₀₀₄ to evaluate using modified CS5 software.
	Cod VIIe-k	Proposed management plan (ACFM).	Management objectives: There are no explicit management objectives for this stock.	WG ₂₀₀₄ to evaluate using modified CS5 software.
WGNPBW	Norwegian spring spawning herring	Management plan	<p>Management objectives: EU, Faroe Islands, Iceland, Norway, and Russia agreed to implement a long-term management plan. This plan consists of the following elements:</p> <ol style="list-style-type: none"> <i>1. Every effort shall be made to maintain a level of Spawning Stock Biomass (SSB) greater than the critical level (B_{lim}) of 2 500 000 t.</i> <i>2. For the year 2001 and subsequent years, the Parties agreed to restrict</i> 	For Norwegian spring spawning herring harvesting control rules were evaluated in a WD several years ago. However, together with a PhD student in fisheries economics we are running HCR evaluations more or less on a daily basis. For these evaluations SeaStar is being used, in which there is a variety of recruitment options. A paper will be

			<p><i>their fishing on the basis of a TAC consistent with a fishing mortality rate of less than 0.125 for appropriate age groups as defined by ICES, unless future scientific advice requires modification of this fishing mortality rate.</i></p> <p>3. <i>Should the SSB fall below a reference point of 5 000 000 t (B_{pa}), the fishing mortality rate, referred to under paragraph 2, shall be adapted in the light of scientific estimates of the conditions to ensure a safe and rapid recovery of the SSB to a level in excess of 5 000 000 t. The basis for such an adaptation should be at least a linear reduction in the fishing mortality rate from 0.125 at B_{pa} (5 000 000 t) to 0.05 at B_{lim} (2 500 000 t).</i></p> <p><i>The Parties shall, as appropriate, review and revise these management measures and strategies on the basis of any new advice provided by ICES.</i></p>	submitted soon.
	Icelandic summer spawners	Management plan	<p>Management objectives: The practice has been to manage this stock at $F=F_{0.1}=F_{pa}$ for more than 20 years. However, no formal management strategy has been adopted.</p>	<p>Jakobsson and Stefansson (1999) made a risk analysis and stated that the probability of stock collapse needs no further consideration as long as the target fishing mortality is kept below 0.25</p> <p>The target $F_{0.1}=0.22$.</p> <p>The Icelandic summer spawning herring is only a update stock this spring and as the program CS5 for evaluating HCR is not ready this HCR will not be evaluated this time.</p>
	Barents sea capelin	HCR	<p>Management objectives: The fishery is managed according to a target escapement strategy, with a harvest control rule allowing the SSB (with 95% probability) to be above the proposed B_{lim}, taking into account predation by cod.</p>	<p>For Barents Sea capelin runs have been made with experimental target reference point at the two last assessment meetings (see the assessment reports). The same software (i.e. Bifrost in prognostic mode) can be used for evaluating the present HCR. It is quite complicated, though, because of the influence from herring. Due to time constraint this can not be done before next meeting in</p>

				spring (2004).
NWWG	Icelandic cod	HCR	<p>Management objectives: A formal Harvest Control Rule was implemented for this stock in 1995. The TAC for a fishing year was set as a fraction (25%) of the “available biomass” which is computed as the biomass of age 4 and older fish, B(4+), averaged over the two adjacent calendar years. In the long-term, this corresponds to a fishing mortality of about 0.4. This harvest control rule was considered by ICES to be in accordance with the precautionary approach.</p> <p>In spring 2000 the government introduced an amendment to the catch rule limiting inter-annual changes in catches to 30 000 t. Limited studies, using a similar approach as when the initial catch rule was adopted were the basis for this amendment. ICES has not evaluated the amendment. The 30 000 t stabilizer was in effect in the fishing years 2000/2001 and 2001/2002, but not in 2002/2003. For the coming fishing year, the increase in TAC without applying the stabilising constraint is close to 30 000 t.</p> <p>Management objectives: There are no explicit management objectives for this stock.</p>	
WGMHSA	NEA Mackerel	N-EC agreement	<p>Management objectives: The agreed record of negotiations between Norway, Faroe Islands, and EU in 1999, states:</p> <p><i>“For 2000 and subsequent years, the Parties agreed to restrict their fishing on the basis of a TAC consistent with a fishing mortality in the range of 0.15 - 0.20 for appropriate age groups as defined by ICES, unless future scientific advice requires modification of the fishing mortality rate.”</i></p> <p><i>“Should the SSB fall below a reference point of 2 300 000 tonnes (B_{pa}), the fishing mortality rate, referred to under paragraph 1, shall be adapted in the light of scientific estimates of the conditions prevailing. Such adaptation shall ensure a safe and rapid recovery of the SSB to a level in excess of 2 300 000 tonnes.”</i></p> <p><i>“The Parties shall, as appropriate, review and revise these management measures and strategies on the basis of any new advice provided by ICES.”</i></p>	Medium term simulations using STPR and/or other tools will be used to evaluate single species HCR, with a view to proposing multiannual TAC.
	Anchovy sub area VIII	HCR	<p>Management objectives: There are no explicit management objectives for this stock. However, for any management objectives to meet precautionary criteria,</p>	Existing HCR proposals will be evaluated for suitability with current management regime. Stalemate in

			<p>their aim should be to keep SSB above B_{pa} and reduce or maintain F below F_{pa}. If a harvest control rule can be established, one of the objectives of this rule would imply a high probability of maintaining the stock above B_{lim}.</p>	<p>progress here without feedback from management.</p>
AFWG	NEA cod	Management plan under review	<p>Management objectives: In recent years, the advice has been to reduce fishing mortality below F_{pa} and to keep the spawning stock above B_{pa}, which was considered to be the minimum value, required to have a low probability of poor recruitment.</p> <p>At the 31st Session of The Joint Norwegian-Russian Fishery Commission in November 2002 the following decision was made:</p> <p><i>“The Parties agreed that the management strategies for cod and haddock should take into account the following:</i></p> <ul style="list-style-type: none"> - <i>conditions for high long-term yield from the stocks</i> - <i>achievement of year-to-year stability in TACs</i> - <i>full utilisation of all available information on stock development</i> <p><i>On this basis, the Parties determined the following decision rules for setting the annual fishing quota (TAC) for Northeast Arctic cod (NEA cod) from 2004 and onwards:</i></p> <ul style="list-style-type: none"> - <i>estimate the average TAC level for the coming 3 years based on F_{pa}. TAC for the next year will be set to this level as a starting value for the - year period.</i> - <i>the year after, the TAC calculation for the next 3 years is repeated basing on the updated information about the stock development, however the TAC should not be changed by more than +/- 10% compared with the previous year’s TAC.</i> - <i>if the spawning stock falls below B_{pa}, the Parties should consider a lower TAC than the decision rules would imply.”</i> <p>The Norwegian Ministry of Fisheries sent a letter to ICES (February 2003), requesting that the advice for TAC on cod and haddock should correspond to the decision rule. The ACFM report on NEA cod as of May 2003 and its answer to the request for advice made by the Commission (Section</p>	<p>The proposed management plan, as well as alternative plans, will be tested by doing long-term stochastic simulations using PROST software. Group of experts will meet before AFWG.</p> <p>During AFWG meeting in May 2004 medium-term simulation will be performed and advice will be given in accordance with the proposed harvest control rules.</p> <p>The results will be evaluated by ACFM.</p>

			<p>3.1.10) is given in ICES (2003c). ACFM gave the advice that the TAC on NEA Cod should not exceed 398.000 tonnes, corresponding to a fishing mortality of $F_{pa}=0.40$. ACFM also calculated the catch corresponding to the decision rule, as requested, and did not find this catch in accordance with the PA, because it would lead to a fishing mortality above F_{pa} for 2004. ACFM did not evaluate whether the decision rule as such would be in accordance with the PA, but made the following statement:</p> <p><i>“The 2004 catches calculated by applying the harvest rule imply a fishing mortality above F_{pa}. However, the precautionary reference points as currently used by ICES are defined in the context of advising on an annual TAC based on a predicted catch based on a maximum F. The objective of this Harvest Control Law is to have a low risk of falling below a B_{lim} point. The proposed harvest control rule or modifications of it may actually secure a low probability of SSB dropping below a B_{lim} point and hence be in accordance with the Precautionary Approach because the decision rule is different from that implied in calculating F_{pa}. Simulation studies are needed to reveal if this is the case. ICES is prepared to review and evaluate results of such studies. “</i></p>	
	NEA Haddock	Management plan under review	<p>Management objectives:</p> <p>In recent years, the advice has been to reduce fishing mortality below F_{pa} and to keep the spawning stock above B_{pa}, which was considered to be the minimum value, required to have a low probability of poor recruitment.</p> <p>At the 31st Session of The Joint Norwegian-Russian Fishery Commission in November 2002 the same decision as for NEA cod was made for haddock:</p> <p><i>“The Parties agreed on similar decision rules for haddock, based on F_{pa} and B_{pa} for haddock, and with a fluctuation in TAC from year to year of no more than +/-25% (due to larger stock fluctuations).”</i></p>	The same simulation as for NEA cod will be done using PROST software, if it will be possible.
WGNSSK	North Sea Cod	Recovery plan	<p>Management objectives: In 1999 the EU and Norway have <i>“agreed to implement a long-term management plan for the cod stock, which is consistent with the precautionary approach and is intended to constrain harvesting within safe biological limits and designed to provide for sustainable fisheries and greater potential</i></p>	

			<p>yield. The plan shall consist of the following elements:</p> <ol style="list-style-type: none"> 1. Every effort shall be made to maintain a minimum level of SSB greater than 70 000 t (B_{lim}). 2. For 2000 and subsequent years the Parties agreed to restrict their fishing on the basis of a TAC consistent with a fishing mortality rate of 0.65 for appropriate age groups as defined by ICES. 3. Should the SSB fall below a reference point of 150 000 t (B_{pa}), the fishing mortality referred to under paragraph 2 shall be adapted in the light of scientific estimates of the conditions then prevailing. Such adaptation shall ensure a safe and rapid recovery of SSB to a level in excess of 150 000 t. 4. In order to reduce discarding and to enhance the spawning biomass of cod, the Parties agreed that the exploitation pattern shall, while recalling that other demersal species are harvested in these fisheries, be improved in the light of new scientific advice from, inter alia, ICES. <p>The Parties shall, as appropriate, review and revise these management measures and strategies on the basis of any new advice provided by ICES.”</p>	
	North Sea Plaice	Agreement	<p>Management objectives: In 1999, the EU and Norway have “agreed to implement a long-term management plan for the plaice stock, which is consistent with the precautionary approach and is intended to constrain harvesting within safe biological limits and designed to provide for sustainable fisheries and greater potential yield. The plan shall consist of the following elements:</p> <ol style="list-style-type: none"> 1. Every effort shall be made to maintain a minimum level of SSB greater than 210 000 t (B_{lim}). 2. For 2000 and subsequent years the Parties agreed to restrict their fishing on the basis of a TAC consistent with a fishing mortality of 0.3 for appropriate age groups as defined by ICES. 3. Should the SSB fall below a reference point of 300 000 t (B_{pa}), the fishing mortality referred to under paragraph 	

			<p>2 shall be adapted in the light of scientific estimates of the conditions then prevailing. Such adaptation shall ensure a safe and rapid recovery of SSB to a level in excess of 300 000 t.</p> <p>4. In order to reduce discarding and to enhance the spawning biomass of plaice, the Parties agreed that the exploitation pattern shall, while recalling that other demersal species are harvested in these fisheries, be improved in the light of new scientific advice from, inter alia, ICES.</p> <p>The Parties shall, as appropriate, review and revise these management measures and strategies on the basis of any new advice provided by ICES.”</p>	
	North Sea Haddock	Agreement	<p>Management objectives: In 1999 the EU and Norway have “agreed to implement a long-term management plan for the haddock stock, which is consistent with the precautionary approach and is intended to constrain harvesting within safe biological limits and designed to provide for sustainable fisheries and greater potential yield. The plan shall consist of the following elements:</p> <ol style="list-style-type: none"> 1. Every effort shall be made to maintain a minimum level of SSB greater than 100 000 t (B_{lim}). 2. For 2000 and subsequent years the Parties agreed to restrict their fishing on the basis of a TAC consistent with a fishing mortality rate of 0.70 for appropriate age groups as defined by ICES. 3. Should the SSB fall below a reference point of 140 000 t (B_{pa}), the fishing mortality referred to under paragraph 2 shall be adapted in the light of scientific estimates of the conditions then prevailing. Such adaptation shall ensure a safe and rapid recovery of SSB to a level in excess of 140 000 t. 4. In order to reduce discarding and to enhance the spawning biomass of haddock, the Parties agreed that the exploitation pattern shall, while recalling that other demersal species are harvested in these fisheries, be improved in the light of new scientific advice from, inter alia, ICES. 	

			<i>The Parties shall, as appropriate, review and revise these management measures and strategies on the basis of any new advice provided by ICES.”</i>	
	North Sea Whiting	Agreement	Management objectives: No explicit management objectives are set for this stock.	
	North Sea Saithe	Agreement	<p>Management objectives: In 1999 the EU and Norway have “<i>agreed to implement a long-term management plan for the saithe stock, which is consistent with the precautionary approach and is intended to constrain harvesting within safe biological limits and designed to provide for sustainable fisheries and greater potential yield. The plan shall consist of the following elements:</i></p> <ol style="list-style-type: none"> 1. <i>Every effort shall be made to maintain a minimum level of SSB greater than 106 000 t (B_{lim}).</i> 2. <i>For 2000 and subsequent years the Parties agreed to restrict their fishing on the basis of a TAC consistent with a fishing mortality rate of 0.40 for appropriate age groups as defined by ICES.</i> 3. <i>Should the SSB fall below a reference point of 200 000 t (B_{pa}), the fishing mortality referred to under paragraph 2 shall be adapted in the light of scientific estimates of the conditions then prevailing. Such adaptation shall ensure a safe and rapid recovery of SSB to a level in excess of 200 000 t.</i> <p><i>The Parties shall, as appropriate, review and revise these management measures and strategies on the basis of any new advice provided by ICES.”</i></p>	
WGNSDS	West of Scotland cod	Proposed recovery plan	The European Commission proposal for a Council Regulation (COM(2003) 237 final, 2003/0090 (CNS)) proposes measures that may be established for the recovery of cod stocks. ICES evaluated these measures in 2003.	As was done in 2003, the WGNSDS ₂₀₀₄ will use CS software to provide forecast options consistent with the scenarios specified in the recovery plan proposal. Examples of mixed fisheries forecasts using MTAC will also include as management objectives the scenarios specified in the recovery plan proposal.
	Irish Sea cod	Proposed recovery plan	The European Commission proposal for a Council Regulation (COM(2003) 237 final, 2003/0090 (CNS)) proposes measures that may be established for the recovery of cod stocks. ICES evaluated these measures in	As was done in 2003, the WGNSDS ₂₀₀₄ will use CS software to provide forecast options consistent with the scenarios specified in the

			2003.	recovery plan. Examples of mixed fisheries forecasts using MTAC will also include as management objectives the scenarios specified in the recovery plan proposal. These tasks will be hampered by a disimprovement in assessment input data for 2003 caused by a denial of access to samples from the Northern Ireland fisheries (one of the main States fishing in the Irish Sea).
	Rockall haddock	Proposed recovery plan	The European Community, after consultation with Russia, has requested ICES advice concerning Rockall haddock recovery plans. ICES evaluated the proposed measures in January 2004 at an <i>ad hoc</i> Expert Group meeting.	As there is currently no accepted assessment for Rockall haddock ICES has been unable to present definitive forecasts as requested in the recovery plan proposal. WGNSSDS ₂₀₀₄ will therefore first try to achieve an acceptable assessment and then (if time allows) evaluate the proposed recovery plan scenarios using CS software.
WGPAND	Pandalus in IVa East and Skagerrak		No management objectives. Stock fluctuations probably more dependant on predators than fisheries.	
HAWG	North Sea herring	HCR	<p>Management objectives: According to the EU-Norway agreement (December 2001):</p> <ol style="list-style-type: none"> 1. <i>Every effort shall be made to maintain a level of Spawning Stock Biomass (SSB) greater than the Minimum Biological Acceptable Level (MBAL) of 800 000 tonnes.</i> 2. <i>A medium-term management strategy, by which annual quotas shall be set for the directed fishery and for by-catches in other fisheries as defined by ICES, reflecting a fishing mortality rate of 0.25 for 2-ringers and older and 0.12 for 0- to 1-ringers, shall be implemented.</i> 3. <i>Should the SSB fall below a reference point of 1.3 million tonnes, the fishing mortality rates referred to under paragraph 2 will be adapted in the light of scientific estimates of the precise conditions then prevailing, to ensure rapid recovery of SSB to levels in excess of 1.3 million tonnes.</i> 	<p>The WG will evaluate the HCR, using software available for single stocks (STPR)</p> <p>The version of software available (CS4&5), does not allow simulation of HCR for stocks with more than one level of target points.</p>

			<p><i>The recovery plan referred to above may, inter alia, include additional limitations on effort in the form of special licensing of vessels, restrictions on fishing days, closing of areas and/or seasons, special reporting requirements or other appropriate control measures.</i></p> <p>4. <i>By-catches of herring may only be landed in ports where adequate sampling schemes to effectively monitor the landings have been set up. All catches landed shall be deducted from the respective quotas set, and the fisheries shall be stopped immediately in the event that the quotas are exhausted.</i></p> <p>5. <i>The allocation of the TAC for the directed fishery for herring shall be 29% to Norway and 71% to the Community. The by-catch quota for herring shall be allocated to the Community.</i></p> <p>6. <i>The parties shall, if appropriate, consult and adjust management measures and strategies on the basis of any new advice provided by ICES, including that from the assessment of the abundance of the most recent year class.</i></p> <p><i>A review of this arrangement shall take place no later than 31 December 2004.</i></p> <p><i>This arrangement entered into force on 1 January 2002.</i></p>	
	Celtic sea herring	Management plan	<p>Management objectives: A local Irish management committee has been established for this stock. One of its objectives is the protection of first-time spawning fish, which is enforced by an area closure (by Irish statute).</p>	
WGHMM	Northern hake	Recovery plan	<p>Recovery plan: Rebuilding of the hake stock can be obtained by reducing the fishing mortality, or by a reduction in F combined with an improvement of the selection pattern. However, an improvement in the selection pattern alone is unlikely to be sufficient to reduce exploitation to the level needed to rebuild the hake stock. Direct effort reduction rather than just TAC controls, are required to promote reduction in fishing mortality. Closed areas and seasons may contribute to stock recovery, but only if accompanied by major reductions in effort.</p> <p>The minimum legal mesh-size was increased from 55/65 mm to 70 mm in the</p>	<p>Make simulation using the CS5 Program with the current management actions already proposed by EC</p>

			<p>Bay of Biscay since 1 January 2000. An emergency plan for Northern hake was implemented on 1 September 2001. This plan combines a low TAC in recent years, and requires the use of a 100-mm mesh size for trawlers targeting hake in the Bay of Biscay and for trawlers operating in two non-<i>Nephrops</i> areas (one in the Bay of Biscay, one in the Celtic Sea). ICES has not been able to quantify the likely impact of these changes in mesh size, but, since hake is a late maturing fish, any improvement in the selection pattern that reduces the catch of younger fish (ages 0-2, ~ less than 30 cm) will have little short-term effect on SSB and only increase SSB in the medium-term. An improvement of the selection pattern would increase the probability that a reduction in fishing mortality will allow the rebuilding of SSB.</p> <p>The recovery plan proposed by the EU Commission (Doc. COM2003-374 final) in July 2003 aims at an annual increase of the SSB of 10% with a limit on the annual TAC variation of 15%. ICES has not evaluated this plan. ICES notes that the reductions indicated in the proposed plan are very far from cuts in fishing mortality that could rebuild the stock in the short-term. The catch option table presented below suggests that a cut in fishing mortality of 70% in 2004 would rebuild the stock in the short-term.</p>	
	Southern hake	Proposed recovery plan	Management objectives: There are no explicit management objectives for this stock.	using the CS5 Program; making the most logical scenarios, eg: achieving F_{max} , $F_{0.1}$, B_{pa}

3 Fisheries based advice

3.1 Scope and status

In 1992, assessment working groups were re-organised on to an area-basis in order to facilitate the provision of advice on an area and fishery basis. Although some progress was made (Anon 1992a,b), the ultimate goal of providing fishery-based advice has not been achieved. In 2001, the European Commission sent to ICES a request for provision of advice in a fisheries context rather than on an individual stock basis (EC, 2001). The Commission suggested that ICES should prepare plans for developing a database, which would collate catch at age data disaggregated by fleet and by area.

At the Fisheries Council of December 2001, the Council and the Commission emphasized the need to further develop the scientific basis for management that takes appropriate account of the mixed nature of the fisheries, and stressed the importance that objective information about the consequences of fisheries interactions be available when TACs are being considered for the year 2003. This issue resulted in the Commission sending to ICES a more explicit request regarding scientific advice on mixed fisheries (EC, 2002). In the short term, ICES should, (i) propose appropriate definitions of operational fishing units and, (ii) provide the STECF (SGRST sub-group) with catch data,

disaggregated by species, fleet and ICES rectangle. For the longer term, EC(2002) recommended that ICES should establish a working group to address a number of questions, including fleet definitions, age-structured data assembly, development of multi-fleet and multi-species short term projection software, collation of datasets including partial and total fishing mortalities at age.

3.2 Data issues

During the SGDFP meeting it became clear that the shift towards the routine provision of data and advice on a fishery basis is proving to be a substantial task, with implications for both national sampling schemes and data compilation. Based on the experiences of actually providing the national data, SGDFP redefined the data exchange format, however, with the knowledge that further revisions probably will be needed.

The task of compiling all the national data by fishery into an international database is not a trivial one. For consistency, the fishery based database should form the basis for both the ICES routine assessments and the mixed species forecasts. The current system to obtain fisheries data using "stock-coordinators" will not be sufficient as it operates on a stock level. The SGLTA concluded that in the coming year *ad hoc* methods and software will be used. On a longer term however, a standardised and verified tool for data compilation of fleet based data seems preferable.

The ICES Secretariat will in the future take over quite a bit of the work done now by the stock coordinators, by fishery fleet, country and area. The WGs should decide the rules and procedures for how to compile the data to international data for use in the XSA type assessment, and by fleet for use in MTAC type models.

The frame for the ICES Fish Stock and Fisheries Assessment database is presented below.

3.2.1 The ICES Fish Stock and Fisheries Assessment Database (IFISFADB)

The IFISFADB system includes three subsystems

1) a database with associated functions. The database holds data for input to fish stock assessment (analytical model). The database include facilities for manipulating the data and the end products are input files for fisheries assessment and fish stock assessment models;

2) a package of assessment tools;

3) a system for producing publications presenting fish stock assessment results.

The IFISFADB database has drawn on the system developed as a part of the EU funded project EMAS (Evaluation of MARKET Sampling strategies for a number of commercially exploited stocks in the North Sea and development of procedures for consistent data storage and retrieval, CFP Study Project 98/075), see Sparre et al (2001).

The assessment package is developed outside the IFISFADB project.

The publication production system is not covered in this note.

Organisational Framework

The system is built on the following organisational assumptions:

National fisheries laboratories will each produce definitions of species/stock specific national Fleet/Fisheries.

Where mixed fisheries issues are agreed to be relevant at the Working group level these fleet/fisheries definitions shall remain identical for all the stocks involved. These Fleet/Fisheries shall remain unchanged over years;

National fisheries laboratories will provide data broken down by month, quarter or year as agreed for that specific assessment, i.e. the seasonal breakdown is species/stock specific. A laboratory can provide data on a finer breakdown that agreed for the assessment;

National laboratories will provide data broken down by area as agreed by the assessment working group.

Laboratories may provide data on a finer breakdown than agreed;

Data are collected by national fisheries laboratories and raise to age compositions by fleet/fisheries, by area and by season according to the agreements made by the WG as specified above;

Data are submitted annually as part of the Assessment process. The submission is electronically and using an agreed protocol and is made from national fisheries laboratories to the ICES Secretariat. The protocol shall be consistent with the protocol developed for the EC system running under the Data Collection Regulation and the FIGIS XML-Fisheries developed by FAO;

The ICES Secretariat will screen the data submitted and after ensuring data integrity store the data on IFISFADB;

IFISFADB data can be manipulated through the web. The system will include a web tool that allows manipulation of the data and in particular assigning appropriate age compositions to those fragments of the catches (Landings and discards) for which no age composition is available;

The system will produce aggregates on the stock/fleet (or fisheries) level. These files shall be input to the next level – the assessment packages. This package is developed in the national laboratories.

Data submitted from the National Fisheries Research institutes as input to the ICES assessment process

The system accepts data broken down by (Identifier)

Species
Stock
Country
Fleet/Fishery (Country specific)
Year
Season within year (typically month or quarter)
Area (Typically ICES Division(s)) may be entire stock area

The information that is communicated to ICES includes catch and discard data corrected to the extent possible for misreporting and non-reporting, i.e. the data represent “best scientific estimates” at the agreed disaggregated level. The may be a “non-reported” category in the submitted data;

Landings (Tons) supplemented with the age compositions
Sampled weight
Age composition (in numbers)
Mean weights per individual
Discards (Tons) supplemented with the age compositions as above

3.3 Implementation plan

The WGs will provide basic data for the use in MTAC, with a limited number of fleets by major area. ACFM should then make actual forecasts once the overall area advice is decided.

This section gives the WG chairs’ description of how the mixed fishery issue has been treated by their working groups to date and gives an overview of the possibilities and plans for implementing mixed fisheries advice for the coming WG meetings.

Generally the working groups can be divided in two – those (mainly dealing with pelagic stocks) where mixed fisheries problems are considered of less relevance and those where and understanding of mixed fisheries is crucial to management.

3.3.1 Working groups where mixed fisheries issues are considered important

3.3.1.1 Working group for demersal stocks in the North Sea and Skagerrak [WGNSSK]

The mixed-fishery approach is of paramount importance for management advice for the stocks covered by this Working Group. With few exceptions, the groundfish fisheries in the North Sea and adjoining areas are conducted as mixed demersal fisheries. This means that each fishery catches fish from several different species and stocks, and also that each stock is fished by several different fisheries. Most fisheries have large bycatches of non-target species, which may be heavily discarded as a result. Thus, the ToRs for WGNSSK have included the following additional instruction for several years: *The assessment should take into account the technical interactions among the stocks due to the mixed-species fisheries.* Similarly, the advice from ACFM has included for some time the warning that *management advice [species X] should take into account the advice for [species Y and Z]*, although without specifying the quantitative basis on which to do so.

This importance is reflected in the fact that much of the preceding development work on fisheries-based approaches as been done using the North Sea fisheries as case studies. In the report of its 2002 meeting (ICES 2002), and in response to the 2002 Commission request for more explicit advice on mixed fisheries, WGNSSK provided fleet-disaggregated landings data over a number of recent years for the North Sea. These data were used subsequently by the SGRST subgroup of STECF to provide fishery-based forecasts in 2002. Further progress in determining how to define appropriate fishery units for the North Sea was made at the first and second meetings of SGDFE (ICES 2003a, 2004), and this was carried forward into the exploratory analyses of MTAC model sensitivity carried out by the 2003 meeting of WGNSSK (ICES 2003c).

There are three principal development needs for effective mixed-fisheries analyses in the North Sea. Firstly, there is the general issue of the development and availability of suitable software. The MTAC program is effective as a simple analysis tool, but more realistic operational management tools will be required in the future. Secondly, and probably most importantly, the definition of suitable fishery units in the North Sea has caused much trouble and debate. The work of SGDFE, WGNSSK and STECF has gone some way towards addressing this problem, but there is still a great reliance on national institutes to provide definitions which have not thus far been universally forthcoming. For example, the 2004 meeting of SGDFE (ICES 2004) was not provided with the necessary data to enable it to evaluate new fleet definitions and MTAC analyses. And thirdly, it is likely that restructuring of the current assessment Working Groups would facilitate analysis of fishery interactions: a specific example of this would be the proposed inclusion of North Sea *Nephrops* stocks in the remit of WGNSSK. However, no amount of restructuring will be able to solve all cross-area and cross-species bycatch problems, and these wider interactions must be accommodated in ACFM advice rather than at the WG level.

Even if these issues are addressed, the fact that fishery-based forecasts will still be based on data from commercial fleets must cause concern. The extent of misreporting in the North Sea cannot be quantified, but anecdotal evidence

from the participating fisheries would suggest that it has recently become more prevalent following stringent management action. Discard estimates are included in assessments for haddock and whiting, and have been evaluated for cod. However, these are derived entirely from the Scottish sampling programme, and it may be that the discard rates of the Scottish fleet are not appropriate for the fleets of other countries (particularly for cod and whiting in southern areas). Discard estimates for other stocks are currently lacking. These factors will all impact the utility of fishery-based forecasts for the North Sea, and indeed all other ICES areas.

In terms of data availability, the fishery-based approach using MTAC in the North Sea is possible (that is, it is possible to collate enough data to run the software), although there are several caveats. Data from some countries are already provided on the basis of fleets as defined by those countries, but this is not universally true. In addition, the fleet definitions used are not always appropriate (being broadly based on vessel or gear type) and will need to be addressed. The provision of fishery-based data will need to be done in future for nearly all stocks assessed by WGNSSK (with the possible exception of the northern shelf saithe fishery). Several national laboratories are engaged in ongoing work to refine current fleet definitions and collate the necessary data, and it is hoped that these will be available in time for the WGNSSK meeting in September 2004.

The following mixed-fishery activities are planned for 2004. It is intended that these will be carried out for *all* stocks assessed by WGNSSK, given the importance of fishery interactions in every case.

Fishery definitions will be finalised intersessionally, as far as practical. Older definitions will be used where this is not possible.

Data will be submitted to coordinators disaggregated by fishery, rather than by stock as is sometimes the case currently.

MTAC input datasets will be compiled, intersessionally where possible, and sample MTAC runs will be carried out to check data formats.

More complete MTAC analyses, including sensitivity to model choices, will be performed for those cases where management plans are to be evaluated.

These steps will be repeated and refined in 2005.

3.3.1.2 Working group for Baltic Fisheries Assessment [WGBFAS]

The mixed fishery approach may be of relevance for the main target species in commercial fishery cod, herring and sprat. They form about 95 % of the total catch.

Pelagic fisheries in the Baltic are dominated by pelagic trawlers catching a mixture of herring and sprat. The proportion of the two species in the catches varies according to area and season. In addition, fisheries for predominantly herring are carried out with trap-nets/pound-nets and gill-nets in coastal areas and with bottom trawls in some areas.

The catches of the pelagic species are used for human consumption, reduction to oil and meal and to animal fodder. The allocation of the catches into these categories differs not only by country, but also over time. The usage is to a large extent driven by the market conditions.

Fisheries targeting sprat in spring while sprat concentrates on the spawning grounds in the deep Baltic basins have higher by-catches of cod, especially in pre-spawning time. However, by-catch rates are considered to be well below the enforced by-catch limitation. At the end of the sprat spawning season and with increasing water temperatures sprat leave the basins. Fisheries targeting these concentrations in June to August have little or no by-catch of cod.

The herring TACs have been kept high despite decreasing stock size. This fact together with an increasing sprat stock has created a strong incentive to misreport sprat as herring in order to utilise the quotas of both herring and sprat as much as possible.

WGBFAS has so far not attempted to conduct mixed fisheries analysis using MTAC. The main problem with the mixed fisheries approach for this working group is to

- a) define fleet/fisheries in the different areas of the Baltic Sea and
- b) expend substantial effort to provide data for mixed fisheries analysis purposes.

For 2004:

The WG will give an detailed overview on fisheries by countries, as a basis to define fleet/fisheries in different areas. Furthermore the WG will review the problem concerning the species composition of pelagic landings in order to improve the input data quality.

For 2005:

Based on the detailed fisheries information given in 2004, fleet/fishery definitions shall be proposed within the frame of the Planning Group on Commercial Catch, Discards and Biological Sampling (PGCCDB). Further plans - depending on the given fleet/fisheries definitions - are to construct, if possible, appropriate fleet/fisheries data sets.

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3.3.1.3 Working group for Nephrops Stocks [WGNEPH]

Mixed fishery issues are increasingly relevant to the *Nephrops* stocks assessed by WGNEPH, particularly given recent declines in stocks of some finfish species taken alongside *Nephrops*. The species compositions of catches taken

alongside *Nephrops* vary regionally. Gadoids such as cod, haddock and whiting are a major component of catches in the northerly areas (IIIa, IV, VIa, VIIa), whereas hake, monkfish and megrim tend to be of greater importance in western and southern areas (VIIbcjk, VIIIabc, IXa). In the case of some of the Iberian stocks (VIIIc, IXa), *Nephrops* are taken only as a by-catch of fisheries directed at mixed demersal species.

The level of technical interaction between genuinely *Nephrops*-directed fisheries and other fisheries is likely to be less than would appear from aggregated fishery statistics. In some cases, fleets involved in *Nephrops*-directed fishing are also involved in fishing directed at other species. The definition of 'directed' thus needs to take into account the characteristics of individual fishing trips. These characteristics include the types of gear used (e.g. otter trawls), cod-end mesh size and the location of fishing. Most *Nephrops* stocks are confined to areas with particular types of sediment. Fishing trips targeting other areas are thus likely to be directed at other species.

For some stocks WGNEPH has used definitions of directed effort that are based on minimum proportions (by weight or value) of *Nephrops* in the landings. Whilst this approach has been satisfactory for representing trends in commercial effort, LPUE and CPUE, such definitions are unlikely to be acceptable for representing *Nephrops* fishing activities in a wider mixed fishery context. Appropriate definitions of operational fishing units for multi-species and multi-fleet management systems are essential if advice on *Nephrops* management is to be integrated successfully into this wider context.

Technical interactions between stocks and fisheries have been referred to in the ToR of recent WG meetings, but time constraints and a lack of adequate data have prevented WGNEPH from providing management considerations that actually took into account such interactions. A joint recovery plan for southern hake and *Nephrops* around the Iberian peninsula developed at a recent STECF meeting is the first example of proposed management action that takes into account interaction between *Nephrops* and other fisheries (SGMOS 2003), although this plan has yet to be implemented. WGNEPH has never attempted to construct mixed fishery analyses using MTAC, although analyses including *Nephrops* have been considered by some other WGs (e.g. WGNSSK, WGNSDS). In practice, there are several major obstacles to overcome before *Nephrops* fisheries can meaningfully be integrated in any mixed fishery forecasting system:

- There is a mismatch between *Nephrops* and finfish species in the spatial scale of stocks and fishing activities. *Nephrops* are mainly confined to discrete patches of fine sediments, and there can be marked differences between stocks in both biological (e.g. growth, maturity) and fishery characteristics (e.g. exploitation pattern). For example, within the North Sea (IV) there are eight separate Functional Units (assessed individually and representing discrete biological stocks) grouped into five Management Areas (the scale at which management advice is given). These Functional Units vary from dense inshore stocks with relatively high levels of exploitation, to large offshore stocks occurring at a lower density and with relatively low (and spatially heterogeneous) levels of exploitation. Large parts of the North Sea lie outside the main stock areas, and record only low levels of *Nephrops* catches. This heterogeneity of stocks, fisheries and exploitation levels poses major problems, firstly for the aggregation of *Nephrops* data into a meaningful North Sea data set, and secondly for construction of projections which are valid or useful for any given management unit. Future progress may depend on the development of spatially-structured approaches to multi-species/fleet modelling. The problem may be less severe in some areas than others. In the Irish Sea (VIIa), for example, there is a single Management Area for *Nephrops*, containing two Functional Units but dominated by the very large stock in the western part of the area.
- WGNEPH has reported extensively on *Nephrops* assessment problems, both stock-specific (e.g. availability of data and biological parameters) and generic (e.g. effects of deterministic 'slicing' of length-classes into 'age'-classes, sex differences in exploitation levels). *Nephrops* is not a special case in terms of assessment difficulties, and on their own these do not pose insuperable obstacles to inclusion of *Nephrops* within a multi-species framework, provided that model outcomes are interpreted with sufficient caution. More fundamentally, however, *Nephrops* assessments have conspicuously failed to provide reliable information on stock-recruitment relationships. This has precluded the definition of PA-type biological reference points for *Nephrops*, and has meant that even single species stock projections for *Nephrops* are of questionable validity. WGNEPH has employed short- and medium-term projections only for those stocks for which management action has been required to rebuild stock biomass, and these projections are considered as indicative of likely stock trends under possible management and recruitment scenarios rather than as definitive predictions. WGNEPH has considered various alternative approaches to stock assessment, and it is probable that there will be increasing use of length- rather than age-based assessment approaches in future. It is also likely that increasing emphasis will be placed on fishery-independent assessment approaches (e.g. underwater TV surveys of burrow densities). Future work should focus on how the results of these assessments can be used within an integrated multi-species framework that includes *Nephrops*.
- Analytical assessments are not undertaken for all *Nephrops* stocks. In the North Sea, for example, there are major offshore stocks (Fladen Ground and Norwegian Deep) for which there is insufficient information to allow meaningful assessment based on commercial catch data. Precautionary advice for these stocks is based on fishery-independent survey data and/or the past history of landings. Since these may also be areas where there is scope for

significant fishery interactions to take place, there is a need to investigate how such stocks can be integrated within multi-species modelling frameworks.

The future for considering *Nephrops* in a mixed fishery context lies partly outside WGNEPH. It has been proposed that *Nephrops* assessment tasks be devolved to the area-based WGs best suited to deal with the mixed fishery issues. Accordingly, based on information on the species caught alongside *Nephrops* in different areas, WGNEPH has proposed to allocate the Functional Units to four area-based WGs: WGNSSK (IV and IIIa stocks), WGNSDS (VIa and VIIa stocks), WGSSDS (VIIb stocks, where gadoids are important species taken alongside *Nephrops*) and WGHMM (VIIbcjk, VIIIabc, IXa, where hake monkfish and megrim are important species taken alongside *Nephrops*). It is proposed that WGNEPH continues to operate with a focus on biological and methodological issues. Relevant to mixed fishery issues, WGNEPH proposes in future to consider:

- identification of *Nephrops* métiers and fisheries, along the lines suggested by SGDFE;
- the development of alternative assessment approaches, with implications for stock projections and integration within multi-species models.

3.3.1.4 Southern Shelf Demersal WG [WGSSDS]

The mixed fishery approach may be of relevance to some stocks and fisheries covered by this working group. ACFM advice hitherto has included, for some stocks, recommendations that 'management advice should take into account the advice for, which are also taken in the fishery'. For instance, sole in the Celtic Sea are taken in the same fishery as plaice.

However, there are some potential problems with the mixed fisheries approach for this working group, and these need to be addressed before the group expends substantial effort to provide fleet data for mixed fisheries analysis purposes.

These include:

The need to define those areas suitable for the construction of mixed fisheries analyses.

The present inconsistency in stock management areas and how this should be addressed with respect to mixed fisheries – for instance for cod the management area is VII, VIII, IX, X etc.; the assessment area (for this group) is VIIe-k; yet cod are taken in several fisheries for which other single species management areas (and in some cases even assessment areas) are not consistent.

The group would need to identify stocks/areas for which mixed fisheries analyses could be appropriate, given guidance on the above problems. It may be that for some stocks such analyses could not be done at all; for others the solution might be to carry out analyses at the stock level and then aggregate the results to management area level (although the implications of this approach would need to be carefully considered).

To date, WGSSDS has not attempted to construct mixed fishery analyses using MTAC.

The WG does not have an agreed set of fleet definitions, although data by fleet exists in various forms dependent on stock. Thus the first task, given an identified need to provide mixed fishery analyses, would be to agree a set of definitions based on some analysis (analytical; catch composition by gear; catch composition by country). Then other considerations such as level of aggregation required, treatment of missing data, availability of discard data etc. could be addressed.

The ability of the WG to conduct MTAC analyses in the near future therefore depends on the above issues being resolved.

For 2004: the WG could identify one (or more) fisheries, for which management and assessment areas coincided for the main species involved, in order to construct appropriate fleet data sets and carry out trial analyses using MTAC.

For 2005: plans would depend on the above issues being resolved.

3.3.1.5 Northern Shelf Demersal Stocks WG (WGNSDS)

The adoption of a mixed fisheries approach to fisheries analysis is particularly relevant to species assessed by the WGNSDS. The main fleets operating in the West of Scotland (Division VIa) include the mixed roundfish otter trawl fleet, the *Nephrops* otter trawl fleet, the otter trawl fleet targeting anglerfish, megrim and hake and the fleet targeting saithe and/or deep sea species. To a large extent, the roundfish fishery in Division VIa is an extension of the similar fishery in the North Sea. The demersal fisheries in Division VIa are predominantly conducted by otter trawlers fishing for cod, haddock, anglerfish, and whiting, with bycatches of saithe, megrim, and lemon sole. In the Irish Sea (Division VIIa) the demersal fisheries are also strongly mixed. Many stocks are exploited together in various combinations in different fisheries. Four main fishery units can be described in the Irish Sea: these are *Nephrops* otter trawlers, round fish otter trawlers, semi-pelagic trawlers, and beam trawlers.

Implementation of mixed fisheries analyses of Northern Shelf fisheries is simplified by the general consistency in management areas and statistical reporting areas of stocks assessed by the WGNSDS. Whilst *Nephrops* is assessed by a different area, it is possible to generate aggregations of *Nephrops* data consistent with the Irish Sea assessment and management area used for the most important commercial fish species

Mixed fisheries analyses using MTAC were first run by National Institutes for the West of Scotland and Irish Sea in late 2002. These analyses were preliminary and were not reported to ICES or to the European Commission. In 2003 the STECF *Ad Hoc* Working Group on Mixed Fisheries (October 2003) conducted a further analysis for the Irish Sea but did not have sufficient data, time or expertise to conduct mixed fishery forecasts for the West of Scotland. Further MTAC analyses for the Irish Sea (evaluating a broader range of management objectives) were run after the STECF meeting by some National Institutes.

Fleet and fishery definitions for the Northern Shelf are currently based broadly on gear type and area (West of Scotland or Irish Sea only) (SGDFF 2004). Some division of fleets within particular gear types is possible based on catch compositions. This has been achieved based on analyses of catch compositions by vessel and month. The relative proportion of particular species within the catch has been used to define thresholds above or below which vessels were assigned into particular fisheries for each month. The current SGDFF definitions of Irish Sea fisheries are consistent with those used by STECF in 2003 to calculate MSTAC for the Irish Sea.

Data are available for all the major fleets fishing in the area. Landings data are based on official landings statistics. Estimates of unallocated catches and discards are only available for a small number of fisheries. Estimates of quantities discarded are poorly estimated for Division VIIa. Discard estimates of cod, haddock, plaice and sole are patchy and variable in quality. Time-series and better quality discard data are available for the Irish and Northern Irish *Nephrops* trawlers, but are limited to whiting. These data are included in the annual catch data and assessment for the whiting stock.

Software capable of aggregating fleet/fishery-based data is only used in the Scottish laboratory. Data aggregation is generally done using *ad hoc* procedures by WG data co-ordinators. Some spreadsheet based tools could be adapted to accept and aggregate fleet/fishery-based data. Time will be required within National Institutes to reconstruct data aggregation tools and complete aggregation prior to the WGNSDS 2004.

Expected activities by WGNSDS in 2004 related to mixed fisheries analysis:

Data to be submitted to WG data co-ordinators on fleet/fishery basis (using SGDFF 2004 definitions)

Data aggregation tools to be adapted to aggregate data and to allocate age compositions to unsampled catches.

Sensitivity analyses to be evaluate sensitivity of outputs to allocation choices.

MTAC input datasets to be compiled.

Example MTAC run to be performed to confirm successful operation of the program. Evaluation of the output will only be made where clearly defined recovery plan strategies / harvest control rules are provided.

Ambition of WGNSDS for 2005 related to mixed fisheries analysis:

National Institutes to refine fishery/fleet definitions using SGDFF 2004 three-step approach

Activities of WGNSDS 2004 to be repeated.

3.3.1.6 Pandalus assessment WG

North sea area

Stocks, fleets and fisheries

The *Pandalus* stocks and fisheries covered by this WG have until 2004 been few and confined to the North Sea areas. Two *Pandalus* stocks are recognised in the North sea area: one distributed in The Norwegian deeps (IVa east) and Skagerrak (IIIa) and the other in the Fladen ground area in the North Sea (IVa). The fleets and fisheries for *Pandalus* in the North Sea area (ICES sub-area IV and div. IIIa) are well defined by target and area.

The 'fleets' and 'fisheries' exploiting these stocks are currently defined as shown in the table below:

Fleet	Fishery	
Danish trawlers	Fladen ground	IIIa and IVa east
Swedish trawlers		IIIa and IVa east
Norwegian trawlers		IIIa and IVa east
UK (Scotland) trawlers	Fladen ground	

This grouping is consistent with the classification suggested by the ICES SGDF (2003, 2004). The trawls used for catching *Pandalus* are small-meshed and has a cod-end mesh size of 35-45 mm. Apart from the geographical separation of the two areas there are also distinct differences in catch composition of the by-catch.

The by-catch of fish species in the *Pandalus* fisheries can be considerable at times, most of it being discarded or landed for reduction. However, the valuable species are landed according to the current management rules for by-catches in small meshed gear. The most recent WG estimate of by-catch of HC finfish was around 10-20% (weight) of *Pandalus* landings. For instance, for 2001 it was estimated that roughly 1% of landed NS cod came from the *Pandalus* fisheries.

Even if the impact from the *Pandalus* fisheries on e.g. the various North Sea roundfish species is minor compared to other fisheries, it should be evaluated in a mixed fisheries context for the North Sea for management of the North sea fisheries.

Available data for the *Pandalus* fisheries in the North Sea.

Biological samples, (*Pandalus*): length distribution in catches. by fishery. by quarter. (DEN, NOR, SWE). These can be aggregated at all levels, at present by 'Ad hoc' procedures.

Data on HC by-catch are available from log book records, by fishery, by quarter. (DEN, NOR, SWE). These can be aggregated at all levels. Danish and Swedish time series are available for at least 10 years. Norwegian data are available from 1998. Example : se WGPAND, 2003.

Biological samples (age and length distributions) from the HC by-catch: are not available at present. Samples of discards and by-catch for reduction has begun. No reliable estimates of discards (fish) expected for the 2004 WG meeting.

It is noted, that The (EU- Norway) management areas are not the same as the current assessment areas !

What can be accomplished regarding the mixed fisheries issue at the 2004 WG meeting?

A follow up of the data presented in the 2003 WG report and a plan for collecting information on discards and by-catch of fish for reduction could be discussed and agreed.

3.3.1.7 Barents Sea fisheries for *Pandalus*

Here we should wait until after the first WG meeting with the(se) *Pandalus* fisheries included.

3.3.1.8 Southern Shelf Stocks of Hake, Monk and Megrin WG [WGHMM]

The mixed fisheries approach is quite relevant to species assessed by the WGHMM Group. The majority of the fleets catching hake, monks and megrims are involved in mixed fisheries covering both northern and southern stocks of these species; this is less true for long-liners and gill-netters operating in offshore areas because the target species represent more than 90% of the catches. So, in case of otter trawlers and inshore fleets this approach should be a better tool, since it corresponds more to the "reality" of the fishery and for this, it should be desirable to assess and manage them from this new perspective.

The current assessments' areas considered by the Group are still in contradiction with some management areas and obviously this conflict can be extended in the mixed fisheries and ecosystem approach framework. For this reason, it should be desirable to have consistency across the whole framework, considering: objectives, analysis and sampling strategies, covering all these aspects at the same time, i.e.: biological definitions, fleets' activities, assessment and management areas considering the current approach and even with new one, based on mixed fishery and ecosystem approach. In conclusion, for the stocks involved in the WGHMM, the areas should be reconsidered taking into account at least the biological boundaries and fleet dynamics, to better facilitate assessment and management of these stocks.

Historically, the current fleets' definition used by WGHMM comes from 1985 under the umbrella of the Working Group on Fishery Units in Subareas VII and VIII, so this means that clearly it is necessary to update them. This has already been made for some countries involved in Western Scotland, South West of Ireland, Celtic Sea and Bay of Biscay Waters (northern stocks), but no for the Iberian Peninsula (southern stocks).

Apart from the problems mentioned before in terms of definition of fisheries/fleets and conflicts between areas, there is a problem with the availability of discard data, since it is only available for northern hake and megrim. For the rest of the species (and for northern hake as well), there is some partial information for some countries, areas, gears and years.

In relation to the data aggregation, the Group does not use any specific software to compile the information, though the information is completely aggregated before the meeting and for the majority of stocks the allocation process is explicitly explained in the respective reports.

The Group will try for 2004 to carry out the mixed fisheries analysis based on the current defined areas of stocks but just for northern components and with some partial information, i.e.: only the species dealt with by this Group and without considering the rest of species caught. For this reason, this analysis should be considered as an initial exercise and the Group will follow with components' definition, fleets' data aggregation, input data and hopefully it will obtain some outputs from MTAC program.

For 2005 WG, the Group will continue developing with this approach, including southern stocks and reinforce the collaboration with WGSSDS and WGNSSDS, in order to obtain a more adequate procedure.

3.3.2 Working groups where mixed fisheries issues are considered minor

3.3.2.1 Northern Pelagic and Blue Whiting WG [WGNPBW]

The fisheries covered by this group are directed single species fisheries of capelin, herring or blue whiting.

Landings data are based on official landings statistics. They are delivered to the working group disaggregated by nation, fleet (purse seiners or pelagic trawlers), quarters and ICES divisions. They are also given by nation, quarter and ices rectangles. Sampling data (number of age and length samples) are delivered by nation, ICES divisions and quarters. Catch in numbers are given by nation, ICES divisions and quarters. Stock coordinators combine these data for each species by use of the SALLOC program before they are used in the assessment. A TAC is set for each species alone.

The working group recommended last year (2003) that all bycatch data for blue whiting would be made available for the wg.

This mixed fishery topic will be brought up to discussion in the working group in spring (2004). This will however not affect the assessments made for the species which will be made in the next years as up to now by single species only.

3.3.2.2 Mackerel, Horse Mackerel, Sardine and Anchovy WG [WGMHSA]

Given the single species nature of all fisheries for stocks assessed by the WGMHSA, mixed-fisheries analyses are not relevant. The WGMHSA deals with 8 pelagic stocks (1 mackerel 3 horse mackerel, 1 sardine and 3 anchovy stocks). For the greater part each of these stocks is taken in single species targeted fisheries, with insignificant¹ bycatch of other species. Single species TAC advice is appropriate for these stocks.

There is no inconsistency between management areas and TAC areas for mackerel sardine or anchovy stocks. However the boundaries for the horse mackerel stocks are due to be redrawn in 2004 (on the basis of results from the Homsir project) and not withstanding this there has been a mismatch between TAC areas and assessment areas between western and north sea horse mackerel. The new stock boundaries will not improve this situation.

Fleet and fishery definitions exist for most stocks considered by the WGMHSA. These are normally updated every 3-5 years. The documentation of these definitions is not archived and exist as WD's to the working group in the years when the reviews were conducted.

Disaggregated data (in standard format) is available since 1997. In general each country has only 1 fleet per stock, so the data is reported to the working group as catch (in numbers if available) by ICES subdivision by quarter by nation. In the case where more than one fleet per country exists, the data is reported by country-fleet by ICES subdivision and quarter. The data is stored at this level of disaggregation in the archive folder in the ICES WG directory. Discard data is included when available but it is not available across all fleets. Some fleets provide discard data in numbers at age and some as tonnes. As with other unsampled catches this data is converted to catch in numbers using the most appropriate age structure. Disaggregated fisheries data is reported on standardised Excel sheets, which are locked for editing and contain validation rules and cross checks.

Data is aggregated using the salloc programme (Patterson 1997). Allocation is carried out using an allocation key file, which provides for tracking the basis under which the catch in numbers is arrived at. The catch in tonnes, by fleet by ICES subdivision and quarter, along with catch in number at age, mean weight at age and mean length at age, by quarter and ICES sub division, and a log of allocations made, is given in a single output file. (unallocated catches and discards are grouped by ICES subdivision and quarter, to protect the source). Catch in tonnes by statistical rectangle by quarter is available for about 85% of the NEA mackerel catches, however this is a mixture of official and WG estimates and is used for descriptive purposes only.

¹ Salmon bycatch in mackerel fisheries in Ila will be considered again in the 2004 WG report due to a request from SGBYSAL

As the WGMHSA meets in September there is generally (just) enough time to compile the data before the meeting. Some national institutes do not complete their ageing of year-1 data until May of the assessment year. Timeliness of data submission for widely distributed stocks such as NEA mackerel, is only achieved through regular communication between the stock co-ordinator and the person responsible at the national lab, without this the system would fail.

Work to be carried out in 2004:

In 2004 the WGMHSA could update fleet and fishery descriptions for all stocks. As it is not in the ToR for the 2004 WGMHSA this would be on a voluntary basis and success will depend on workload within the national labs. The WGMHSA will concentrate on conducting simulations to support single species harvest control rules for NEA mackerel and anchovy in Biscay in 2004.

Future work:

Due to the single species fisheries the WG has no plan to consider mixed fishery interactions in 2004 or 2005. When the current single species HCRs have been successfully evaluated the WGMHSA may then look at other stocks on a priority basis, which could be defined by managers.

3.3.2.3 Arctic Fisheries WG [AFWG]

At present, there do not appear to be mixed-fishery problems with the stocks covered by AFWG, as most fisheries target and take single species. In addition, the current levels of single species quotas generally avoid the need for MF analyses. Instances where by-catches of e.g. young redfish and cod, taken in shrimp fisheries, are covered by specific technical measures in the shrimp fishery regulations.

The statistical data on NEA cod catch for 1985-2002 are available disaggregated by countries and fleets with different gear types. They used in multi-fleet Fleksibest model, which is applied as an alternative assessment method for NEA cod stock in addition to XSA.

There is growing evidence of both substantial discarding and misreporting of catches throughout the Barents Sea for most groundfish stocks in recent years. Several estimates of cod discards have been made using different approaches and presented to the AFWG as working documents. The comparison of results obtained using different methods to estimate cod discard in the Barents Sea in 1993-2002 was presented to AFWG in 2003. The discard was found to be highly variable over time and affected mainly age groups 3 and 4. There were some differences in the results obtained by the methods. The total effect of the discarding is still very unclear and requires a lot more work before it can be included in the assessments.

The group will need to discuss the relevance of the mixed fishery approach to Barents Sea stocks, and whether any further data or analyses are required.

3.3.2.4 Herring Assessment Working Group for the Area South of 62° N [HAWG]

The Mixed Fishery approach is considered to be of little relevance in the fisheries for pelagic stocks covered by HAWG.

In this group, a total of 8 herring stocks and 3 sprat stocks are considered.

Four fleets are defined for the North Sea herring fishery and the HAWG is at present giving prognosis by fleet for the North Sea autumn spawners.

Since 1999 (catch data 1998), the working group members have used a spreadsheet to provide all necessary landing and sampling data adapted to the special needs of the HAWG. The majority of commercial catch data of multinational fleets was again provided on these spreadsheets and further processed with the SALLOCL-application (Patterson *et al.*, 1997). This program gives the needed standard outputs on sampling status and biological parameters.

Data on discards are included in the single species assessment when available. Until 2002 discards were not considered to be problematic in the North Sea herring fishery (less than 5% of the total catch, based on observer sampling programs). In 2002 for the first time, onboard sampling observed substantial discards of herring in the mackerel fishery in the 3rd and 4th quarter in Div. IVa (W).

The final aggregation by total catches by area has been completed during the first days of the WG. Herring catches from the North Sea and Div. IIIa are mixtures of North Sea Autumn Spawners and Western Baltic Spring Spawners. The splitting procedure is based on microstructure analyses of otoliths. The final data for splitting has not been available to the WG at the start of the meeting.

Expected activities by HAWG in 2004 related to mixed fisheries analysis:

ICES will provide new aggregating software to the assessment groups. The software will bring data from national level to an aggregated level ready for VPA programs. The 2004-HAWG will test a proposed new system on the 2003-data along with the "old" system.

Discuss in the WG if there are relevant plans for the 2005-WG to be presented for other fisheries/areas.

4 New methodologies and WG issues

TOR b) Lowestoft will check this year's assessments (those where Lowestoft have an interest) and rerun them in the FLR framework to test the FLR and to have the software ready next year.

The WGMG listed a range of issues for methodology in assessment WGs including a suggestion for sensitivity analysis of forecasts on basis of biomass outcomes and presentation of input data and diagnostics.

Given the expanded workload to working groups this year it was decided not to add sensitivity analysis this year.

Software for presentation of data and diagnostics is being developed and will be developed to accommodate inputs for most assessment programmes this year. The assessment programmes used by HAWG, WGHMSA, WGNSSK, WGNSSDS, WGHMM and WGSSDS will be accommodated in 2004 while the programmes used exclusively by AFWG, NWWG, WGBFAS, WGNPBW, WGPAND and WGBAST will not be accommodated on the short term. In 2004 WG chairs may approach the software developer (Lawrence Kell, CEFAS) directly to check on the status prior to the meeting of their WG. From 2005 presentations should be included routinely.

Other WG issues:

Bias is an important problem both in simulations and existing forecasts. The WGMG should provide guidance on bias estimation for the WGs. Reference is made to retrospective analysis but only few stocks have a constant bias.

Recent regulatory changes should be taken into consideration when making simulations. The WGs is the best source for awareness of these and WGs should ensure communication of regulations in force and how they are dealt with in simulations.

5 Outcomes on the NSCFP October 2003 meeting

TOR e) respond to feedback from meeting to be held by NSCFP in October 2003.

The report of the external reviewers to the NSCFP meeting was presented and discussed. The WG chairs have noted the comments on the North Sea assessments which are of a general nature.

6 Implementation of new approach revised format of advice

The ICES advice will from 2004 be given in an integrated format which are organised on an ecosystem basis. The format including the responsibilities of WG's to provide draft text is presented in annex 1.

The responsibilities in 2004 will be:

Working groups produce single stock summary sheet drafts and drafts of specific sections of the area advice sections (sections requiring specific understanding of the ecosystem, fisheries and the stocks).

Working groups set up the data for the MTAC simulations.

Review groups will produce second draft of single stock summary sheets and relevant sections of area advice sections.

ACFM will produce the final advice section of the area advice and run MTAC forecasts.

The Secretariat will make templates available prior to the working groups for both the fisheries sections in the area advice and for the single stock summaries including the old ACFM text when such exist.

7 References

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Annex 1

Format of fisheries advice in new advice format from 2004 indicating responsibilities of Working Groups

Fisheries advice in the new structure

The new format should include the main points listed above (ecosystem approach, fisheries approach, starting from long term perspectives) but should also explicitly address a range of issues which have been underexposed so far:

Highlighting uncertainties and explaining them, especially qualifying the precision of the advice, and explaining how uncertainties have been considered in the advice

Inclusion of information from the fishery

Relating to the influence of environmental factors and how this has been included in the advice.

Discuss regulatory measures which have been taken and evaluate their effects

TOC's of fisheries sections

Book 1: Fisheries section in overview

The fisheries advice section in an ecosystem section will consist of:

In the Human impacts section:

a general description of the fisheries, main stocks exploited , overall outtake and overall ecosystem impacts

In the assessment and advice section:

Ecosystem impacts of fisheries

Response to requests regarding ecosystem impacts

Other considerations of ecosystem impacts

Mixed fisheries and fisheries interactions

[This section should identify the fisheries groups with similar ecosystem impacts or similar catch compositions to be used in forecasts and impact assessments]

Single stock exploitation boundaries

[Table summarising single stock boundaries as presented in single stock summary sheets, book2]

Identification of critical stocks

Summary of those stocks which are considered as the overall concern for mixed fisheries management

Advice on xxx

The summary of critical stocks and single stock boundaries

Management considerations

Similar to relevant factors

Short term implications

[Catch forecasts]

Specific requests

Regulations in force and their effect

Information from the fishing industry

Factors affecting fishing operations

Quality of assessments and uncertainties

Book 2: Single stock summary

A single stock summary will consist of

State of the stock – relative to limits and to targets

Management objectives

Overall

Existing HCR's, recovery plans etc

Reference points – limits and targets

Single stock exploitation boundaries

In relation to existing management plan or HCR

In relation to long term sustainable exploitation (if different from HCRs etc)

In relation to high long term yields, low risk of depleting reproductive potential and including ecosystem considerations

Short term implications
 Management considerations (rationale for section 4)
 Management plan evaluations
 specific ecosystem considerations
 Factors affecting the fisheries and the stock (this may for mixed fisheries be referred to the ecosystem section)
 Regulations in force
 Changes in fishing technology and fishing patterns
 The environment
 Other factors
 Scientific basis
 Data and methods
 Information from the fishing industry
 Uncertainties in assessment and forecast
 Environment conditions
 Comparison with previous assessment and advice
 Source of information

Notes on format and procedure/responsibility

Book 1

3. Ecosystem overviews

.....

3.x The xxx Sea

3.x.1 The ecosystem

3.x.1.1 Major features

.....

3.x.1.2 Overall status

.....

3.x.2 The human use of the ecosystem

3.x.2.1 Overall impacts

.....

3.x.2.2 Fisheries

3.x.2.2.1 The fisheries in the area

[a brief description of the fisheries and the harvest, similar to old report sec 'Description of fisheries' in overview section to be drafted by WGs]

.....

3.x.2.2.2 Status and impacts

[exploitation and stock status overview and status regarding ecosystem impacts. This is the overall status resume while the assessment and advice section further down relates to requests]

[summary of exploitation

similar to old report section 'Overview of resources' in the overview section to be drafted by WGs]

.....

[section on ecosystem impacts to be written by ACE].

.....

[we also need to discuss the multispecies interactions and their relevance at present stock levels]

3.x.2.3 Other extractive uses

.....

3.x.2.4 Pollution

.....

3.x.3 Assessments and advice

3.x.3.1 Assessments and advice regarding protection of biota and habitats

.....

3.x.3.2 Assessments and advice regarding fisheries

[this section should present an assessment as an overview of single stock status and ecosystem considerations, list the single stock exploitation boundaries, describe the key technical interactions and then provide fleet based forecasts. The section should then include – when available and relevant - information from the industry, expansion on ecosystem consideration, the significance of environmental changes, expansion on regulations in force and their effects, factors affecting the fisheries including technological development etc and any other relevant factors] [based on 2003 north sea section]

3.x.3.2.1 Ecosystem impacts of fisheries

[General considerations of ecosystem impacts, response to special requests, this will include responses top requests by ACE]

[...]

3.x.3.2.2 Mixed fisheries and fisheries interactions

[This section should identify the fisheries groups with similar ecosystem impacts or similar catch compositions to be used in forecasts and impact assessments. The difference between this section and the fisheries description in 3.x.2.2 is that the former gives a general description while this section forms the basis for forecasts and therefore should focus on interactions and should result in some grouping of mixed fisheries to be used in the advice and forecasts to be drafted by WGs]

Descriptive text of interactions and groupings, possibly a table of groups and which fleets they include – also including those fisheries which are considered single stock fisheries

3.x.3.2.2 Single stock exploitation boundaries

[summary of single stock boundaries as presented in stock summaries.]

The state and the limits to exploitation of the individual stocks are presented in the individual stock summaries in Book 2 (Sections xxx-xxx). ICES considers limits to the exploitation of single stocks as follows:

Species	State of the stock			ICES considerations in relation to single stock exploitation boundaries			Upper limit corresponding to single stock exploitation boundary for agreed management plan or in relation to precautionary limits. Tonnes or effort in 2005
	Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to target reference points	In relation to agreed management plan	in relation to precautionary limits	in relation to target reference points	
	acceptable	acceptable	Appropriate				
B	Unsafe	acceptable	Overfished				
C	acceptable	acceptable	Below target				
D	acceptable	High risk	Overfished				
e	acceptable	acceptable	Overfished				

Red and yellow shaded scenarios are considered inconsistent with the precautionary approach.

[The right column is the overall advice – since we may be presenting contents in more than one advice column – see comments in stock summary section]

[Classifications – this is included in the form of advice section:

Species	Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to target reference points
	Acceptable (if $B > B_{pa}$)	Acceptable (If $F < F_{pa}$)	Below target
	Unsafe (if $B_{lim} < B < B_{pa}$)	Unsafe (If $F_{lim} > F > F_{pa}$)	Appropriate
	High risk (if $B < B_{lim}$)	High risk (if $F > F_{lim}$)	Overfished

3.x.3.2.3 Identification of critical stocks

[Summary of those stocks which are considered as the overall concern for mixed fisheries management]

The above table identifies the stocks outside precautionary reference points, i.e. xxx. These stocks are the overriding concerns in the management advice of all demersal fisheries:

- For xxx [resume of critical stock concerns]

3.x.3.2.4 ICES advice for fisheries in xxx

Fisheries in xxx should in 2005 be managed according to the following rules, which should be applied simultaneously:

They should fish:

- [...]
- [...]

Furthermore, unless ways can be found to harvest species caught in a mixed fisheries within precautionary limits for all those species individually then fishing should not be permitted.

[include further specific advice relating to ecosystem considerations if any here]

3.x.3.2.5 Management considerations

[similar to former section on relevant factors in overview section. Should include comments of direct relevance to management decisions

WGs can contribute any observations on management considerations here]

[...]

3.x.3.2.6 Short term implications

[mixed fisheries forecasts or text discussing mixed fisheries forecasts

Scenaraia representing a range of combinations of various stock weightings and other decision rules are presented to illustrate the trade off between various priorities. The range of scenaraia is selected to represent extremes and combinations of what is envisaged to be of special interest for managers.]

[...]

3.x.3.2.7 Regulations in force and their effect

[major regulatory regime and regulations, comments about effects. Account of implementation problems including information from inspectors

to be drafted by wgs]

[...]

3.x.3.2.8 Information from the fishing industry

[any information from the industry which is considered representative and important is presented and it is discussed how this relates to the advice and how it has been taken into account. Info from fishing industry can be from sandwioch meetings, NSCFP, future RACs etc

to be drafted by WGs on basis of what they have at that time, ACFM supplements with whatever comes later]

[...]

3.x.3.2.9 Factors affecting fishing operations

[account of changes in the fishing practices such as technological change, fleet structural change, changes in fishing patterns. Input from FTC should come in here in the future

to be drafted by WGs]

[...]

3.x.3.2.10 Quality of assessments and uncertainties

[data problems, brief explanation on quality of assessments and forecasts and indications of uncertainties

to be drafted by WGs]

[...]

3.x.3.3 Assessments and advice regarding pollution

.....

Single stock summary book 2 in section 4

The summaries are drafted by the WGs

4.x.1 xxx in yyy

State of the stock

[similar to text in old format but with addition regarding long term reference points. Starting sentence gives classification. Then the main features leading to this conclusion. The opening summary table is reproduced in the area section]

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield	Comment <i>[used if qualifiers to present state are necessary]</i>
Acceptable	acceptable	Overfished	

Based on the most recent estimates of SSB and fishing mortality ICES classifies the stock as [...]

Management objectives

[similar to old format. Account on any agreed management plans, HCR's etc.]

[...]

ICES considers the agreement to be consistent / not to be consistent with the precautionary approach.

Reference points

[Table of reference points. As old format but to be expanded to include any longer-term reference points relating to yield etc. once such have been identified]

	ICES considers that:	ICES proposed that:
Limit reference points	B_{lim} is xxx t	B_{pa} be set at xxx t
	F_{lim} is xxx	F_{pa} be set at xxx
Target reference points	F_y be set at xxx	

Technical basis:

B_{lim} : xxx	B_{pa} : xxx
F_{lim} : xxx	F_{pa} : xxx
F_y : xxx	

Single stock exploitation boundaries

Exploitation boundaries in relation to existing management plans

[boundaries as per management plans, recovery plans, HCR's etc where such have been agreed, see MOU section 2.1]

Following the agreed management plan would imply catches of xxx t in 2005 which is expected to lead to xxx

[...]

Exploitation boundaries in relation to high long term yield, low risk of depletion of production potential and considering ecosystem effects

[boundaries based on the target reference points where such have been identified and including ecosystem considerations if such are pertinent on single stock level and if they are different from advice relating to management plans. More general ecosystem effects are dealt with in book 1, see MOU section 2.3]

[...]

Exploitation boundaries in relation to precautionary limits

[boundaries relative to pa reference points – similar to 'old' advice. This is only given if there is no agreed management plan or if agreed management plans are considered inconsistent with the precautionary approach generally or will lead to SSB below B_{pa} in the short term, see MOU section 2.3]

[...]

Short term implications

[Forecast for next year – This should include options as per section 2.4 in MOU]

Catch forecast for 2005:

Basis: $F(2004) = xxx$; $SSB(2004) = xxx$; catch (2004) = xxx

The fishing mortality applied according to the agreed management plan ($F(\text{management plan})$) is xxx

The maximum fishing mortality which would be in accordance with precautionary limits ($F(\text{precautionary limits})$) is xxx

The fishing mortality which is consistent with taking high long-term yield and achieving low risk of depleting the productive potential of the stock ($F(\text{long term yield})$) is xxx

Rationale	F(2005)	Basis	SSB(2005)	Landings(2005)	SSB(2006)
Zero catch	0	$F=0$			
Status quo		F_{sq}			
High long term yield		$F(\text{long term yield})$			
Agreed management plan		$F(\text{management plan}) * 0.1$			
		$F(\text{management plan}) * 0.25$			
		$F(\text{management plan}) * 0.50$			
		$F(\text{management plan}) * 0.75$			
		$F(\text{management plan}) * 0.90$			
		$F(\text{management plan})$			
		$F(\text{management plan}) * 1.1$			
Precautionary limits		$F(\text{prec limits}) * 0.1$			
		$F(\text{prec limits}) * 0.25$			
		$F(\text{prec limits}) * 0.5$			
		$F(\text{prec limits}) * 0.75$			
		$F(\text{prec limits}) * 0.90$			
		$F(\text{prec limits})$			
		$F(\text{prec limits}) * 1.1$			
	$F(\text{prec limits}) * 1.25$				

Shaded scenarios not consistent with the precautionary approach.

[text explaining implications in words]

[...]

Management considerations

[The rationale for the single stock exploitation boundaries above + expansion with further considerations for management. This is similar to the old 'relevant factors' but now expanded to include the long term considerations]

[...]

Management plan evaluations

[medium term simulations relative to the long term reference point(s), existing HCR's, proposed HCR's].

[...]

Ecosystem considerations

[explanation regarding single stock ecosystem considerations if any]

[...]

Factors affecting the fisheries and the stock

[this may for mixed fisheries be referred to the area/ecosystem section, this section may therefore only be complete for stocks mainly exploited by single-stock fisheries]

Regulations and their effects

[a brief account of the regulation regime and major regulations in force. Account of their effects if this has been evaluated. Information from inspectors is also included here]

[...]

Changes in fishing technology and fishing patterns

[account of changes in practices and technology. The section should focus on features which have implications for management, that is technological developments which are expected to be important in increasing catchability or changes in fishing patterns which may lead to different catch compositions, more discards etc. This section would benefit from inputs from the technology committee]
[...]

The environment

[account of any known environmental impacts on this stock. This should be followed by considerations regarding the implications for management]

[...]

Other factors

[...]

Scientific basis

Data and methods

[methods, data used, and any problems encountered. Highlight how misreporting or other problems with data quality has been handled and how bias in the assessment has been handled in the forecast. If fisheries information has not been used or has low weighting explain why]

[...]

Information from the fishing industry

[...]

Uncertainties in assessment and forecast

[...]

Environment conditions

[...]

Comparison with previous assessment and advice:

[...]

Source of information

[...]