

# ICES WGMIXFISH REPORT 2011

ICES ADVISORY COMMITTEE

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## Report of the Working Group on Mixed Fisheries Advice for the North Sea (WGMIXFISH)

29 August – 2 September 2011

ICES Headquarters, Copenhagen, Denmark



**ICES**

International Council for  
the Exploration of the Sea

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Conseil International pour  
l'Exploration de la Mer

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## Executive summary

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The ICES' Working Group on Mixed Fisheries Advice for the North Sea [WGMIX-FISH] (Chair: Steven Holmes (UK)) met at ICES HQ, 29 August-2 September 2011 to apply mixed fisheries forecasts to the North Sea single species advice released by ACOM in June 2011.

The meeting has produced a North Sea Mixed Fisheries Advice (Annex 4) for use by the ACOM advice drafting group. The associated North Sea Mixed Fisheries Annex is unchanged from that produced last year and has been made a separate document.

The mixed fisheries runs followed the approach used by ICES; management plan where it exists and MSY transition otherwise. The species considered here as part of the demersal mixed fisheries of the North Sea are cod, haddock, whiting, saithe, plaice, sole and *Nephrops norvegicus*. All of these are now subject to multi-annual management plans apart from *Nephrops*.

Five scenarios were considered

- 1) **min**: The underlying assumption was that fishing stops when the catch for the first quota species meets the upper limit corresponding to single stock exploitation boundary.
- 2) **max**: The underlying assumption was that fishing stops when all quota species are fully utilised with respect to the upper limit corresponding to single stock exploitation boundary.
- 3) **cod**: The underlying assumption was that all fleets set their effort at the level corresponding to their cod quota share, regardless of other stocks.
- 4) **sq\_E**: The effort was set as equal to the effort in the most recently recorded year for which there are landings and discard data.
- 5) **Ef\_Mgt**: The effort in métiers that used gear controlled by the EU effort management regime had effort adjusted according to the regime.

The max and min scenarios were included to bracket the space of potential catch and SSB outcomes but for most fleets are considered unrealistic scenarios. Of the remaining scenarios none was picked as a preferred scenario. However, information on effort uptake during 2011 indicates similar effort levels to 2010 during the first half of the year for the main fleets considered.

As a cross check, the landings by national fleets were summed over nation for each scenario, and the share by country was compared with the initial values input to the model. The results show that only minor deviations are observed across all scenarios, indicating that the approach used does not lead to violation of the underlying hypothesis of relative stability in the TAC sharing (quotas) across nations.

No methodological problems were encountered with the Fcube package, but issues were encountered with respect to data submissions. As last year, the data call for 2011 mirrors that for the STECF 'effort' meetings. Following intercessional debate and a workshop held on the second day of WGMIXFISH it was agreed that

- The data needs of the STECF effort meetings and WGMIXFISH are different.
- A single data call sufficient for both WGNSSK and WGMIXFISH was possible. Work is already underway to take this forward with the first joint data submission in 2012.

## 1 Introduction

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### 1.1 Background

The **Working Group on Mixed Fisheries Advice for the North Sea** [WGMIXFISH] (Chair: Steven Holmes (UK)) met at ICES HQ, 29 August-2 September 2011 to apply mixed fisheries forecasts to the North Sea single species advice released by ACOM in June 2011. The output from this group is the second operational application of the methodology and advice template developed by the ICES' Workshop on Mixed Fisheries Advice for the North Sea [WKMIXFISH] (ICES 2009a) and Ad hoc Group on Mixed Fisheries Advice for the North Sea [AGMIXNS] (ICES 2009b) which met in 2009.

The current interest in fleet- and fishery-based approaches has its origins around 2002, when the conflicting states of the various demersal stocks in the North Sea made the limitations of the traditional, single-species approach to advice particularly apparent. The history of the adoption and development of the Fcube approach (after Fleet and Fishery Forecast) used by this WG is detailed in ICES (2009a)

The mixed fishery advice will be based on the CFP TAC regime and take relative stability into account. The circumstances of 2002 have also lead to the introduction of effort restrictions alongside TACs as a management measure within EU fisheries and there has been an increasing use of single-species multi-annual management plans, partly in relation to cod recovery, but also more generally. These developments are of key importance for the general approach to mixed-fisheries advice, which must build on the existing legal and management system. The species considered here as part of the demersal mixed fisheries of the North Sea are cod, haddock, whiting, saithe, plaice, sole and *Nephrops norvegicus*. All of these are now subject to multi-annual management plans apart from *Nephrops*.

### 1.2 Effort limitations

For vessels registered in EU member states, effort restrictions in terms of days at sea were introduced in Annex XVII of Council Regulation 2341/2002 and amended by Council Regulation 671/2003 of 10 April 2003. The days at sea allowances have been revised by subsequent Council Regulations and the documents listing these days at sea limitations are given in Table 1.2.1

In 2008 the system was radically redesigned. For 2009 effort limits were changed to be on the basis of a kWdays effort pots assigned per nation per fleet effort category. The baselines assigned in 2009 were based on track record per fleet effort category averaged over 2004-2006 or 2005-2007 depending on national preference. The latest effort allocations available by nation and gear are given in Appendix 1 of Annex IIa of Council Regulation (EU) 57/2011. Member states are permitted slightly larger allocations of effort in cases where that effort involves low cod catches, e.g. through the implementation of more selective gears or cod avoidance measures. Full details are given in Article 13 of Council Regulation (EC) 1342/2008 and a table summarising effort reductions imposed in the current year are included in the mixed fisheries advice annex. In relation to this, some member states have implemented real-time closure schemes. The closures apply to areas with high cod catch rates with the intention that closing these will lead to an overall reduction in the catchability of cod (Holmes *et al*, 2011).

### 1.3 Stock-based management plans

The species considered here as part of the demersal mixed fisheries of the North Sea were cod, haddock, whiting, saithe, plaice, sole and *Nephrops norvegicus*. All of these were subject to multi-annual management plans apart from *Nephrops*. These plans all consist of harvest rules to derive annual TACs depending on the state of the stock relative to biomass reference points and target fishing mortality. The harvest rules also impose constraints on the annual percentage change in TAC.

These plans have been discussed, evaluated and adopted on a stock-by-stock basis, involving different timing, procedures, stakeholders and scientists, and as such have never been evaluated in an integrated approach.

The full details and references of these plans are not always easy to find. The most important points of these plans are therefore reproduced in Annex 5.

### 1.4 Definitions

Two basic concepts are of primary importance when dealing with mixed-fisheries, the Fleet (or fleet segment), and the Métier. Their definition has evolved with time, but the most recent official definitions are those from the CEC's Data Collection Framework (DCF, Reg. (EC) No 949/2008), which we adopt here:

- *A Fleet segment* is a group of vessels with the same length class and predominant fishing gear during the year. Vessels may have different fishing activities during the reference period, but might be classified in only one fleet segment.
- *A Métier* is a group of fishing operations targeting a similar (assemblage of) species, using similar gear, during the same period of the year and/or within the same area and which are characterized by a similar exploitation pattern.

### 1.5 Terms of Reference

The terms of reference for WGMIXFISH were as follows

2010/2/ACOM23      The **Working Group on Mixed Fisheries Advice for the North Sea** (WGMIXFISH), chaired by Steven Holmes, UK, will meet at ICES Headquarters, 29 August – 2 September 2011 to:

- a) Carry out mixed demersal fisheries projections for the North Sea taking into account the single species advice for cod, haddock, whiting, saithe, plaice, sole and *Nephrops norvegicus* that is produced by ACOM in June 2011, and the management measures in place for 2012;
- b) Update the mixed fisheries annex for the North Sea based upon the format provided by AGMIXNS; and
- c) Produce a draft mixed-fisheries section for the ICES' advisory report 2011 that includes a dissemination of the fleet and fisheries data and forecasts based upon the format provided by AGMIXNS (2009).
- d) Identify elements of the EGs work that may help determine status for the 11 Descriptors set out in the Commission Decision (available at

<http://eurlex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:232:0014:0024:EN:PDF>;

- e) Provide views on what good environmental status (GES) might be for those descriptors, including methods that could be used to determine status.
- f) take note of and comment on the Report of the Workshop on the Science for area-based management: Coastal and Marine Spatial Planning in Practice (WKC MSP)  
<http://www.ices.dk/reports/SSGHIE/2011/WKCMSP11.pdf>
- g) provide information that could be used in setting pressure indicators that would complement biodiversity indicators currently being developed by the Strategic Initiative on Biodiversity Advice and Science (SIBAS). Particular consideration should be given to assessing the impacts of very large renewable energy plans with a view to identifying/predicting potentially catastrophic outcomes.
- h) identify spatially resolved data, for e.g. spawning grounds, fishery activity, habitats, etc.

The majority of effort at WGMIXFISH and the focus of this report are ToRs a) to c). ToRs d) to h) are addressed below

ToR d)

Under the Marine Strategy Framework Directive (MSFD) the EU Commission published a catalogue of criteria and methodological standards on good environmental status (GES) of marine waters (Commission Decision: notified under document C(2010) 5956; text with EEA relevance; 2010/477/EU; L 232/14 Official Journal of the European Union of 2.9.2010) where Part B of the document includes a list of 11 descriptors. The descriptors of relevance to WGMIXFISH are

**Descriptor 3: Populations of all commercially exploited fish and shellfish are within safe biological limits, exhibiting a population age and size distribution that is indicative of a healthy stock.**

**Descriptor 4: All elements of the marine food webs, to the extent that they are known, occur at normal abundance and diversity and levels capable of ensuring the long-term abundance of the species and the retention of their full re-productive capacity.**

WGMIXFISH considers whether – and to what extent – management targets for individual commercial species (fishing mortality levels corresponding to a set level of removals) are likely to be undermined by mixed fisheries interactions. No quantitative measure has been defined for the degree of consistency (or otherwise) between single species targets and management measures given current fishing fleet practices but the results from WGMIXFISH are at a minimum a useful qualitative tool for assessing the likely success of management measures to achieve good status under descriptor 3. The same comment can be made with respect to descriptor 4, bearing in mind the output from the working group is only applicable to commercial species.

ToR e)

For Descriptor 3 ‘safe biological limits’ have traditionally been associated with the single species stock assessment ‘reference points’. Work to define reference points for stocks where they have not yet been defined or to review the suitability of existing reference points is something ICES could consider. For species where studies have



been conducted into the links (if any) between age and size distributions and recruitment success, results could be synthesized to establish whether a minimum (or reference point) proportion of fish or shellfish over a given size and/or age can be equated to the boundary between successful (average) and unsuccessful (below average) recruitment.

For descriptor 4 'normal abundance' can be interpreted for commercial species to be SSB levels above the biomass reference level.

ToR f)

WGMIXFISH notes the suggestions from WKCMSP to define scenarios and set priorities for both pressure and ecosystem status. The assessments done in the WGMIXFISH are based on current single species management plans, and the scenarios are built on possible outcomes from the policies and represent the anthropogenic pressure from mixed fisheries on the analyzed stocks. The F-cube model developed is the most adequate model developed to date for this analysis. The results and runs are available and should be used also in marine spatial planning together with geographical data from the fishery activities.

Maps from fisheries, spawning and habitats to identify vulnerability, and spatial/temporal maps: see ToR h).

ToR g)

WGMIXFISH supports the report and recommendations from WGNSSK given in WGNSSK chapter 1.4 Ecosystem considerations.

ToR h)

Spatially resolved data is not coordinated in any ICES WG as such, but data are presented and reported based on personal initiatives from different members and expert groups.

The working group have identified that spatially resolved data for effort is included for EU-member states in the STECF website <https://stecf.jrc.ec.europa.eu/> under "Final Reports", (e.g. in the "SG-MOS 10-05" folder for 2010). Effort data by gear category, vessel size and statistical rectangle is available. Effort data is recorded by hours fishing. The gear categories are based on those of current regulations. The data are presented using coding developed by STECF (see [https://stecf.jrc.ec.europa.eu/c/document\\_library/get\\_file?p\\_l\\_id=53310&folderId=44891&name=DLFE-3641.pdf](https://stecf.jrc.ec.europa.eu/c/document_library/get_file?p_l_id=53310&folderId=44891&name=DLFE-3641.pdf)). (i.e. to get North Sea data, Annex "IIa" and area "3b" must be chosen).

To avoid repetition of work but to make data relevant to the ICES community (i.e. by including non-EU data) the publically available, aggregated, spatially resolved STECF data could be amended by ICES. The working group recommends that ICES consult with STECF on including spatial resolved landings data as an addition to the data requested by STECF.

WGMIXFISH also recommends that resulting maps including effort and landings be made available on the ICES website.

## 2 Software

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All analyses were conducted using the FLR framework (Kell *et al.* (2007); [www.flr-project.org](http://www.flr-project.org)) running with R2.11.1 (R Development Core Team, 2008). All forecasts

were projected using the same `fwd()` function in the Flash Package. The Fcube method is developed as a stand-alone script using FLR objects as inputs and outputs.

The Fcube model has been presented and described in Ulrich *et al.* (2008; 2011). Brief details are presented below and a summary of the methodology is incorporated in the Mixed Fisheries Annex:

<http://www.ices.dk/reports/ACOM/2011/WGMIXFISH/North%20Sea%20Mixed%20Fisheries%20Annex.pdf>

## 2.1 Fcube

The basis of the model is to estimate the potential future levels of effort by a fleet corresponding to the fishing opportunities (TACs by stock and/or effort allocations by fleet) available to that fleet, based on fleet effort distribution and catchability by métier. This level of effort was used to estimate landings and catches by fleet and stock, using standard forecasting procedures.

In 2011, single-species ICES advice was no longer given according to several approaches as in 2010, but according to a single preferred option (Management plan if implemented, according to the MSY transition framework otherwise). The basis for each single stock advice was retained in the current mixed-fisheries framework.

As in previous years, the following five options (or scenarios) were explored:

- 1) **min**: The underlying assumption was that fishing stops when the catch for the first quota species meets the upper limit corresponding to single stock exploitation boundary.
- 2) **max**: The underlying assumption was that fishing stops when all quota species are fully utilised with respect to the upper limit corresponding to single stock exploitation boundary.
- 3) **cod**: The underlying assumption was that all fleets set their effort at the level corresponding to their cod quota share, regardless of other stocks.
- 4) **sq\_E**: The effort was set as equal to the effort in the most recently recorded year for which there are landings and discard data.
- 5) **Ef\_Mgt**: The effort in métiers that used gear controlled by the EU effort management regime had effort adjusted according to the regime. In 2011, that implies a 15.4% effort reduction in TR1 and TR2 gear categories compared to 2010, and another 18.2% reduction in 2012 compared to 2011. In addition, some effort reductions in the BT2 category are implemented in 2011 on the basis of the EU flatfish management plan, on a country-specific magnitude of up to 10% (6.6% for Belgium, 5.18% for Denmark, 9.79% for Germany, 9.9% for the Netherlands and 8.55% for the UK, source Council Reg. 57/2011).

In addition, the WG investigated results of a “pok” scenario, i.e. following the underlying assumption that all fleets set their effort at the level corresponding to their saithe quota share, regardless of other stocks. This was in response to the fact that the 2011 advice for saithe appeared to represent the most restrictive 2012 TAC across demersal WGNSSK stocks.

Finally, in 2011, the WG considered including a second new scenario, following the outcomes of the joint ICES/STECF Evaluation of the North Sea cod LTMP (ICES WKROUNDMP 2011), stating that a key issue in the current implementation of the plan was, as shown in previous WGMIXFISH reports in 2009 and 2010, an overopti-

mistic single-stock short-term forecast with regards to the intermediate year. To better address this, WGMIXFISH considers that it would be useful to evaluate the up-take levels for TACs and effort ceilings in the intermediate (current) year and compare these with their equivalent over the same period the previous year, as a first rough proxy for the actual fishing pressure in the intermediate (current) year. The resulting SSBs at the start of the TAC year would lead to another set of TAC advice for the North Sea demersal stocks. Ultimately, no new scenario was presented by the WG, but valuable information could nevertheless be gathered (see section 5.1).

### 3 Input data and recent trends

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#### 3.1 Stocks

##### 3.1.1 Data

The assessment data for the different stocks were taken from ICES WGNSSK (2011). For, plaice, saithe, and sole, no modifications were needed to incorporate the assessment and forecast inputs into the mixed fisheries routine. For whiting, the industrial bycatch component was included in the landings, whereas it is dealt with separately in the single-stock forecast. The same applied for haddock, for which the industrial bycatch is now extremely low. The single species haddock forecast also includes some non-standard procedures for projecting mean weight and mean selectivity, and this was accounted for as far as possible in the current mixed-fisheries forecast.

The main change compared to last year with regards to stocks was the methodological changes in the cod assessment, following ICES WKCOD (2011a) and ICES WGNSSK (2011b). The cod assessment is now performed with the state-space SAM model. In addition, while in previous years unallocated removals were implicitly included in landings and discards, requiring all fleets' catch data to be raised to the higher total through use of a catch multiplier (see ICES WGMIXFISH 2010), they are now considered as a category on their own, and raising of the fleet data is no longer required.

*Nephrops* stocks were incorporated in the evaluation by functional unit. For the *Nephrops* stocks in FU 5, FU6, FU7, FU8, FU9, FU32, FU33 and *Nephrops* from areas outside the functional units, the ICES advices were taken for the Fmsy approach or the precautionary approach if no Fmsy figure was available. For the mixed fisheries forecasts the values calculated by STECF for the Policy paper COM(2011) 298-final were used (see table 3.1.1.1), (STECF, 2011). STECF did not provide values for the other FU's. The Working Group decided to apply a 25% reduction as stipulated in the policy paper for 'category 3' stocks.

The functional units with separate stock indices from underwater surveys (FU6, FU7, FU8 and FU9) were treated as separate *Nephrops* identities in the projections whereas the four other functional units (FU 5, 10, 32 and 33) and catches outside of the functional units in the North Sea were omitted in the projections.

##### 3.1.2 Trends and advice

Recent trends are described on a stock-by-stock basis in ICES (2011), and latest advice by stock is available on the ICES website. In order to give a global overview of all North Sea demersal stocks at one time, this information is collected directly below. It should be noted that although there is only one advice, additional management considerations are also listed.

### 3.1.2.1 Cod in IIIa – IV – VIId

#### Trends

There has been a gradual improvement in the status of the stock over the last few years. SSB has increased from the historical low in 2006, but remains below  $B_{lim}$ . Fishing mortality declined from 2000, but is estimated to be well above  $F_{MSY}$ , and is just above  $F_{pa}$ . Recruitment since 2000 has been poor. Although discards are still high, there has been a decreasing trend since 2008.

#### Advice

**ICES advises on the basis of the EU–Norway management plan that landings in 2012 should be no more than 31 800 t.**

Additional management considerations

- 1) The EU–Norway agreement management plan as updated in December 2008 aims to be consistent with the precautionary approach and is intended to provide for sustainable fisheries and high yield leading to a target fishing mortality of 0.4.

The EU has adopted a long-term plan for this stock with the same aims (Council Regulation (EC) 1342/2008). In addition to the EU–Norway agreement the EU plan also includes effort restrictions, reducing kW-days available to community vessels in the main métiers catching cod in direct proportion to reductions in fishing mortality until the target  $F$  of 0.4 has been reached. This implies a 15.4% reduction in effort in 2011.

In both plans fishing mortality should be reduced to levels corresponding to 75% of  $F_{2008}$  in 2009 and 65% of  $F_{2008}$  in 2010. Until the long-term phase of the management plans has been reached, further annual reductions of 10% must be applied which lead to an  $F$  in 2012 equal to 45% of  $F_{2008}$ . This would lead to a TAC reduction within the limits of the 20% TAC constraint. According to these rules, landings should be 31 800 t in total for Subarea IV and Divisions IIIa West and VIId in 2012.

- 2) Following the ICES MSY framework implies fishing mortality to be reduced to 0.08 (lower than  $F_{MSY}$  because  $SSB_{2012} < MSY_{Btrigger}$ ), resulting in landings of less than 9500 t in 2012. This is expected to lead to an SSB of 134 600 t in 2013.

To follow the transition scheme towards the ICES MSY framework the fishing mortality must be reduced to  $(0.6 \times 0.68) + (0.4 \times (0.19 \times 0.40)) = 0.44$ , which is lower than  $F_{pa}$ . This results in landings of less than 42 000 t in 2012, which is expected to lead to an SSB of 95 100 t in 2013.

The stock is below  $B_{lim}$  and recruitment remains poor. Therefore, a more rapid transition to the MSY framework may be necessary to rectify the situation. ICES highlights catch options for transition periods ranging from one to four years (2012 to 2015, respectively).

- 3) Following the precautionary approach, even a zero catch in 2012 is not expected to result in SSB reaching  $B_{pa}$  in 2013.

### 3.1.2.2 Haddock in IIIa – IV

#### Trends

Fishing mortality has been below  $F_{pa}$  and SSB has been above  $MSY_{Btrigger}$  since 2001. Recruitment is characterized by occasional large year-classes, the last of which was the strong 1999 year class. Apart from the 2005 and 2009 year classes which are about average, recent recruitment has been poor.

### Advice

**ICES advises on the basis of the EU-Norway management plan that landings in 2012 should be 41 575 t.**

#### Additional management considerations

- 1) In 2008 the EU and Norway agreed a revised management plan for this stock, which states that every effort will be made to maintain a minimum level of SSB greater than 100 000 t (Blim). Furthermore, fishing was restricted on the basis of a TAC consistent with a fishing mortality rate of no more than 0.30 for appropriate age groups, along with a limitation on interannual TAC variability of  $\pm 15\%$ . Following a minor revision in 2008, interannual quota flexibility ("banking and borrowing") of up to  $\pm 10\%$  is permitted (although this facility has not yet been used). The stipulations of the management plan have been adhered to by the EU and Norway since its implementation in January 2007.

Following the management plan implies a TAC of 41 575 t in 2012 which is expected to lead to a TAC increase of 15% and an F increase of 23%.

- 2) Following the ICES MSY framework implies fishing mortality to be increased to 0.3, resulting in human consumption landings of less than 43 000 t in 2012. This would be expected to lead to an SSB of 227 000 t in 2013.
- 3) Following the precautionary approach, fishing mortality in 2011 should be no more than  $F_{pa}$  corresponding to human consumption landings of less than 86 000 t in 2011. This is expected to keep SSB above  $B_{pa}$  in 2013.

#### 3.1.2.3 Plaice in IV

##### Trends

The stock is well within precautionary boundaries, and has reached its highest levels in recorded history. Recruitment has been around the long-term average from 2005 onwards.

##### Advice

ICES advises on the basis of the first stage of the EU management plan (Council Regulation No. 676/2007) that landings in 2012 should be no more than 84 410 t. ICES notes that according to the management plan, transitional arrangements to the second stage of the plan should be established since both North Sea plaice and sole have now been within safe biological limits for two consecutive years.

#### Additional management considerations

- 1) Both the North Sea plaice and sole stocks have been within safe biological limits in the last two years. According to the management plan (Article 3.2), this signals the end of stage one. Transitional arrangements for stage two (Article 5) should amend the objectives and the procedures for setting TACs and effort limitations, but these have not been decided on yet. Therefore, ICES advice is limited to the procedures defined for stage one.

Following the first stage of the EU management plan would imply increasing  $F$  to the target value of 0.3, with a maximum TAC increase of 15%. For 2012 the latter applies, resulting in a TAC of 84 410 t ( $F = 0.29$ ). This is expected to increase the SSB to 587 600 t in 2013.

Following the second stage of the EU management plan would imply increasing  $F$  to the target value of 0.3 without TAC constraint (Article 4). This would result in a TAC of 87 100 t. This is expected to increase the SSB to 583 400 t in 2013.

ICES has evaluated this management plan and considers it precautionary.

- 2) Following the ICES MSY framework implies fishing mortality to be increased to 0.25, resulting in landings of 74 000 t in 2012. This is expected to lead to an SSB of 604 700 t in 2013.

Given that the current (2010) estimate of fishing mortality is only slightly below  $F_{MSY}$  there is no need to follow a transition scheme towards this reference value.

- 3) Following the precautionary approach, the fishing mortality in 2012 should be no more than  $F_{pa}$  (0.6) corresponding to landings of less than 155 500 t in 2012. This is expected to keep SSB above  $B_{pa}$  in 2013.

#### 3.1.2.4 Sole in IV

##### Trends

SSB has fluctuated around the precautionary reference points for the last decade and is estimated to be above  $B_{pa}$  in 2010. Fishing mortality has shown a declining trend since 1995 and is estimated to be below  $F_{pa}$  since 2008.

##### Advice

**ICES advises on the basis of the first stage of the EU management plan (Council Regulation No. 676/2007) that landings in 2012 should be no more than 15 700 t. ICES notes that according to the management plan, transitional arrangements to the second stage of the plan should be established since both North Sea sole and plaice have now been within safe biological limits for two consecutive years.**

#### Additional management considerations

- 1) Both the North Sea sole and plaice stocks have been within safe biological limits in the last two years. According to the management plan (Article 3.2), this signals the end of stage one. Transitional arrangements for stage two (Article 5) should amend the objectives and the procedures for setting TACs and effort limitations, but these have not been decided on yet. Therefore, ICES advice is limited to the procedures defined for stage one.

Following the first stage of the EU management plan would imply a 10% reduction of  $F$  to 0.31, resulting in a TAC of 15 700 t in 2012 and implying a 10% reduction in fishing effort. This is expected to lead to an SSB of 45 600 t in 2013. The TAC increase of 11% is within the 15% bounds of the management plan TAC change constraints.

Following the second stage of the EU management plan would imply decreasing  $F$  to 0.2 (Article 4), resulting in a TAC of 11 000 t in 2012. This is expected to lead to an SSB of 50 100 t in 2013.

ICES has evaluated this management plan and considers it can be accepted as precautionary.

- 2) Following the ICES MSY framework implies fishing mortality to be reduced to 0.22 (FMSY, as SSB 2012 > MSY Btrigger), resulting in landings of less than 11 800 t in 2012. This is expected to lead to an SSB of 49 300 t in 2013.

Following the transition scheme towards the ICES MSY framework implies fishing mortality to be reduced to  $((0.34 \cdot 0.6) + (0.22 \cdot 0.4)) = 0.29$ , which will result in landings of less than 15 100 t in 2012. This is expected to lead to an SSB of 46 200 t in 2013.

- 3) The precautionary  $F_{pa}$  for North Sea sole is 0.4. This would lead to landings of 19 700 t in 2012 (a 40% increase in TAC) and an SSB of 41 700 t in 2013.

### 3.1.2.5 Saithe in IIIa - IV - VI

#### Trends

The status of the stock has deteriorated in the last few years. SSB is estimated to have been above  $B_{pa}$  from 2001–2008 but has substantially declined during the last three years towards  $B_{lim}$ . From 2001–2007,  $F$  has been at or below the fishing mortality target of the management plan (0.3), but has now increased to  $F_{lim}$ . Because of lack of input data, no assessment was conducted in 2010, and these trends could not be recognized until now.

#### Advice

**Given the recent poor recruitment and low SSB ICES advises that paragraph 6 of the EU-Norway management plan be invoked to reduce the catches beyond the 15% TAC reduction (i.e. below 87 544 t).**

#### Additional management considerations

- 1) The EU-Norway agreement management plan does not clearly state whether the SSB in the intermediate year or the SSB in the beginning or end of the TAC year should be used to determine the status of the stock. ICES interprets this as being the SSB in the beginning of the intermediate year (2011). Since SSB in the beginning of 2011 is above  $B_{lim}$ , but below  $B_{pa}$ , § 3 of the harvest control rule applies. This would result in an  $F$  of 0.16 and a TAC of 33 000 t, which implies a change of more than 15%. The 15% TAC constraint (§ 5) leads to a TAC of 87 544 t, which results in SSB in 2013 of 111 000 t. In addition the management plan opens up for reductions of more than 15% where considered appropriate (§ 6).

The EU-Norway agreement management plan was evaluated by ICES in 2008 to be precautionary in the short term (~5 years). However, the HCRs in the management plan are not clear enough when the stock falls below the SSB of

200 000 t. The change in fishery distribution and stock productivity (lower growth and recruitment) imply that a re-evaluation of the management plan is needed.

- 2) Following the ICES MSY framework implies a fishing mortality of  $F_{MSY} \cdot SSB_{2012} / MSY_{trigger} = 0.16$ , which results in landings of less than 33 000 t in 2012.

The MSY transition implies a fishing mortality of  $(0.6 \cdot F_{2010}) + (0.4 \cdot 0.16) = 0.42$ , above  $F_{pa}$ . Therefore the scheme will lead to  $F = F_{pa} = 0.4$  and landings of 75 000 t in 2012.

- 3)  $B_{pa}$  cannot be reached by 2013 even with a zero catch. Advice based on the precautionary approach would give landings of 0 t in 2012.

#### 3.1.2.6 Whiting in IV - VIId

##### Trends

SSB in 2010 is slightly higher than in 2009 and is around the long-term average. Fishing mortality has been stable since 2003. Recruitment has been very low between 2003 and 2007, with above-average recruitments estimated in 2008 and 2009. Whiting is no longer considered to be in a period of impaired recruitment.

##### Advice

**ICES advises on the basis of the EU–Norway interim management plan TAC of 24 300 t (human consumption for the combined area) in 2012.**

##### Additional management considerations

- 1) The response to the Joint EU–Norway request on the management of whiting in Subarea IV (North Sea) and Division VIId (Eastern Channel) from ICES in September 2010 stated that “maintaining fishing mortality at its current level of 0.3 would be consistent with long-term stability if recruitment is not poor” (ICES, 2010). Consequently the EU and Norway have agreed to interim management of whiting at this level of total fishing mortality for 2011, conditional on a 15% TAC constraint. ICES are in the process of developing and evaluating the management plan (ICES, 2011b).

Following the management plan for 2011 in 2012 as well implies a TAC of 21 275 in 2012, which corresponds to a 15% increase in TAC and an effort decrease of 15% in 2012. The implied TACs for Subarea IV and Division VIId would be 17 020 t and 4 255 t.

- 2) There are no reference points to enable MSY advice.
- 3) There are no reference points to enable precautionary advice.

#### 3.1.2.7 *Nephrops* in Botney Gut (FU 5)

##### Trends

The state of this stock is unknown.

##### Advice

The 2010 advice for this *Nephrops* stock is biennial and valid for 2011 and 2012 (see [ICES 2010](#)). This year ICES adopts the transition to the MSY approach as the basis for advice, which corresponds to reducing catches.



**To protect the stock in this functional unit, management should be implemented at the functional unit level.**

Additional management considerations

- 1 ) There is currently no management plan for this Functional Unit.
- 2 ) Following the transition to the MSY approach ICES advice that catches should be reduced.
- 3 ) There is currently no advice given following the precautionary approach for this Functional Unit.

#### 3.1.2.8 *Nephrops* in Farn Deep (FU 6)

##### Trends

The UWTV survey indicates that the stock status has been fluctuating around MSY  $B_{trigger}$  since 2007. Changes in survey methodology in 2007 make comparison with the preceding series difficult.

##### Advice

**ICES advises on the basis of the MSY transition that landings in 2012 should be no more than 1400 t.**

**To protect the stock in this functional unit (FU), management should be implemented at the functional unit level.**

Additional management considerations

- 1 ) There is currently no management plan for this Functional Unit
- 2 ) Following the ICES MSY framework implies a harvest rate of 8%, resulting in landings of 1300 t in 2012.

Following the transition scheme towards the ICES MSY framework implies fishing mortality to be reduced to  $(0.6 \cdot F_{2010} + 0.4 \cdot F_{MSY}) = 8.2\%$ , corresponding to landings of no more than 1400 t in 2012.

- 3 ) There is currently no advice given following the precautionary approach for this Functional Unit.

#### 3.1.2.9 *Nephrops* Fladen Ground (FU 7)

##### Trends

The stock remains at a high level, well above MSY  $B_{trigger}$ . The harvest rate has been increasing but is still below  $F_{MSY}$ .

##### Advice

**ICES advises on the basis of the MSY approach that landings in 2012 should be no more than 14 100 t.**

**To protect the stock in this functional unit (FU), management should be implemented at the functional unit level.**

Additional management considerations

- 1 ) There is currently no management plan for this Functional Unit.
- 2 ) Following the ICES MSY framework implies a harvest rate lower than 10.3%, corresponding to landings of less than 14 100 t in 2012.

- 3) There is currently no advice given following the precautionary approach for this Functional Unit.

#### 3.1.2.10 *Nephrops* in Firth of Forth (FU 8)

##### Trends

The stock remains at a high level, well above  $MSY_{Btrigger}$ . The harvest rate remains slightly above  $F_{MSY}$ .

##### Advice

ICES advises on the basis of the transition to the MSY approach that landings in 2012 should be no more than 1700 t.

To protect the stock in this functional unit (FU), management should be implemented at the functional unit level.

Additional management considerations

- 1) There is currently no management plan for this Functional Unit.
- 2) To follow the ICES MSY framework the harvest rate should be reduced to 16.3%, corresponding to maximum landings of 1600 t in 2012.

To follow the transition scheme towards the ICES MSY framework the harvest rate should be reduced to 17.5% ( $0.6 \cdot F_{2010} + 0.4 \cdot F_{MSY}$ ), corresponding to landings of no more than 1700 t in 2012 (where  $F_{2010}$  is the observed harvest rate in 2010 (18.4%)).

- 3) There is currently no advice given following the precautionary approach for this Functional Unit.

#### 3.1.2.11 *Nephrops* in Moray Firth (FU 9)

##### Trends

The stock remains above  $MSY_{Btrigger}$ . The harvest rate has declined since 2006 and is now at  $F_{MSY}$ .

##### Advice

ICES advises on the basis of the MSY approach that landings in 2012 should be no more than 1100 t.

To protect the stock in this functional unit (FU), management should be implemented at the functional unit level.

Additional management considerations

- 1) There is currently no management plan for this Functional Unit
- 2) Following the ICES MSY framework implies the harvest rate should be less than 11.8%, resulting in landings of less than 1100 t in 2012.
- 3) There is currently no advice given following the precautionary approach for this Functional Unit.

#### 3.1.2.12 *Nephrops* in Noup (FU 10)

##### Trends

The state of the stock is unknown.

### Advice

The 2010 advice for this *Nephrops* stock was biennial and valid for 2011 and 2012 (see [ICES, 2010](#)) and indicated that there is no basis for advice. Based on the 2012 advisory framework in these circumstances, ICES advises on the basis of precautionary considerations that catches should be reduced.

To protect the stock in this functional unit (FU), management should be implemented at the functional unit level.

Additional management considerations

- 1 ) There is currently no management plan for this Functional Unit.
- 2 ) There is currently no advice given following the transition to the MSY approach for this Functional Unit.
- 3 ) Trends in the stock are unknown and there is no information on exploitation status. Therefore, catches should be reduced.

#### 3.1.2.13 *Nephrops* in Norwegian Deep (FU 32)

### Trends

Landings per unit effort (lpue) have been relatively stable over the last 16 years and suggest that current levels of exploitation are sustainable. A slight increase in mean size in the catches in 2007 could indicate a reduced exploitation pressure.

### Advice

The 2010 advice for this *Nephrops* stock is biennial and valid for 2011 and 2012 (see [ICES, 2010](#)). This year ICES adopt the transition to the MSY approach as the basis for advice, which corresponds to reducing catches.

To protect the stock in this functional unit (FU), management should be implemented at the functional unit level.

Additional management considerations

- 1 ) There is currently no management plan for this Functional Unit.
- 2 ) Following the transition to the MSY approach ICES advice that catches should be reduced
- 3 ) There is currently no advice given following the precautionary approach for this Functional Unit.

#### 3.1.2.14 *Nephrops* off Horn's Reef (FU 33)

### Trends

The state of this stock is unknown. Lpue has been increasing up to 2008, probably reflecting increase in gear efficiency (technological creep) in the last years. The mean sizes in 2005 catches and the increased lpue's in the subsequent years could indicate a high recruitment in 2005. The development in 2009 then suggests that the contribution of the 2005 recruitment to the stock now has faded.

### Advice

The 2010 advice for this *Nephrops* stock is biennial and valid for 2011 and 2012 (see [ICES, 2010](#)). This year ICES adopts the transition to the MSY approach as basis for advice, which corresponds to reducing catches.

**To protect the stock in this functional unit (FU), management should be implemented at the functional unit level.**

Additional management considerations

- 1) There is currently no management plan for this Functional Unit.
- 2) Following the transition to the MSY approach ICES advice that catches should be reduced
- 3) There is currently no advice given following the precautionary approach for this Functional Unit.

### 3.1.2.15 *Nephrops* in Other rectangles (NEPOTH)

#### Trends

The stock status is unknown.

#### Advice

**No separate advice is given for this area**

Additional management considerations

- 1) There is currently no management plan for this area.
- 2) There is currently no advice given following the ICES MSY framework for this area.
- 3) There is currently no advice given following the precautionary approach for this area.

### 3.1.3 Software

The collation of WGNSSK data highlighted the great diversity of software and settings used in the single species assessments and forecasts, as illustrated in the text table below

Species	Assessment	Forecast
HADDOCK IV, IIIa and VIIb	FLR 2x, FLXSA	MFDP
COD IV, IIIa and VIIb	SAM	SAM
PLAICE IV	FLR 3.0, FLXSA	FLR3.0, FLSTF
WHITING IV and VIId	FLR 2.x, FLXSA	MFDP
SAITHE IV, IIIa and VI	FLR 2.x, FLXSA	FLR 2.x, FLSTF
SOLE IV	FLR 2.x, FLXSA	FLR 2.x, FLSTF

In the mixed-fisheries runs, all forecasts run were done with the same FLR forecast method (see chapter 2), but using the Flash package rather than the FLSTF package which is not maintained anymore.

## 3.2 Fleets and métiers

### 3.2.1 Catch and effort Data

For this working group runs were performed using data submitted in response to a data call issued by ICES on 7 July 2011. The specification of the data call was the same as in 2010, and was based to a large extent on that used for the STECF SGMOS 10-04 for the evaluation of effort management, the main exceptions being vessel size categories specified to match fleet segments from the STECF AER (Annual Economic Re-

port), catch and effort for *Nephrops* partitioned by *Nephrops* Functional Unit (FU), and the inclusion of economic value. The data call is included in Annex 2. Data was received from Belgium, Denmark, France, Germany, the Netherlands, Norway, Sweden, the UK(E,W,Nl) and UK(Scotland). Not all data could be provided by all nations. Data for 2009 was not available from France so that catch and effort for French fleets had to be assumed equal to 2008 values. Also discard data was incomplete for most countries. Points to note regarding data by nation are contained in Annex 3.

A complicating factor when incorporating *Nephrops* is the fact that the species is found in a number of distinct areas or functional units (FU), only some of which receive an abundance estimate (necessary to calculate a catchability). This WG followed the approach adopted by ICES (2009b) which is to perform the normal Fcube prediction for those FUs with absolute abundance estimates, then to calculate a ratio (R) of the yields to the ICES' advice for the same FUs. For those FUs without absolute abundance estimates, landings resulting from the Fcube run were simply taken to be the most recently recorded landings multiplied by the same ratio R. To do this, landings for each métier had to be apportioned across the FUs. This was facilitated by the supply of effort and catch data by FU.

### 3.2.2 Definitions of fleets and métiers

The starting point for defining fleets and métiers was to match definitions used in the cod long term management plan (Table 3.2.2.1). Fleets were further split by nation, and sometimes further by vessel length category. The decision to split by vessel length category was initially dependent on the availability of cost data from the Annual Economic Report (AER, cf ICES 2009a), and then to the overall importance of the fleet in terms of total effort. The latter consideration was to prevent unbalance in the relative size of fleets in the model.

In order to reduce the number of categories, an aggregation threshold, established through trial and error was used to determine 'small' métiers. A métier failing to catch 1.0% on average of at least one of the stocks considered was classified as small. All these small métiers are then aggregated by fleet in one "Other" métier (OTH). Further, all small fleets (i.e. containing only the "OTH" métier), were aggregated into one single "OTH" fleet.

The final data used contained 27 national fleets (plus the OTH fleet) from nine countries, from 2003 to 2010. These fleets engage in one to 5 different métiers each, resulting in 68 combinations of country\*fleet\*métier catching cod, haddock, whiting, saithe, plaice, sole and *Nephrops* (Table 3.2.2.2)

As a cross check of the data the total landings and discards across all fleets was compared to the values estimated from the single species stock assessments (Figure 3.2.2.1). Some landings may not be allocated to fleets, due to for example missing countries or areas (e.g. area VIa for saithe) or national landings with missing logbook information that cannot be allocated to a fleet. The landings coverage for most stocks is high (from 75 to 100% of landings could be allocated to one of the fleets). Since cod 'unallocated removals' are now removed from the landings in the 2011 SAM assessment, the match of cod landings was also satisfactory this year (above 85%, against 50% in previous years). To solve the small inconsistencies between fleets data and stock data, the differences between them were pooled into the "OTH" fleet (both landings and discards).

### 3.2.3 Trends

A number of overview graphs (using the Lattice package in R) were produced to aid quality checking of the data once compiled into the final fleets object. Some are useful to show the relative importance of the fleets chosen and trends in their effort and catches. Effort by fleet in absolute levels (Figure 3.2.3.1) and relative trends (Figure 3.2.3.2), effort share by métier and fleet (Figure 3.2.3.3) and landings by fleet and stock (Figure 3.2.3.4) are included in this report.

## 4 Mixed fisheries forecasts

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### 4.1 Description of scenarios

#### 4.1.1 Baseline Runs

The objectives of the single species stock baseline runs were to:

- 1) reproduce as closely as possible the single species 2011 advice produced by ACOM, and
- 2) act as the reference scenario for subsequent mixed fisheries analyses.

The various single-stock forecasts presented by WGNSSK are performed using different software and setups (see 3.1.3 above). However, for the purpose of the mixed-fisheries analyses, it is necessary to gather all forecasts into a single unified framework, which builds on the 'fwd()' method in FLR (Flash R add-on package). The same forecast settings as in WGNSSK are used for each stock regarding weight-at-age, selectivity and recruitment, as well as assumptions on the F in the intermediate year and basis for advice (LTMP or MSY framework).

Some differences can occur in the forecast calculations, (sometimes because of the diversity of single-stock assessment methods used) and the WG always investigates in depth the reasons for potential discrepancies. Adjustments to the Fcube forecasts are made if necessary to minimise discrepancies to the largest extent possible.

The intention of the baseline runs was thus mainly to act as a check to ensure that the projections were set-up correctly within the Fcube script, but these runs also have the incidental benefit of acting as a quality control check on the WGNSSK projections themselves.

#### 4.1.2 Mixed fisheries runs

##### 4.1.2.1 Fcube analyses of the intermediate year (2011)

The single species stock forecast settings and target F for 2011 from the baseline run were used to perform Fcube scenario analyses for 2011 (Run "One Year Fcube" – Single-Stock TargetF 2011). The aim of these analyses was to provide alternative sets of plausible levels of F by stock in 2011 accounting for mixed-fisheries interactions. This is similar to the base case run described and analysed in ICES (2008).

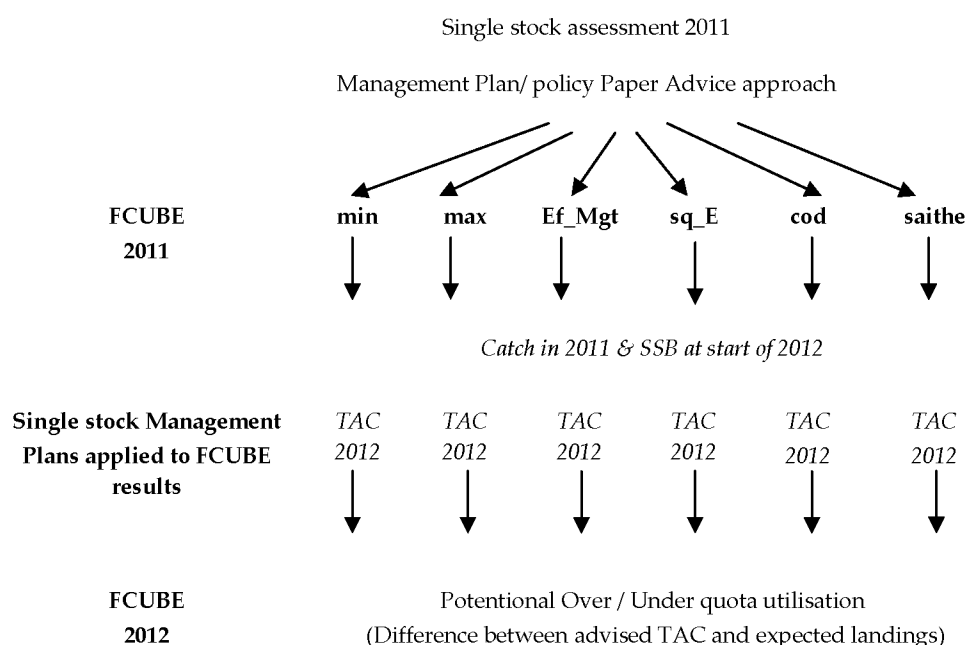
The Fcube scenarios **min**, **max**, **cod**, **sq\_E** and **Ef\_Mgt** were performed, and the **pok** scenario was run subsequently (see Section 2.1).

#### 4.1.2.2 Fcube analyses for the TAC year (2012)

The new F2011 values by stock derived from the Fcube scenarios were used as input for the Intermediate Year in single-species forecasts, instead of the values from WGNSSK. The stocks were again projected to 2013, using the same settings (objectives and constraints) for 2012 as in the Baseline Run. The aim was to derive single species stock TAC advice for 2012 following the single species advice approach but as if catch resulting from the assumed mixed-fisheries interactions in 2011 had come about and the data were available for the intermediate year. Finally, for each Fcube scenario, the same scenario was applied in 2012 to the stock results (numbers-at-age) resulting from applying that scenario for 2011. In this way the following could be calculated:

- Differences in recommended TACs for 2012 resulting from the single species advice approach being applied to the stock status at the end of the intermediate year of different scenarios and
- An estimate of the cumulative difference between baseline run (single species advice) intermediate year catch plus TAC and realised catches over two years from each scenario,

In summary, the Fcube runs followed the scheme below:



## 4.2 Results of Fcube runs

### 4.2.1 Baseline run

The rationale behind the single species baseline runs is given in Section 4.1.1. Table 4.2.1.1 contains the outputs from these runs.

The issues and problems encountered in replicating the single species advice for each species are given below. The results from these baseline runs are compared with the results from the corresponding ICES runs in Tables 4.2.1.2 and 4.2.1.3.

**Cod:** The entire basis for North Sea assessment and forecast was changed from the B-Adapt to the SAM assessment package in early 2011 (ICES WKCOD 2011), and this had important consequences for the WG's ability to reproduce it in Fcube. The cod forecast is produced internally in the SAM assessment method using 5000 stochastic replicates drawn within the confidence interval of the F, N and Catch multiplier estimates, while the WGMIXFISH forecast is only a deterministic projection. As the median of the forecasted assessment may be slightly different from the forecast of the median assessment, small discrepancies may appear. In addition, the assessment and projection include a component of unallocated removals, while a usual FLR setup normally copes only with landings and discards. This latter issue was handled in two steps, first by combining unallocated removals and discards within the projections, to maintain the TAC constraint on the landings component, and second by splitting the resulting 'discards' into actual discards and unallocated removals based on 2010 ratios. The final discrepancy between the ICES cod advice and the WGMIXFISH replicate was very low (0.3% in estimated 2012 landings), and the FLR forecast could thus be used as a satisfactory basis for the mixed-fisheries projection. At the fleet level, unallocated removals were technically treated as a specific fleet to ease the automatic calculations in Fcube.

**Haddock:** The methods developed in WGNSSK to parameterise future selectivity and weight-at-age for haddock are sometimes quite specific and do not always follow common standards, and therefore some input data had been entered manually rather than through automation. Afterwards the results were largely similar.

**Whiting:** There are some discrepancies in the forecast catches from the WG and the FLR forecasts. A small error was discovered in the single-species whiting advice, linked to an overestimation of the share of the VIIId catches in the forecast. Whilst this doesn't affect the advice of a 15% TAC increase in the North Sea for 2012, it may have some small consequences for the estimation of the whiting TAC for subarea VII. The WGMIXFISH projections are based on the corrected share between areas. A second source of differences between WGMIXFISH and WGNSSK can be attributed to differences in the way the industrial by-catch is handled by the two approaches. In the WGNSSK forecast this is handled as a separate fleet with a fixed multiplier, whereas in the FLR forecasts it is included within the landings component.

**Saithe:** Straightforward, no problems encountered

**Plaice:** Straightforward, no problems encountered

**Sole:** Straightforward, no problems encountered

**Nephrops:** The forecasts applied the recommended harvest rates to the most recent abundance estimates available for the relevant FUs; hence the process replicated precisely the ICES advice.

#### **4.2.2 Mixed fisheries analyses**

##### **4.2.2.1 Fcube analyses of the intermediate year**

The Target F by stock for 2011 were set as the landings component of the F used in the Baseline (see table 4.2.1.1). That implies a 15% F reduction for cod. It is to be noted that for cod, whiting and sole, the single-species forecast assumptions used by ICES' WGNSSK (ICES 2011) (and reproduced here in the *baseline*) imply to some extent expected landings for 2011 higher than the actual TAC.



The Fcube scenarios **min**, **max**, **sq\_E**, **cod** and **Ef\_Mgt** were applied to these target Fs (Table 4.2.2.1.1 and Figures 4.2.2.1.2 to 4.2.2.1.6).

The results are interesting when contrasted to those obtained at AGMIXNS in 2009. In 2009 the most striking results were the discrepancies between the **cod** scenario and the other scenarios, due to the fact that the cod forecast in 2009 implied a very sharp reduction in F in the intermediate year, which had consequences for all other stocks. In 2011 no such large discrepancies occurred, indicating a fairly good consistency across the various single-stock forecasts and also between these single-stock forecasts and the status quo effort (**sq\_E**) scenario. This is not surprising, since most single-stock forecasts assumed status quo F in the intermediate year, and should therefore be in line with status quo effort. However, this consistency has important consequences in terms of advice, as it suggests that 1) the cod forecast is not considered overoptimistic for 2011, and the implementation error in the LTMP is therefore expected to be limited, and 2) some reduction in cod fishing mortality is expected to occur in 2011 under current levels of effort for the various fleets. Some reductions in cod catchability have been observed over the last two years for a number of the most important cod fleets (Figure 4.2.2.1.1), and assuming that they continue in 2011, these lower catchability levels would translate into lower levels of fishing mortality for the same amount of effort.

The outcomes of the **cod** scenario are no longer comparable to the outcomes of the **min** scenario (cf ICES WGMIXFISH 2010), indicating that the cod stock is not necessarily the limiting stock for the majority of fleets. Indeed, as can be seen in Figure 4.2.2.1.2, some fleets are now limited by other stocks for which they may have low quota shares or higher catchabilities.

The **Ef\_Mgt** scenario implies quite large effort reductions in 2011 in the main cod métiers (TR1, TR2 and to a lower extent BT2), and this is expected to have a considerable impact on the catches of all other stocks beyond cod.

The **min** and **max** scenarios are still kept in the figures as illustrative boundaries, but WGMIXFISH consider that these scenarios are not realistic in a management perspective. Hindcasting exercises over historical data (up to 2008) have been conducted by Ulrich et al. (2011.), showing that actual realised fleet effort had been in almost all cases between but far from the **min** and **max** estimates, and closer to the **sq\_E** and **val** scenarios. This can be understood when looking at the effort estimates for the various fleets corresponding to their various quota share (Figures 4.2.2.1.2 and 4.2.2.1.3) estimated through the relationships between F, effort and catches, where it is clear that for most fleets the **max** estimate is driven up by non-important by-catch species, e.g. saithe for the Belgian beam trawl fleet (BE\_beam).

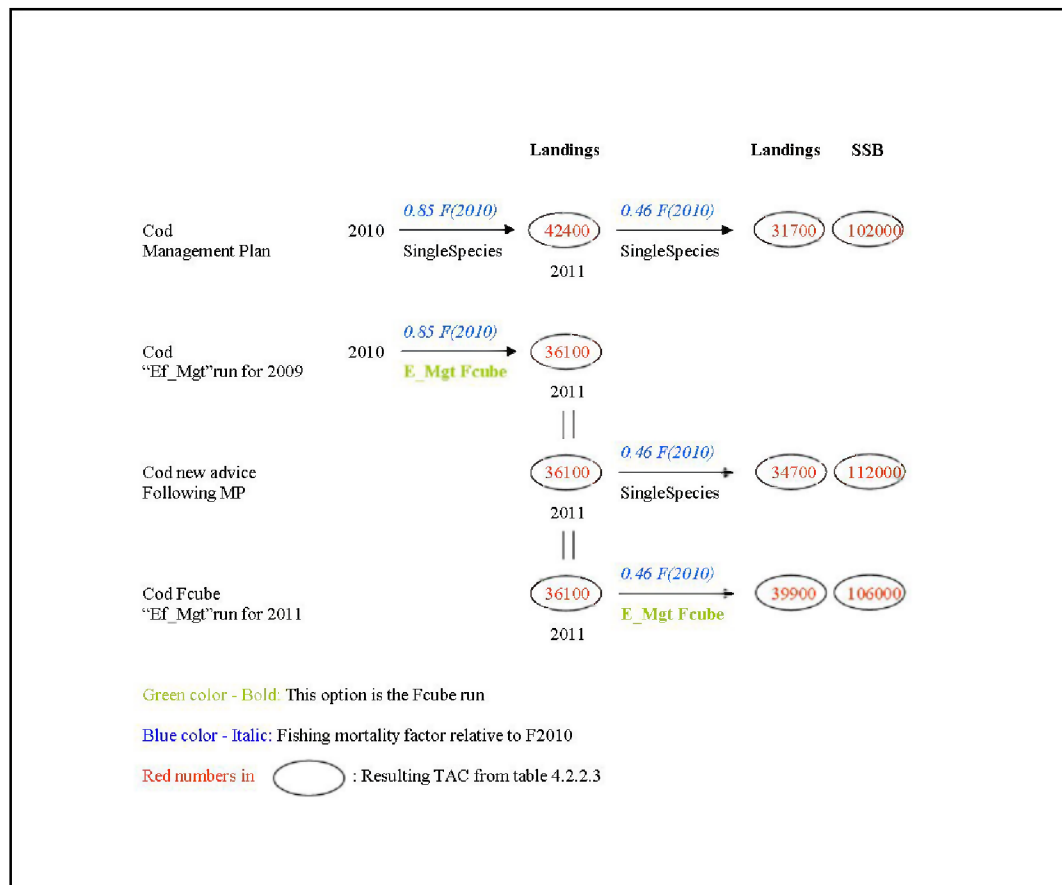
Importantly, Figure 4.2.2.1.5 displays only information on *landings*, i.e. the share of predicted catches that corresponds to marketable fish, according to the discards ratio observed in assessment data (as in the single-stock forecast). Potential overshoot/undershoot on this figure are calculated by comparing the single-stock landings estimates for 2011 with the mixed-fisheries landings estimates. To get an overview of the amount of total catches for the various scenarios, Figure 4.2.2.1.6 displays the catch by category, i.e. potential 'legal' landings (i.e. below the official 2011 TAC, which in practice acts as a TAL), potential 'over TAC' landings, i.e. estimated landings above this official TAC, if any, and discards, as calculated according to the discards ratio observed in assessment data (as in the single-stock forecast). Therefore the discards in this figure reflect undersize discarding rather than overquota discard-

ing. In the case of cod there is also the issue of ‘unallocated removals’. These are simply considered constant over all scenarios.

#### 4.2.2.2 Fcube analyses for the TAC year (2012)

The full overview of the runs up to 2012 is presented in Table 4.2.2.3 and Figures 4.2.2.2.1 and 4.2.2.2.2.

The Fcube outputs for 2012 are quite comprehensive and their interpretation is not easy. An example of interpretation is given in the scheme below to aid understanding of the advice tables. The example follows the landings results for the cod stock in the Fcube **Ef\_Mgt** scenario under the Management Plan advice approach:



In this example, the baseline run, which follows the single-stock ICES advice, assumes landings of 42400 tonnes in 2011 (corresponding to a 15% reduction in F from F2010 to F2011 following the Management Plan), and 31700 tonnes in 2012. The resulting SSB in 2013 is estimated to be 102000 tonnes. However, assuming that the effort restrictions imposed for 2011 on TR1, TR2 and BT2 (15% reduction for TR1 and TR2 and 5-10% reductions for BT2 depending on the country) are applied, the 2011 landings are estimated at 36100 tonnes, i.e. 15% less than assumed in the baseline. If this was the case, then the TAC advice for 2012 could be set to 34700 tonnes in order to comply with the management plan rules on single species advice in 2012, i.e. an increase of 9% compared to the single-species advice. The resulting SSB in 2013 is estimated to be 112000 tonnes, 10% higher than the resulting SSB following the single species advice according to the cod Management Plan.

If again we assume that the fleets fish in line with the effort reductions in 2012 (15% reduction for TR1, TR2 and a 5-10% reduction for BT2), then the landings in 2012 would be estimated at 39900 tonnes, i.e. 26% above the initial single-stock baseline

and 15% above the landings corresponding to the Management Plan. While the Single-Stock advice estimates an SSB level around 102000 tonnes by 2013 under full compliance with the MP, the **Ef\_Mgt** Fcube scenario (following the effort reduction from the Management Plan) estimates SSB in 2013 as high as 106000 tonnes. In other words, effort reductions in 2011 would be more beneficial to the stock than was assumed in the single-stock projection, but the further effort reductions proposed for 2012 would not be sufficient to achieve the Management Plan target in terms of F.

Considering results table 4.2.2.3 with respect to all species, the first set of results to investigate is the sensitivity of the single-stock advice to the Fcube hypotheses applied to the intermediate year, i.e. what happens if we maintain the same single-stock target for 2012 as in the current advice, but change the 2011 hypotheses (Block D in the output tables compared to the 2012 Baseline in Block C {uppermost line}). Due to TAC constraints included in the management plans for most stocks, the differences are in most cases relatively small (usually less than +/-10% changes compared to the single-stock forecast), although some more extreme values can sometimes appear in the **min** and **max** scenarios. From 2011 this situation is true for all stocks including whiting because an interim LTMP for whiting has been implemented with a similar basis to other demersal stocks. Previously the basis for whiting advice (that “SSB must not decrease”) was very sensitive to implementation error. Whiting advice for 2012 is now also robust to different assumptions in the intermediate year.

The second set of results to investigate is the difference between i) the potential 2012 landings (~TAC advice) when considering mixed-fisheries interactions during both 2011 and 2012 (block C), ii) the single-species advice (2012 baseline in block C and horizontal lines in Figure 4.2.2.2.1) and iii) the mixed-fisheries advice accounting for single species Management Plans (Block D). This provides estimates of potential over/under shooting of 2012 TACs due to mixed-fisheries interactions. It is worth noting that applying the **max** scenario two years in a row, returns much less dramatically low estimates of future cod SSB than was the case in previous years (ICES WKMIXFISH 2009 and WGMIXFISH 2010), with a lowest bound of 44000 t at the end of the TAC year. This is an indication that the global consistency of the various single-species management objectives have increased, and that some further increase of the cod stock can be expected over the next two years in spite of the implementation error due to mixed-fisheries. Figure 4.2.2.2.4 however, indicates that the proposed 2012 TAC for cod will again make that stock the limiting stock for the majority of fleets.

In terms of effort management, the simulations indicate that while current levels of effort (**sq\_E**) are likely to achieve the expected 15% reduction in cod fishing mortality in 2011, they are unlikely to achieve the target 55% reduction of F in 2012 compared to 2008 as stipulated by the management plan, and further effort reductions may be required. Alternatively, stepwise effort reductions in TR1 and TR2 in both 2011 and 2012 (**Ef\_Mgt**) would imply stronger reductions in F for 2011, requiring less abrupt reductions of catch opportunities in 2012 in order to achieve the cod target in 2012. But these effort reductions would also have strong negative impacts on the ability of the fleets to catch their other 2012 TACs, mainly haddock and plaice. The likely TAC increase for these two stocks in 2012 (according to ICES advice and as repeated in the baseline run) will create strong incentives for maintaining effort at its current level – or even to increase it slightly – since even in the **sq\_E** scenario the estimated 2012 landings are below the baseline for these stocks (Figure 4.2.2.2.1).

To get an overview of the amount of total catches for the various scenarios, Figure 4.2.2.2 displays the catch by scenario for each of the species while Figure 4.2.2.3 displays catch by species for each scenario explored.

These results are now used to form the basis of mixed fisheries advice for the North Sea in Annex 4 of this report.

#### 4.2.2.3 Relative stability

Relative stability as such is not directly included as an input to the model. Instead, an assumption that the relative landings share of the fleets are constant is used as a proxy, and in the scenarios above, this input is calculated as the average landing share by fleet and stock over 2008-2010. As a cross check, the landings by national fleets were summed over nation for each scenario, and the share by country was compared with this initial input (Figure 4.2.2.3). The results show only minor deviations across all scenarios, except for the **min** and **max** scenarios that can sometimes lead to some deviations for the main fishing nations; however it is reiterated again that these two extreme scenarios are unlikely to reflect real patterns (Ulrich et al., 2011).

#### 4.2.2.4 Saithe scenario

This year, an exploratory **pok** scenario was also conducted, on the consideration that the 2011 advice for saithe calls for TAC reduction in 2011, unlike most other demersal stocks in the area. The 'bar plot' results for 2012 are given in Figure 4.2.2.4, contrasting the **pok** scenario to the **sq\_E** scenario. The projections conclude that under the current levels of effort, there is a risk that potential landings may exceed TAC in 2012, and effort adjustments may be necessary. Such adjustments may also be beneficial for the cod stock.

The WGMIXFISH group underlines however, that the results for saithe are likely to be sensitive to the current definitions of fleets and fisheries. Under the current scheme, saithe fisheries, which largely operate with large mesh size otter trawls, are included as a TR1 metier within each national fleet, whereas it is considered that saithe fisheries are usually targeted fisheries with little bycatch, and are distinct from the remaining whitefish fisheries in the North Sea. However, the current metier definition based on mesh sizes does not allow for such a distinction and this issue is one driver among others behind WGMIXFISH's initiative of improving metier and fleet definitions and data collection (see chapter 5).

## 5 Future Developments

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### 5.1 Future scenario: in-year effort comparison

The outcomes from previous WGMIXFISH results (ICES, 2009, 2010b), as well as the general evaluation of the successes and failures of the cod LTMP (STECF/ ICES WKROUNDMP 2011c) have pointed out the importance of the specification of the intermediate (current) year for minimising implementation error. In 2009 in particular, the TAC advice was based on a literal interpretation of the LTMP stating that F would be reduced by 25% in the first year of implementation, while effort data have shown that only limited effort reduction took place that year (STECF 2010) – and indeed F was estimated as not having decreased in 2009.

ICES WGMIXFISH and WKROUNDMP have also investigated the link between fishing effort and fishing mortality for North Sea cod (and Irish Sea cod). The results

showed that, although imperfect and not necessarily fully linear, a link was nevertheless observed. In particular, it was shown that the correlation between fishing effort and fishing mortality was visible for the fisheries catching cod as bycatch (e.g. TR2 and BT2), but less significant for the targeted fishery TR1.

In consequence, the possibility of collecting information on the current level of effort in the intermediate year, to form the basis of a more realistic Fcube scenario for the intermediate year, was considered.

Effort by fleet so far in 2011 could not be made available for all countries during WGMIXFISH 2011, but useful information was nevertheless collected, as summarised below:

- Belgium: Quantitative information could not be collected in time for this year, but qualitative expectations are that effort may not have decreased in 2011 compared to 2010. This information is expected to be made available next year.
- Denmark: Up-to-date monthly effort uses are publicly available on the Ministry's website: <http://webfd.fd.dk/stat/havdage/tabelnor11.html>. The initial expectation was for a 15.4% reduction in TR1 and TR2 effort ceiling in 2011 compared to 2010, as stipulated by the cod LTMP plan. However, these effort ceilings were not reached in 2010. Actual effort use in 2011 up to the end of August showed a 5% decrease in TR1 effort compared to the same period last year, and a 12% increase in TR2.
- France: Quantitative information could not be collected on time for this year, but qualitative expectations are that effort may not have decreased in 2011 compared to 2010.
- Germany: Information on effort ceilings and effort use for 2010 and 2011 was provided by the German Ministry upon demand. It has not been possible to estimate a ratio of effort use over the same number of months between both years; however, the effort ceilings have been increased by 5% for TR1 and TR2 in the North Sea, so the actual total effort may not vary substantially between 2011 and 2010.
- The Netherlands: Effort data for the first two quarters of 2011 were provided to WGMIXFISH, in the same format as the effort data submission. For category BT2 in the North Sea, there has been so far a 5% decrease in 2011 effort compared to the same period in 2010.
- Norway: Mesh size data for 2011 is at present not available for the métiers that have been used up to 2010. At present, it is not known if these data can be provided by the 2012 data submission.
- UK: effort uptake for the UK according to gears regulated under the cod LTMP is available (see web address below). At present it is not known whether these totals can be divided into totals for UK(England, Wales and Northern Ireland) and UK(Scotland).

[http://www.marinemanagement.org.uk/fisheries/statistics/documents/effort/110816\\_crz.pdf](http://www.marinemanagement.org.uk/fisheries/statistics/documents/effort/110816_crz.pdf)

The conclusion from this investigation is that concerning the first half of 2011, there is no indication of any major effort reduction for the countries and gears for which information could be made available. In consequence, the **Ef\_Mgt** scenario is likely to

be unrealistic, and cannot be used as the basis for advice. This consideration is corroborated by the conclusions from STECF/ICES WKROUNDMP (2011), which underlined the design issues in the effort management regime, with initial baselines that are defined too high, and with annual effort reduction targets that can be interpreted in many ways and can thus be circumvented.

By contrast, it is the WGMIXFISH perception that the **sq\_E** scenario may be the most realistic scenario for the intermediate year, and a mixed-fisheries advice for 2012 could be based on this option.

## 5.2 Workshop on co-ordinated data calls

What follows below is an initiative to solve current data issues occurring in WGNSSK and WGMIXFISH from the data end-users perspective. It is meant to be complementary to the work currently being performed by data providers at RCMs and PGCCDBS etc.

A one day workshop was convened to discuss the practicalities and feasibility of issuing a single data call for the purposes of WGNSSK and WGMIXFISH thus avoiding duplication of effort and addressing the inconsistencies which sometimes arise between the data sets provided to the two groups. The membership of WGMIXFISH was augmented by 5 participants, via web-ex (Scotland and England) and physical representation from Germany and Denmark. In total 5 hours were spent in discussion and significant progress was made.

It was briefly considered to try and harmonise the ICES data call with the STECF 'effort regime' data calls but it quickly became clear that this could not be done because

- The STECF data are at the discretion of the EU commission
- As such STECF data calls could be subject to change
- The practicalities of data collection means that the sampling frames used by different member states do not necessarily match up directly with the DCF format.

The potential number of disaggregation categories prescribed by the current WGMIXFISH data call is in excess of 380 (the STECF data call potentially has over 500 categories). The DCF currently requires the collection of biological data at level 6 of the metier structure given in Appendix IV of Commission Decision 2008/949/EC. The Level 6 metiers are defined by gear type, target assemblage, mesh size and physical characteristics of any selectivity devices fitted (in practice the latter are rarely included in the metier definitions given by the Regional Coordination Meetings, as this is not a mandatory reporting requirement on EU logbooks). The metier represents a principal domain of interest for which sampling data are required. Table 4 of the RCM (2010) report gave a list of 18 broader levels based on those comprising 90% of either landings, effort or value (of which only 8 have any real significance to the demersal stocks of the North Sea) and was proposed as a starting point for a more practical data call. Three problems with this list were identified

- 1) The mesh size categories at level 6 are based on the Council Reg. 850/1998 and are not necessarily consistent with the current effort regime therefore making the link between biological data and fisheries management difficult, e.g. the current gear regulation in the Skagerrak uses a different mesh size range for the Nephrops fishery than in the North Sea, and the DCF level 6 have been defined accordingly, however they are managed under the same category (TR2) in the current cod long term management plan.

- 2) Fleet/metiers important to one or more member state are not listed in the 18 broader RCM levels mentioned above, e.g. the large mesh size beam trawl metier (corresponding to BT1).
- 3) Species specific fleets/metiers (i.e. fleets/metiers exclusively targeting Saithe) could not be distinguished. This last point could be readily addressed by including an additional field in the metier name to distinguish these (i.e. invoking the use of the 'level 7' of the metier definition matrix which can be defined at the national level).

Prior to 2009, precursors to WGMIXFISH compiled age-disaggregated data over a large number of categories. Analyses in 2008 highlighted that the age composition of landings showed distinct differences between that supplied to WGNSSK and therefore it was decided to run projections on the basis of total landings and discards alone. The data supplied to WGNSSK is often aggregated to a level considerably higher than desirable for fleet based analysis and, as the raising is done largely within country, there are hidden assumptions and aggregations. Raising entirely within country also prevents the potential for sharing of sample strata. A single data call needs to reconcile the requirement of the two groups and to make the process of raising international catches more transparent.

During the discussion two different starting positions became clear, one opinion being that data should be provided at the DCF metier level, the other being that data should only be disaggregated to the level of the sampling scheme employed in order to retain the statistical integrity of the data. It became clear that sampling schemes may not necessarily be the same as the DCF metier matrix. Ignoring the sampling design when raising catch data can lead to significant bias and error in the final estimates of numbers at age/length. This second opinion implies that data calls should simply request raised catch data, and landings only for those metiers not sampled (effort data would simply match these categories).

Three categories of catch data can be considered according to their biological sampling intensity, category 1 (C1) are those strata with adequate biological sampling to provide age disaggregated data, category 3 (C3) are those strata with no sampling and category 2 (C2) are those strata with some samples but where the quality or quantity are not considered robust enough on their own. In order to ensure the effort expended in collecting these C2 data is not wasted, some system is required for the ability to collate and pool these samples prior to their use. There was some debate with regards to C3 strata, as to whether they should be treated as individual metiers, or grouped into broader categories (e.g. TR1, BT2 etc). It was concluded member states should be free to aggregate as they see fit in anticipation of allocation to suitable age compositions.

ICES has been encouraging working groups to utilise the InterCatch database system to report and raise catch data for a number of years and WGNSSK has been making progress in recent years. A large push towards the use of InterCatch will be made in 2012 as the historically used spreadsheet process of exchanging and raising roundfish data will cease. The FishFrame database is anticipated to provide additional functionality which will be of benefit to WGMIXFISH, but although it is ICES' intention to convert to this database and exchange format this can not happen in 2012 as FishFrame is currently not fully operational. Therefore it is the intention of WGMIXFISH (and therefore WGNSSK) to utilise the InterCatch system.

At present sampled landings for a metier entered into InterCatch must be raised to the total landings of that metier. Whilst this is appropriate for C1 strata, it is not con-

sidered appropriate to be required to raise C2 strata to landings in order to make the underlying sampling available (i.e. in case pooling the C2 samples may be of some use). Data submitters and stock coordinators will need to collaborate prior to entering data into InterCatch in order to determine how C2 samples can be used. Given that data for submission are to be prepared in InterCatch format it seems sensible that C2 sample data are also prepared in InterCatch format, however a tool for reading them and manipulating/aggregating them needs to be constructed.

There was some discussion regarding harmonisation of codes for country and species. ICES plans to adopt codes that conform to ISO 3166-1 but internal database codes do not currently. Until that time, ICES standard codes should continue to be used.

The group concluded that data submission would follow the statistically robust route and that age disaggregated data would be provided at the level of the sampling frame. A list of which metiers contribute to each sampling level will be provided. As a first step, a description of the sampling design along with a map of metiers to samples and likely categorisation into C1, C2 and C3 is to be provided by **September 15<sup>th</sup> 2011**. Subsequently national laboratories are requested to work up the 2010 catch at age data (including discards) for all stocks assessed at MIXFISH, to be submitted to ICES by the **1<sup>st</sup> December 2011** in InterCatch format. C1 level strata should be entered directly as aged data. Landings and effort for sampling categories C2 and C3 should be entered as landings and effort only. C2 level sample data will need to be sent to a central data coordinator and a process devised for storing the data in a common format. The working group could not identify who should do this and therefore did not consider it possible in time for the 2012 WGNSSK. **In order to prevent over-writing existing 2010 data, this test data MUST be submitted with the year changed to 1111.**

A meeting (possibly web-ex) will then be convened (**5 December**) to investigate the submitted data and to decide how to deal with C2 and C3 level landings. It is important that this meeting comprises data submitters as well as stock coordinators so that the processes and pit-falls are understood by all parties.

The group expressed the hope that the conclusions from this data workshop can be fed back to the North Sea RCM meeting in September. The working group considers that the combined support of data providers (including RCMs and PGCCDBS) and stock assessors is essential for the success of this initiative.

### 5.3 Future developments for WGMIXFISH

The following sections (5.3.1 and 5.3.2) reflect discussions held amongst members of WGMIXFISH and between the WG and an observer from the EU Commission.

#### 5.3.1 Towards mixed-fishery management plans

At present, WGMIXFISH provides annual advice on the implications of single stock management advice in the context of the mixed fisheries of the North Sea. In practice the TAC advice for many of the North Sea demersal stocks is derived from long-term management plans for those stocks. A logical development for the work of the WG would be the explicit incorporation of mixed-fishery effects within long-term management plans. Recent proposals on the reform of the European Union's Common Fisheries Policy (CFP) provide a context for this. Long-term management plans have been an important component of EU fisheries management since the 2002 CFP reform. Public consultation in relation to the recent reform proposals has found very



strong support for the implementation of long-term management plans (CEC, 2011a). The current proposals (CEC, 2011b) widen the basis for the use of management plans as follows:

“Multi-annual plans should where possible cover multiple stocks where those stocks are jointly exploited. The multiannual plans should establish the basis for fixing fishing opportunities and quantifiable targets for the sustainable exploitation of stocks and marine ecosystems concerned, defining clear timeframes and safeguard mechanisms for unforeseen developments.”

The proposals also give more detail on the anticipated content of management plans in this context (see Article 11 in CEC, 2011b).

In the North Sea, mixed-fishery effects have been implicated as a contributing factor to the lack of recovery of the cod stock (Bannister, 2004; Hamon *et al.*, 2007; STECF/ICES WKROUNDMP 2011), hence the demersal stocks of the North Sea would be an obvious candidate for a mixed-fishery management plan of the type anticipated in the CFP reform proposals.

The scientific input to long-term management plans generally involves the evaluation of harvest control rules, the parameters of which are typically derived from simulation studies. Such studies also provide a means of translating the objectives of the plan (e.g. “Achieve MSY”) into numeric values, i.e. a target  $F$  that is likely to lead to maximum long-term yield. In any move to a mixed-fishery management plan, there would be a need to revisit both the objectives of the plan and the associated harvest control rules. There would also be a need to address the linkages between the different stocks within the plan, i.e. the mixed-fishery interactions.

With regard to the possible objectives of a mixed fishery plan, questions arise as to whether MSY objectives should be set, e.g. as a set of single stock MSY targets, or in more ecological and/or socio-economic terms. Similar questions arise with regard to candidate HCRs, i.e. could TACs be specified on some combined basis with constraints on catches of individual stocks. Experience with similar approaches off Alaska and New Zealand might be instructive here. The issue of how to deal with linkages between stocks might be best addressed by comprehensive simulation/management strategy evaluation studies with full, explicit representation of technical interactions in the way that is possible with the Fcube approach (Ulrich *et al.*, 2011).

### **5.3.2 Roadmap for fuller integration of mixed fisheries forecasts into stock advice**

After discussions with an observer from the EU commission and the head of the ICES advisory programme it is clear to the group that one of the biggest obstacles to the integration of mixed fisheries projections into stock advice is the current timing of the working group. Single species advice is issued in June and WGMIXFISH currently meets at the beginning of September, by which time the single species advice has gained a certain ‘momentum’. Fcube is conditioned on the input data and assumptions of the single species short term forecasts requiring WGMIXFISH to be held once the single species assessments have been completed but if WGMIXFISH could be held before ICES ADGNS that would allow mixed fisheries forecasts to be considered by the advice drafting group and important points of note to be included under management considerations in the advice sheets.

ACOM proposed WGMIXFISH meet in May 2011 but it was not possible to identify a time before ADGNS when experts needed for WGMIXFISH were not already committed to other meetings (both ICES and STECF). Providing data to WGNSSK and WGMIXFISH according to separate specifications by May was also impracticable for some member states. The working group believes that careful coordination between ICES and STECF would allow time for WGMIXFISH to convene in early June. The revised data call allowing a joint data submission for both WGNSSK and WGMIXFISH should remove the second logistic obstacle to mixed fisheries forecasts being considered before ADGNS.

Ultimately the mixed fisheries forecasts need to be more fully integrated into single species advice than simply consideration by ADGNS for comments under management considerations. One idea is for an iterative process whereby Fcube is used to test the likelihood of assumptions made in single species short term forecasts, which in turn implies the mixed fisheries forecasts being imbedded into the WGNSSK meeting. It is not felt this should be attempted before the ability to make a joint WGNSSK/WGMIXFISH data submission has been proven. However the process of making the mixed fishery forecast runs and compiling the output tables and figures from those runs may have become sufficiently routine for WGMIXFISH to meet by WebEx rather than in a physical location.

A meeting by WebEx (or by correspondence) is not considered appropriate for work focused on methodological advances. WGMIXFISH this year identified two new scenarios that should improve understanding of the dynamics of the North Sea mixed fisheries. It was therefore considered that if a purely operational WGMIXFISH meeting (physical or virtual) was held in June to inform that year's advice, a second meeting (held as now in August/September) could be convened to focus on methodological development, taking on board output from research projects such as EU framework projects and with possible collaboration with other working groups addressing a holistic view of the North Sea e.g. ICES WGSAM and WGINOSE.

## 6 Conclusions and Recommendations

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As last year the WGMIXFISH has produced a North Sea Mixed Fisheries advice (Annex 4) for use by ACOM. The associated North Sea Mixed Fisheries Annex (Annex 5 to the WGMIXFISH\_2010 report) has been made a separate document:

<http://www.ices.dk/reports/ACOM/2011/WGMIXFISH/North%20Sea%20Mixed%20Fisheries%20Annex.pdf>

No methodological problems were encountered with the Fcube package, although some changes were required to accommodate the methodological changes in the cod assessment and forecast procedures. But issues were encountered with respect to data submissions. Errors in and/or incomplete submission of data meant the dataset for the Fcube software was only completed part way through the meeting.

To increase trust in the results from alternative scenarios it is considered important for the Fcube code to reproduce as exactly as possible the single species projections in the first instance. At WGMIXFISH\_2010 producing the 'baseline' run exposed detailed differences in short term forecast methodology between species that are unrelated to restrictions imposed by different software packages. The WG notes there remains no agreed standard approach to e.g. scaling a mean selection pattern to terminal year mean F. Reproducing the single-stock advice led to the discovery of a mis-

take in the computation of the whiting advice published in June 2011, which will be amended.

The use of multiple Fcube scenarios leads to a very data rich set of results. The move to give single species advice according to a single criteria (management plan if it exists, FMSY transition otherwise) helps reduce the level of complexity and is welcomed by WGMIXFISH. The **max** and **min** scenarios were included to bracket the space of potential catch and SSB outcomes but for most fleets are considered unrealistic scenarios.

The effect of fleet behaviours on

- The TAC set for 2012 (assuming perfect knowledge of catches in the intermediate year),
- The amount caught compared to single species TAC recommendations,
- The SSB remaining at the start of 2013,

all need to be considered when reviewing the results of mixed fisheries analysis and this process will continue beyond this WG. However, some initial conclusions are that

Results across scenarios are similar for the intermediate year. This overall result can be attributed to a number of factors

- Assumptions for the intermediate year in the single species cod forecast more in line with an assumption of status quo effort.
- Data provided to WGMIXFISH showing reduced catchabilities on cod by significant cod catching fleets.
- Increases in assessed cod SSB in recent years.
- The introduction of a long term management plan for whiting.

Results from the cod scenario were very similar to the **sq\_E** scenario. The **Ef\_Mgt** scenario intermediate year landings are (as in the forecasts performed in 2010) as restrictive as, if not more restrictive than, those from the **min** scenario. Data supplied to WGMIXFISH as well as other expert groups suggest, however, that effort in fleets subject to the EU effort regime have not to date reduced effort by the amounts expected from a straightforward interpretation of the effort regulations. The working group is therefore investigating the possibility of using within year effort uptake as an alternative to the **Ef\_Mgt** scenario (see section 5.1)

The advised single stock TACs for 2012 can not be said to be consistent given the current landings compositions of North Sea fleets as can be seen from Figure 4.2.2.2. If the TAC for cod is assumed to limit the activity of fleets (**cod** scenario) the forecasts predict considerable underutilisation of other TACs, particularly those for haddock and plaice. Interestingly the **Ef\_Mgt** scenario is predicted to lead to an overshoot of cod landings but an even bigger underutilisation of haddock quota than under the **cod** scenario. While the “cod” scenario affects almost all metiers, thus sharing the burden of F reduction across most fleets and countries, the **Ef\_Mgt** scenario affects uniquely and to a larger degree the trawl metiers, which catch the bulk of haddock landings.

Results showing the effort required for different fleets to fully utilise the different quotas available to them (Figure 4.2.2.1.2) suggest that for a number of significant fleets cod is not the limiting stock in 2011. The revised perception of stock status and reduced TACs in recent years appears to have made saithe the limiting stock for a

number of fleets. The working group felt, however, that the true mixed fisheries effects of the TACs on other demersal species (and vice versa) are currently clouded by incorporation of effectively 'clean' saithe targeted vessels as a métier within fleets catching a broader mix of species.

The data calls used for WGMIXFISH\_2010 and WGMIXFISH\_2011 were derived from those used currently for the STECF 'effort' expert working groups. When formulated it was hoped the calls would be sufficiently similar that additional work for national data providers could be minimised. However, as described in section 5.2 the requirements of STECF and mixed fisheries forecasts are sufficiently different that what resulted was a data request still requiring considerable effort on the part of national data providers to service but which is not ideal for mixed fishery projections. It is also recognised by WGMIXFISH and the wider ICES advice community that for mixed fishery forecasts to play a full role in considerations of future TAC and effort allowances they need to be available alongside the ICES single species advice in June. A major obstacle to a meeting of WGMIXFISH earlier in the year was the inability of member states to service different data requirements for the North Sea stock assessments (WGNSSK), STECF "effort" meeting and WGMIXFISH all by early May. As a result of intercessional dialogue and a data workshop held on the second day of the WGMIXFISH it was agreed a single data call sufficient for both WGNSSK and WGMIXFISH was possible and work is already underway to take this forward with the first joint data submission in 2012.

The joint WGNSSK-WGMIXFISH data call does not affect data submissions to STECF, however, WGMIXFISH still recommends to the EU commission that métier classes be made compatible between the effort, catch and economic datasets requested of nations by STECF as soon as possible.

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**Table 1.2.1, Council regulations introducing and modifying fishing effort (days at sea) allowances in EU fisheries.**

<b>Year of application</b>	<b>Regulation</b>
2003	(EC) No 2341/2002–Annex XVII
2004	(EC) No 2287/2003–Annex V
2005	(EC) No 27/2005–Annex IVa
2006	(EC) No 51/2006–Annex IIa
2007	(EC) No 41/2007–Annex IIa
2008	(EC) No 40/2008–Annex IIa
2009	(EC) No 43/2009–Annex IIa
2010	(EU) No 23/2010–Annex IIa
2011	(EU) No 57/2011_Annex IIa

**Table 3.1.1.1: Summary of the TACs and target Fs/harvest ratios resulting from the Advice Approaches considered by ICES. Target Fs are left justified; harvest ratios are right justified. Where a stock does not have a management plan the TAC following the Commission communication COM (2011) 298-final was used. The advice approach used for WGMIX-FISH forecasts is highlighted in bold.**

Species	Transition to an MSY approach		Precautionary Approach		Management Plan / Policy paper	
	TAC	Target F / Harvest ratio	TAC	Target F / Harvest ratio	TAC	Target F / Harvest ratio
Cod IIIa-IV-VIIId	< 42 000 t	0.44	zero	0.00	<b>&lt; 31 800 t (MP)</b>	<b>0.32</b>
Haddock IIIa-IV	< 43 000 t HC	0.30	< 86 000 t HC	0.70	<b>&lt; 41 575 t HC (MP)</b>	<b>0.29</b>
Plaice IV	< 74 000 t	0.25	< 155 500 t	0.60	<b>&lt; 84 410 t (MP)</b>	<b>0.29</b>
Sole IV	< 15 100 t	0.29	< 19 700 t	0.40	<b>&lt; 15 700 t (MP)</b>	<b>0.31</b>
Saithe IIIa-IV-VI	< 75 000 t	0.40	zero	0.00	<b>&lt; 87 544 t (MP)</b>	<b>0.48</b>
Whiting IV-VIIId	n/a <sup>1</sup>	n/a	n/a <sup>1</sup>	n/a	<b>&lt; 21 275 t (MP)</b>	<b>0.23</b>
Nephrops in Botney Gut (FU 5)	Reduce catches <sup>2</sup>	n/a	n/a	n/a	<b>&lt; 704 t (Pol)</b>	<b>n/a</b>
Nephrops in Farn Deep (FU 6)	< 1 400 t	8.2	n/a	n/a	<b>&lt; 1 400 t (Pol)</b>	<b>8.2</b>
Nephrops Fladen Ground (FU 7)	< 14 100 t	10.3	n/a	n/a	<b>&lt; 14 100 t (Pol)</b>	<b>10.3</b>
Nephrops in Firth of Forth (FU 8)	< 1 700 t	17.5	n/a	n/a	<b>&lt; 1 700 t (Pol)</b>	<b>17.5</b>
Nephrops in Moray Firth (FU 9)	< 1 100 t	11.8	n/a	n/a	<b>&lt; 1 100 t (Pol)</b>	<b>11.8</b>
Nephrops in Noup (FU 10)	n/a <sup>3</sup>	n/a	Reduce catches <sup>3</sup>	n/a	<b>&lt; 80 t (Pol)</b>	<b>n/a</b>
Nephrops in Norwegian Deep (FU 32)	Reduce catches <sup>4</sup>	n/a	n/a	n/a	<b>&lt; 900 t (Pol)</b>	<b>n/a</b>
Nephrops in Moray Firth (FU 33)	Reduce catches <sup>5</sup>	n/a	n/a	n/a	<b>&lt; 907 t (Pol)</b>	<b>n/a</b>
Nephrops in Other rectangles (NEPOTH)	n/a <sup>6</sup>	n/a	n/a	n/a	<b>&lt; 1 419 t <sup>6</sup> (Pol)</b>	<b>n/a</b>

<sup>1</sup> Value adopted from Management Plan: 21 275 t HC

<sup>2</sup> Value adopted from the Policy paper category 3 (-25%): 704 t

<sup>3</sup> Value adopted from the Policy paper category 3 (-25%): 80 t

<sup>4</sup> Value adopted from the Policy paper category 3 (-25%): 900 t

<sup>5</sup> Value adopted from the Policy paper category 3 (-25%): 907 t

<sup>6</sup> Value adopted from the Policy paper category 3 (-25%): 1419 t

Table 3.2.2.1: Métiers consistent with the cod long term management plan and AER database.

<b>Gear</b>	<b>Mesh Size</b>	<b>fleet</b>	<b>Métier</b>
Gillnet			GN1
Pots		Static	OTH
Longlines			LL1
Trammel			GT1
Pelagic Trawl		Pelagic	OTH
Pelagic Seine			OTH
Demersale Seine	>=120		TR1
	110-119		
	90-99	Dseine	TR2
	80_89		
	70-79		
	16-31		TR3
Otter	>=120		TR1
	110-119		
	90-99	Otter	TR2
	80_89		
	70-79		
	16-31		TR3
Beam	>=120		BT1
	110-119		
	90-99	Beam	BT2
	80_89		
Dredge		Dredge	OTH



**Table 3.2.2.2: Final fleet and métier categories used in the mixed fishery analysis. 4, 3AN and 7D refer to the area.**

<b>fleet</b>	<b>metier</b>
BE_Beam	BT1.IV
	BT2.IV
	OTH
DK_Beam	BT1.IV
	OTH
DK_DSeine	TR1.3AN
	TR1.IV
DK_Otter<24	TR1.IV
	TR2.3AN
	TR2.IV
	OTH
DK_Otter>40	otter.IV
	TR3.IV
DK_Otter2440	TR1.IV
	TR2.IV
	TR3.IV
	OTH
DK_Static	GN1.3AN
	GN1.IV
	GT1.IV
	OTH
EN_Beam	BT1.IV
	BT2.IV
	OTH
EN_Otter<24	TR1.IV
	TR2.IV
	OTH
EN_Otter>24	TR1.IV
	TR2.IV
EN_Static	GN1.IV
	OTH
FR_Otter	TR1.IV
	TR2.7D
	TR2.IV
	OTH

<b>fleet</b>	<b>metier</b>
FR_Static	GT1.IV
	OTH
GE_Beam	BT2.IV
	OTH
GE_DSeine	TR1.IV
	OTH
GE_Otter	TR1.3AN
	TR1.IV
	TR2.IV
NL_Beam<24	BT2.IV
	OTH
NL_Beam>40	BT2.IV
	OTH
NL_Beam2440	BT2.IV
	OTH
NL_Otter	TR2.IV
	OTH
NO_Otter>24	TR1.IV
	OTH
SC_Beam	BT2.IV
SC_DSeine	TR1.IV
SC_Otter<12	TR2.IV
	OTH
SC_Otter>24	TR1.IV
	TR2.IV
SC_Otter1224	TR1.IV
	TR2.IV
	OTH
SW_Otter	TR1.IV
	TR2.3AN
	OTH
OTH_OTH	OTH
unalloc	unalloc

Management plan		COD	HAD	PLE	POK	SOL	WHG
2011	Fbar	0.57	0.23	0.24	0.61	0.34	0.27
	FmultVsF09	0.85	1	1	1.03	1	1
	landings	42400	31400	68700	103000	15800	24100
	ssb	52300	235000	52300	13400	36000	207000
2012	Fbar	0.31	0.28	0.29	0.48	0.3	0.23
	FmultVsF09	0.46	1.19	1.2	0.81	0.9	0.84
	landings	31700	41600	84400	87600	15700	21300
	ssb	64900	25500	55600	106000	45500	20200
2013	ssb	10200	23100	58800	11100	45600	213000

Management plan		NEP5	NEP6	NEP7	NEP8	NEP9	NEP10	NEP32	NEP33	NEPOTH
2011	Harvest rate		0.1	0.1	0.22	0.13				
	FmultVsF09		1.13	1.13	1.13	1.13				
	landings	1100	1600	14500	2100	1200	40	460	910	1600
2012	Harvest rate		0.08	0.1	0.18	0.12				
	FmultVsF09		0.94	1.1	0.9	1.05				
	landings	700	1400	14100	1700	1100	80	900	910	1400

Management plan		COD	HAD	PLE	POK	SOL	WHG
2011	landings						
	Baseline	42400	31400	68700	103000	15800	24100
	ICES	41800	32000	69000	103000	15800	24400
	% difference	-1.4%	1.9%	0.4%	0.0%	0.0%	1.4%
2012	landings						
	Baseline	31700	41600	84400	87600	15700	21300
	ICES	31800	41575	84410	87544	15700	24300*
	% difference	0.3%	-0.1%	0.0%	-0.1%	0.0%	14.1%*

Table 4.2.1.3: Comparison between baseline run and ICES advice for *Nephrops* The values for *Nephrops* FUs that do not receive an absolute ICES abundance estimate are set according to the policy paper category 3 (-25%). No 'ICES advice' values are given for *Nephrops* in the intermediate year because the baseline run uses values based on recorded landings in the previous year which can vary significantly from the advice for each FU.

[illegible]

**Table 4.2.2.1: Results of running Fcube scenarios on intermediate year (2011). Comparison of the actual TAC, baseline landings according to the single-stock projection, and potential landings in the various scenarios.**

	COD	HAD	PLE	POK	SOL	WHG				
TAC2011	32200	36100	73400	102000	14100	14800*				
baseline	42400	31400	68700	103000	15800	24100				
cod	42400	35200	68000	108000	15300	29200				
Ef_Mgt	36100	24100	60400	93000	13700	20600				
max	57400	52700	98600	144000	19500	43000				
min	34300	28700	43900	80400	7900	22300				
sq_E	41900	32500	73200	101000	17000	26300				
* Whiting TAC for area IV only										
	NEP10	NEP32	NEP33	NEP5	NEP6	NEP7	NEP8	NEP9	NEPOTH	
TAC2011	40	460	910	1100	1600	14500	2100	1200	1600	
baseline	40	460	910	1100	1600	14500	2100	1200	1600	
cod	40	450	900	1100	2000	13800	2100	1200	1500	
Ef_Mgt	30	310	600	720	1400	9200	1500	810	1000	
max	50	520	1000	1200	2200	14900	3300	1500	1800	
min	30	350	700	830	1400	10800	1700	950	1200	
sq_E	40	420	830	980	1900	12700	2000	1100	1400	

**Table 4.2.2.3. Results of Final Fcube runs.**

	year	scenario	COD	HAD	PLE	POK	SOL	WHG	NEP10	NEP32	NEP33	NEP5	NEP6	NEP7	NEP8	NEP9	NEPOTH	NEP total	
LANDINGS	2012	BASELINE	31700	41600	84400	87600	15700	21300	80	900	910	700	1400	14100	1700	1100	1400	22290	
Fbar	2011	baseline	0.57	0.23	0.24	0.61	0.34	0.27 -	-	-	-		0.1	0.11	0.22	0.13 -		A	
	2012	baseline	0.31	0.28	0.29	0.48	0.3	0.23 -	-	-	-		0.08	0.1	0.18	0.12 -			
FmultVsF10	2011	baseline	0.85	1	1	1.03	1	1 -	-	-	-		1.13	1.13	1.13	1.13 -		B	
		cod	0.85	1.14	0.99	1.1	0.96	1.25 -	-	-	-		1.37	1.08	1.12	1.14 -			
		Ef_Mgt	0.69	0.75	0.87	0.9	0.85	0.84 -	-	-	-		0.94	0.72	0.79	0.78 -			
		max	1.3	1.79	1.51	1.65	1.29	1.98 -	-	-	-		1.52	1.16	1.77	1.43 -			
		min	0.65	0.91	0.62	0.76	0.46	0.92 -	-	-	-		0.99	0.84	0.92	0.92 -			
		sq_E	0.84	1.04	1.07	1	1.09	1.11 -	-	-	-		1.29	0.99	1.07	1.06 -			
	2012	baseline	0.46	1.19	1.2	0.81	0.9	0.84 -	-	-	-		0.94	1.1	0.9	1.05 -			
		cod	0.46	0.62	0.54	0.6	0.53	0.68 -	-	-	-		0.75	0.59	0.61	0.63 -			
		Ef_Mgt	0.55	0.46	0.75	0.79	0.79	0.58 -	-	-	-		0.56	0.42	0.47	0.46 -			
		max	1.34	1.82	1.6	1.69	1.46	2.06 -	-	-	-		1.64	1.24	1.85	1.53 -			
		min	0.44	0.61	0.43	0.51	0.32	0.64 -	-	-	-		0.69	0.58	0.6	0.62 -			
		sq_E	0.84	1.04	1.07	1	1.09	1.11 -	-	-	-		1.29	0.99	1.07	1.06 -			
landings	2011	baseline	42400	31400	68700	103000	15800	24100	40	460	910	1100	1600	14500	2100	1200	1600	23510	C
		cod	42400	35200	68000	108000	15300	29200	40	450	900	1100	2000	13800	2100	1200	1500	23090	
		Ef_Mgt	36100	24100	60400	93000	13700	20600	30	310	600	720	1400	9200	1500	810	1000	15570	
		max	57400	52700	98600	144000	19500	43000	50	520	1000	1200	2200	14900	3300	1500	1800	26470	
		min	34300	28700	43900	80400	7900	22300	30	350	700	830	1400	10800	1700	950	1200	17960	
		sq_E	41900	32500	73200	101000	17000	26300	40	420	830	980	1900	12700	2000	1100	1400	21370	
	2012	baseline	31700	41600	84400	87600	15700	21300	80	900	910	700	1400	14100	1700	1100	1400	22290	
		cod	31700	22400	40500	67000	9900	16700	20	230	460	550	1100	7600	1100	650	800	12510	
		Ef_Mgt	39900	18100	56300	90300	14600	15600	20	170	330	400	800	5400	890	480	580	9070	
		max	55000	51800	95400	121000	21800	37700	50	520	1000	1200	2400	15900	3500	1600	1800	27970	
Ld_MgtPlan	2012	cod	31700	41600	84400	87600	15400	21300	80	900	910	700	1400	14100	1700	1100	1400	22290	D
		Ef_Mgt	34700	41600	84400	87600	14200	21300	80	900	910	700	1400	14100	1700	1100	1400	22290	
		max	25800	38500	77000	87600	16200	21300	80	900	910	700	1400	14100	1700	1100	1400	22290	
		min	35600	41600	84400	87600	12500	21300	80	900	910	700	1400	14100	1700	1100	1400	22290	
		sq_E	31900	41600	84400	87600	16200	21300	80	900	910	700	1400	14100	1700	1100	1400	22290	
	ssb	2011	baseline	52300	235000	523000	134000	36600	207000										E
		2012	baseline	64900	255000	556000	106000	45500	202000										
		2013	baseline	102000	231000	588000	111000	45600	213000										
	ssb	2012	cod	64900	250000	557000	102000	46000	195000										
			Ef_Mgt	72000	266000	569000	113000	47500	207000										
		max	48200	224000	507000	76300	42000	175000											
		min	74100	259000	597000	123000	53200	205000											
		sq_E	65400	254000	548000	108000	44400	199000											
	2013	cod	102000	250000	661000	121000	51800	213000											
	Ef_Mgt	106000	274000	653000	118000	48800	225000												
	max	44000	182000	501000	52600	36200	169000												
	min	116000	260000	728000	148000	61700	221000												
	sq_E	80000	236000	593000	100000	42200	203000												
ssb_MgtPlan	2013	cod	102000	225000	589000	106000	46500	207000										F	
		Ef_Mgt	112000	243000	607000	120000	49200	217000											
		max	77000	200000	530000	74400	41600	191000											
		min	115000	235000	647000	131000	56500	215000											
		sq_E	103000	229000	577000	113000	44000	211000											

### Share of Landings and Discards compare to single-species analyses

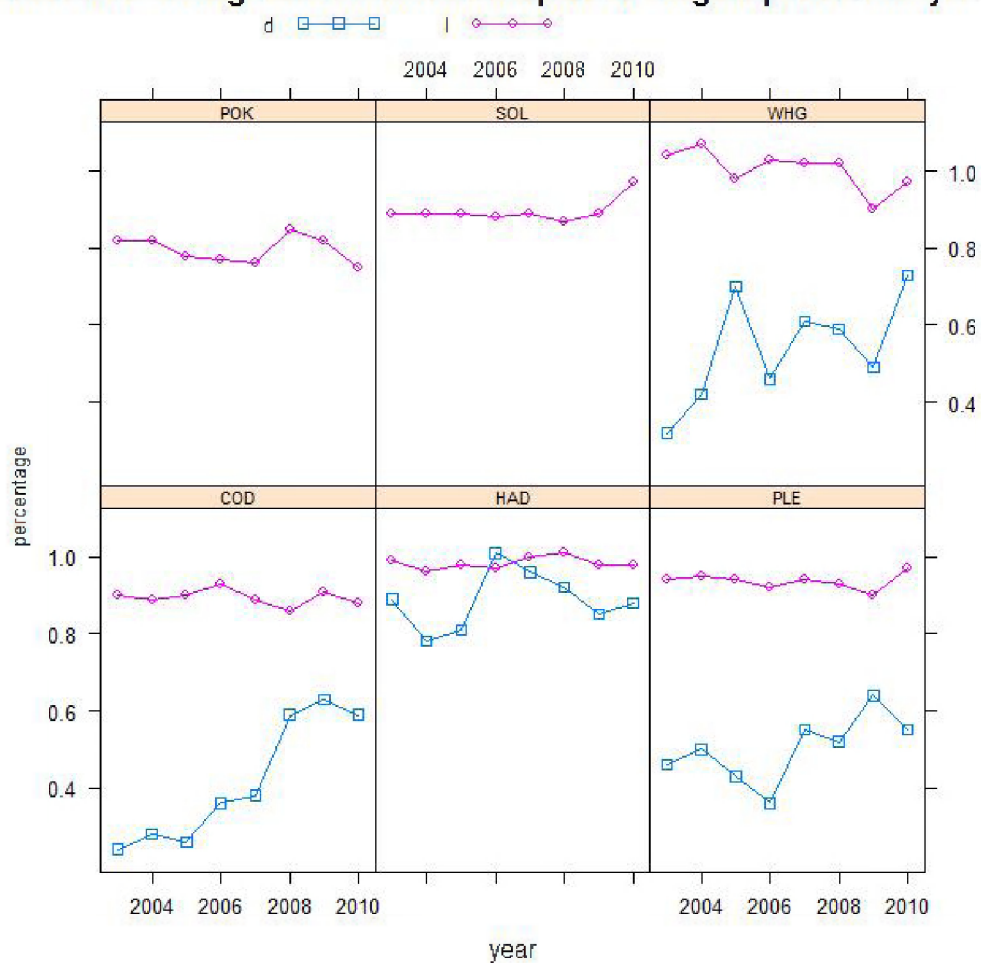


Figure 3.2.2.1. Ratio between the sum of landings and discards across fleets used in the MIXFISH analysis and the landings and discards estimated by the WGNSSK stock assessments.

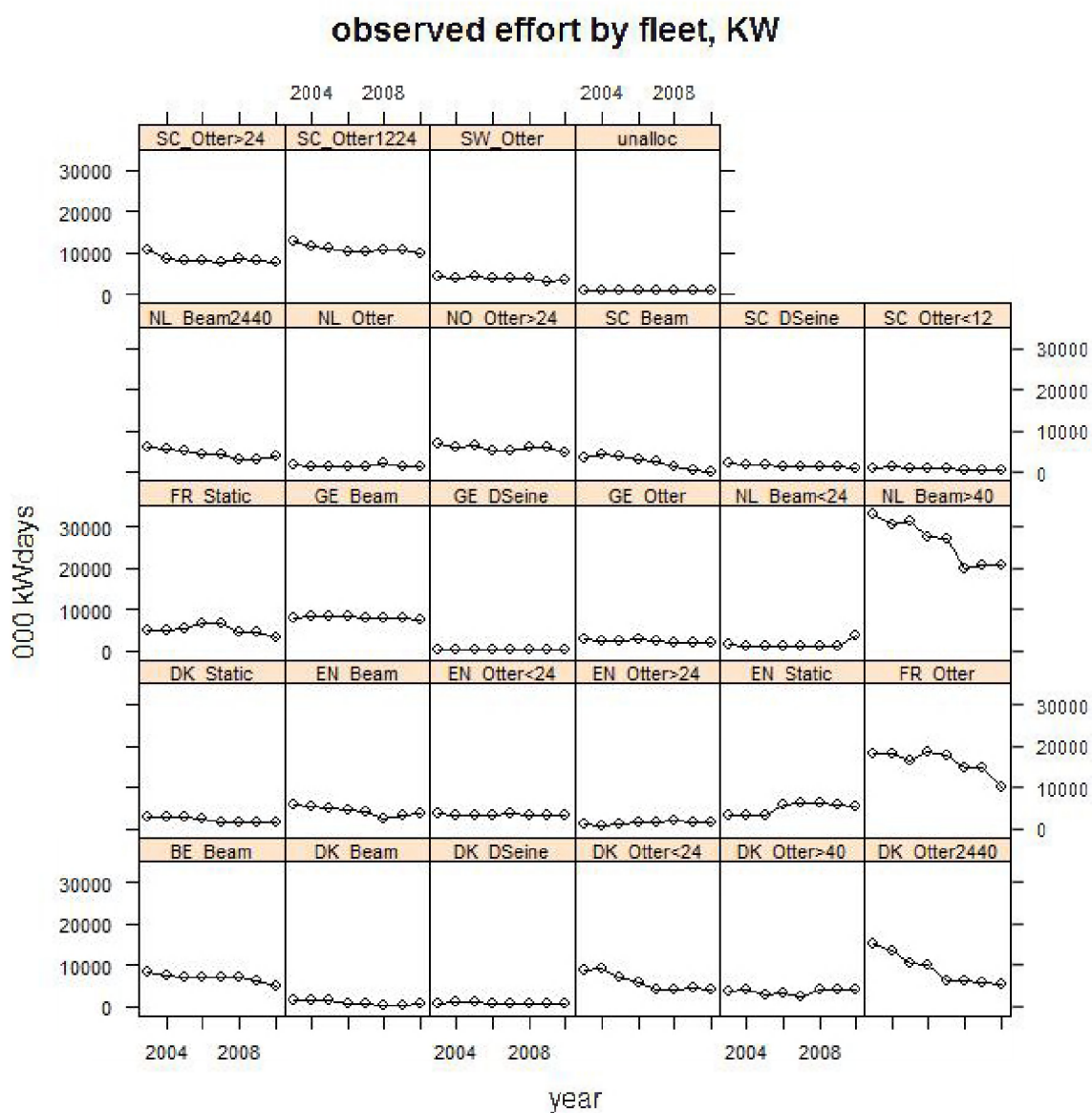
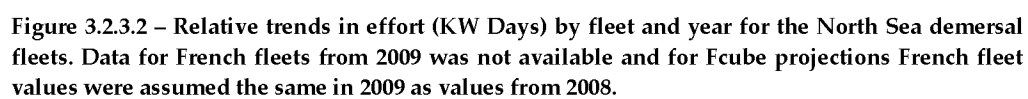


Figure 3.2.3.1 – Effort by fleet and year for the North Sea demersal fleets, in '000 KWdays. Data for French fleets from 2009 were not available and for Fcube projections French fleet values were assumed the same in 2009 as values from 2008.



**Figure 3.2.3.2 – Relative trends in effort (KW Days) by fleet and year for the North Sea demersal fleets. Data for French fleets from 2009 was not available and for Fcube projections French fleet values were assumed the same in 2009 as values from 2008.**

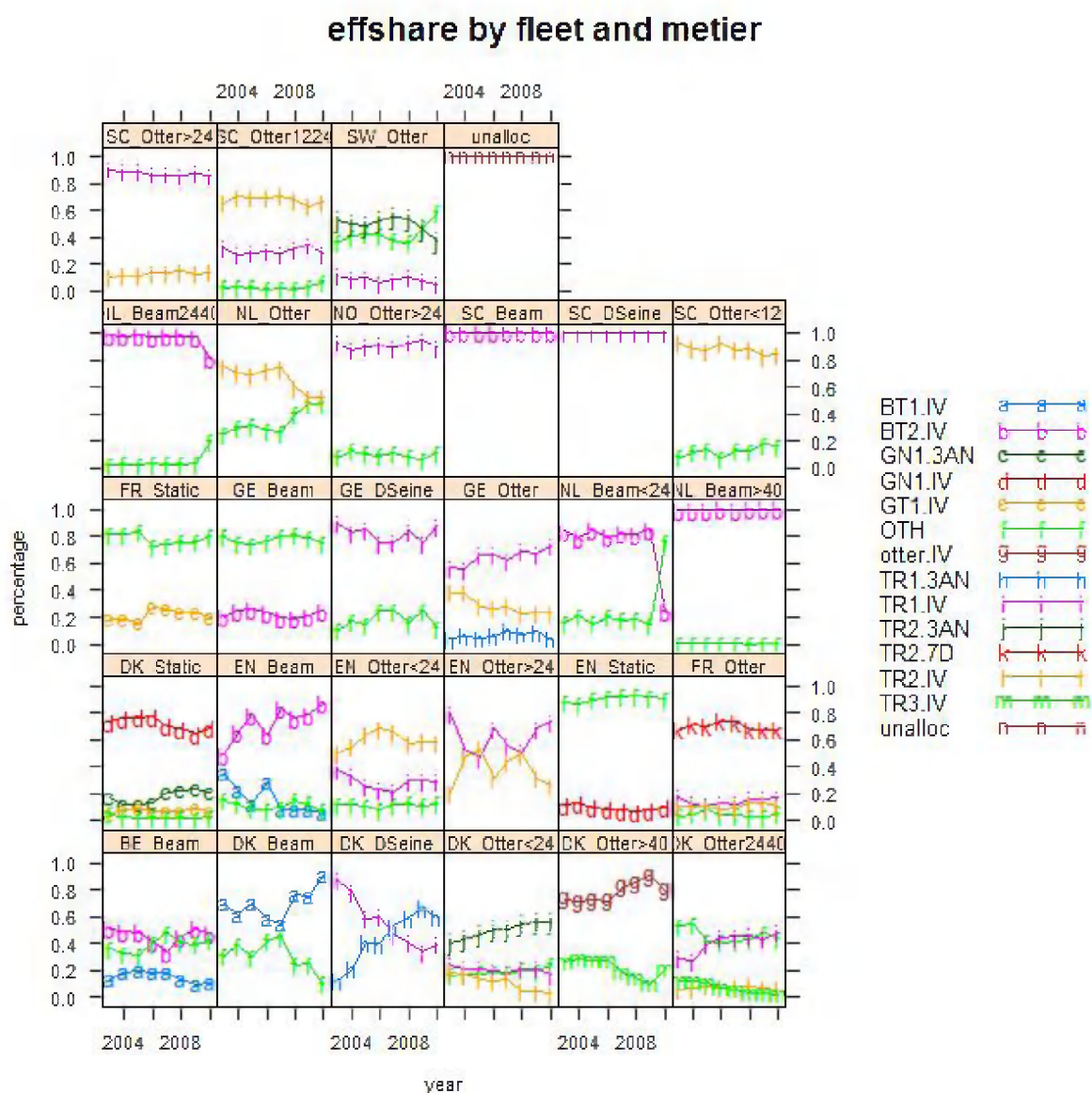
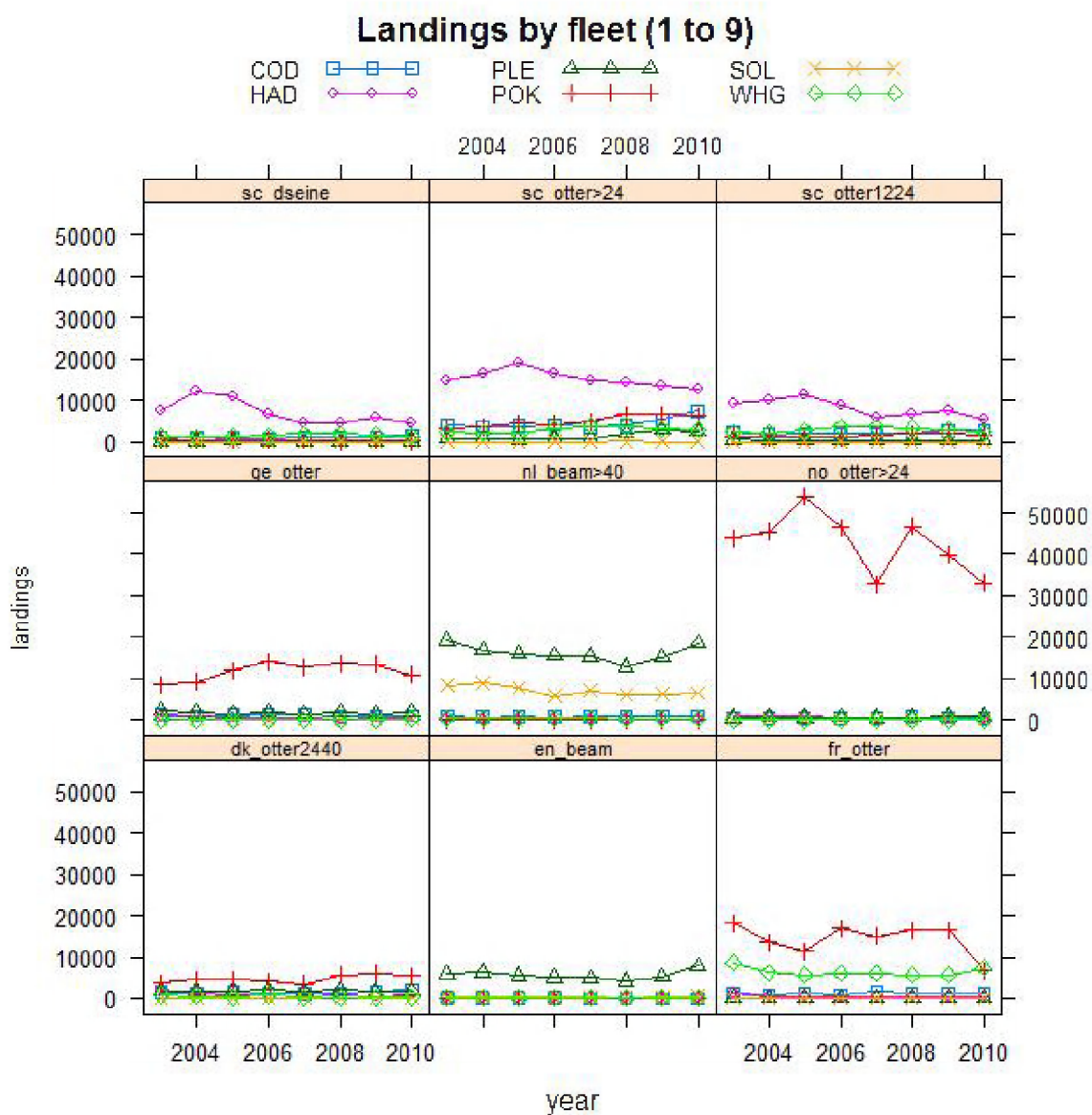


Figure 3.2.3.3 – Effort share (in proportion) by métier for each fleet.





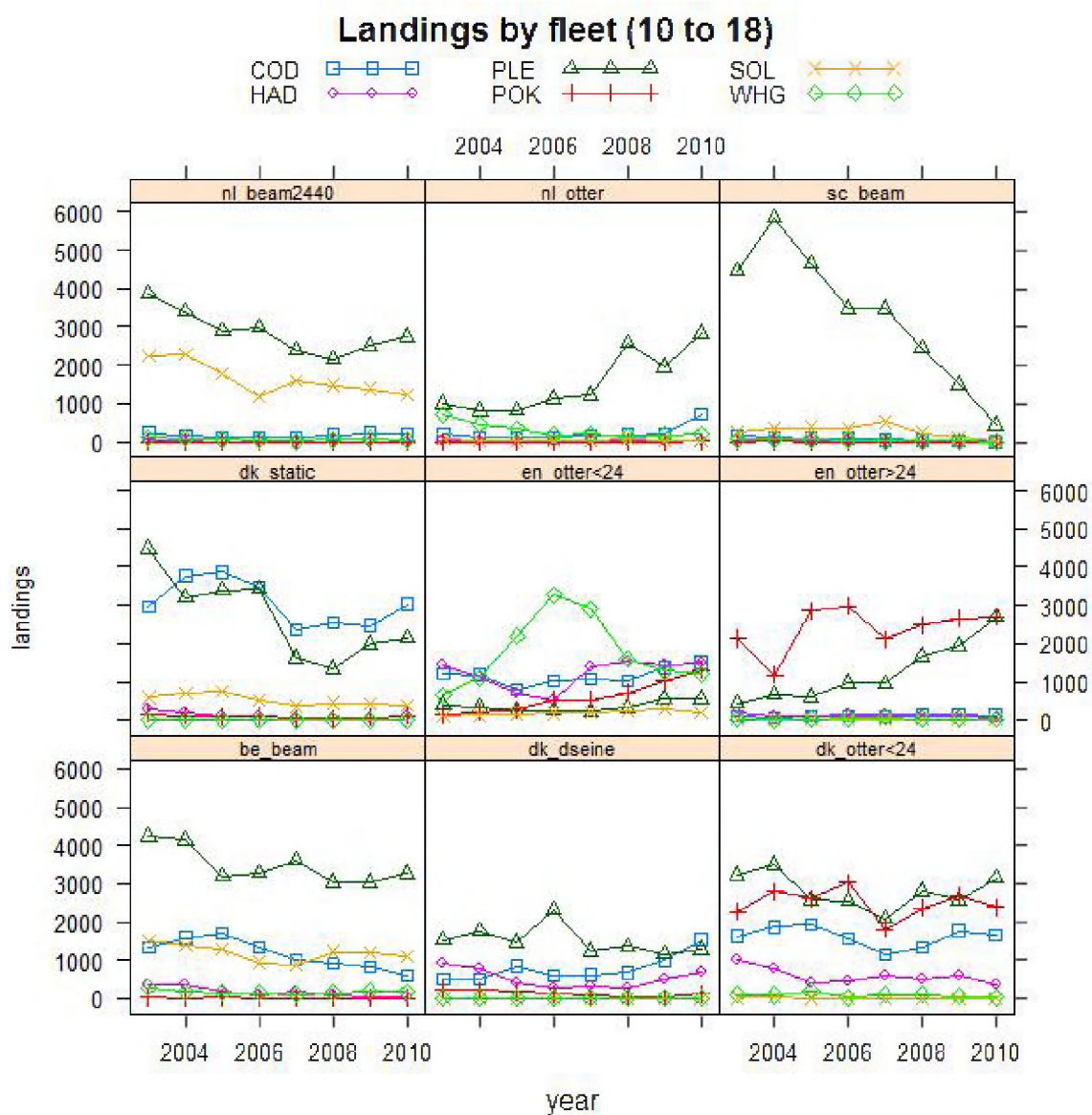


Figure 3.2.3.4 (cont). Landings by fleet, stock and year. Fleets are shown in decreasing groups of total landings and with different scales.

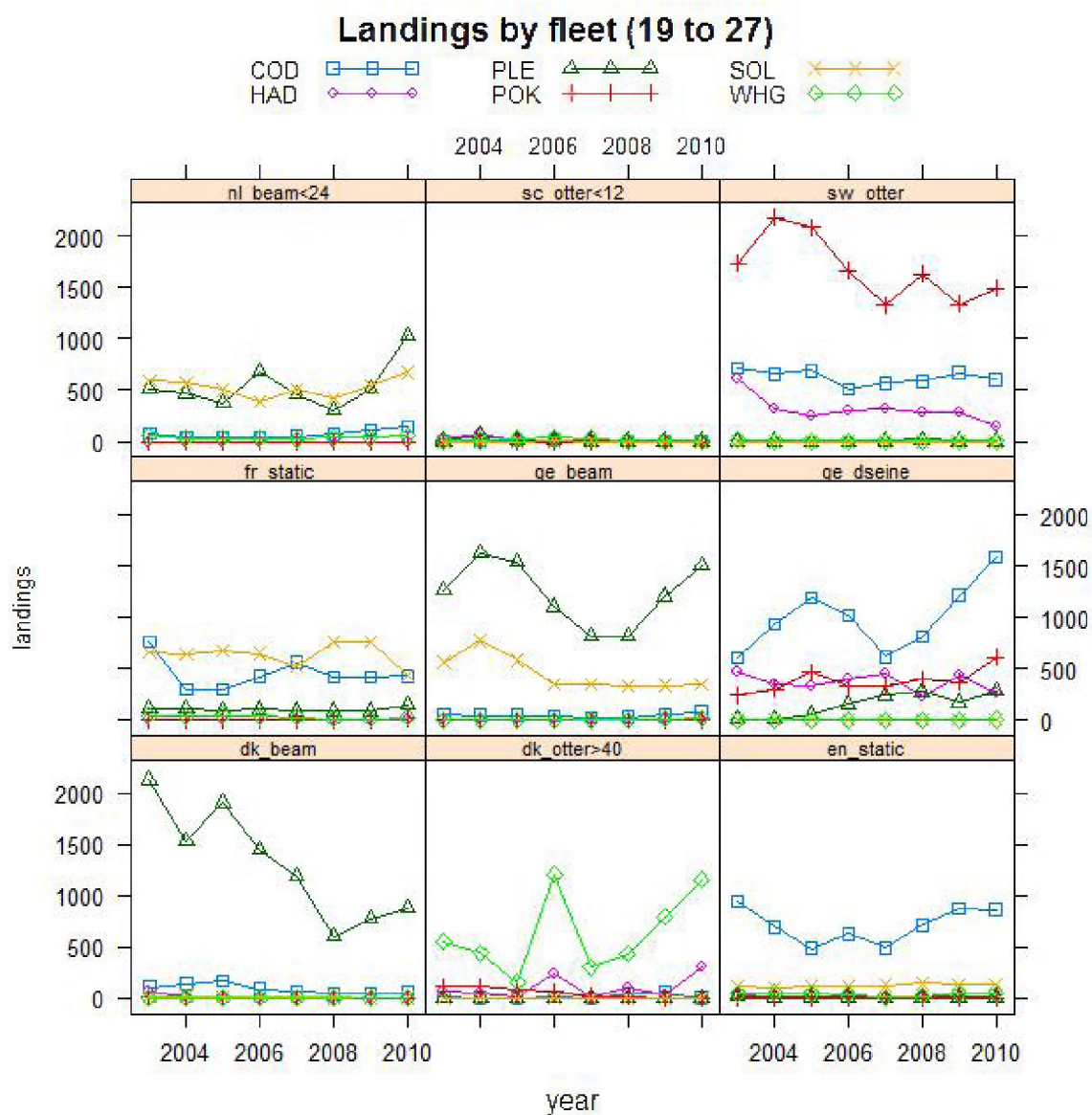


Figure 3.2.3.4 (cont). Landings by fleet, stock and year. Fleets are shown in decreasing groups of total landings and with different scales.

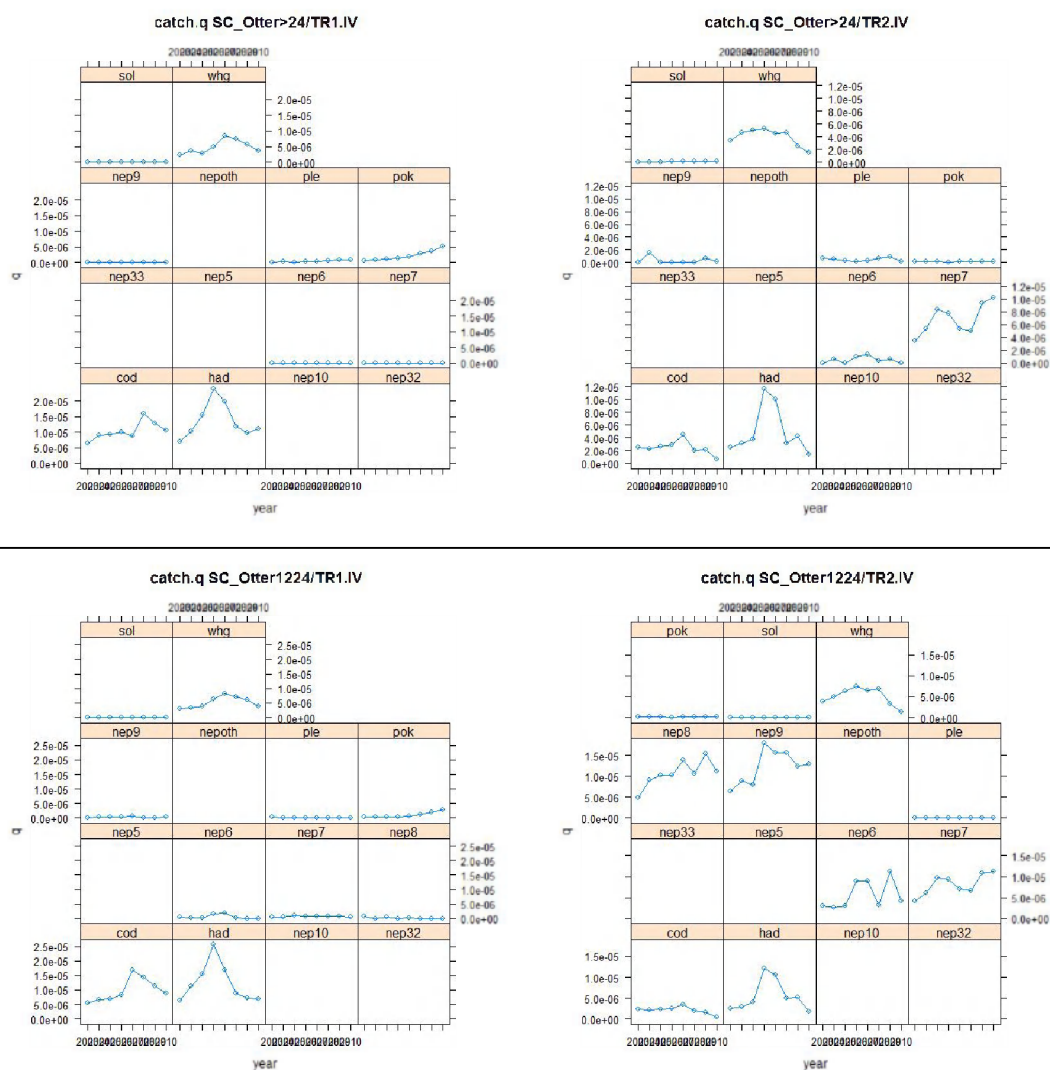


Figure 4.2.2.1.1. Time series of catchability of MIXFISH stocks by example fleet-metier combinations with significant cod catches.

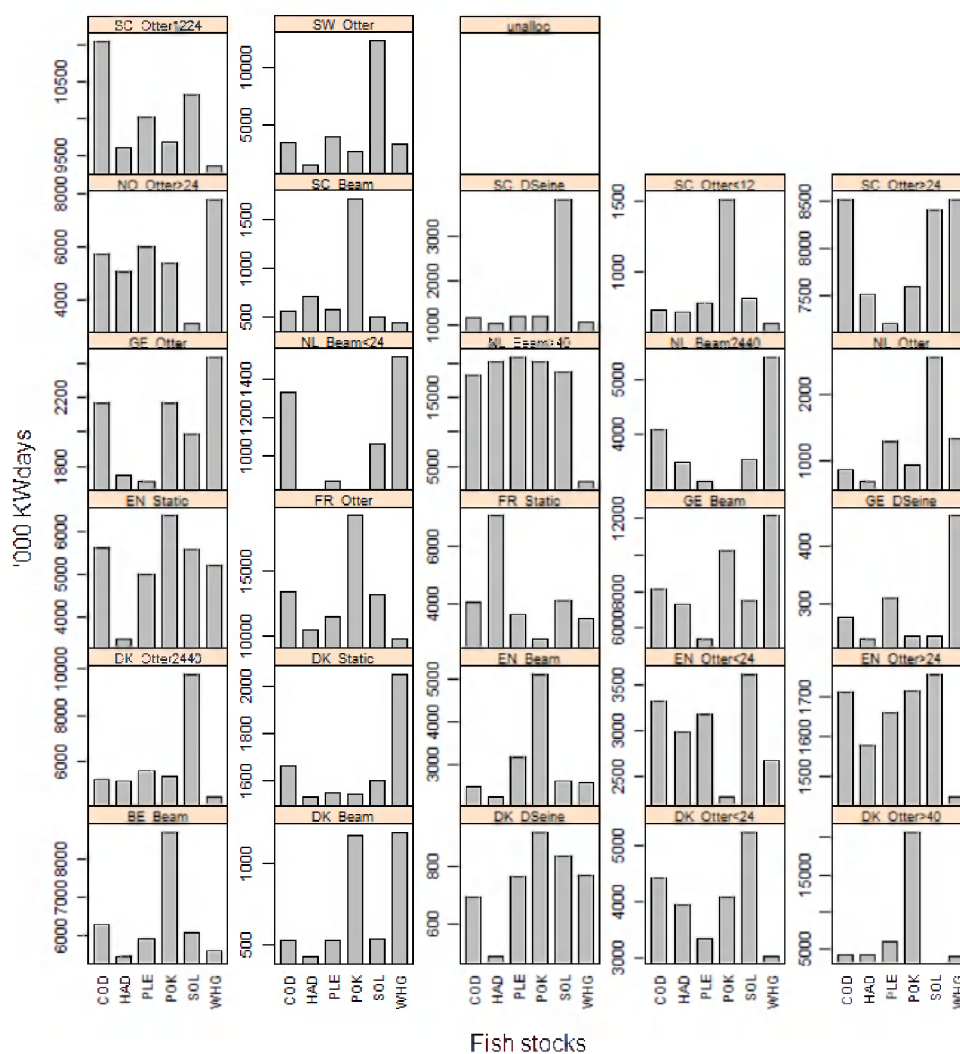


Figure 4.2.2.1.2. Intermediate year results. Single-Stock Target F in 2011; Fcube estimates of effort by fleet corresponding to the individual "quota share" (or partial target F) by stock in 2011. Fin-fish species.



### 2011 Effort corresponding to single-stock quota share, nep stocks

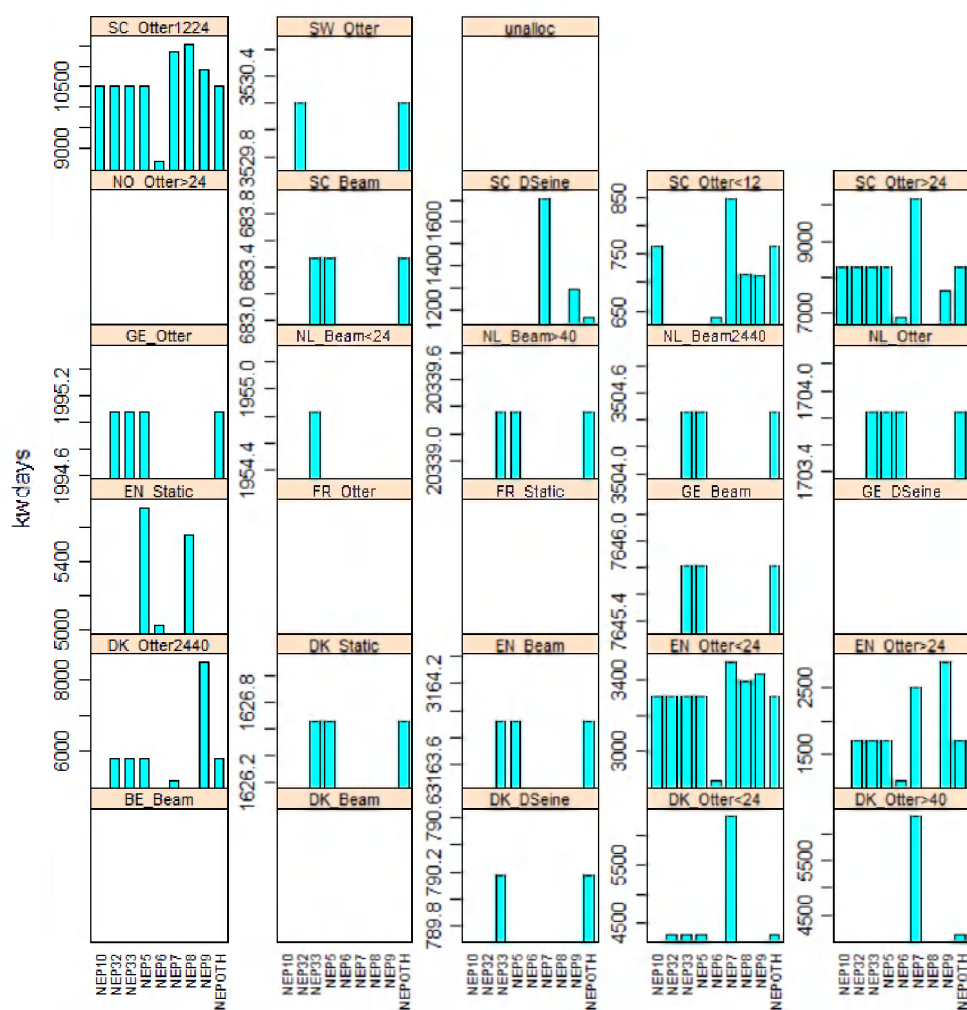


Figure 4.2.2.1.3. Intermediate year results. Single-Stock Target F in 2011; Fcube estimates of effort by fleet corresponding to the individual "quota share" (or partial target F) by stock in 2011 when applying the five scenarios. Nephrops FUs.

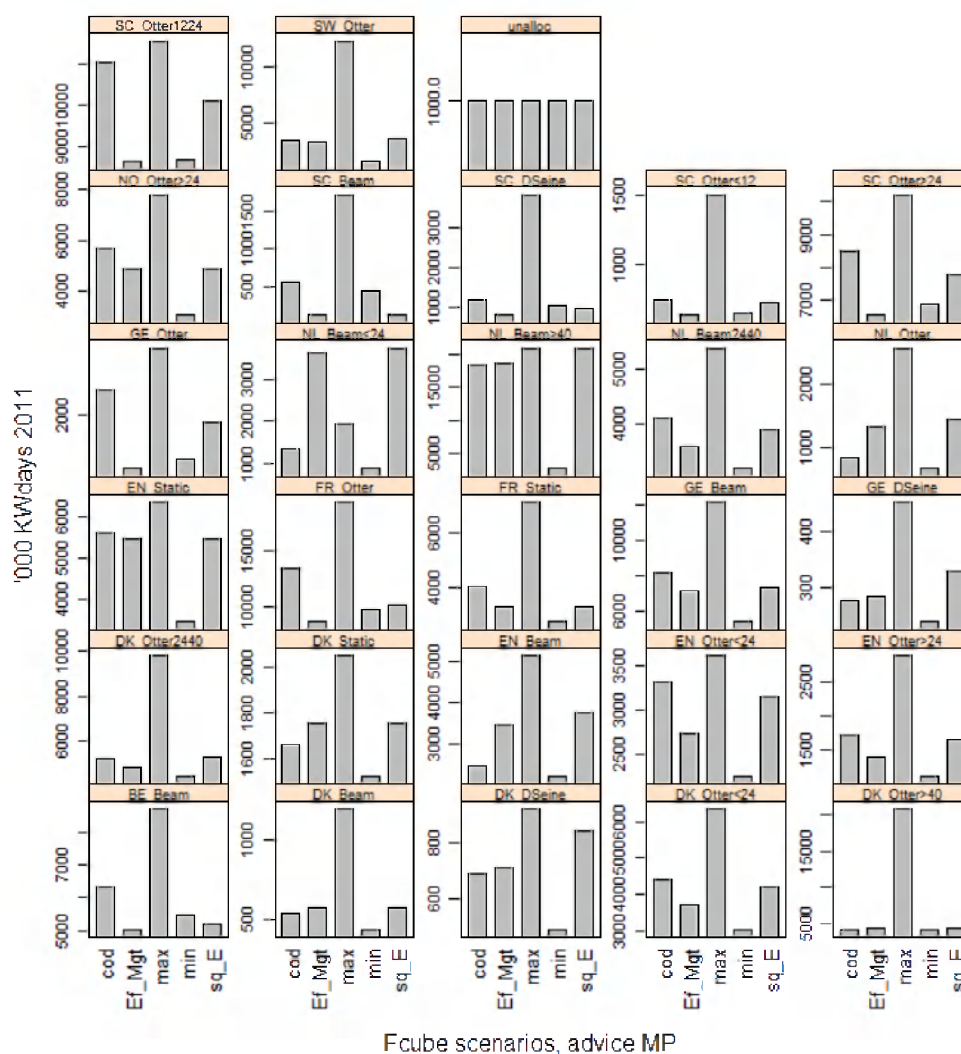


Figure 4.2.2.1.4. Intermediate year results. Fcube estimates of effort by fleet implied by the Fcube scenarios in the intermediate year (2011).

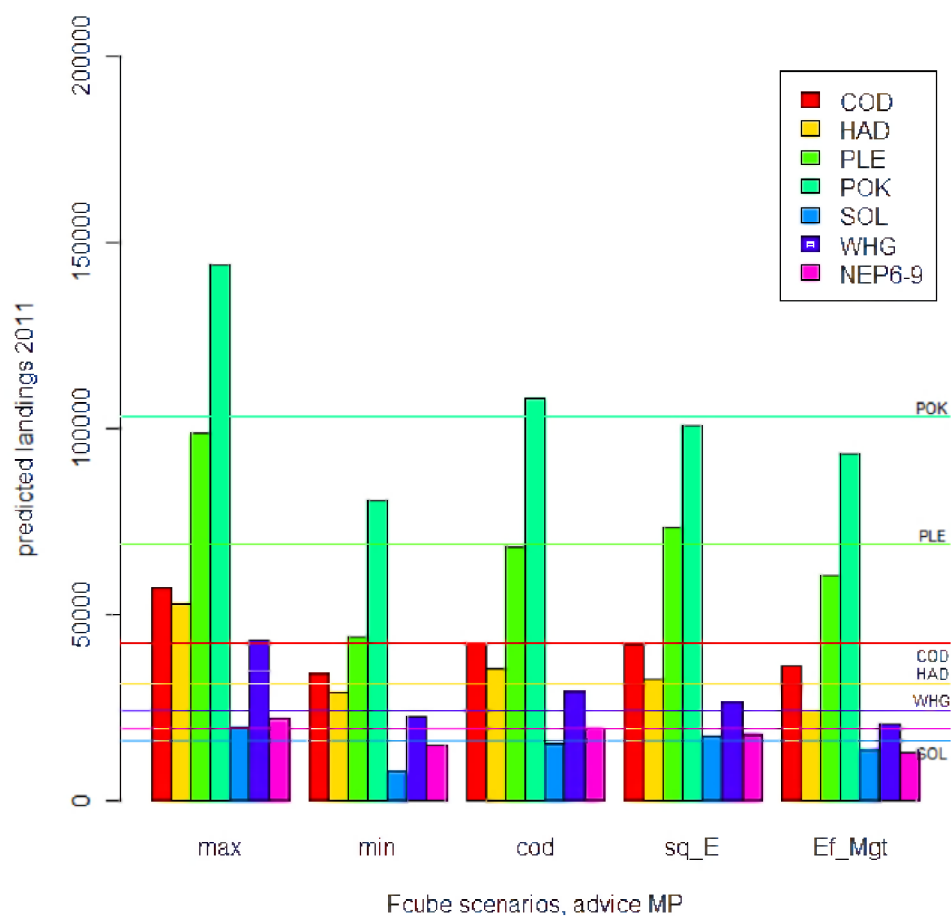


Figure 4.2.2.1.5. Intermediate year results. Fcube estimates of potential landings by stock for the Fcube scenarios in the intermediate year (2011). Coloured horizontal lines correspond to the intermediate year assumptions for landings from the single species stock assessments (as reproduced by the 'baseline run').



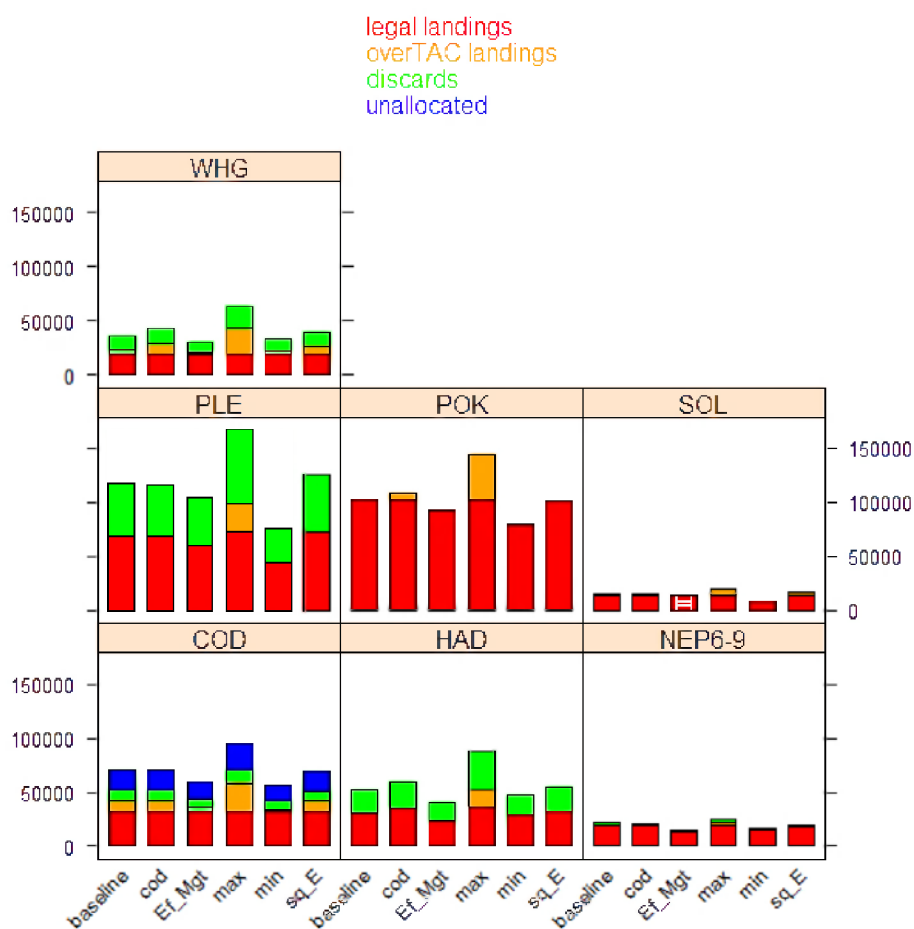


Figure 4.2.2.1.6. Intermediate year results. Total estimated catches by stock and Fcube scenario in 2011. Red: potential landings (as estimated from previous ratios of landings vs. discards) up to the actual 2011 TAC. Orange: potential landings (as estimated from previous ratios of landings vs. discards) above the actual 2011 TAC. Green: Discards. Blue: Unallocated removals (maintained constant across scenarios).

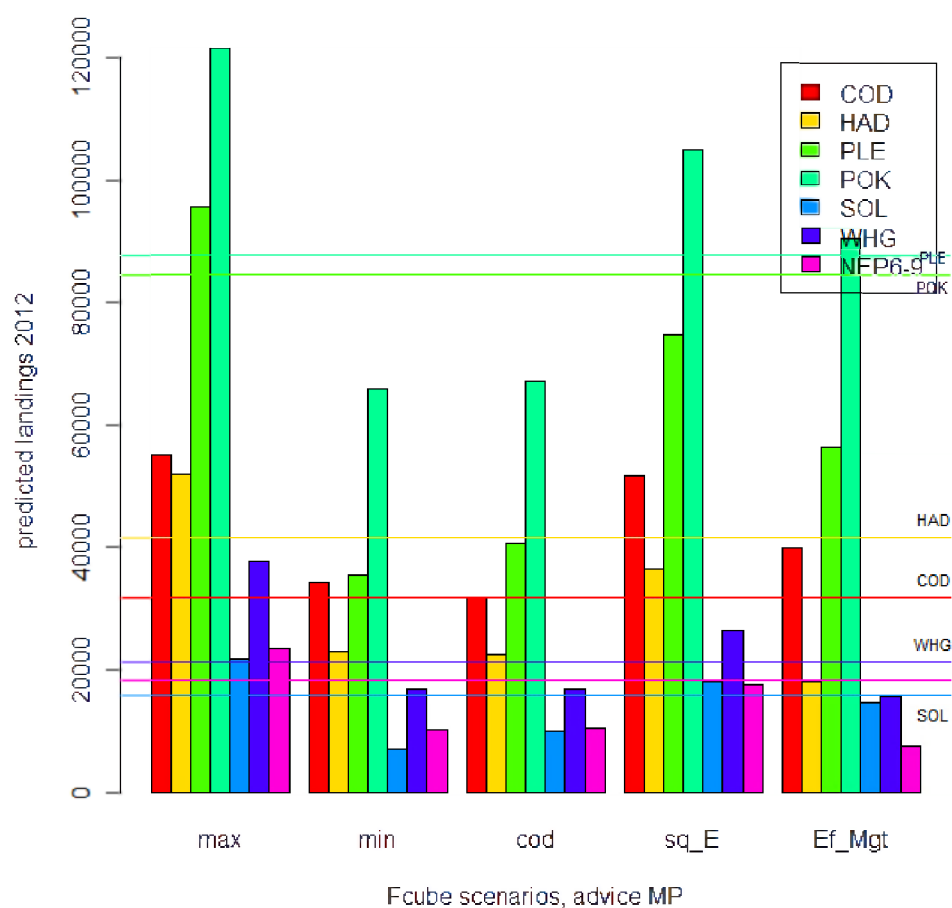


Figure 4.2.2.2.1 TAC year results (2012). Fcube estimates of potential landings by stock after two successive years of applying the Fcube scenarios. Coloured horizontal lines correspond to the TAC set by the single stock advice (as reproduced by the 'baseline run').

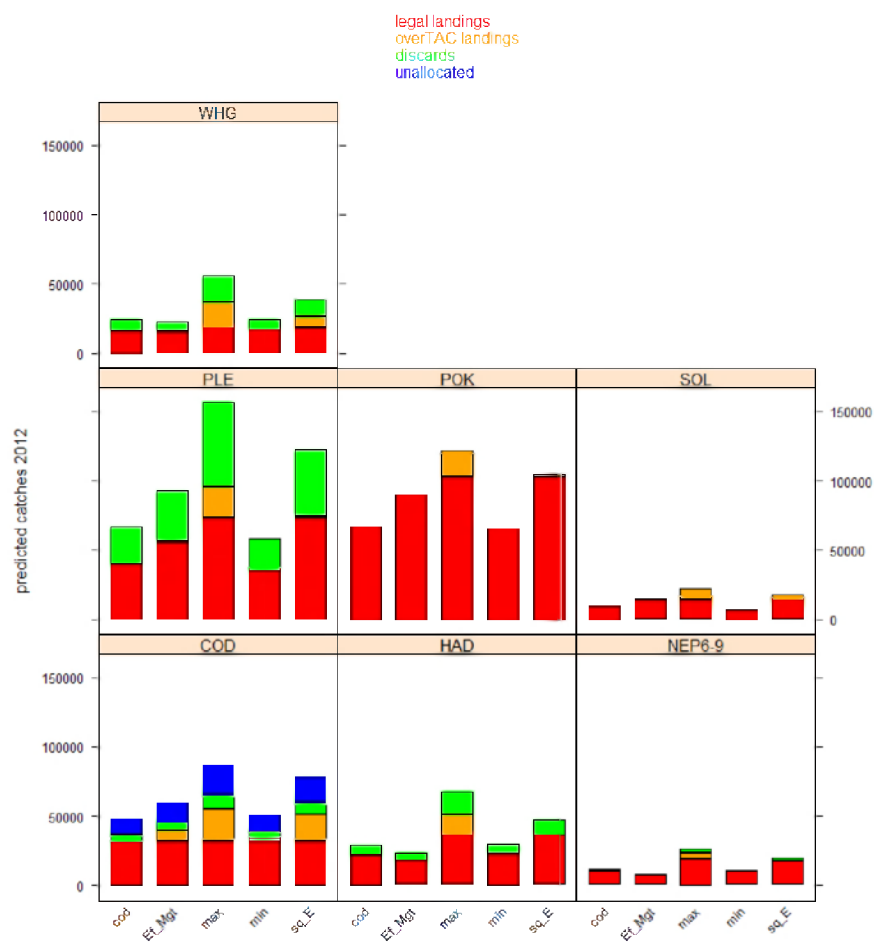


Figure 4.2.2.2.2. TAC year results (2012). Total estimated catches by stock and Fcube scenario in 2012. Red: potential landings (as estimated from previous ratios of landings vs. discards) up to the advised single stock 2012 TAC. Orange: potential landings (as estimated from previous ratios of landings vs. discards) above the advised single stock 2012 TAC. Green: Discards. Blue: Unallocated removals (maintained constant across scenarios).

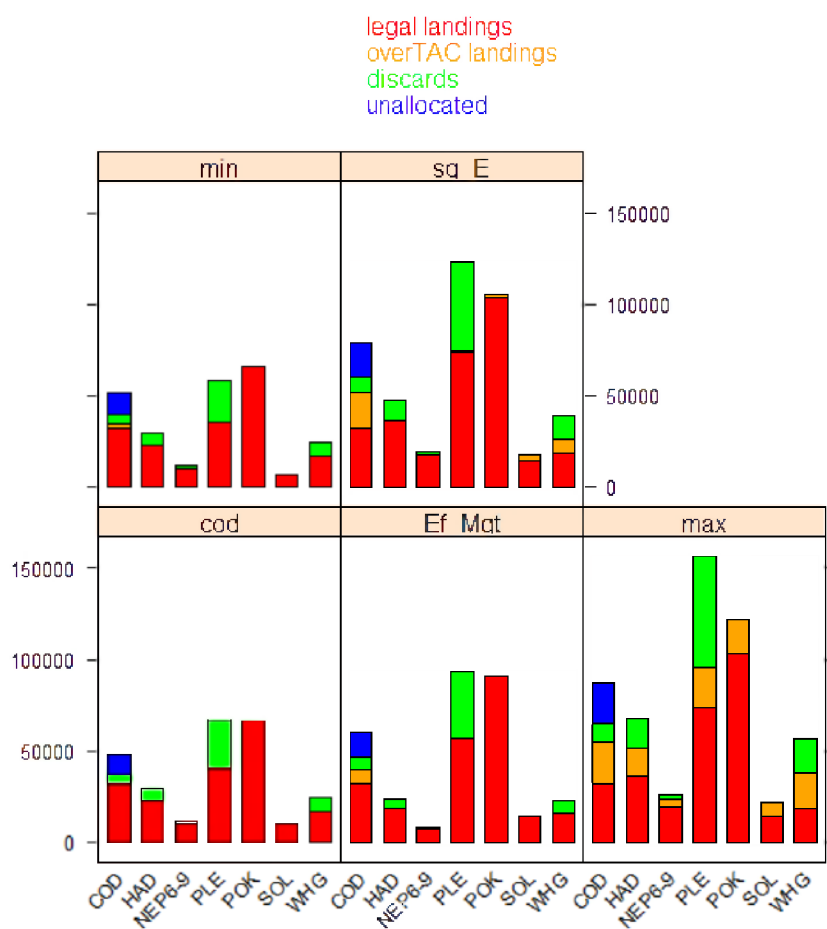


Figure 4.2.2.2.3. TAC year results (2012). Total estimated catches by stock and Fcube scenario in 2012. Red: potential landings (as estimated from previous ratios of landings vs. discards) up to the advised single stock 2012 TAC. Orange: potential landings (as estimated from previous ratios of landings vs. discards) above the advised single stock 2012 TAC. Green: Discards. Blue: Unallocated removals (maintained constant across scenarios).

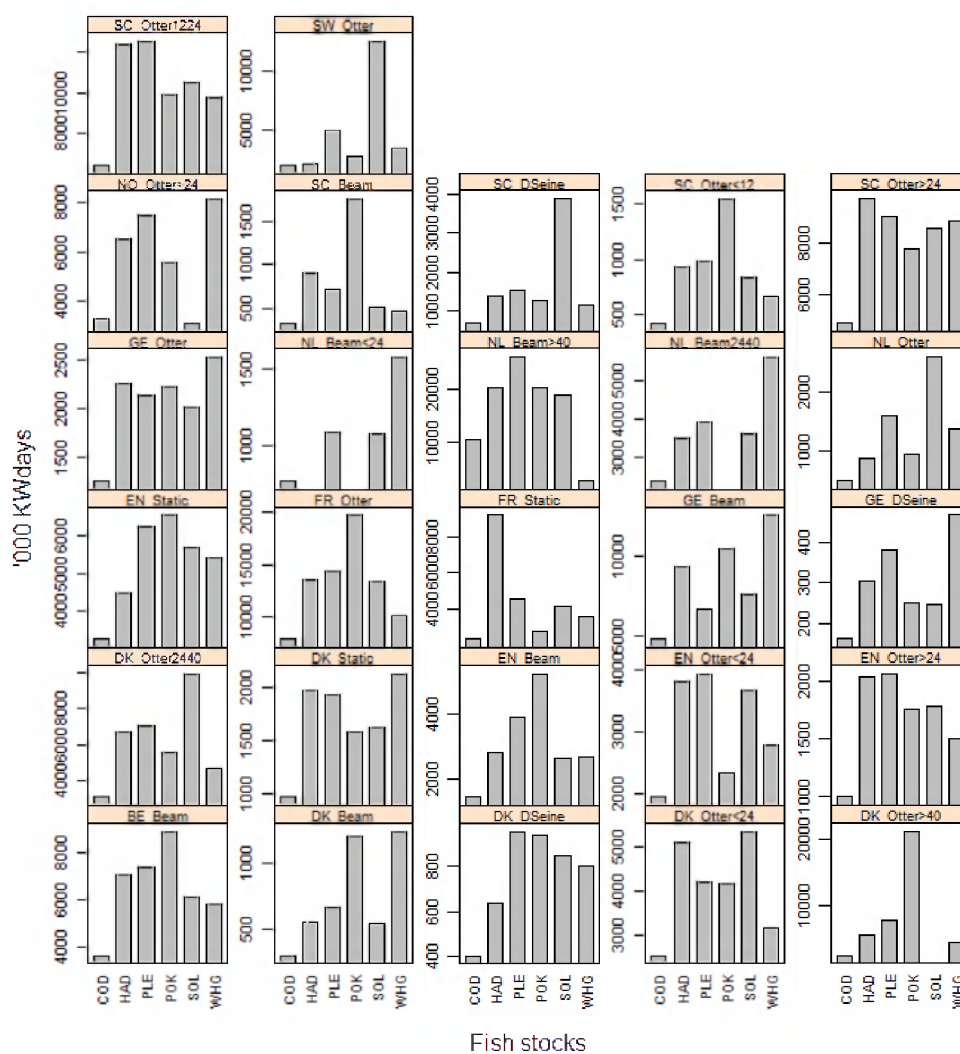


Figure 4.2.2.2.4. TAC year results (2012). Fcube estimates of effort by fleet corresponding to the individual “quota share” (or partial target F) by stock in 2012. Finfish species.

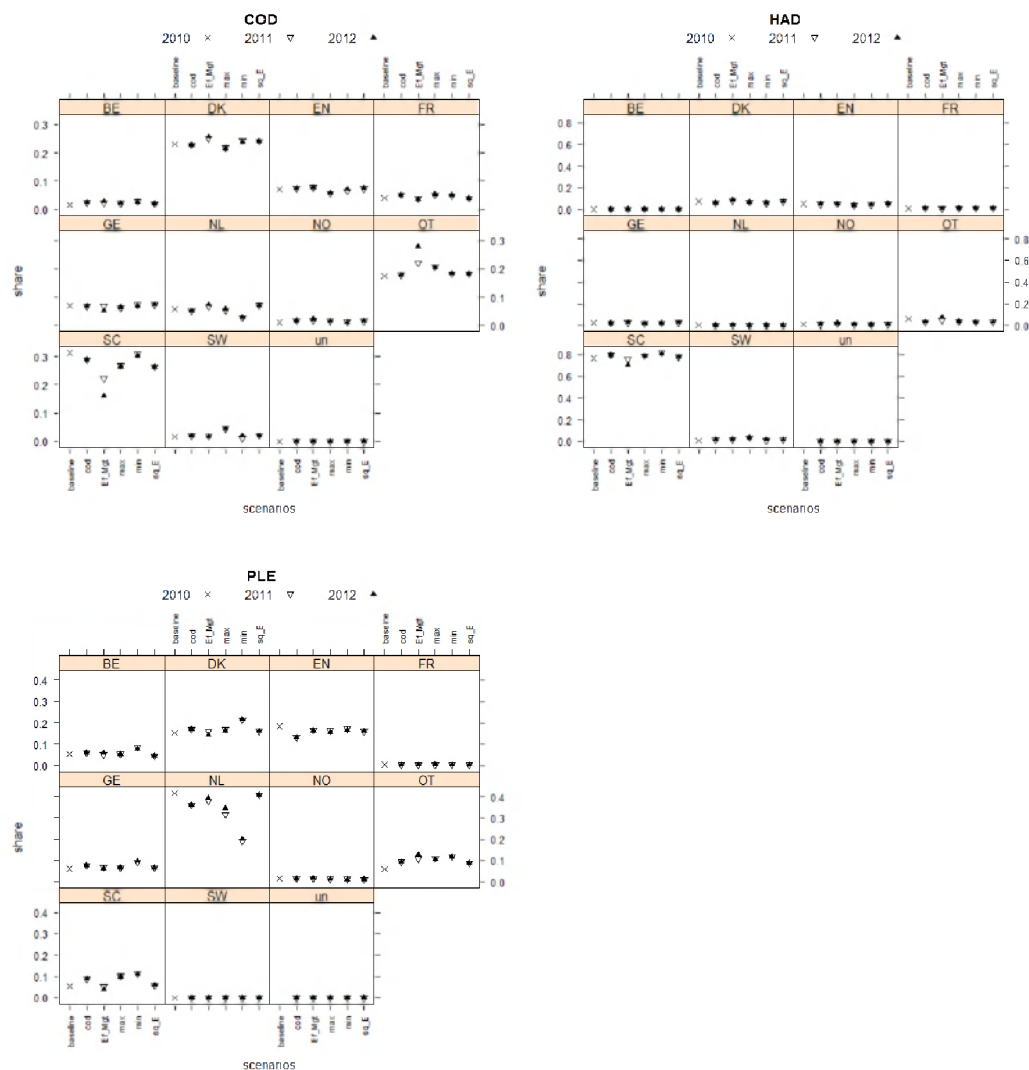
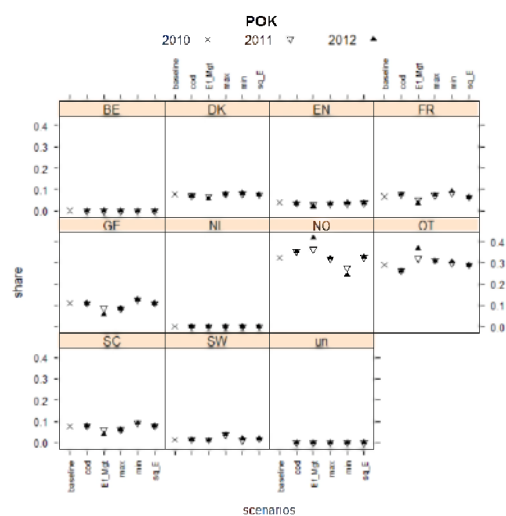


Figure 4.2.2.3: Test for relative stability. Changes of relative share of species' landings by country in 2011 and 2012 compared to the 2010 share, for the 'baseline' and 5 Fcube scenarios.



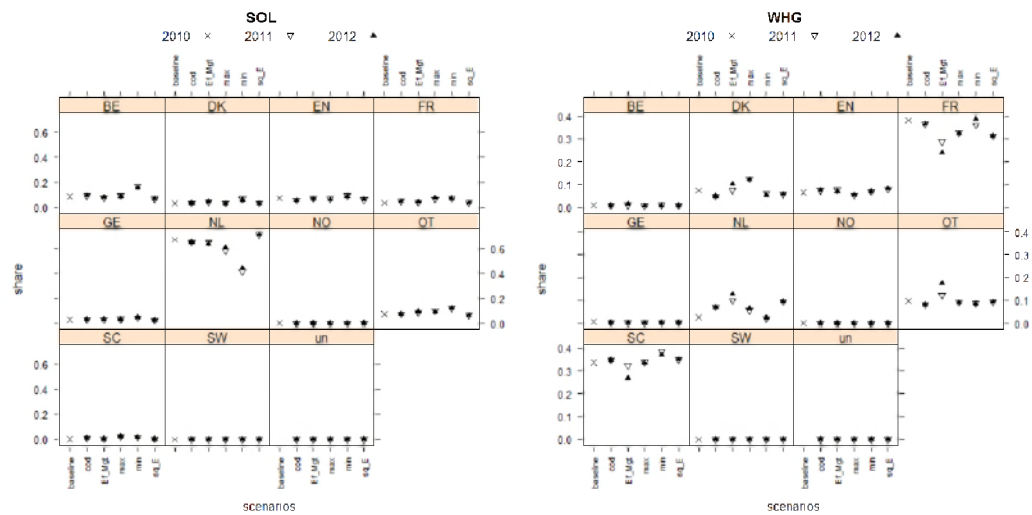


Figure 4.2.2.3 (cont): Test for relative stability. Changes of relative share of species' landings by country in 2011 and 2012 compared to the 2010 share, for the 'baseline' and 5 Fcube scenarios.

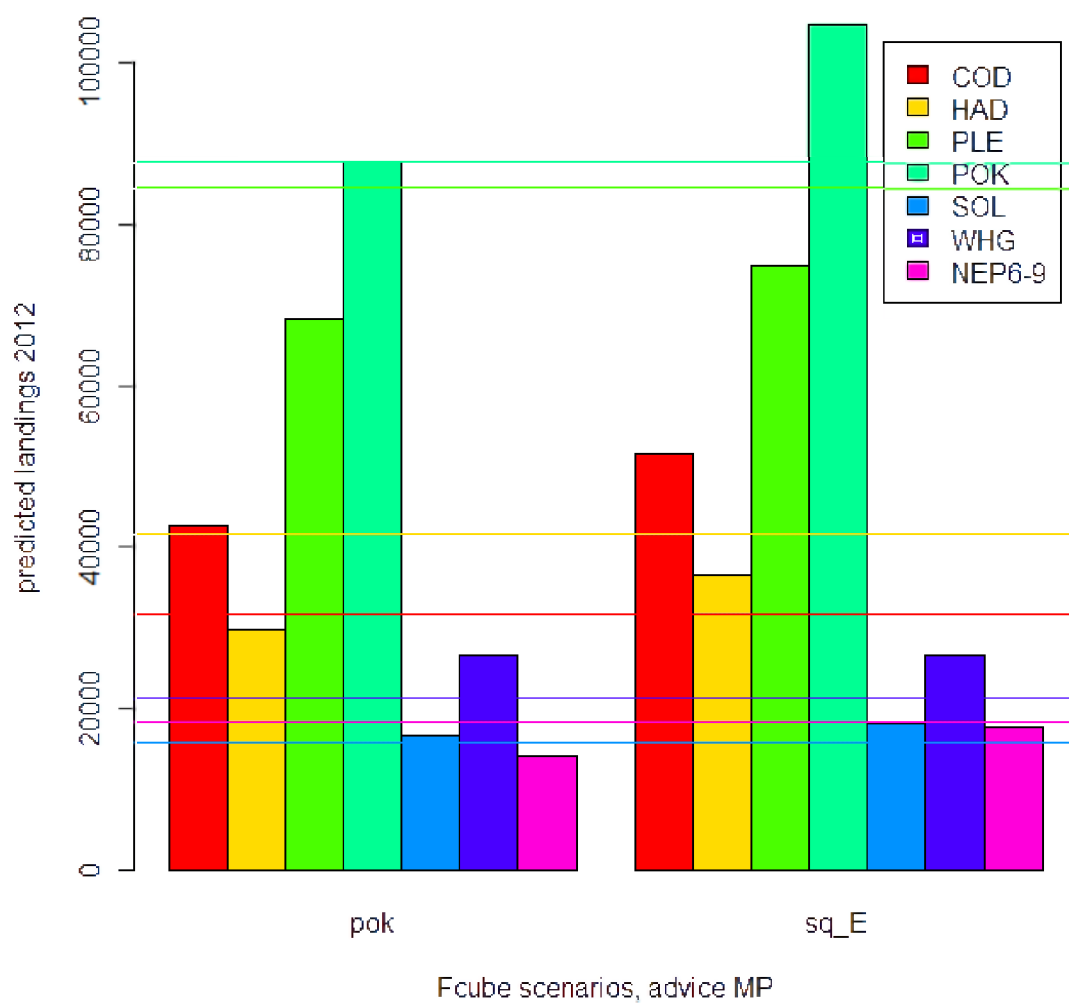


Figure 4.2.2.4. TAC year results (2012). Fcube estimates of potential landings by stock after two successive years of applying the Fcube scenarios "Pok" and "sq\_E". Coloured horizontal lines correspond to the TAC set by the single stock advice (as reproduced by the 'baseline run').



## Annex 1: List of participants

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## Annex 2: Specification of the ICES' data call

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### **Format of data submission for ICES working Group on Mixed Fisheries Advice for the North Sea (WGMIXFISH):**

*Data reports can be provided in simple comma separated text files, Microsoft EXCEL or ACCESS formats. All missing values (empty data cells) must be indicated by a -1.*

A. Mandatory Catch data for 2003-2010 aggregated (sum) by ID. Please ensure that data entries are fully consistent with coding given in Appendixes.

- 1 ) ID (this is a unique identifier; e.g. the combination of country, year, quarter, vessel length, gear, mesh size range, and area; this is free text with a maximum of 40 characters without space)
- 2 ) COUNTRY (this should be given according to the code list provided in Appendix 1)
- 3 ) YEAR (this should be given in four digits), like 2004
- 4 ) QUARTER (this should be given as one digit), like 1, 2, 3, or 4
- 5 ) VESSEL\_LENGTH (this should be given according to the code list provided in Appendix 2)
- 6 ) GEAR (gear should be given according to the code list provided in Appendix 3, which follows the EU data regulation 1639/2001)
- 7 ) MESH\_SIZE\_RANGE (the mesh size range should be given according to the code list provided in Appendix 4, which largely follows the Council regulation 850/98)
- 8 ) AREA (the ICES division or sub-area should be given according to the code list provided in Appendix 5)
- 9 ) SPECIES (the species should be given according to the code list provided in Appendix 6, which - except for the special case of Nephrops - follows the Council Regulation EC 2287/2003)
- 10 ) LANDINGS (estimated landings from domestic and foreign ports in metric tonnes should be given)
- 11 ) DISCARDS (estimated discards in metric tonnes associated with the landings should be given)
- 12 ) VALUE (total amount received – price\*landings – at first sale, expressed in Euros).

Note: The specification of the VALUE field is an area where the specifications of this data call differ from that issued by DG Mare for consideration by STECF. This is to allow inclusion of a prediction scenario where market value influences quota uptake on different species by different metiers.

B. Mandatory effort data for 2003-2010, aggregated (sum) by ID.

- 1 ) ID (*this is a unique identifier; e.g. the combination of country, year, quarter, gear, mesh size range, fishery or metier, and area; this is free text with a maximum of 40 characters without space*)
- 2 ) COUNTRY (*this should be given according to the code list provided in Appendix 1*)
- 3 ) YEAR (*this should be given in four digits*)
- 4 ) QUARTER (*this should be given as one digit*)
- 5 ) VESSEL\_LENGTH (*This should be given according to the code list provided in Appendix 2*)
- 6 ) GEAR (*this identifies gear, and should be given according to the code list provided in Appendix 3, which follows largely the EU data regulation 1639/2001*)
- 7 ) MESH\_SIZE\_RANGE (*the mesh size range should be given according to the code list provided in Appendix 4, which follows largely the Council regulation 850/98*).
- 8 ) AREA (*the ICES division or sub-area should be given according to the code list provided in Appendix 5*)
- 9 ) KW\_DAYS\_EFFORT (*effort should be given in kWdays, i.e. engine power in kW times days at sea; if kWdays effort is not available, "-1" should be given*)
- 10 ) DAYS\_AT\_SEA\_EFFORT (*effort should be given in days at sea; if Days\_at\_sea effort is not available "-1" should be given*)
- 11 ) NO\_VESSELS (*simple integer value of the number of vessels, if the number is not available, "-1" should be given.*)

**Appendix 1 Country coding**

<i>COUNTRY</i>	<i>CODE</i>
<i>Belgium</i>	<i>BEL</i>
<i>Denmark</i>	<i>DEN</i>
<i>Estonia</i>	<i>EST</i>
<i>Finland</i>	<i>FIN</i>
<i>France</i>	<i>FRA</i>
<i>Germany</i>	<i>GER</i>
<i>Ireland</i>	<i>IRL</i>
<i>Latvia</i>	<i>LAT</i>
<i>Lithuania</i>	<i>LIT</i>
<i>Netherlands</i>	<i>NED</i>
<i>Norway</i>	<i>NOR</i>
<i>Poland</i>	<i>POL</i>
<i>Portugal</i>	<i>POR</i>
<i>Spain</i>	<i>SPN</i>
<i>Sweden</i>	<i>SWE</i>
<i>United Kingdom (Jersey)</i>	<i>GBJ</i>
<i>United Kingdom (Guernsey)</i>	<i>GBG</i>
<i>United Kingdom (Alderny/Sark/Herm)</i>	<i>GBC</i>
<i>United Kingdom (England and Wales)</i>	<i>ENG</i>
<i>United Kingdom (Isle of Man)</i>	<i>IOM</i>
<i>United Kingdom (Northern Ireland)</i>	<i>NIR</i>
<i>United Kingdom (Scotland)</i>	<i>SCO</i>
<i>Other countries</i>	<i>OTH</i>

**Appendix 2 Vessel Length**

*Note: This is an area where the specifications of this data call differ from that issued by DG Mare for consideration by STECF. This is to allow consistency in fleet definitions between landings, effort and economic data. Also, according to the Data Collection Framework, Member States should be able to provide data according to these segmentations (at least covering years from 2009 if not before)*

<i>Vessel Length</i>	<i>Code</i>
<i>Under 12m</i>	<i>u12m</i>
<i>≥ 12m &lt; 24m</i>	<i>o12t24m</i>
<i>≥ 24m &lt; 40m</i>	<i>o24t40m</i>
<i>≥ 40m</i>	<i>o40m</i>

**Appendix 3 Gear coding**

TYPES OF FISHING TECHNIQUES			Gear code to be used when answering the data call	Gear code specified for metiers in App. IV of 1008/949/CE
<b>Mobile gears</b>	Beam trawls		BEAM	TBB
	Bottom trawls & demersal seines	Bottom trawls, Multi-rig otter trawls or Bottom pair trawls	OTTER	OTB, OTT, PTB
		Fly shooting seines, Anchored seines or Pair seines	DEM_SEINE	SSC, SDN, SPR
	Pelagic trawls & pelagic Seines	Midwater otter trawls or Midwater pair trawls	PEL_TRAWL	OTM, PTM
		Purse seines, Fly shooting seines or Anchored seines	PEL_SEINE	PS
	Dredges		DREDGE	DRB, HMD
<b>Passive gears</b>	Drift longlines or Set longlines		LONGLINE	LHP, LHM, LTL, LLD, LLS
	Driftnets or Set gillnets (except Trammel Nets)		GILL	GNS, GND
	Trammel nets		TRAMMEL	GTR
	Pots and traps		POTS	FPO

**Appendix 4 Mesh size coding**

Gear type	Code
Mobile gears	<16
	16-31
	32-54
	55-69
	70-79
	80-89
	90-99
	100-119
	>=120
Passive gears	10-30
	31-49
	50-59
	60-69
	70-79
	80-89
	90-99
	100-109
	110-149
	150-219
	>=220

## Appendix 5 Area coding

### *Finfish*

3an

4

7d

## Appendix 6 Species coding according to Council Regulation (EC) No. 2298/2003

	<i>Common name</i>	<i>Code</i>	<i>Scientific name</i>
1	Cod	COD	<i>Gadus morhua</i>
2	Common sole	SOL	<i>Solea solea</i>
3	Haddock	HAD	<i>Melanogrammus aeglefinus</i>
4	Plaice	PLE	<i>Pleuronectes platessa</i>
5	Saithe	POK	<i>Pollachius virens</i>
6	Whiting	WHG	<i>Merlangius merlangus</i>

*Note: The species coding for Nephrops is an area where the specifications of this data call differ from that issued by DG Mare for consideration by STECF. This is to allow calculation of catchabilities and mixed fishery predictions for functional units where abundance estimates are available.*

<i>Common name</i>	<i>Functional Unit</i>	<i>Code</i>
Norway lobster	5	NEP5
Norway lobster	6	NEP6
Norway lobster	7	NEP7
Norway lobster	8	NEP8
Norway lobster	9	NEP9
Norway lobster	10	NEP10
Norway lobster	32	NEP32
Norway lobster	33	NEP33
Norway lobster	OTHER ICES RECTANGLES <sup>1</sup>	NEPOTH

<sup>1</sup> landings/discards from the other ICES' rectangles in the North Sea



*Nephrops Functional Units and descriptions by statistical rectangle follow*

Functional Unit	Stock	ICES Rectangles	Division
5	Botney Gut	36-37 F1-F4; 35F2-F3	IV
6	Farn Deep	38-40 E8-E9; 37E9	IV
7	Fladen	44-49 E9-F1; 45-46E8	IV
8	Firth of Forth	40-41E7; 41E6	IV
9	Moray Firth	44-45 E6-E7; 44E8	IV
10	Noup	47E6	IV
32	Norwegian Deep	44-52 F2-F6; 43F5-F7	IV
33	Off Horn Reef	39-41F4; 39-41F5	IV

### **Annex 3: Data issues for specific nations**

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#### **Belgium**

The Belgium landings and effort data were compiled according to the specification of the data request. Discard information was only available for the main metiers (Beam trawls) and since 2004.

#### **Denmark**

Landings and effort data for 2010 were compiled according to the specification of the data request, and appended to the dataset from last year. It was only possible to attach discard information to some metiers.

#### **France**

The France data used for this Workshop and for the period before 2009 is the dataset submitted to the STECF effort review meeting. The vessel categories are less than 10 m, 10 m to 15 m and over 15 m.

Data for 2009 were not available for the meeting due to delays in the data processing.

#### **Germany**

Landings and effort data for 2010 were compiled according to the specification of the data request, and appended to the dataset from last year. It was only possible to attach discard information to some metiers. Value information was available for 2010 data only.

#### **The Netherlands**

Revised Dutch data series were provided. Value information was available for the first time but no discards data were included. Figures 3.2.3.2 and 3.2.3.3 may indicate corrections are needed with respect to the smaller beam trawler fleet.

#### **Norway**

The Norwegian data used for this workshop were provided directly by IMR, without discards estimates.

#### **UK (England, Wales and Northern Ireland)**

Data were provided for England, Wales and Northern Ireland for the period 2003-2010 according to the data call. Discard data were applied where available. Not all length classes of vessels are routinely sampled for discards, but the discard data were applied to all vessel length categories irrespective of this. The dataset includes some vessels from UK (Northern Ireland) and from Guernsey that fish in the North Sea and/or Eastern Channel. These vessels are lumped in with the English fleet for analysis.

#### **Scotland**

Landings and effort data were compiled according to the specification of the data request. It was only possible to attach discard information to some metiers; also the design of the Scottish discard observer scheme changed in 2009 and aggregation strata were revised again for 2010 data. For data between 2003 and 2008 the Scottish discard observer scheme was designed to achieve a reasonable coverage of vessels in each of the following categories

- MTR: Motor trawl (bottom trawls, boat length  $\geq 27.432\text{m}$ , targeting demersal species)
- LTR: Light trawl (bottom trawls, boat length  $< 27.432\text{m}$ , targeting demersal species)
- PTR: Pair trawl (all pair trawls targeting demersal species)
- SEN: Seine nets (single and pair)
- NTR: *Nephrops* trawls (all trawls targeting *Nephrops*)

Where the gear categories for records in the landings dataset could be mapped to one of the above categories a discard value was assigned according to the discard ratio of that category. Therefore records mapped to these categories always receive the same ratio of discards to landings.

Vessels with OTTER and PEL\_TRAWL gear and in the length categories o24t40m and o40m were mapped to the MTR category. However, as for STECF effort calculations all records with OTTER gear and with mesh between 70 and 100mm are mapped to NTR.

For 2009 data discard fractions were available for the two categories

- ☐ DEF: Demersal otter, demersal seine and beam trawls targeting demersal fish
- ☐ CRU: Demersal otter, demersal seine and beam trawls targeting crustaceans

Vessels with PEL\_TRAWL gear and with OTTER gear with mesh  $> 100\text{mm}$  were mapped to the DEF category. Vessels with OTTER gear with mesh  $< 100\text{mm}$  were mapped to the CRU category. The Scottish fleet consists of few beam trawlers and the discard rates in the DEF and CRU categories reflect those from otter and demersal seine gears. Discards were therefore not attached to beam trawl landings.

For 2010 data discard fractions were available for the two categories

- ☐ TR1: Demersal otter and demersal seine gears with mesh  $\geq 100\text{mm}$
- ☐ TR2: Demersal otter and demersal seine gears with mesh  $\geq 70$  &  $< 100\text{mm}$

Again discards were not attached to beam trawl landings.

The sampling of vessels  $< 10\text{m}$  is very limited and it is considered unreasonable to assume they have the same discarding patterns as larger boats. Scotland does not provide discard estimates for vessels  $< 10\text{m}$  to STECF. Discard estimates are therefore not estimated for vessels in the u12m category.

## Annex 4: North Sea Mixed Fisheries Advice

### Mixed fisheries advice

Area	North Sea
Fisheries	Demersal

Mixed fisheries advice is dependent upon the choice of species considered and the criteria selected. In contrast to single species advice there is no single recommendation but a range of plausible options. ICES single species advice provides TACs expected to keep a species above a biomass level regarded as safe for the stock, or to return a species to a safe biomass level within a precautionary timeframe. To be consistent with these biological objectives a scenario is necessary that delivers the SSB and/or F objectives of the single species stock advice for all stocks considered simultaneously. This document presents five scenarios out of which the *minimum* scenario guarantees this outcome. However, the minimum scenario assumes that fleets would stop fishing when their first quota share is exhausted, regardless of the actual importance of this quota share, thus leading to a distorted perception of plausible fleet behaviour. It is included only to demonstrate the lower bound of potential fleet effort and stock catches.

In addition to the minimum scenario a maximum scenario is included. This is included to demonstrate the upper bound of potential fleet effort and stock catches but, through assuming all fleets continue fishing until all their quotas are exhausted irrespective of the economic viability of such actions, is also considered a scenario with low plausibility. Currently three other scenarios are included, reflecting basic current management measures and also the status quo option.

### Scenario Descriptions

	Underlying assumption
<b>min</b>	Minimum scenario: fishing stops when the catch for the first quota species meets the upper limit corresponding to single stock exploitation boundary.
<b>max</b>	Maximum scenario: fishing stops when the last quota species is fully utilised with respect to the upper limit corresponding to single stock exploitation boundary.
<b>cod</b>	All fleets set their effort at the level corresponding to their cod quota share, regardless of other stocks
<b>sq_E</b>	Status quo Effort: The effort is set as equal to the effort in the most recently recorded year for which there is landings and discard data.
<b>Ef_Mgt</b>	Effort management: The effort in métiers using gear controlled by the EU effort management regime have their effort adjusted according to the regime.

ICES is willing to consider further options that may be suggested by ICES' clients.

### Species involved

The species considered here as part of the demersal mixed fisheries of the North Sea are cod, haddock, whiting, saithe, plaice, sole and *Nephrops norvegicus*. All of these are now subject to multi-annual management plans apart from *Nephrops*.

Species	ICES single stock advice area	Mgt area	Mgt plan ref(s)
Cod	Subarea IV, Division VIIId and IIIa West (Skagerrak)	<ul style="list-style-type: none"> <li>EU TAC Skagerrak</li> <li>EU TAC VIIId</li> <li>IV; EC waters of IIa; that part of IIIa not covered by the Skagerrak and Kattegat</li> </ul>	<ul style="list-style-type: none"> <li>EU and Norway management plan</li> <li>Council Reg (EC) 1342/2008</li> </ul>
Haddock	Haddock in Subarea IV and Division IIIa West (Skagerrak)	<ul style="list-style-type: none"> <li>EU TAC IIIa, EC waters of IIIb, IIIc and IIId</li> <li>IV; EC waters of IIa</li> </ul>	<ul style="list-style-type: none"> <li>EU and Norway management plan</li> </ul>
Whiting	IV and VIIId (MF advice includes human consumption and industrial landings)	<ul style="list-style-type: none"> <li>IV</li> <li>EU TAC VII</li> </ul>	<ul style="list-style-type: none"> <li>EU and Norway management plan (interim)</li> </ul>
Saithe	Subarea IV, Division IIIa West (Skagerrak) and Subarea VI	<ul style="list-style-type: none"> <li>IIIa and IV; EC waters of IIa, IIIb, IIIc and IIId</li> <li>VI; EC waters of Vb; EC and international waters of XII and XIV</li> </ul>	<ul style="list-style-type: none"> <li>EU and Norway management plan</li> </ul>
Plaice	Sub-area IV	<ul style="list-style-type: none"> <li>IV; EC waters of IIa; that part of IIIa not covered by the Skagerrak and the Kattegat</li> </ul>	<ul style="list-style-type: none"> <li>Council Reg (EC) No 676/2007</li> </ul>
Sole	Sub-area IV	<ul style="list-style-type: none"> <li>EC waters of II and IV</li> </ul>	<ul style="list-style-type: none"> <li>Council Reg (EC) No 676/2007</li> </ul>
<i>Nephrops</i>	Functional Units: 5, 6, 7, 8, 9, 10, 32, 33, other areas outside FUs	<ul style="list-style-type: none"> <li>EU: TAC for IV</li> <li>Norway: no TAC</li> </ul>	<ul style="list-style-type: none"> <li>na</li> </ul>

### Management objectives and Advice Approaches

The 2011 ICES advice for the North Sea demersal stocks (ICES, 2011) was according to existing management plans where these existed and a transition to maximum sustainable yield (MSY) advice otherwise. Reflecting this, mixed fishery projections were run using the same advice approaches. In the case of *Nephrops*  $F_{MSY}$  and management plan advice is not available. For *Nephrops* TAC setting along the lines of the Policy document presented by the EU policy paper COM (2011) 298-final is adopted.

### Projected TACs

The results under the scenarios in table XX give the expected outcome if TAC and effort management measures specified under single species advice remain unchanged and

- 'Fcube interm YR and MP in TAC YR': the assumptions of each scenario hold true in the intermediate year but the rules of the advice approach (LTMP or

MSY framework) are applied and adhered to in the TAC year. In this case the comparison to the single stock exploitation boundary for a given species gives an indication of the robustness of the advice approach (i.e. the TAC specified) to assumptions about catches in the intermediate year.

- 'Fcube interm YR and Fcube in TAC YR': the assumptions of each scenario hold true in both the intermediate year and TAC year. In this case, if the scenario total is lower than the single stock exploitation boundary for a given species the difference is an estimate of unused TAC. If the scenario total is higher than the single stock exploitation boundary for a given species the difference is an estimate of the overshoot of the landings component of catch. If all existing discards are considered to comprise non-marketable fish an estimate of overall discards from the scenario would be the 'overquota landings' plus a tonnage of discards obtained by applying to the quota + overquota landings the same ratio of landings to discards as found from input data.

Figure #1 displays graphically the information in Table XX 'Fcube interm YR and Fcube in TAC YR'. Again it is emphasised this only presents information on *landings*, i.e. the share of predicted catches that corresponds to marketable fish. Figures #2 and #3 provide an overview of the amount of total catches for the various scenarios, landings up to the proposed 2012 TAC, potential 'over TAC' landings (i.e. estimated landings above this TAC, if any) and discards, as calculated according to the discards ratio observed in assessment data. Therefore the discards in these figures reflect undersize discarding rather than overquota discarding. In the case of cod there is also the issue of 'unallocated removals'. These are simply considered constant over all scenarios.

### Projected SSBs in 2013

Catches predicted to be above the single stock exploitation boundary can be for two reasons

- The scenario predicts over-exploitation in both the intermediate and TAC year, in which case the biomass of the stock at the end of the TAC year will be reduced compared to if catches remained at the single stock exploitation boundary.
- The scenario predicts under-exploitation in the intermediate year leading to an enhanced SSB at the end of the intermediate year. The single species HCR for the TAC year may then be fulfilled even if catches are higher than the single stock exploitation boundary for the TAC year.

The catch predictions for each species must therefore be considered in combination with the predicted SSB at the end of the TAC year. The results under the scenarios in table YY give the expected SSBs in 2013. Again, for each scenario, a contrast is made between

- Assuming the scenario holds true in the intermediate year but the rules of the single species advice approach are applied and upheld in the TAC year.
- Assuming the scenario holds true in both the intermediate year and TAC year.

Table XX: Estimated landings in 2012. Result of applying the assumptions of the Fcube scenarios.

Species	Single stock expl. Boundaries	Scenario A, mixed fisheries		Scenario B, mixed fisheries		Scenario C, mixed fisheries		Scenario D, mixed fisheries Cod		Scenario E, mixed fisheries	
		MIN		MAX		Status Quo Effort		Management Plan		Effort Management	
		Fcube interm YR and MP in TAC YR	Fcube interm YR and Fcube in TAC YR	Fcube interm YR and MP in TAC YR	Fcube interm YR and Fcube in TAC YR	Fcube interm YR and MP in TAC YR	Fcube interm YR and Fcube in TAC YR	Fcube interm YR and MP in TAC YR	Fcube interm YR and Fcube in TAC YR	Fcube interm YR and MP in TAC YR	Fcube interm YR and Fcube in TAC YR
COD	31705	35637	34290	25793	54982	31931	51537	31705	31705	34722	39905
HAD	41575	41575	23040	38541	51773	41575	36514	41575	22360	41575	18112
PLE	84410	84410	35390	76982	95448	84410	74755	84410	40480	84410	56339
POK	87550	87550	65746	87550	121406	87550	104706	87550	66957	87550	90286
SOL	15723	12477	7059	16215	21758	16215	18056	15362	9873	14168	14552
WHG	21275	21275	16815	21275	37667	21275	26469	21275	16698	21275	15647
NEP10	80	80	21	80	49	80	37	80	22	80	16
NEP32	900	900	229	900	521	900	394	900	233	900	169
NEP33	907	907	454	907	1032	907	780	907	461	907	334
NEP5	704	704	540	704	1226	704	927	704	548	704	397
NEP6	1362	1362	998	1362	2372	1362	1857	1362	1082	1362	804
NEP7	14103	14103	7493	14103	15922	14103	12689	14103	7555	14103	5388
NEP8	1676	1676	1131	1676	3459	1676	1999	1676	1147	1676	887
NEP9	1084	1084	644	1084	1574	1084	1098	1084	646	1084	476
NEPOTH	1419	1419	786	1419	1785	1419	1350	1419	798	1419	578

**Table YY: SSB in 2013 as a result of applying the assumptions of the Fcube scenarios.**

Species	Single stock expl. boundaries	Scenario A, mixed fisheries MIN		Scenario B, mixed fisheries MAX		Scenario C, mixed fisheries Status Quo Effort		Scenario D, mixed fisheries Cod Management Plan		Scenario E, mixed fisheries Effort Management	
		Fcube intern YR and MP in TAC YR	Fcube intern YR and Fcube in TAC YR	Fcube intern YR and MP in TAC YR	Fcube intern YR and Fcube in TAC YR	Fcube intern YR and MP in TAC YR	Fcube intern YR and Fcube in TAC YR	Fcube intern YR and MP in TAC YR	Fcube intern YR and Fcube in TAC YR	Fcube intern YR and MP in TAC YR	Fcube intern YR and Fcube in TAC YR
COD	102000	115000	116000	77000	44000	103000	80000	102000	102000	112000	106000
HAD	231000	235000	260000	200000	182000	229000	236000	225000	250000	243000	274000
PLE	588000	647000	728000	530000	501000	577000	593000	589000	661000	607000	653000
POK	111000	131000	148000	74400	52600	113000	100000	106000	121000	120000	118000
SOL	45600	56500	61700	41600	36200	44000	42200	46500	51800	49200	48800
WHG	213000	215000	221000	191000	169000	211000	203000	207000	213000	217000	225000

**Management considerations***Effort management*

The Effort management scenario applies the effort changes on relevant gear types according to the latest effort management legislation and as outlined in Table AA2. The effort reductions are applied to all fleets equally regardless of whether the fleets have had their kWdays effort pot reduced or whether they are subject to a scheme intended to reduce fishing mortality on cod to the same extent as the effort cuts, e.g. fleets operating under article 13 of the cod LTMP.

*Environment*

The relative impact on the wider environment (i.e. outside the effect on the SSB of the species included in the projections) of the different scenarios is currently outside the scope of this advice.

*Economics*

Economic data have not been taken into consideration in the current projections.

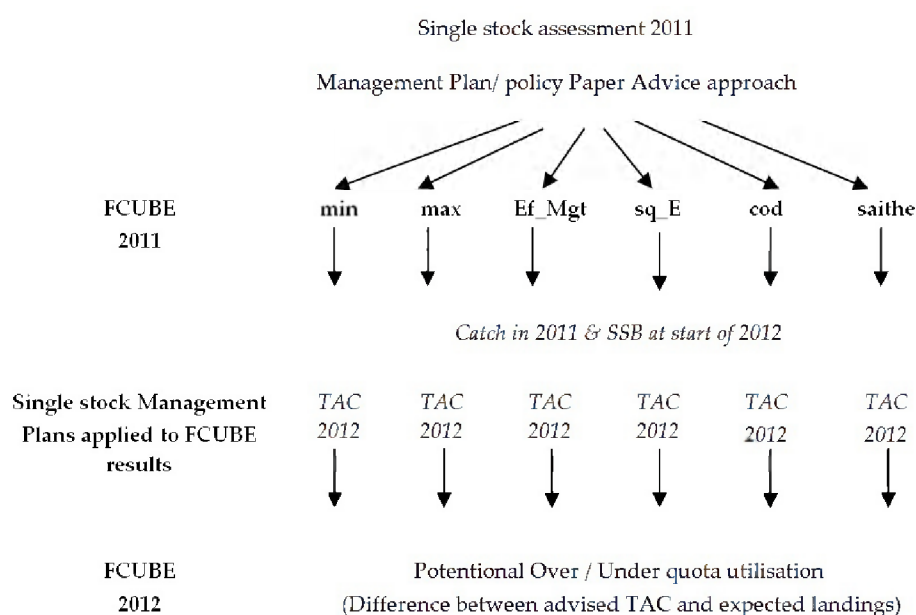


## ANNEX

### Technical information

The mixed fisheries Fcube model was developed in order to be able to predict the effect of, and to advise on, TAC and effort management of stocks in mixed fisheries circumstances. The North Sea demersal fisheries have been used as a starting point for this modelling.

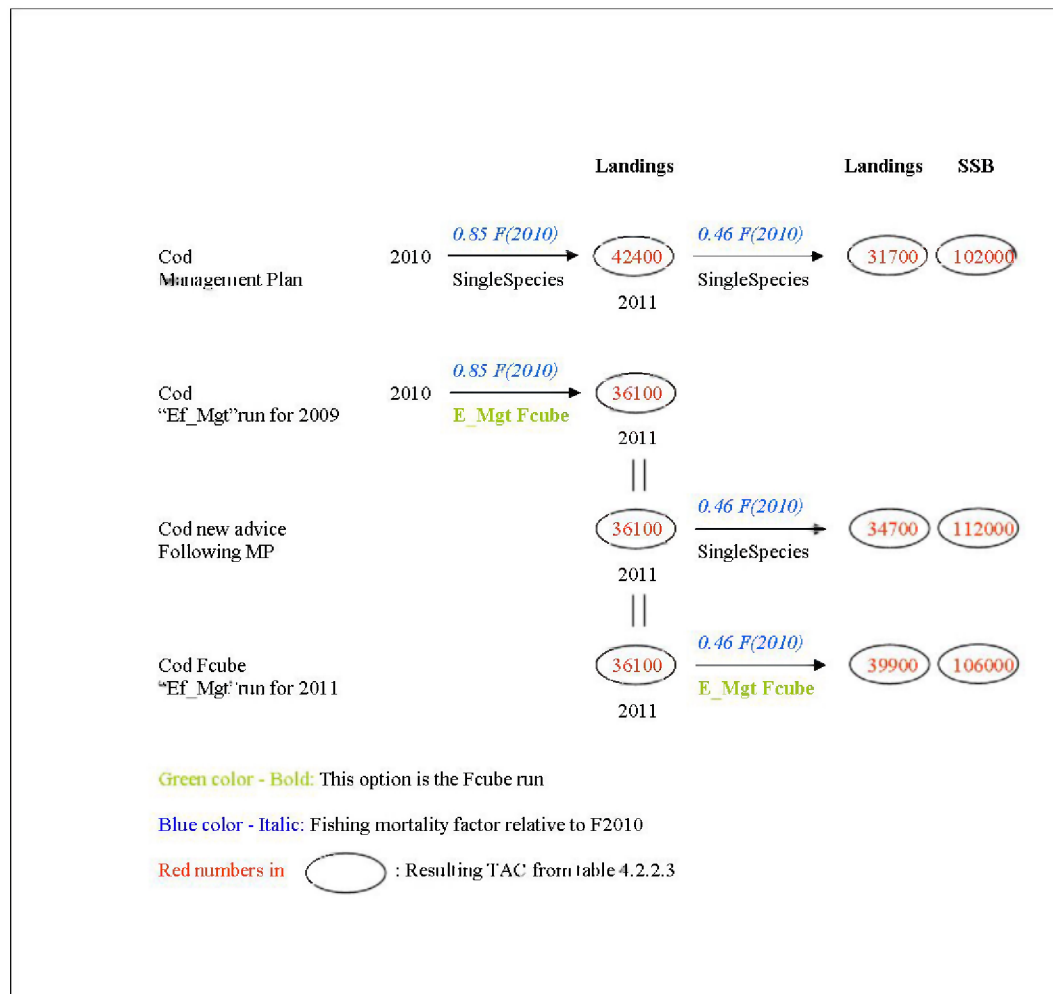
The model takes into account the effort and catches of separate metiers and predicts catches on the basis of different scenarios with effort and catch limitations.



### Assumptions in Fcube

- i) Stock-metier catchability is determined according to
  - A) Average over last three years if a linear fit to log catchabilities demonstrates no significant trend (5% confidence limit)
  - B) Catchability from most recent year if a linear fit to log catchabilities demonstrates a significant trend (5% confidence limit)
- ii) Fleet effort share by metier is the same as averaged over a number of years (usually most recent three years). It does not change within the management year as a result of restrictions except in the **Ef\_Mgt** scenario. In the **Ef\_Mgt** scenario, for appropriate metiers effort is changed by the same amount as in the effort ceilings for metiers imposed for the intermediate year by the Commission.
- iii) Discards are allocated to fleets based on available data
- iv) Relative stability (of quota) and average landing shares

The following flow diagram and text is aimed to aid the interpretation of tables XX and YY. The example follows the landings results for the cod stock in the Fcube Ef\_Mgt scenario under the MP advice approach:



In this example, the baseline run, which follows the single-stock ICES advice, assumes landings of 42400 tonnes in 2011 (corresponding to a 15% reduction in F from F2010 to F2011 following the Management Plan), and 31700 tonnes in 2012 (2<sup>nd</sup> column Table XX). The resulting SSB in 2013 is estimated to be 102000 tonnes (2<sup>nd</sup> column Table YY). However, assuming that the effort restrictions imposed for 2011 on TR1, TR2 and BT2 (15% reduction for TR1 and TR2 and 5-10% reductions for BT2 depending on the country, compared to 2010) are applied, the 2011 landings are estimated at 36100 tonnes, i.e. 15% less than assumed in the baseline. If this was the case, then the TAC advice for 2012 could be set to 34700 tonnes in order to comply with the management plan rules on single species advice in 2012, i.e. an increase of 9% compared to the single-species advice (11<sup>th</sup> column Table XX). The resulting SSB in 2013 is estimated to be 112000 tonnes (11<sup>th</sup> column Table YY), 10% higher than the resulting SSB following the single species advice according to the cod Management Plan.

If again we assume that the fleets fish in line with the effort reductions in 2012 (18% reduction for TR1 and TR2 compared to 2011), then the potential landings in 2012 would be estimated at 39900 tonnes (12<sup>th</sup> column Table XX), i.e. 26% above the initial single-stock baseline and 15% above the landings corresponding to the Management Plan. While the Single-Stock advice estimates an SSB level around 102000 tonnes by

2013 under full compliance with the MP, the **Ef\_Mgt** Fcube scenario (following the effort reduction from the Management Plan) estimates SSB in 2013 as high as 106000 tonnes (12<sup>th</sup> column Table YY).

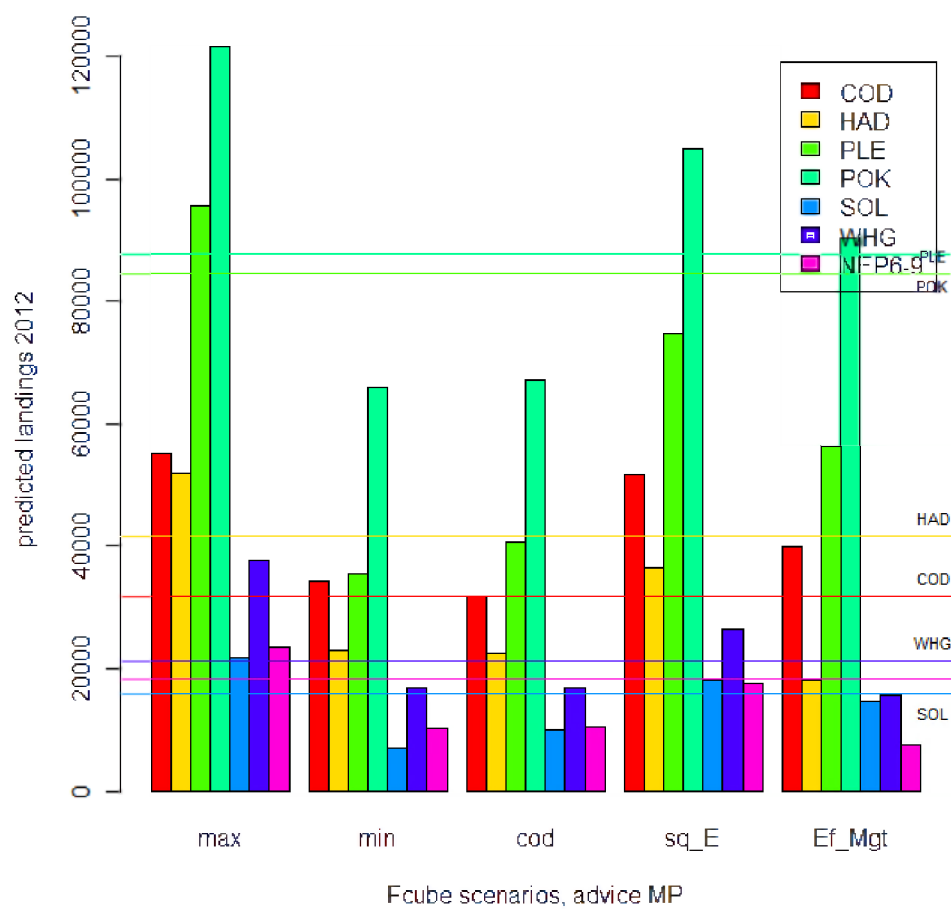
### Baseline for the prediction

**Table AA1: Baseline values used in the mixed fisheries projections**

	Management Plan		
	Landings in intermediate year ('000 t)	F multiplier	SSB ('000 t)
COD	42.4	0.85	52.3
HAD	31.4	1.0	235.0
PLE	68.7	1.0	523.0
POK	103.0	1.03	134.0
SOL	15.8	1.0	36.0
WHG	24.1	1.0	207.0
NEP5	1.1		
NEP6	1.6	1.13	
NEP7	14.5	1.13	
NEP8	2.1	1.13	
NEP9	1.2	1.13	
NEP10	0.04		
NEP32	0.46		
NEP33	0.91		
NEPOTH	1.6		

**Table AA2: Effort reductions in 2011 compared to 2010 and 2012 compared to 2011 by EU regulated fleet segment.**

Gear Description	Code	% effort reduction 2011	% effort reduction 2012
Bottom trawls and seines >= 100mm	TR1	15.4%	18.2%
Bottom trawls and seines >= 70mm & < 100mm	TR2	15.4%	18.2%
Bottom trawls and seines >= 16mm & < 32mm	TR3	0%	0%
Beam trawls >= 120mm	BT1	0%	0%
Beam trawls >= 80mm & < 120mm	BT2	Between 0% and 9.92% for some countries	0%
Gill nets and entangling nets, excluding	GN1	0%	0%
Trammel nets	TN1	0%	0%
Longlines	LL1	0%	0%
Not regulated gear	None	0%	0%



**Figure #1.** TAC year results. Fcube estimates of landings by stock after two successive years of applying the Fcube scenarios. Coloured horizontal lines correspond to the TAC set by the single species advice (as reproduced by the 'baseline run').

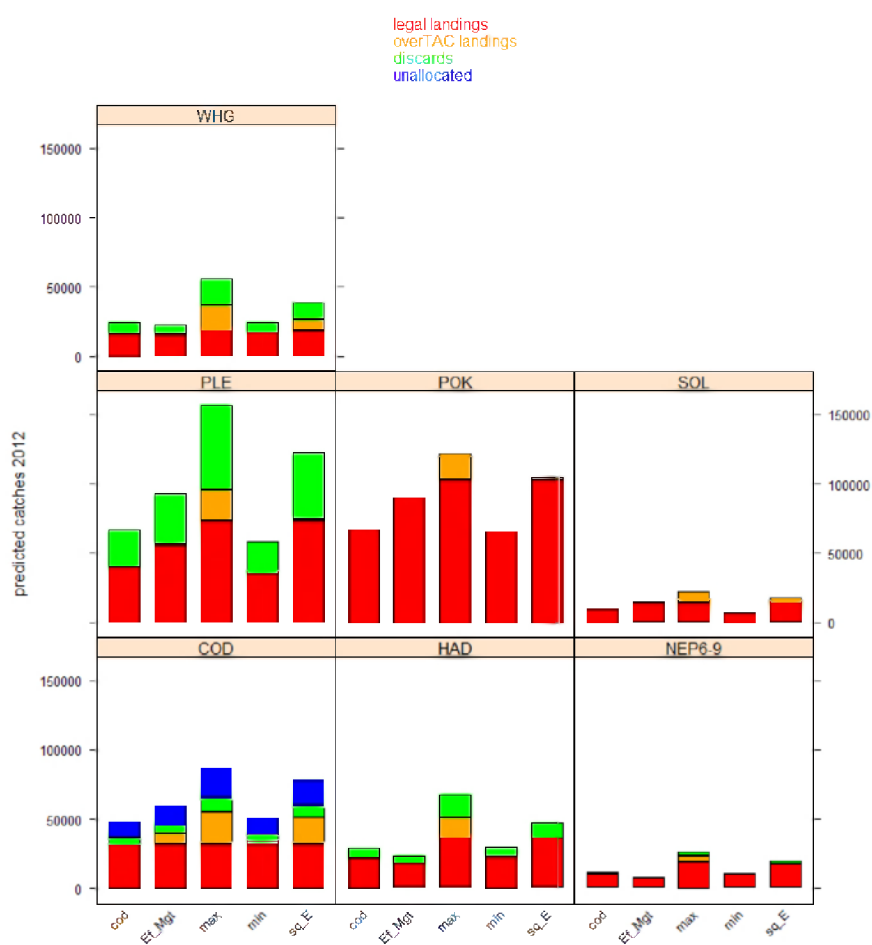
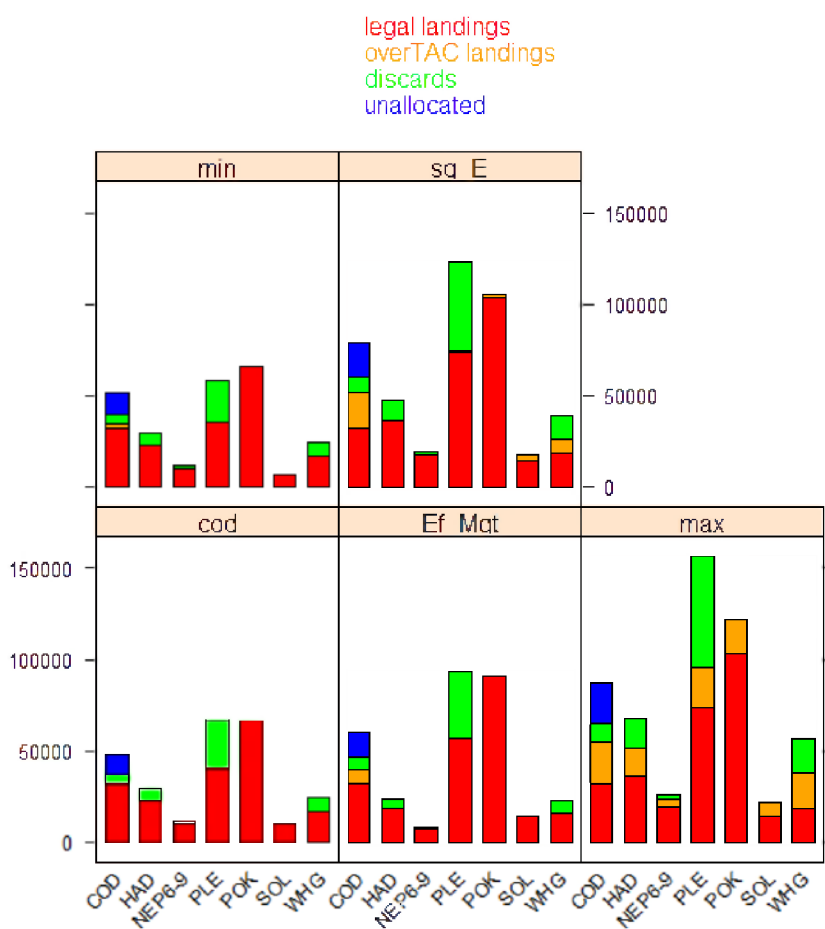


Figure #2. TAC year results (2012). Total estimated catches by stock and Fcube scenario in 2012. Red: potential landings (as estimated from previous ratios of landings vs. discards) up to the advised single stock 2012 TAC. Orange: potential landings (as estimated from previous ratios of landings vs. discards) above the advised single stock 2012 TAC. Green: Discards. Blue: Unallocated removals (maintained constant across scenarios).



**Figure #3. TAC year results (2012). Total estimated catches by stock and Fcube scenario in 2012. Red: potential landings (as estimated from previous ratios of landings vs. discards) up to the advised single stock 2012 TAC. Orange: potential landings (as estimated from previous ratios of landings vs. discards) above the advised single stock 2012 TAC. Green: Discards. Blue: Unallocated removals (maintained constant across scenarios).**

## References

ICES, 2011. Report of the Working Group on Mixed Fisheries Advice for the North Sea (WGMIXFISH), 29 August - 2 September 2011. ICES CM 2011/ACOM:22.

## Annex 5: Stock-based management plans

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### Cod in IIIa – IV – VIId (Norway-EU management plan and EU management plan – EC 1342/2008)

#### EU Norway management plan

In 2008 the EU and Norway renewed their initial agreement from 2004 and agreed to implement a long-term management plan for the cod stock, which is consistent with the precautionary approach and is intended to provide for sustainable fisheries and high yield.

#### Transitional arrangement

F will be reduced as follows: 75 % of F in 2008 for the TACs in 2009, 65 % of F in 2008 for the TACs in 2010, and applying successive decrements of 10 % for the following years.

The transitional phase ends as from the first year in which the long-term management arrangement (paragraphs 3- 5) leads to a higher TAC than the transitional arrangement.

#### Long-term management

1. If the size of the stock on 1 January of the year prior to the year of application of the TACs is:
  - a. Above the precautionary spawning biomass level, the TACs shall correspond to a fishing mortality rate of 0.4 on appropriate age groups;
  - b. Between the minimum spawning biomass level and the precautionary spawning biomass level, the TACs shall not exceed a level corresponding to a fishing mortality rate on appropriate age groups equal to the following formula:
 
$$0.4 - (0.2 * (\text{Precautionary spawning biomass level} - \text{spawning biomass}) / (\text{Precautionary spawning biomass level} - \text{minimum spawning biomass level}))$$
  - c. At or below the limit spawning biomass level, the TAC shall not exceed a level corresponding to a fishing mortality rate of 0.2 on appropriate age groups.
2. Notwithstanding paragraphs 2 and 3, the TAC for 2010 and subsequent years shall not be set at a level that is more than 20 % below or above the TACs established in the previous year.
3. Where the stock has been exploited at a fishing mortality rate close to 0.4 during three successive years, the parameters of this plan shall be reviewed on the basis of advice from ICES in order to ensure exploitation at maximum sustainable yield.
4. The TAC shall be calculated by deducting the following quantities from the total removals of cod that are advised by ICES as corresponding to the fishing mortality rates consistent with the management plan:
  - a. A quantity of fish equivalent to the expected discards of cod from the stock concerned;
  - b. A quantity corresponding to other relevant sources of cod mortality.
5. The Parties agree to adopt values for the minimum spawning biomass level (70,000 tonnes), the precautionary biomass level (150,000 tonnes) and to review these quantities as appropriate in the light of ICES advice.

#### Procedure for setting TACs in data-poor circumstances

6. If, due to a lack of sufficiently precise and representative information, it is not possible to implement the provisions in paragraphs 3 to 6, the TAC will be set according to the following procedure.
  - a. If the scientific advice recommends that the catches of cod should be reduced to the lowest possible level the TAC shall be reduced by 25% with respect to the TAC for the preceding year;
  - b. In all other cases the TAC shall be reduced by 15% with respect to the TAC for the previous year, unless the scientific advice recommends otherwise.

This plan shall be subject to triennial review, the first of which will take place before 31 December 2011. It enters into force on 1 January 2009.

The main changes between this and the plan of 2004 are the phasing (transitional and long-term phase) and the inclusion of an F reduction fraction.

In December 2008 the European Council agreed on a new cod management plan implementing the new system of effort management and a target fishing mortality of 0.4 (EC 1342/2008). The HCR for setting TAC for the North Sea cod stock are as follows:

#### **EU management plan**

Article 7 1.(a) and 1.(b) are required for interpretation of Article 8.

*Article 7: Procedure for setting TACs for cod stocks in the Kattegat the west of Scotland and the Irish Sea*

1. Each year, the Council shall decide on the TAC for the following year for each of the cod stocks in the Kattegat, the west of Scotland and the Irish Sea. The TAC shall be calculated by deducting the following quantities from the total removals of cod that are forecast by STECF as corresponding to the fishing mortality rates referred to in paragraphs 2 and 3:
  - (a) a quantity of fish equivalent to the expected discards of cod from the stock concerned;
  - (b) as appropriate a quantity corresponding to other sources of cod mortality caused by fishing to be fixed on the basis of a proposal from the Commission. [...]

*Article 8: Procedure for setting TACs for the cod stock in the North Sea*

1. Each year, the Council shall decide on the TACs for the cod stock in the North Sea. The TACs shall be calculated by applying the reduction rules set out in Article 7 paragraph 1(a) and (b).
2. The TACs shall initially be calculated in accordance with paragraphs 3 and 5. From the year where the TACs resulting from the application of paragraphs 3 and 5 would be lower than the TACs resulting from the application of paragraphs 4 and 5, the TACs shall be calculated according to the paragraphs 4 and 5.
3. Initially, the TACs shall not exceed a level corresponding to a fishing mortality which is a fraction of the estimate of fishing mortality on appropriate age groups in 2008 as follows: 75 % for the TACs in 2009, 65 % for the TACs in 2010, and applying successive decrements of 10 % for the following years.
4. Subsequently, if the size of the stock on 1 January of the year prior to the year of application of the TACs is:
  - (a) above the precautionary spawning biomass level, the TACs shall correspond to a fishing mortality rate of 0,4 on appropriate age groups;



- (b) *between the minimum spawning biomass level and the precautionary spawning biomass level, the TACs shall not exceed a level corresponding to a fishing mortality rate on appropriate age groups equal to the following formula:  $0,4 - (0,2 * (\text{Precautionary spawning biomass level} - \text{spawning biomass}) / (\text{Precautionary spawning biomass level} - \text{minimum spawning biomass level}))$*
- (c) *at or below the limit spawning biomass level, the TACs shall not exceed a level corresponding to a fishing mortality rate of 0,2 on appropriate age groups.*
- 5. *Notwithstanding paragraphs 3 and 4, the Council shall not set the TACs for 2010 and subsequent years at a level that is more than 20 % below or above the TACs established in the previous year.*
- 6. *Where the cod stock referred to in paragraph 1 has been exploited at a fishing mortality rate close to 0,4 during three successive years, the Commission shall evaluate the application of this Article and, where appropriate, propose relevant measures to amend it in order to ensure exploitation at maximum sustainable yield.*

*Article 9: Procedure for setting TACs in poor data conditions*

*Where, due to lack of sufficiently accurate and representative information, STECF is not able to give advice allowing the Council to set the TACs in accordance with Articles 7 or 8, the Council shall decide as follows:*

- (a) *where STECF advises that the catches of cod should be reduced to the lowest possible level, the TACs shall be set according to a 25 % reduction compared to the TAC in the previous year;*
- (b) *in all other cases the TACs shall be set according to a 15 % reduction compared to the TAC in the previous year, unless STECF advises that this is not appropriate.*

*Article 10: Adaptation of measures*

- 1. *When the target fishing mortality rate in Article 5(2) has been reached or in the event that STECF advises that this target, or the minimum and precautionary spawning biomass levels in Article 6 or the levels of fishing mortality rates given in Article 7(2) are no longer appropriate in order to maintain a low risk of stock depletion and a maximum sustainable yield, the Council shall decide on new values for these levels.*
- 2. *In the event that STECF advises that any of the cod stocks is failing to recover properly, the Council shall take a decision which:*
  - (a) *sets the TAC for the relevant stock at a level lower than that provided for in Articles 7, 8 and 9;*
  - (b) *sets the maximum allowable fishing effort at a level lower than that provided for in Article 12;*
  - (c) *establishes associated conditions as appropriate.*

### **Haddock in IIIa – IV (EU and Norway management plan)**

*“The plan consists of the following elements:*

1. Every effort shall be made to maintain a minimum level of Spawning Stock Biomass greater than 100,000 tonnes (Blim).
2. For 2009 and subsequent years the Parties agreed to restrict their fishing on the basis of a TAC consistent with a fishing mortality rate of no more than 0.3 for appropriate age-groups, when the SSB in the end of the year in which the TAC is applied is estimated above 140,000 tonnes (Bpa).
3. Where the rule in paragraph 2 would lead to a TAC, which deviates by more than 15 % from the TAC of the preceding year, the Parties shall establish a TAC that is no more than 15 % greater or 15 % less than the TAC of the preceding year.
4. Where the SSB referred to in paragraph 2 is estimated to be below Bpa but above Blim the TAC shall not exceed a level which will result in a fishing mortality rate equal to  $0.3 - 0.2 * (Bpa - SSB) / (Bpa - Blim)$ . This consideration overrides paragraph 3.
5. Where the SSB referred to in paragraph 2 is estimated to be below Blim the TAC shall be set at a level corresponding to a total fishing mortality rate of no more than 0.1. This consideration overrides paragraph 3.
6. In the event that ICES advises that changes are required to the precautionary reference points Bpa (140,000t) or Blim, (100,000t) the Parties shall meet to review paragraphs 1-5.
7. In order to reduce discarding and to increase the spawning stock biomass and the yield 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.
8. No later than 31 December 2010, the parties shall review the arrangements in paragraphs 1 to 7 in order to ensure that they are consistent with the objective of the plan. This review shall be conducted after obtaining inter alia advice from ICES concerning the performance of the plan in relation to its objective.
9. This arrangement enters into force on 1 January 2009.”

### **Saithe in IIIa – IV – VI (EU and Norway management plan)**

In 2008 EU and Norway renewed the existing agreement on “a long-term plan for the saithe stock in the Skagerrak, the North Sea and west of Scotland, which is consistent with a precautionary approach and designed to provide for sustainable fisheries and high yields. The plan shall consist of the following elements.

1. Every effort shall be made to maintain a minimum level of Spawning Stock Biomass (SSB) greater than 106,000 tonnes (Blim).
2. Where the SSB is estimated to be above 200,000 tonnes the Parties agreed to restrict their fishing on the basis of a TAC consistent with a fishing mortality rate of no more than 0.30 for appropriate age groups.
3. Where the SSB is estimated to be below 200,000 tonnes but above 106,000 tonnes, the TAC shall not exceed a level which, on the basis of a scientific evaluation by ICES, will result in a fishing mortality rate equal to  $0.30 - 0.20 * (200,000 - SSB) / 94,000$ .
4. Where the SSB is estimated by the ICES to be below the minimum level of SSB of 106,000 tonnes the TAC shall be set at a level corresponding to a fishing mortality rate of no more than 0.1.
5. Where the rules in paragraphs 2 and 3 would lead to a TAC which deviates by more than 15 % from the TAC of the preceding year the Parties shall fix a TAC that is no more than 15 % greater or 15 % less than the TAC of the preceding year.

6. *Notwithstanding paragraph 5 the Parties may where considered appropriate reduce the TAC by more than 15 % compared to the TAC of the preceding year.*
7. *A review of this arrangement shall take place no later than 31 December 2012.*
8. *This arrangement enters into force on 1 January 2009."*

#### **Plaice in IV (Multiannual plan for sole and plaice in the North Sea EC 676/2007)**

Extract from Council Regulation (EC) No 676/2007 of 11 June 2007 establishing a multiannual plan for fisheries exploiting stocks of plaice and sole in the North Sea:

##### **Article 2 Safe biological limits**

1. *For the purposes of this Regulation, the stocks of plaice and sole shall be deemed to be within safe biological limits in those years in which, according to the opinion of the Scientific, Technical, and Economic Committee for Fisheries (STECF), all of the following conditions are fulfilled:*
  - (a) *the spawning biomass of the stock of plaice exceeds 230 000 tonnes;*
  - (b) *the average fishing mortality rate on ages two to six years experienced by the stock of plaice is less than 0,6 per year;*
  - (c) *the spawning biomass of the stock of sole exceeds 35 000 tonnes;*
  - (d) *the average fishing mortality rate on ages two to six years experienced by the stock of sole is less than 0,4 per year.*
2. *If the STECF advises that other levels of biomass and fishing mortality should be used to define safe biological limits, the Commission shall propose to amend paragraph 1*

##### **Article 3 Objectives of the multiannual plan in the first stage**

1. *The multiannual plan shall, in its first stage, ensure the return of the stocks of plaice and of sole to within safe biological limits.*
2. *The objective specified in paragraph 1 shall be attained by reducing the fishing mortality rate on plaice and sole by 10 % each year, with a maximum TAC variation of 15 % per year until safe biological limits are reached for both stocks.*

##### **Article 4 Objectives of the multiannual plan in the second stage**

1. *The multiannual plan shall, in its second stage, ensure the exploitation of the stocks of plaice and sole on the basis of maximum sustainable yield.*
2. *The objective specified in paragraph 1 shall be attained while maintaining the fishing mortality on plaice at a rate equal to or no lower than 0,3 on ages two to six years.*
3. *The objective specified in paragraph 1 shall be attained while maintaining the fishing mortality on sole at a rate equal to or no lower than 0,2 on ages two to six years.*

##### **Article 5 Transitional arrangements**

1. *When the stocks of plaice and sole have been found for two years in succession to have returned to within safe biological limits the Council shall decide on the basis of a proposal from the Commission on the amendment of Articles 4(2) and 4(3) and the amendment of Articles 7, 8 and 9 that will, in the light of the latest scientific advice from the STECF, permit the exploitation of the stocks at a fishing mortality rate compatible with maximum sustainable yield.*

**Article 7 Procedure for setting the TAC for plaice:**

1. *The Council shall adopt the TAC for plaice at that level of catches which, according to a scientific evaluation carried out by STECF is the higher of*
  - (a) *that TAC the application of which will result in a 10 % reduction in the fishing mortality rate in its year of application compared to the fishing mortality rate estimated for the preceding year;*
  - (b) *that TAC the application of which will result in the level of fishing mortality rate of 0.3 on ages two to six years in its year of application.*
2. *Where application of paragraph 1 would result in a TAC which exceeds the TAC of the preceding year by more than 15 %, the Council shall adopt a TAC which is 15 % greater than the TAC of that year.*
3. *Where application of paragraph 1 would result in a TAC which is more than 15 % less than the TAC of the preceding year, the Council shall adopt a TAC which is 15 % less than the TAC of that year.*

**Sole in IV (Multiannual plan for sole and plaice in the North Sea EC 676/2007)**

Extract from Council Regulation (EC) No 676/2007 of 11 June 2007 establishing a multiannual plan for fisheries exploiting stocks of plaice and sole in the North Sea

**Article 2 Safe biological limits**

1. *For the purposes of this Regulation, the stocks of plaice and sole shall be deemed to be within safe biological limits in those years in which, according to the opinion of the Scientific, Technical, and Economic Committee for Fisheries (STECF), all of the following conditions are fulfilled:*
  - (a) *the spawning biomass of the stock of plaice exceeds 230 000 tonnes;*
  - (b) *the average fishing mortality rate on ages two to six years experienced by the stock of plaice is less than 0,6 per year;*
  - (c) *the spawning biomass of the stock of sole exceeds 35 000 tonnes;*
  - (d) *the average fishing mortality rate on ages two to six years experienced by the stock of sole is less than 0,4 per year.*
2. *If the STECF advises that other levels of biomass and fishing mortality should be used to define safe biological limits, the Commission shall propose to amend paragraph 1*

**Article 3 Objectives of the multiannual plan in the first stage**

1. *The multiannual plan shall, in its first stage, ensure the return of the stocks of plaice and of sole to within safe biological limits.*
2. *The objective specified in paragraph 1 shall be attained by reducing the fishing mortality rate on plaice and sole by 10 % each year, with a maximum TAC variation of 15 % per year until safe biological limits are reached for both stocks.*

**Article 4 Objectives of the multiannual plan in the second stage**

1. *The multiannual plan shall, in its second stage, ensure the exploitation of the stocks of plaice and sole on the basis of maximum sustainable yield.*
2. *The objective specified in paragraph 1 shall be attained while maintaining the fishing mortality on plaice at a rate equal to or no lower than 0,3 on ages two to six years.*

3. *The objective specified in paragraph 1 shall be attained while maintaining the fishing mortality on sole at a rate equal to or no lower than 0,2 on ages two to six years.*

#### **Article 5 Transitional arrangements**

1. *When the stocks of plaice and sole have been found for two years in succession to have returned to within safe biological limits the Council shall decide on the basis of a proposal from the Commission on the amendment of Articles 4(2) and 4(3) and the amendment of Articles 7, 8 and 9 that will, in the light of the latest scientific advice from the STECF, permit the exploitation of the stocks at a fishing mortality rate compatible with maximum sustainable yield.*

#### **Article 8 Procedure for setting the TAC for sole:**

- 1) *The Council shall adopt a TAC for sole at that level of catches which, according to a scientific evaluation carried out by STECF is the higher of*
  - (a) *that TAC the application of which will result in the level of fishing mortality rate of 0,2 on ages two to six years in its year of application;*
  - (b) *that TAC the application of which will result in a 10 % reduction in the fishing mortality rate in its year of application compared to the fishing mortality rate estimated for the preceding year.*
- 2) *Where the application of paragraph 1 would result in a TAC which exceeds the TAC of the preceding year by more than 15 %, the Council shall adopt a TAC which is 15 % greater than the TAC of that year.*
- 3) *Where the application of paragraph 1 would result in a TAC which is more than 15 % less than the TAC of the preceding year, the Council shall adopt a TAC which is 15 % less than the TAC of that year.*

#### **Whiting in IV – VIId (EU and Norway interim management plan)**

The TAC for whiting for 2011 will be fixed by applying an interim management plan consisting of the following elements:

1. *For 2011 and subsequent years the Parties agreed to restrict their fishing on the basis of a TAC consistent with a fishing mortality rate of no more than 0.3 for appropriate age-groups.*
2. *Where the rule in paragraph 1 would lead to a TAC, which deviates by more than 15 % from the TAC of the preceding year, the Parties shall establish a TAC that is no more than 15 % greater or 15 % less than the TAC of the preceding year.*
3. *During 2011, after obtaining advice from ICES, the Parties will refine the management plan, in particular to allow for a reduction in the target fishing mortality when recruitment to the stock has been low for a period of years.*

## Annex 6: Recommendations

Recommendation	For follow up by:
1. ICES should send out a data call for WGNSSK, WGMIXFISH (WGSAM) by end of February 2012 to be fulfilled two weeks before the start of WGNSSK.	ICES' secretariat
2. ICES and STECF liaise in arranging expert group meetings for 2012 such that WGMIXFISH can be held before ICES ADNS and mixed fisheries forecast results incorporated into ICES June advice.	ICES' secretariat and Commission through STECF
3. ICES and STECF liaise over adding spatially resolved landings data to the STECF 'effort meeting' data call already requesting effort by statistical rectangle.	ICES' secretariat and Commission through STECF
4. ICES data centre co-ordinate addition of non-EU data to the publically available spatial data resulting from the STECF 'effort meeting' data call.	ICES data centre
5. ICES data centre produce maps of the landings and effort data described under recommendations 3 and 4 to be hosted on the ICES website.	ICES data centre