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Executive summary

The ICES' Working Group on Mixed Fisheries Advice for the North Sea [WGMIXFISH-NS] (Chair: Steven Holmes (UK)) met at ICES HQ, 20-24 May 2013 to apply mixed fisheries forecasts to the draft North Sea single species advice formed by WGNSSK 2013.

The meeting has produced a North Sea Mixed Fisheries Advice sheet and included lines showing mixed fisheries scenario outcomes in the single species advice sheets (for those stocks considered) for consideration by the ACOM advice drafting group. The North Sea Mixed Fisheries Annex is a separate document with minor updates from last year.

The mixed fisheries runs followed the approach used by ICES; management plan where it exists and MSY approach 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*. The plaiceVIId and soleVIId stocks were added to the full scenario calculations. All of these are now subject to multi-annual management plans apart from plaiceVIId, soleVIId and *Nephrops*. Five scenarios were considered.

1) **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.
2) **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.
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. Effort limits under the EU effort management regime were left unchanged in 2013 and the WG considered the relationship between F and effort changes under the long term management phase of the cod recovery plan open to interpretation but still included the scenario, having made its own interpretation of the control rule.

In a change to previous years, the intermediate year made use of the status quo effort scenario before application of the alternative scenarios in the advice year., (previously each scenario was applied in both intermediate and advice year). The change was considered to better reflect the assumptions on fleet behaviour used in the majority of single species short term forecasts.

The impact of mixed fisheries scenarios on two stocks, northern hake and plaice 3aN were considered without their incorporation into the mixed fisheries projections. The Plaice 3aN TAC is predicted as underutilised even under assumption of status quo effort. The North Sea quota of Northern Hake is predicted to be underutilised under

the **min**, **cod** and **Ef_Mgt** scenarios but assuming status quo effort leads to prediction of over quota landings.

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. In general the results indicate that the approach used does not lead to violation of the underlying hypothesis of relative stability in TAC sharing (quotas) across nations. Only minor deviations are observed across scenarios, except for the **Ef_Mgt** scenario. Here the fact the majority of Scottish vessels come under the scope of the EU effort management regime whereas Norwegian vessels are unaffected by the same regime leads to a shift of landings share from the former to the latter under the assumptions of the model.

As in 2012 data for this WG was requested as part of a joint WGNSSK-WGMIXFISH data call which allows a greater consistency between catch totals supplied to WGMIXFISH and WGNSSK. As an addition to its terms of reference the group also considered the consistency between the data supplied to this WG and that supplied to STECF for comparable fleet categories.

The WG wished to consider more stocks that straddle ICES areas IV and VI and in 2013 a new joint WGCSE-WGMIXFISH data call was issued (this covered e.g. Anglerfish and Megrim in IV and VI). Time pressures were such, however, that it was not possible to consider a second set of data files. The WG considers the best solution is a single joint WGCSE-WGNSSK-WGMIXFISH data call. This would also ensure consistent fleet and metier definitions for the same vessels between areas.

1 Introduction

1.1 Background

The **Working Group on Mixed Fisheries Advice for the North Sea** [WGMIXFISH-NS] (Chair: Steven Holmes (UK)) met at ICES HQ, 20-24 May 2013 to apply mixed fisheries forecasts to the North Sea single species advice. As in 2012 WGMIXFISH advice is to be considered by ADGNS as for the single species advice and so the WG can only consider preliminary advice. The output from this group applies the methodology 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). At WGMIXFISH 2011 the WG considered steps to fuller integration of mixed fisheries forecasts into stock advice. Most of the steps recommended have been implemented starting in 2012.

The mixed fishery advice will be based on the CFP TAC regime and is consistent with relative stability. 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*. The plaiceVIId and soleVIId stocks were added to the full scenario calculations. All of these are now subject to multi-annual management plans apart from plaiceVIId, soleVIId and *Nephrops*.

With the approach of a land all policy by the EU other stocks have been raised as a concern in terms of their limiting nature. Among these are northern hake and plaice 3aN. The working group considers technical issues prevent these stocks from being incorporated into the mixed fisheries projections but, using catchabilities measured in 2012, landings of northern hake (from the North Sea) and plaice 3aN, were calculated once the mixed fisheries projections had determined fleet effort levels.

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 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 Regulations (EU) 39/2013 and (EU) 40/2013. The totals in 2013 are unchanged from those in 2012. 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.

2.1 Stock-based management plans

The majority of the stocks considered here as part of the demersal mixed fisheries of the North Sea are subject to multi-annual management plans. 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.

2.2 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 and Commission Decision 2010/93/UE), 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.

From 2012 WGMIXFISH has requested data according to aggregations based on the definitions of the EU Data Collection Framework (DCF). The data call allowed merging across DCF metiers (see section 3.2 and Annex 2) and as such national data entries were sometimes not by métier in the strict sense. Merging of metiers to reduce to a

manageable number going forwards in the forecasts further leads to the formation of combined or 'supra-metiers'.

2.3 Terms of Reference

The terms of reference for WGMIXFISH were as follows

2012/2/ACOM22a **The Working Group on Mixed Fisheries Advice for the North Sea** (WGMIXFISH-NS), chaired by Steven Holmes, UK, will meet at ICES Headquarters, 20–24 May 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 WGNSSK in April 2013, and the management measures in place for 2013, including an option for reaching F_{MSY} for all stocks in 2015;

b) Update the mixed fisheries annex for the North Sea;

c) Produce a draft mixed-fisheries section for the ICES' advisory report 2013 that includes a presentation of the fleet and fisheries data and forecasts;

WGMIXFISH-NS will report by 31 May 2013 for the attention of ACOM.

2.4 Consistency of data between ICES WGMIXFISH and STECF

Fleet and metier specific catch and effort data is not only necessary for mixed fisheries forecasts but also important in other fora, most notably the STECF reviews of EU effort management schemes. It is also true that variations in the methods used to compile the data, e.g. raising schemes, criteria for assigning effort to areas for multi area trips, or even the date at which raw data was drawn from a national database, can and do lead to different results. To help managers it is important that the international datasets of ICES and STECF are as consistent as possible. As an addition to its terms of reference the group also considered the consistency between the data supplied to this WG and that supplied to STECF for comparable fleet categories. Because of differences in WG timings and the availability of data the comparison was made on 2011 data. The findings from this comparison are given in Annex 4.

3 Software

All analyses were conducted using the FLR framework (Kell *et al*. (2007); www.flr-project.org) running with R2.14.1 (R Development Core Team, 2011). 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:

https://groupnet.ices.dk/WGMIXFISH2013/Report%202013/Forms/AllItems.aspx

3.1 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 2013, single-species ICES advice was given according to a single preferred option; management plan if implemented, MSY approach otherwise. The basis for each single stock advice was retained in the current mixed-fisheries framework.

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.

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 to that supplied to the single species stock assessment working group (WGNSSK) and therefore WGMIXFISH runs projections on the basis of total landings and discards alone. From 2012 age distribution by métier and area is available to WGNSSK in InterCatch and it is ultimately the aim of WGMIXFISH to include age specific data in the projections.

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

1) **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.

2) **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.

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 scenario is set up so that métiers controlled by the EU effort management regime has effort adjusted according to the regime. In 2013 all effort totals were left unaltered and whether effort controls are re-introduced in 2014 is undecided. For 2014 the cod single species advice entered the long term management phase for the first time and the relationship between F and effort becomes open to interpretation. The WG implemented the scenario using the assumption that the % change in effort from 2013 to 2014 is the same as the % change in F. Possible effort reductions resulting from the EU flatfish management plan were not considered this year partly because the WG was

unsure how to invoke country-specific changes based on share of flatfish catches.

4 Input data and recent trends

4.1 Stocks

4.1.1 Data

The assessment data for the different stocks were taken from ICES WGNSSK (2013a). 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 cod assessment is performed using the state-space SAM model. This makes use of stochastic projections which are hard to replicate using the deterministic Fcube software. New for 2012 the cod assessment does not estimate unallocated removals, which simplifies handling within Fcube.

Nephrops stocks were incorporated in the evaluation by functional unit. For the *Nephrops* stocks in FU 5, FU6, FU7, FU8, FU9, FU32, FU33, FU34 and *Nephrops* from areas outside the functional units, the ICES advices were taken for the Fmsy approach.

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 five other functional units (FU 5, 10, 32, 33 and 34) and catches outside of the functional units in the North Sea were omitted in the projections.

The final data set extracted from InterCatch for use by WGNSSK includes cases where discards have been assigned to categories uploaded with only landings data. The data provided to WGMIXFISH, disaggregated by vessel length category and provided in csv files, contains no such assignments. InterCatch data is quarterly and in some cases a metier had raised discard data for some quarters but not others. This lead to different annual discard totals between InterCatch and csv file data. To make the data for Fcube compatible with the InterCatch output the following adjustment was made

$$d^* = \frac{Dl}{L}$$

Where d* is the revised discard value for the metier used by Fcube, l is the weight of landings for the metier used by Fcube and L and D are the weight of landings and discards entered for the (vessel length aggregated) metier in InterCatch.

4.1.2 Trends and advice

This advice is drafted by the WGNSSK-2013 before considerations by ACOM.

Recent trends are described on a stock-by-stock basis in ICES (2013a), 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. Table 3.1.2.1 lists the final advised TACs for 2014 and expected SSBs in 2015.

4.1.2.1 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, and is now in the vicinity of Blim. Fishing mortality declined from 2000 and is now estimated to be around 0.4, between Fpa and the FMSY proxy. Recruitment since 2000 has been poor.

Advice

ICES advises on the basis of the EU–Norway management plan that landings in 2014 should be no more than 28 809 tonnes. If discards rates do not change from those in 2012, this implies catches of no more than 37 496 tonnes.

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; Annex 6.4.3). In addition to the EU–Norway agreement, the EU plan also includes effort restrictions, reducing kW-days available to community vessels in the main metiers catching cod in direct proportion to reductions in fishing mortality until the long-term phase of the plan is reached, for which the target F is 0.4 if SSB is above B_{pa}. In 2013, there has been no reduction in effort ceilings compared to the preceding year.

In the recovery phase of 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 to achieve an F in 2014 equal to 25% of F_{2008} (F_{2014} = 0.16). This would lead to a TAC reduction of more than 20%, necessitating the application of the interannual TAC constraint (leading to F_{2014} = 0.18).

The long-term phase of the management is reached when the TAC derived from the long-term phase exceeds the TAC derived from the recovery phase. Application of the long-term phase calculates the target F as $0.4-(0.2 \times (B_{pa}-SSB_{2013}) / (B_{pa}-B_{lim}))$ which implies F_{2014} = 0.21, and hence leads to a TAC greater than that derived from the recovery phase, implying the management plan now switches to the long-term phase.

Following the management plan long-term phase, landings should be no more than 28 809 t in total for Subarea IV and Divisions IIIa West and VIId in 2014. If discard rates do not change from those in 2012, this implies catches in 2014 of no more than 37 496 t. Because of annual changes in fishing pattern the assumption on discard ratio is based on the most recent estimate.

2) Following the ICES MSY approach requires fishing mortality to be reduced to 0.11 (lower than F_{MSY} because SSB_{2014}< MSY $B_{trigger}$), resulting in catches of less than 21 014 t in 2014. This is expected to lead to an SSB of 141 150 t in 2015.

To follow the transition scheme towards the ICES MSY framework the fishing mortality must be reduced to (0.2 × 0.56) + (0.8 × 0.11) = 0.20, which is lower than F_{pa}. This implies catches of less than 36 507 t in 2014, which is expected to lead to an SSB of 128 251 t in 2015. If discards rates do not change from those in 2012, this implies landings in 2014 of no more than 28 057 t.

3) Following the precautionary approach, a 87% reduction in F is needed to increase SSB to around Bpa in 2015. This corresponds to catches of no more than 10 063 t in 2014. If discard rates do not change from those in 2012, this implies landings in 2014 of no more than 7781 t.

4.1.2.2 Haddock in IIIa – IV

Trends

Fishing mortality has been below Fpa and around FMSY 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 the TAC (Human Consumption landings) should be no more than 40 639 tonnes in 2014. If rates of discards and industrial bycatch do not change from the average of the last 3 years (2010–2012), this implies catches of no more than 45 318 tonnes.

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 ±15%. Following a minor revision in 2008, interannual quota flexibility ("banking and borrowing") of up to ±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 agreed management plan implies fishing at the target rate of 0.3, which results in a TAC (Human Consumption landings) reduction of more than 15%. Therefore, the maximum TAC reduction of 15% is applied, resulting in human consumption landings of no more than 40 639 t in 2014. If rates of discards and industrial bycatch do not change from the average of the last 3 years (2010–2012), this implies catches of no more than 45 318 t.

   This advice implies a reduction in TAC (15%) and increase in F (71%) which is due to the absence of young fish recruiting to the population, and hence a predicted decline in spawning-stock biomass. The possibility of extended periods of low recruitment was accounted for in the 2008 evaluation of the management plan that was deemed to be sustainable.

2) Following ICES MSY approach implies fishing mortality to be increased to 0.3, resulting in a TAC (Human Consumption landings) of no more than 37 146 t in 2014. If rates of discards and industrial bycatch do not change from the average of the last 3 years (2010–2012), this implies catches of no more than 41 418 t. This is expected to lead to an SSB of 204 000 t in 2015.

3) Following the precautionary approach, the fishing mortality in 2014 should be no more than F_{pa}, corresponding to human consumption landings of 85 775 t in 2014. If rates of discards and industrial bycatch do not change from the average of the last 3 years (2010–2012), this implies catches of no more than 95 538 t; this is expected to keep SSB just above B_{pa} in 2015.

4.1.2.3 Plaice in IV

Trends

The stock is well within precautionary limits, has increased in the past ten years, and has reached a record-high level in 2013. Recruitment has been around the long-term average from 2007 onwards. In recent years, fishing mortality has been estimated below FMSY.

Advice

ICES advises on the basis of stage one of the EU management plan (Council Regulation No. 676/2007) that landings should be no more than 111 631 tonnes in 2014. If discard rates do not change from the average of the last three years (2010–2012), this implies catches of no more than 159 584 tonnes.

Additional management considerations

1) The North Sea plaice and sole stocks have both 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. Application of the plan is on the basis of transitional arrangements until an evaluation of the plan has been conducted (as stipulated in article 5 of the EC regulation).

   Following the EU multiannual plan stage 1 (as rules relating to the setting of F for stage 2 are not yet defined) would imply fishing at the target rate of 0.3, which results in a TAC (landings) increase of more than 15%. Therefore, the maximum TAC increase of 15% is applied, resulting in landings of no more than 111 631 t in 2014. If discard rates do not change from the average of the last three years (2010–2012), this implies catches of no more than 159 584 t. This is expected to lead to an SSB of 737 017 t in 2015.

   ICES has evaluated this management plan and considers it to be precautionary (ICES, 2010a).

2) Following the ICES MSY approach implies an increase in fishing mortality to 0.25, resulting in catches of 153 069 t in 2014. If discard rates do not change from the average of the last three years (2010–2012), this implies landings of no more than 106 226 t. This is expected to lead to an SSB of 743 656 t in 2015.

   Given that the current (2012) estimate of fishing mortality is slightly below FMSY, there is no need to follow a transition scheme towards this reference value.

3) Following the precautionary approach, the fishing mortality in 2014 should be no more than Fpa (0.6), corresponding to catches of no more than 317 395 t in 2014. If discard rates do not change from the average of the last three years (2010–2012), this implies landings of no more than 222 529 t. This is expected to keep SSB above Bpa in 2015.

4.1.2.4 Sole in IV

Trends

SSB has fluctuated around the precautionary reference points for the last decade and is estimated to be well above Bpa in 2013. Fishing mortality has shown a declining trend since 1995 and is estimated to be close to Fmsy in 2012.

Advice

ICES advises on the basis of stage one of the EU management plan (Council Regulation No. 676/2007) that landings in 2014 should be no more than 11 900 tonnes. Discards are known to take place but cannot be quantified; therefore total catches cannot be calculated.

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. Application of the plan is on the basis of transitional arrangements until an evaluation of the plan has been conducted (as stipulated in article 5 of the EC regulation).

   Following the EU multiannual plan stage 1 (as rules relating to the setting of F for stage 2 are not yet defined) would imply a 10% reduction of F to 0.21, which results in a TAC (landings) reduction of more than 15%. Therefore, the maximum TAC reduction of 15% is applied, resulting in landings of no more than 11 900 t in 2014. This is expected to lead to an SSB of 46 070 t in 2015. Discards are known to take place but cannot be quantified; therefore total catches cannot be calculated.

   ICES has evaluated the plan and considers it to be precautionary (ICES, 2010b).

2) Following the ICES MSY approach implies fishing mortality to be reduced to 0.22 (F_{MSY}, as SSB 2012 > MSY $B_{trigger}$), resulting in landings of 11 194 t in 2014. Discards are known to take place but cannot be quantified; therefore total catches cannot be calculated. This is expected to lead to an SSB of 46 916 t in 2015.

   Given that the current (2012) estimate of fishing mortality is close to FMSY there is no need to follow a transition scheme towards this reference value.

3) Following the precautionary approach, implies fishing at Fpa for North Sea sole (0.4). This would lead to landings of 18 540 t in 2014 and an SSB of 39 175 t in 2015. Discards are known to take place but cannot be quantified; therefore total catches cannot be calculated.

4.1.2.5 Saithe in IIIa – IV – VI

Trends

SSB increased above Bpa in 1997, but has declined since 2005. The latest SSB estimate is close to Bpa. Fishing mortality has fluctuated around FMSY since 1997. Recruitment has been below average since 2006 and shows a declining trend in recent years.

Advice

ICES advises on the basis of the EU–Norway management plan that landings in 2014 should be no more than 85 581 tonnes for the whole assessment area. Discards

are known to take place but cannot be quantified; therefore total catches cannot be calculated.

Additional management considerations

1) The EU–Norway agreement management plan does not clearly state whether the SSB in the intermediate year or the SSB at 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 at the beginning of the intermediate year (2013).

Since SSB at the beginning of 2013 is below B_{pa}, paragraph 3 of the harvest control rule applies, resulting in a F of 0.29 and a TAC (landings) reduction of more than 15%. Therefore, the maximum TAC reduction of 15% is applied (paragraph 5), resulting in landings of no more than 85 581 t in 2014. This is expected to lead to an SSB of 176 099 t in 2015 which is below B_{pa}. Discards are known to take place but cannot be quantified; therefore total catches cannot be calculated.

2) Following the ICES MSY framework implies a fishing mortality of 0.29 (below F_{MSY} because SSB is below MSY Btrigger). This would result in landings of no more than 82 600 t in 2014. This is expected to lead to an SSB in 2015 of 178 400 t. Discards are known to take place but cannot be quantified, therefore total catches cannot be calculated.

3) Following the precautionary approach: An 49% reduction in F is needed to maintain SSB at B_{pa} in 2015. This corresponds to landings of no more than 56 181 t in 2014. Discards are known to take place but cannot be quantified; therefore total catches cannot be calculated.

4.1.2.6 Whiting in IV – VIId

Trends

SSB has been below average since 2002, while fishing mortality has been declining over the whole time series. Recruitment has been well below average since 2003.

Advice

ICES advises on the basis of precautionary considerations that total catches should be no more than 36 992 tonnes. If rates of discards and industrial bycatch do not change from the average of the last 3 years (2010-2012), this implies human consumption landings of no more than 24 389 tonnes (18 514 tonnes in the North Sea and 5875 tonnes in Division VIId). Management for Division VIId should be separated from the rest of Subarea VII.

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, 2010c). Consequently the EU and Norway have agreed to management of whiting at this level of total fishing mortality, conditional on a ±15% TAC constraint.

Following this management plan in 2013 implies a fishing mortality of 0.3, which would increase the TAC by more than 15%. Applying the TAC constraint would lead to human consumption landings of no more than 19 614 t

for the North Sea. Although not covered by the management plan, this option would lead to landings in Division VIId of no more than 7628 t.

After the considerable revisions in the 2012 assessment, caused by new estimates of natural mortality, the target F is no longer considered applicable and the management target needs re-evaluation.

Following the agreed management plan implies fishing at the target rate of 0.3, which results in a TAC increase for Human Consumption landings in IV of more than 15%. Therefore, the maximum TAC increase of 15% is applied, resulting in human consumption landings for the total area of no more than 28 680 t in 2014. If rates of discards and industrial bycatch do not change from the average of the last 3 years (2010-2012), this implies catches of no more than 43 391 t.

2) There are no reference points to enable FMSY advice

3) As an interim measure, the target F in the plan (0.3) has been scaled according to the proportional change in F between the old and new assessment. The level of F of the whole time-series was revised downwards by around 25% between the 2011 and 2012/2013 assessments, which would generate a target F of 0.225 (0.75 * 0.3).

Following this approach in 2014 with a target fishing mortality of 0.225 would lead to total catches of no more than 36 992 t. If rates of discards and industrial bycatch do not change from the average of the last 3 years (2010-2012), this implies human consumption landings of no more than 24 389 t (18 514 t in the North Sea and 5875 t in Division VIId).

4.1.2.7 Plaice in VIId

Trends

Fishing mortality has declined since the mid-1990s and is presently among the lowest in the time-series. Spawning-stock biomass declined from the 1990s to a record low (2003–2008) and has subsequently increased.

Advice

Based on the ICES approach for data limited stocks, ICES advises that landings of plaice in Division VIId should be no more than 3925 tonnes, and discarding should be reduced. Discards are known to be high but cannot be quantified; therefore total catches cannot be calculated.

Additional management considerations

1) There is currently no management plan for this stock.

2) For data-limited stocks with analytical assessment and forecast that are only treated qualitatively, ICES uses a short-term forecast using the F_{MSY} proxy (or lower, if stock biomass is estimated to be below MSY $B_{trigger}$) as a target to be reached by 2015. A change limit of ±20% is applied to the advice.

For this stock, no MSY Btrigger has been defined, and the method has been applied based on reaching the F_{MSY} proxy in 2015. This implies fishing mortality should be reduced to 0.28, based on (F_{2010}*0.2)+(F_{MSY}*0.8) (= (0.48*0.2)+(0.23*0.8)), resulting in landings of no more than 3925 t in 2014 (including plaice originating from the North Sea and Western English channel). This is expected to lead to an SSB increase of 18% in 2015.

Discards are known to be high but cannot be quantified therefore total catches cannot be calculated.

3) There is currently no advice given following the precautionary approach for this stock.

4.1.2.8 Sole in VIId

Trends

The spawning-stock biomass has fluctuated without trend and is above MSY $B_{trigger}$ since 2002. Fishing mortality has always been above FMSY, and has been above F_{pa} since 2005. Recruitment has been fluctuating without trend.

Advice

ICES advises on the basis of the transition to the MSY approach that catches in 2014 should be no more than 3251 tonnes. All catches are assumed to be landed.

Additional management considerations

1) There is currently no management plan for this stock

2) Following the ICES MSY approach implies fishing mortality to be reduced to 0.29 resulting in catches of less than 2894 t in 2014. This is expected to lead to an SSB of 11 319 t in 2015.

Following the transition scheme towards the ICES MSY approach implies that (F_{2010}*0.2) + (0.8*F_{MSY}) is 0.32, resulting in catches of less than 3251 t in 2014. This is expected to lead to an SSB of 11 054 t in 2015. Discards are not taken into account, but are considered to be small and all catches are assumed to be landed.

3) Following the precautionary approach, implies that fishing mortality in 2014 should be no more than Fpa, corresponding to catches of less than 3803 t in 2014. This is expected to keep SSB well above Bpa in 2015. All catches are assumed to be landed.

4.1.2.8.1 *Nephrops* in Botney Gut (FU 5)

Trends (taken from 2012 advice sheet)

The state of this stock is unknown. Landings per unit effort (lpue) fluctuate without trend.

A new scheme has been developed for *Nephrops* stocks without accepted analytical assessments. This uses the known area of *Nephrops* habitat and the range of densities observed on this (or neighboring) grounds to indicate if historical landings are likely to represent sustainable harvest rates or not.

Advice

The 2012 advice for this stock is biennial and valid for 2013 and 2014 (see ICES, 2012): Based on the ICES approach for data-limited stocks, ICES advises that landings should be no more than 1000 tonnes.

In order to ensure the stock in this FU is exploited sustainably, management should be implemented at the functional unit level.

Additional management considerations

1) There is currently no management plan for this Functional Unit.

2) In the absence of a full analytical assessment, ICES bases advice for *Nephrops* on habitat extent and population characteristics. ICES advises that landings of 1000t should be sustainable for this stock.

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

4.1.2.9 *Nephrops* in Farn Deeps (FU 6)

Trends

The UWTV survey indicates that the stock status has declined since 2005 and has been fluctuating near MSY $B_{trigger}$ since 2007. Changes in survey methodology in 2007 make exact comparisons with the preceding series difficult, but the general trend is considered reliable.

Advice

ICES advises on the basis of the MSY transition that landings in 2014 should be no more than 1173 tonnes. If total discard rates do not change from the average of the last 3 years (2010–2012), this implies total catches of no more than 1329 tonnes. Note that this figure includes discards expected to survive the discarding process – assumed to be 15% of the total number discarded for this stock.

In order to ensure the stock in this FU is exploited sustainably, 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 approach implies a harvest rate of 7.2% (below FMSY because biomass is below MSY Btrigger), resulting in landings of 1091 t in 2014.

Following the transition scheme towards the ICES MSY approach implies fishing mortality to be reduced to $(0.2*F_{2010} + 0.8*(F_{MSY}*(SSB2014/MSYB_{trigger}))$ = 7.6% (biomass is just below MSY $B_{trigger}$, so no additional reductions are considered relevant), corresponding to landings of no more than 1173 t in 2014. If discards rates do not change from the average of the last 3 years (2010–2012, assuming 15% discard survival), this implies total catches of no more than 1329 t.

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

4.1.2.10 *Nephrops* Fladen Ground (FU 7)

Trends

The stock has declined from the highest observed value in 2008 and is now just below the MSY $B_{trigger}$. The harvest rate has fluctuated in recent years, and fell to approximately 4% in 2012 which is below F_{MSY}.

Advice

ICES advises on the basis of the MSY approach that landings in 2014 should be no more than 8959 tonnes. If total discard rates do not change from the average of the last 3 years (2010–2012), this implies total catches of no more than 9059 tonnes. Note

that this figure includes discards expected to survive the discarding process – assumed to be 25% of the total number discarded for this stock.

In order to ensure the stock in this FU is exploited sustainably, management should be implemented at the functional unit level. Should the catch in this FU be lower that advised, the difference should not be transferred to other FUs.

Additional management considerations

1) There is currently no management plan for this Functional Unit.

2) Following the ICES MSY approach implies a harvest rate of 10.0%, (lower than the F_{MSY} because SSB is below MSY $B_{trigger}$), resulting in landings of less than 8959 t in 2013. If discards rates do not change from the average of the last 3 years (2010–2012, assuming 25 % discard survival), this implies total catches of no more than 9059 t.

   ICES notes that this implies an increase in harvest rate when the stock has shown a steady decline since 2008, and is now below MSY Btrigger. Considering the harvest options for this FU have not been utilised, utilisation of the harvest options from FU 7 elsewhere, may result in overexploitation of other FUs.

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

4.1.2.11 *Nephrops* in Firth of Forth (FU 8)

Trends

The stock remains above MSY $B_{trigger}$ but has declined since 2008. The harvest rate remains above F_{MSY}.

Advice

ICES advises on the basis of the transition to the MSY approach that landings in 2013 should be no more than 1417 tonnes. If total discard rates do not change from the average of the last 3 years (2010–2012), this implies total catches of no more than 1646 tonnes. Note that this figure includes discards expected to survive the discarding process – assumed to be 25% of the total number discarded for this stock.

In order to ensure the stock in this FU is exploited sustainably, 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 approach the harvest rate should be reduced to 16.3%, corresponding to maximum landings of 1381 t in 2014.

   To follow the transition scheme towards the ICES MSY – approach, the harvest rate should be reduced to 16.7% ($0.2^* F_{2010} + 0.8^* F_{MSY}$), corresponding to landings of no more than 1417 t in 2013 (where F_{2010} is the observed harvest rate in 2010 (18.4%)). If discards rates do not change from the ratio in 2012, assuming 25% discard survival), this implies total catches of no more than 1646 t.

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

4.1.2.12 *Nephrops* in Moray Firth (FU 9)

Trends

The stock is declining but remains just above MSY $B_{trigger}$. The harvest rate was above F_{MSY} in 2011 and decreased in 2012, although it is still above Fmsy.

Advice

ICES advises on the basis of the MSY approach that landings in 2014 should be no more than 739 tonnes. If total discard rates do not change from the average of the last 3 years (2010–2012), this implies total catches of no more than 796 tonnes. Note that this figure includes discards expected to survive the discarding process – assumed to be 25% of the total number discarded for this stock.

In order to ensure the stock in this FU is exploited sustainably, 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 approach implies the harvest rate should be less than 11.8%, resulting in landings of less than 739 t in 2014. If discards rates do not change from the average of the last 3 years (2010–2012, assuming 25% discard survival), this implies total catches of no more than 796 t.

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

4.1.2.13 *Nephrops* in Noup (FU 10)

Trends (taken from 2012 advice sheet)

The state of the stock is not fully known. Based on guideline evaluation the stock appears to be exploited close to 10% harvest rate on the basis of preliminary TV density estimates of $0.2m^{-2}$.

Advice

The 2012 advice for this stock is biennial and valid for 2013 and 2014 (see ICES, 2012): Based on the ICES approach for data-limited stocks, ICES advises that landings should be no more than 50 tonnes.

In order to ensure the stock in this FU is exploited sustainably, management should be implemented at the functional unit level.

Additional management considerations

1) There is currently no management plan for this Functional Unit.

2) In the absence of a full analytical assessment, ICES bases advice for *Nephrops* on habitat extent and population characteristics. ICES advises that landings of 50t should be sustainable for this stock.

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

4.1.2.14 *Nephrops* in Norwegian Deep (FU 32)

Trends (taken from 2012 advice sheet)

The state of the stock is unknown but lpue is fluctuating without trend indicating a stable stock status and suggest that current and past levels of exploitation are sustainable. A slight increase in mean size in the catches in 2007 and 2010 could indicate a reduced exploitation pressure. A new scheme has been developed for *Nephrops* stocks without accepted analytical assessments. This uses the known area of *Nephrops* habitat and the range of densities observed on this (or neighbouring) grounds to indicate if historical landings are likely to represent sustainable harvest rates or not. The density in FU 32 is most likely found in the range 0.05-0.1 animals m^{-1}, where 0.1 animals m^{-1} is the minimum density observed in the neighbouring Fladen Ground. Historical average (10 year) landings appear to be sustainable and robust to uncertainty in the estimated stock density.

Advice

The 2012 advice for this stock is biennial and valid for 2013 and 2014 (see ICES, 2012): Based on the ICES approach for data-limited stocks, ICES advises that landings should be no more than 800 tonnes.

In order to ensure the stock in this FU is exploited sustainably, management should be implemented at the functional unit level.

Additional management considerations

1) There is currently no management plan for this Functional Unit.

2) In the absence of a full analytical assessment, ICES bases advice for *Nephrops* on habitat extent and population characteristics. ICES advises that landings of 800t should be sustainable for this stock.

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

4.1.2.15 *Nephrops* off Horn's Reef (FU 33)

Trends (taken from 2012 advice sheet)

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.

Following WKLIFE guidelines a new scheme has been developed for *Nephrops* stocks without accepted analytical assessments. This uses the known area of *Nephrops* habitat and the range of densities observed on this (or other) grounds to indicate if historical landings are likely represent sustainable harvest rates or not. *Nephrops* density on this ground is unknown, but the neighbouring Fladen ground has typical densities 0.1-0.3 per m^2 so these values are useful proxies. Historical maximum landings appear to be sustainable and robust to uncertainty in the estimated stock

Advice

The 2012 advice for this stock is biennial and valid for 2013 and 2014 (see ICES, 2012): Based on the ICES approach for data-limited stocks, ICES advises that landings should be no more than 1100 tonnes

In order to ensure the stock in this FU is exploited sustainably, management should be implemented at the functional unit level.

Additional management considerations

1) There is currently no management plan for this Functional Unit.

2) In the absence of a full analytical assessment, ICES bases advice for *Nephrops* on habitat extent and population characteristics. ICES advises that landings of 1100t should be sustainable for this stock.

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

4.1.2.16 *Nephrops* in Devil's Hole (FU 34)

Trends (taken from 2012 advice sheet)

The state of the stock is not fully known. Based on guideline evaluation the stock appears to be to be exploited close to 10% harvest rate.

A new scheme has been developed for *Nephrops* stocks without accepted analytical assessments. An estimate of the total *Nephrops* grounds was used to give a likely envelope for the total abundance of *Nephrops* in the functional unit 34 – Devil's Hole. The discard rate and mean weight was taken from FU7. The 2012 survey shows that density is low to moderate on this ground at 0.3 burrows per metre squared. 10 year average landings of 600 at this density equates to a harvest rate of around 6.3%, which is well below any proxy for Fmsy used on other grounds. There is uncertainty in the TV estimate, but even if the density were over-estimated by 50%, the harvest rate would still be below 10% at the level of average landings. Maximum landings of 1200t carry an appreciably higher risk of exceeding any MSY proxies.

Advice

The 2012 advice for this stock is biennial and valid for 2013 and 2014 (see ICES, 2012): Based on the ICES approach for data-limited stocks, ICES advises that landings should be no more than 600 tonnes.

In order to ensure the stock in this FU is exploited sustainably, management should be implemented at the functional unit level.

Additional management considerations

6) There is currently no management plan for this Functional Unit.

7) In the absence of a full analytical assessment, ICES bases advice for *Nephrops* on habitat extent and population characteristics. ICES advises that landings of 600t should be sustainable for this stock.

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

4.1.2.17 *Nephrops* in Other rectangles (NEPOTH)

Trends

The stock status is unknown.

Advice

On the basis of precautionary considerations, ICES advises that the catches in the other rectangles should not change from the 2012 landings of 608 tonnes.

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) On the basis of precautionary considerations, ICES advises that catches should not change from the 2012 landings of 608 tonnes in these rectangles.

4.1.3 Software

In the mixed-fisheries runs, all forecasts run were done with the same FLR forecast method (see chapter 2), using the Flash package.

Software used in the single species assessments and forecasts was as outlined in the text table below.

Species	Assessment	Forecast
COD IV, IIIa and VIId	SAM	SAM
HADDOCK IV, IIIa and VIId	FLR 2x, FLXSA	MFDP
PLAICE IV	FLR 2.3, FLXSA	FLR2.3, FLSTF
SAITHE IV, IIIa and VI	FLR 2.x, FLXSA	FLR 2.x, FLSTF
SOLE IV	FLR 2.3, FLXSA	FLR 2.3, FLSTF
WHITING IV and VIId	FLR 2.x, FLXSA	MFDP
PLAICE VIId	FLR 2.x, FLXSA	FLR 2.x, FLSTF
SOLE VIId	XSA	MFDP

4.2 Fleets and métiers

4.2.1 Catch and effort Data

The collection of catch and effort data changed significantly in 2012 compared to previous years (cf Annex 2). Previously, data were submitted as comma separated files structured around the distinction of gear, mesh size and vessel length categories (based to a large extent on the format used by the STECF for the evaluation of effort management). In 2012 the data were requested consistent with the definition of DCF métiers, as specified by a joint WGNSSK/WGMIXFISH data call and with data stored in InterCatch. The InterCatch data was not used directly but the same métier-based information was separated into vessel length categories specified to match fleet segments from the STECF AER (Annual Economic Report) and provided directly as comma separated files. Age distribution by métier and area, which is now available in InterCatch, was not integrated in the MIXFISH data, but it is ultimately the aim that these will be included in future. The relative size of catches of the stocks incorporated in the mixed fisheries projections is shown in Figure 3.2.1.1.

In spite of the data now being available according to DCF categorization, WGMIXFISH was of the opinion to continue using the categorization following the EU Cod management plan as used in previous years, both in order to maintain the consistency of the MIXFISH time series and in order to continue addressing management-oriented scenarios and issues. WGMIXFISH métiers are thus defined as combinations of gear, mesh size and area (North Sea (area 4), Skagerrak (area 3AN) or Eastern Channel (area 7D)).

The consistency between DCF and EU Cod plan categories had been investigated by WGMIXFISH 2011 and during the pilot data call performed in autumn 2011. There it

had been shown that most DCF métiers as sampled by individual nations could automatically be allocated to a corresponding EU Cod plan métier, with two exceptions: the TBB_DEF_70-99_0_0 métier in the North Sea (as the corresponding BT2 métier is only defined for the mesh sizes 80-99) and the OTB_DEF (or CRU)_90-119_0_0 métier in the Skagerrak, which straddles the TR1 (>=100 mm) and TR2 (70-99 mm) categories. The proportion of effort and landings in the various mesh size classes for these two métiers was investigated. It was shown that the TBB fisheries with mesh size 70-79 were very small compared to the 80-99 fisheries, and therefore the whole DCF métier was considered equivalent to BT2. Similarly, in the Skagerrak the OTB fishery is dominated by the 90 mm fishery targeting *Nephrops*, and therefore the whole DCF métier was considered a TR2 métier. It was therefore possible to maintain consistency with previous data. One exception is that from 2012 the Swedish *Nephrops* fishery with an escapement grid, OTB_CRU_70-89_2_35 has been kept distinct from the other DCF métiers.

As previously, data for 2009 was not available from France and had to be assumed equal to 2008 values. Points of note regarding data by nation are contained in Annex 3.

A major improvement from 2012 has been the increase of discard coverage in the MIXFISH data. Up to 2011 discards data by fleet/métier were only available for the strata reported by Member States, and these represented only a part (around 50% on average) of the total discards estimates used by WGNSSK (where discard rates had been assigned to unsampled fleets within nations and/or between national 'fleets'). From 2012, the assignments are done by WGNSSK at the métier level. The final data set extracted from InterCatch for use by WGNSSK therefore includes cases where discards are assigned to categories uploaded with only landings data but for categories that are consistent with the categories in the MIXFISH csv files. It is therefore possible to make the data for Fcube more compatible with the WGNSSK InterCatch output, by applying the InterCatch discards ratio by métier to the corresponding MIXFISH métiers, using the following adjustment:

$$d^* = \frac{Dl}{L}$$

Where d* is the revised discard value for the metier used by MIXFISH, l is the weight of landings for the metier used by MIXFISH and L and D are the weight of landings and discards entered for the (vessel length aggregated) metier in InterCatch. Because InterCatch data is aggregated over all vessel lengths the same adjustment is applied to all vessel length categories of otherwise comparable MIXFISH métiers.

4.2.2 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 imbalance in the relative size of fleets in the model. In 2012, more in-depth consideration was given to the relevance of the current groupings of the fleet segments with regards to known national fishing patterns, for example with regards to saithe fisheries and to Fully Documented Fisheries (FDF). This led to some changes in the fleet definition com-

pared to previous years. Fleet definitions remained the same in 2013 and the final choices can be summarized as follows :

- Belgium: Distinction between <24m and >=24m beam trawlers, and shrimp fisheries with 16-31 mm excluded
- Denmark: Distinction of the <10m vessels (trawlers only); separation of the trawlers at <24m, 24-40m and >=40m; FDF vessels in a separate fleet
- England: Distinction of the <10m vessels; Otter trawlers and seiners pooled together, with separation at <24m, 24-40m and >=40m; FDF vessels in a separate fleet,
- France: Distinction of the <10m vessels; separation of the trawlers at <40m and >=40m, specific gill- and trammel net fleet.
- Germany: Distinction between <24m and >=24m beam trawlers, and shrimp fisheries with 16-31 mm excluded; Otter trawlers and seiners pooled together with separation at <24m, 24-40m and >=40m
- Netherlands: Distinction between <24m, 24-40m and >=40m beam trawlers; Otter trawlers and seiners pooled together
- Norway: Otter trawlers and seiners pooled together, with separation at <40m and >=40m.
- Scotland: Distinction of the <10m vessels (trawlers only), separation of the trawlers at <24m and >=24m, FDF vessels in a separate fleet, Otter trawlers and seiners pooled together.
- Sweden: No distinction of vessel size. Selective devices included in métiers definition for 2011 only.

As a second step, a matching procedure is run in order to have consistency between effort and catches. Fleets and métiers for which there is effort but no catches for the stocks included in the MIXFISH projections are considered as irrelevant and removed from the data base. Catches for which there is no corresponding effort are pooled into a single "other" OTH métier in the OTH fleet, in order not to lose that part of fishing mortality.

Finally, a third step aims at reducing the number of fleets and métiers categories involved in modeling. An aggregation threshold, established back in time through trial and error is used to determine 'small' métiers. A métier failing to catch at least 1.0% of at least one of the stocks considered in the most recent data year is classified as small. Within each fleet, 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), are aggregated into one single "OTH" fleet.

In 2013, new stocks from Eastern Channel and Skagerrak were included in the modeling, and this changed significantly the number of fleet and métier categories retained. As such, the final data used contained 43 national fleets (plus the OTH fleet) from nine countries (against 39 in 2012 and 27 in 2011), from 2003 to 2012. These fleets engage in one to four different métiers each, resulting in 118 combinations (against 88 in 2012 and 68 in 2011) of country*fleet*métier*area catching cod, haddock, whiting, saithe, plaice, sole, *Nephrops* and hake (Table 3.2.2.2). The balance of landings of the stocks across gear categories is shown in Figure 3.2.2.1.

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 3.2.2.2). 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). Some issues still remain in the matching of discards estimates; these are being investigated. To solve the remaining small inconsistencies between fleet data used by WGMIXFISH and stock data, the differences between them were pooled into the "OTH" fleet (both landings and discards).

4.2.3 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.

5 Mixed fisheries forecasts

5.1 Description of scenarios

5.1.1 Baseline Runs

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

1) reproduce as closely as possible the single species 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 approach).

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.

There may also be small differences in the catch input to WGNSSK assessments and the more disaggregated data provided for WGMIXFISH. The results from WGNSSK use discard estimating procedures which utilise estimated discard rates from across countries to fill missing gear specific estimates whereas WGMIXFISH input data provided country specific estimates only, which results in some missing discard values for some gear/species combinations compared to the WGNSSK data. This is compensated for by raising discards in the WGMIXFISH data to equal the discard total weight from the records on InterCatch (see section 3.2.1).

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.

5.1.2 Mixed fisheries runs

5.1.2.1 Fcube analyses of the intermediate year (2013)

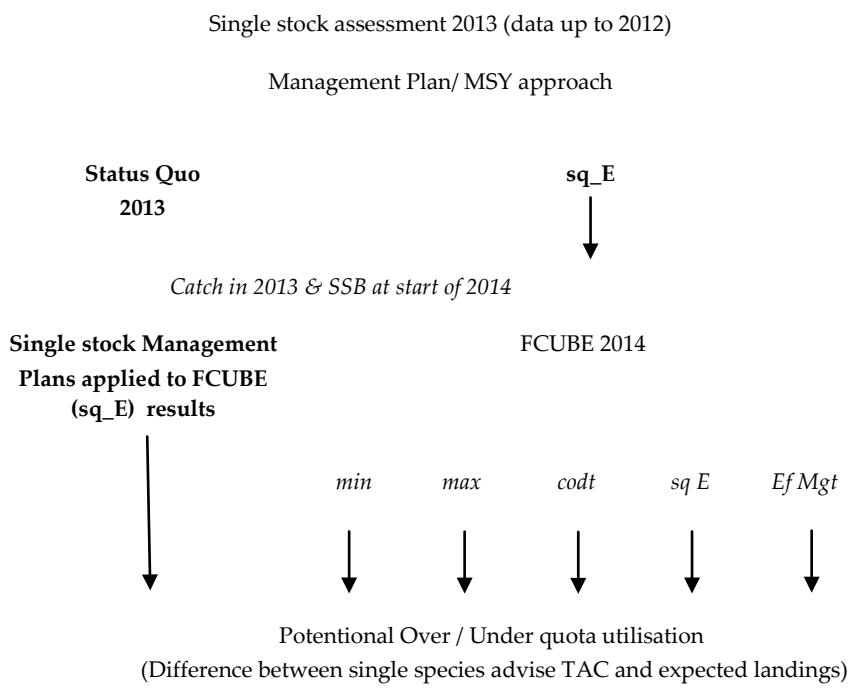
In a change to previous years Fcube scenario analyses for the intermediate year were not performed. This was as a consequence of deciding to change the treatment of the intermediate year when performing Fcube analyses for the TAC year (see next section).

5.1.2.2 Fcube analyses for the TAC year (2014)

In 2013, the set up of the Fcube analyses for the TAC year were changed compared to previously. Until last year, projections were run applying the Fcube scenarios two years in a row, i.e. both for the intermediate year and the TAC year. This allowed WGMIXFISH to analyse why management plans often did not deliver their expected results and why some short-term forecasts had been overoptimistic in the past (see Kraak et al 2013), by evaluating the impact of the assumptions in the intermediate year. Although runs using the scenarios in both years have been performed this year the results are not detailed in the present report or advice.

In 2013 the working group adopted a forecast approach more in line with the standard single-species short-term forecast. On the basis that a roll-over of effort limitations from the cod management plan has been adopted by the EC in 2013, the Status Quo effort assumption has been used for the intermediate year (2013), and the Fcube scenarios used for the TAC year (2014).

In summary, the Fcube runs followed the scheme below:



5.2 Results of Fcube runs

5.2.1 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, and summarised at Figure 4.2.1.1.

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 the 2013 cod assessment, it was decided to remove the unallocated removals for the years 2005-2012 on the basis that since the introduction of buyers and sellers legislation in the UK in 2006 black landings had reduced to negligible levels, and because not including unallocated removals reduced the retrospective pattern in F observed in previous assessments. This change was reflected in the FCube code; the unallocated component was removed from future projections.

In 2012 ACOM changed the basis for the assumption of F in the intermediate year to reflect the fact that the realised decline in F has been slower than the Management Plan stipulated. The new assumption is based on the slope of the recent trends in reduction in F over 2006-2010, giving an F multiplier of 0.87 between 2011 and 2012. In 2013, the basis for the assumption of F in the intermediate year was status quo F, reflecting the fact that the EU Fisheries Council meeting in December 2011 agreed that there would be no effort reduction in 2012 as compared to 2011 (EU Regulation 44/2012). This same assumption was carried across into the Fcube simulations.

The final discrepancy between the ICES cod advice and the WGMIXFISH replicate was slightly higher than last year (3.2% in estimated 2013 landings and -2.6% in 2014, compared to 0.4% and 0%). The cause of these discrepancies were investigated but could not be fully resolved, likely coming from the difference in assessment and forecast procedure coming from the SAM model as discussed above. Nevertheless, the FLR forecast was considered sufficiently close that it could be used as a satisfactory basis for the mixed-fisheries projection. Future SSB projections were <1% difference in 2013 and 2.1% difference for 2014.

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 very similar with less than 1% discrepancy between SSB projections. Forecasted landings in 2013 showed a 3.2% difference in 2013 but no difference in 2014. Therefore the FLR forecasted landings in the advice year were the same as the forecasted landings from the single species advice.

Whiting: There was a small difference between WGMIXFISH and WGNSSK forecast in landings that 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. The difference in landings was only 0.4% for 2013 and -0.8% for 2014 and considered not significant in terms of outturn results.

Saithe: Straightforward, no problems encountered.

North Sea Plaice: Straightforward, no problems encountered.

North Sea 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. However, there are two issues that arise due to different assumptions to the WGNSSK.

Firstly, there is a difference in the assumed harvest ratio in the intermediate year. Whereas WGNSSK assumes that the harvest ratio is equivalent to the average ratio of the most recent three years, the WGMIXFISH value is based on a share of the 2013 TAC applied to the abundance estimates in 2013 for that particular FU (equal to proportion of the N Sea TAC that was taken from the FU in the most recent year). This can cause pronounced differences if the harvest ratio has a steep decrease or increase in the most recent year. The assumption taken in WGMIXFISH may be more appropriate, as it's quicker to react to changes in biomass or exploitation patterns where activity moves between FUs; however it has no consequence either for WGNSSK or WGMIXFISH TAC year harvest ratio or TAC advice as the harvest ratio in 2013 is not used in the forecasts for 2014.

Secondly, the TAC result for FUs may be different between WGNSSK and WGMIXFISH. This results because the TAC advice from the single species assessments is an advised landing per FU. However, because management is currently by a combined TAC, not FU, WGMIXFISH assumes that the total TAC is taken in proportion to the ratio of last year's landings by FU, distributing the landings differently to the advice. Such an approach assumes the same catchability as last year, as for other stocks in the Fcube simulations.

Eastern Channel Plaice: The inclusion of this stock was new for 2013. Implementing the assessment and forecast in FLR was relatively straight forward. However, the forecast is complicated by the fact that there is known to be significant migration of plaice between the North Sea, Eastern Channel and Western Channel; the forecast (and assessment) attempts to take account of the expected quantity of plaice caught in the eastern channel adjusting for these migrations. The forecast landings for 2013 were the same in the FCube runs and the single species runs, but slightly different (-1.8% difference) in the TAC year (2014). This was not considered to affect the outcome from the FCube runs.

Eastern Channel Sole: The inclusion of this stock was new for 2013. There were no problems implementing the forecast in FLR with only minor differences in landings projections (0.2% in 2013 and -0.6% in 2014).

5.2.2 Mixed fisheries analyses

5.2.2.1 Fcube analyses of the intermediate year (2013)

For the baseline run used to replicate the single species forecasts the Target F by stock for 2013 were set as the landings component of the F (see table 4.2.1.1). It is to be noted that for cod and plaice in area IV the single-species forecast assumptions used by

ICES' WGNSSK (ICES 2013a) (and reproduced here in the *baseline*) imply expected landings for 2013 higher than the actual TAC.

In 2013 haddock tends to be the most limiting species (Figure 4.2.2.1.1) but the limiting species is predominantly cod in 2014. This flip-flop between species was also observed in last year's mixed fisheries forecasts. Unlike last year, however, haddock is not subject to a TAC constraint for the intermediate year. The cause is likely because haddock recruitment remains low and the single species forecasts for haddock demonstrate that even reduced landings result in higher F values and reductions in SSB in 2015.

From Table 4.2.2.2.1 there is generally good consistency between the single-stock forecasts and the status quo effort (**sq_E**) scenario, as most single-stock forecasts assumed status quo F in the intermediate year, and should therefore be in line with status quo effort. As stated earlier only the **sq_E** scenario was used in the intermediate year.

5.2.2.2 Fcube analyses for the TAC year (2014)

The full overview of the two year projections to 2014 is presented in Table 4.2.2.2.1 and Figures 4.2.2.2.1 to 4.2.2.2.5.

The Fcube outputs for the TAC year are easier to interpret this year compared to previously, since there is now a single unique assumption for the intermediate year (status_quo effort) instead of different assumptions for the different scenarios. Therefore the results for 2014 can be compared to each other as in a single-species option table.

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 42222 tonnes in 2013 (F2013 assumed to equal F2012), and 28041 tonnes in 2014. The resulting SSB in 2015 is estimated to be 118399 tonnes. WGMIXFISH assumes status quo effort (**sq_E**) in 2013 resulting in a slight increase in F compared to 2012 and landings of 43865 tonnes in 2013. If it is assumed the **sq_E** scenario was used as the basis for the single species advice instead of the actual single species basis the rules of the management plan would lead to TAC advice of 27567 tonnes, representing the same F value but applied to a smaller biomass than in the baseline. The resulting SSB in 2015 is estimated to be 116438 tonnes, 2% lower than the resulting SSB following the single species advice according to the cod Management Plan.

If we now assume that the fleets fish in line with the effort reductions in 2014, **Ef_Mgt** Fcube scenario (46% reduction for TR1, TR2), then the landings in 2014 would be estimated at 29314 tonnes, 4.5% above the initial single-stock baseline. The **Ef_Mgt** Fcube scenario (following the effort reduction from the Management Plan) estimates SSB in 2015 as 114641 tonnes or 3% lower than the baseline (full compliance with the MP).

The outcomes of the "minimum" and "maximum" scenarios are driven by which of the stocks will be most and least limiting for each individual fleet. In 2014, 31 fleets are estimated to be limited by their cod quota, and 11 fleets by their NEP6 quota (70% and 30% of the effort in 2012 respectively, **min** scenario). Conversely, haddock is least limiting quota for 29 fleets, NEP7 for 8 fleets and whiting for 5 fleets (representing 68%, 22%, and 10% of the effort in 2012 respectively, **max** scenario). It is also noted that the implied F would exceed F_{pa} for cod, saithe, and sole in the Eastern Channel in this scenario, which is therefore not considered precautionary for those species.

The **min** 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 to demonstrate the lower bound of potential fleet effort and stock catches. Similarly, the **max** scenario demonstrates 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, this is also considered a scenario with low plausibility. The **min** and **cod** scenarios do, however, give similar results (Table 4.2.2.2.1 and Figure 4.2.2.2.1) because cod is the limiting species for such a high percentage of fleet effort.

The three other scenarios represent intermediate plausible scenarios reflecting basic current management measures and also the *status quo* option. ICES WGMIXFISH has not conducted work to assess which of these scenarios may represent the most likely outcome, but hindcasting projections have been run previously (Ulrich et al., 2011) and should be reiterated.

The **cod** scenario presents the expected outcome if the F reductions on cod stipulated in the cod long-term management plan were achieved in full and the catchability of different species by fleets and metiers remained constant. According to the single-stock advice a reduction of 46% in cod F is required (from 0.39 in 2013 to 0.21 in 2014). In this scenario it is assumed that effort reductions in fleets (to achieve new partial Fs) apply equally to all fleets with any cod catch, including those where it represents a small bycatch component. In 2014 the most pronounced example of this effect is for saithe-targeted fisheries where application of the "cod" scenario leads to small reductions in cod catch for these fisheries, but very large reductions in saithe catches.

As was the case last year, the single species advice for a reduction in cod TAC in light of an increasing biomass means that catchability would likely increase whilst quota decreases, implying significantly lower activity or changes to catchability required in order to achieve the cod target in 2014. If this is achieved through effort reductions alone (**Ef_Mgt** scenario) it would also have strong negative impacts on the ability of the fleets to catch all other 2014 TACs, particularly haddock, whiting and *Nephrops* but also to some extent plaice and saithe. Already in the **sq_E** scenario estimated 2014 landings are below the baseline for haddock, plaice4, whiting and most *Nephrops* FUs (Table 4.2.2.2.1; Figure 4.2.2.2.1).

The **Ef_Mgt** scenario does, however, considerably reduce the underutilisation of saithe quota compared to 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 the trawl metiers, which catch the bulk of cod, haddock and whiting landings. The **Ef_Mgt** scenario leads to greater underutilisation of whiting quota compared to the **cod** scenario.

The newly incorporated stocks of sole and plaice in the Eastern English Channel have low landings compared to other stocks and the results for these stocks are presented in detail in Figure 4.2.2.2.2. The decrease in the 2014 single-stock advice for sole is likely to be restrictive for the fishery at *status quo* effort. 2014 Landings for plaice are not restricted at the current level of effort (**sq_E** scenario). Both stocks show an undershoot of the quota in the **cod** scenario, suggesting that the fleets catching sole and plaice are restricted by their cod (by)catches.

Mixed-fisheries results for *Nephrops* are displayed after combining over functional units (FUs) in plots, but stock status and fishing opportunities differ widely across FUs. In particular, FU6 (Farn Deep) is currently exploited over the MSY target, and

this FU acts therefore as a limiting stock for some fleets in the mixed-fisheries advice 2014. Conversely, FU7 (Fladen Ground) is exploited below the MSY target, and acts as a least limiting stock. In order to ensure *Nephrops* stocks are exploited sustainably in the different FUs, management should therefore be implemented at the FU level. Potential undershoot of catch opportunities for FU7 should not be transferred to other FUs.

To get an overview of the amount of total catches for the various scenarios, Figure 4.2.2.2.3 displays the catch by scenario for each of the species. Importantly, Figure 4.2.2.2.1 displays only information on *landings*, i.e. the share of predicted catches that corresponds to landed 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 species TAC advice for 2014 with the mixed-fisheries landings estimates. Figure 4.2.2.2.3 displays catch by category; potential 'legal' landings (i.e. below the 2014 TAC advice, which in practice acts as a TAL), 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 (as in the single-stock forecast).

The anticipated SSBs in 2015 of the Fcube scenarios are shown in Figure 4.2.2.2.4. Cod and sole 7d suffer the greatest shortfall in SSB compared to the level predicted compatible with the single species advice if status quo effort and catchabilities are assumed (**sq_E** scenario).

Figures 4.2.2.2.5 and 4.2.2.2.6 show the level of effort required by each fleet to catch their quota share of the single species TAC advice for each stock for finfish species and *Nephrops* FUs respectively. From Figure 4.2.2.2.5 it is clear cod is the limiting species by some margin for many of the fleets.

5.2.2.3 Ancillary stocks

Northern hake and plaice 3aN were considered for the first time as ancillary stocks. It is reiterated that these stocks do not influence the results from the scenarios (fleet and metier effort levels) but instead once scenario results are determined the landings of northern hake (from the North Sea) and plaice 3aN, using catchabilities measured in 2012, are calculated. Figure 4.2.2.3.1 shows the outcome.

The Plaice 3aN TAC is underutilised even under assumption of status quo effort. Unsurprisingly all other scenarios (except the **max** scenario) show a major underutilisation of the Plaice 3aN TAC. The North Sea quota of Northern Hake is predicted to be underutilised under the **min**, **cod** and **Ef_Mgt** scenarios but assuming status quo effort leads to prediction of over quota landings. For both stocks the **Ef_Mgt** scenario appears more restrictive than even the **min** scenario, suggesting that with current catchabilities some metiers are unable to fully utilise quota for any species.

5.2.2.4 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 in 2012. 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 4.2.2.4.1). The results show only minor deviations across all scenarios, except for the **Ef_Mgt** scenario. Here the fact the majority of Scottish vessels come under the scope of the EU effort management regime whereas Norwegian

vessels are unaffected by the same regime leads to a shift of landings share from the former to the latter under the assumptions of the model.

6 New Developments

6.1 MIXFISH methodology meeting (WGMIXFISH-METH)

In 2012 a second meeting of WGMIXFISH was held to investigate the feasibility of using the Fcube software for stocks west of Scotland (ICES division VIa) in a way similar to in the North Sea and also to consider (for North Sea stocks) the EU commission request for a scenario of all species fished at Fmsy in 2015; a scenario considering the mean F on each stock two years beyond the TAC year (ICES 2013b).

It was hoped a regular ICES WG meeting could be established in its own right to consider future developments and this has now been done with the establishment of WGMIXFISH-METH to be held in August 2013.

With a view to regular mixed fisheries projections for the west of Scotland region a joint data call with the assessment working group responsible for west of Scotland and the Celtic Seas (WGCSE) was issued in 2013. WGMIXFISH worked to ensure fleet and metier definitions were consistent between the WGCSE and WGNSSK data calls because it is known fishing vessels will fish in both the North Sea and west of Scotland in a given year and because of stocks such as saithe, anglerfish and megrim that straddle ICES areas IV and VI. Even so it was not possible to include (in any capacity) straddling stocks assessed by WGCSE because the heavy work loads and time restrictions experienced by scientists in the April-May period meant there was insufficient time to screen and process a second set of input files. To ensure consistency of fleet-metier definitions and to allow for a single set of input files for Fcube WGMIXFISH believes a single WGNSSK-WGCSE-WGMIXFISH data call would be preferable. It is also intended to explicitly include all stocks assessed by WGNSSK.

The EU commission has expressed a preference for a more prescriptive type of advice from WGMIXFISH. One possibility (for investigation by a future WGMIXFISH-METH) would be to take the recommended mean F values from the single species assessments and attach a buffer around those values (of 10% say). Fcube could be modified to search for the minimum difference between the max and min scenarios, adjusting the mean F values within their bounds to do so.

It was also discussed whether the mean F from the newly developed multi-species model for the North Sea should be used but it was considered this was problematic for any attempt to predict beyond the short term as the interaction between species makes optimal mean F values on a given species dynamic (i.e. dependant on the relative abundance of that species compared to others).

7 Conclusions and Recommendations

WGMIXFISH-NS has produced a draft North Sea Mixed Fisheries advice for use by ACOM. Since 2012 WGMIXFISH-NS is held so that mixed fisheries advice can be available alongside ICES single species advice in June. No methodological problems were encountered with the Fcube package and this year two additional stocks were fully incorporated and two more considered partially. As last year, however, problems were encountered because of the close proximity of this WG to that of WGNSSK with revisions of single species advice during WGMIXFISH.

From 2012 a joint WGNSSK-WGMIXFISH data call has allowed a greater consistency between catch totals supplied to WGMIXFISH and WGNSSK (see section 3.2.2). To date, however, WGMIXFISH data cannot be obtained through an extraction from the ICES database (InterCatch) of the data compiled for WGNSSK, primarily because the level of fleet disaggregation best suited to the mixed fisheries projections are incompatible with national sampling schemes and the need to keep the number of fleet-metier combinations used in InterCatch to a manageable number. Separate files containing vessel length specific data had to be requested and (as in 2010, 2011 and 2012), late, incomplete or data with errors meant the dataset for the Fcube software was only completed part way through the meeting.

The joint WGNSSK-WGMIXFISH data call is similar to, but separate from, data submissions to STECF. WGMIXFISH recommends to the EU commission that metier classes be made compatible between the effort, catch and economic datasets requested of nations by STECF as soon as possible.

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. As also shown in previous years, running mixed fisheries projections can provide a valuable quality assurance for the single species forecasts. 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.

The use of multiple Fcube scenarios leads to a very data rich set of results although a change to only using the **sq_E** scenario in the intermediate year leads to welcome simplification. For the TAC year 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.

Scenarios are based on central assumptions that fishing patterns and catchability in 2013 and 2014 are the same as those in 2012 (similar to procedures in single-stock forecasts where growth and selectivity are assumed constant). Options that result in under- or overutilization are useful in identifying the main points of friction between the fishing opportunities of the various stocks. They indicate in which direction fleets may have to adapt to fully utilize these catch opportunities. However, the adaptation mechanisms themselves, which occur largely at the level of the individual vessels (e.g. changes in fishing patterns, catchability, or discarding practices), cannot be easily predicted. Improved mixed-fisheries management should act towards reducing these areas of friction, to limit risks of not achieving the single-stock management objectives.

The effect of fleet behaviours on

- The TAC set for 2014 (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 2015,

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:

The requirements of the cod management plan again make cod the limiting stock in most fleets in the TAC year (2014), (Figure 4.2.2.2.5). For the intermediate year of the projections (2013), however, haddock is most often the limiting stock. The single species (baseline) projection assumes status quo F for cod and haddock in the intermediate year but the cod stock biomass is increasing whereas prolonged poor recruitment in the haddock stock means lower landings for a given mean F.

The advised single stock TACs for 2014 cannot be said to be consistent given the current landings compositions of North Sea fleets as can be seen from Figure 4.2.2.2.5. Cod is the limiting stock for the large majority of fleets (those representing 70% of the effort in 2012). If the cod TAC is assumed to limit the activity of fleets (**cod** scenario) the forecasts predict considerable underutilisation of other TACs, particularly those for haddock, plaice and saithe.

Implementation of the **Ef_Mgt** scenario as modelled would also have strong negative impacts on the ability of the fleets to catch all other 2014 TACs, particularly haddock, whiting and *Nephrops* but also to some extent plaice and saithe. Already in the **sq_E** scenario estimated 2014 landings are below the baseline for haddock, plaice4, whiting and most *Nephrops* FUs.

Because the **Ef_Mgt** scenario affects uniquely the trawl metiers, which catch the bulk of cod, haddock and whiting, it considerably reduces the underutilisation of saithe quota compared to the **cod** scenario, although the **Ef_Mgt** scenario leads to greater underutilisation of whiting quota compared to the **cod** scenario.

Applying fleet effort resulting from the **sq_E** scenario leads to prediction of over-quota landings of northern hake compared to the North Sea component of this stock's TAC. In contrast no scenario leads to over-quota landings of plaice IIIaN.

Northern hake and plaice IIIaN are the first stocks where the effect of mixed fishery scenarios were shown even though the stocks could not be included in the projections and therefore not influence the **max** and **min** scenarios. Other potential stocks for inclusion in this way were anglerfish and megrim. These stocks straddle the North Sea and west of Scotland and data for them was collected as part of a new joint data call with WGCSE. Even so time pressures meant they could not be included. There is little prospect these time pressures will reduce in future years. In this case, and given the medium term aim of making joint North Sea and west of Scotland mixed fisheries projections, the best solution is considered a single joint WGCSE-WGNSSK-WGMIXFISH data call. This would also ensure consistent fleet and metier definitions for the same vessels between areas.

8 References

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9 Aggregations

If national data are aggregated over several DCF level 6 categories, the metier tag corresponding to the most significant category is chosen e.g. a mobile gear with mesh sizes covering 70-119 mm (combining 70-99 and 100-119) but 70-99mm is most significant – code 70-99.

Exceptions to this general rule are cases where data has been aggregated over all mesh size ranges within the national fleet. In these instances the tag "all" can be entered.

In addition Member states have indicated national sampling scheme designs do not take account of vessel lengths and therefore only the non-standard entry of "all" is currently provided for in InterCatch against vessel length. The option has been left open for length category specific metier tags to be added in future years if nations begin to sample and raise data independently for different length categories.

10 Aggregations vs. WGMIXFISH Requirements

Age specific data is best raised and entered to InterCatch using metiers / groups of vessels that match national sampling schemes. For 2012 data this means that the vessel length categories will be omitted in the data submitted to InterCatch (e.g. metier tag TBB_DEF_>=120_0_0_all). This is sufficient to address the data needs for WGNSSK. However, - for otter and beamtrawl gears only - these aggregations may be too broad for WGMIXFISH needs (leading to overly large fleet entries in the mixed fisheries projections). To fulfil the additional WGMIXFISH specific need for information by vessel length categories[1], we kindly request estimates of catch weight totals and effort in a format similar to previous WGMIXFISH data calls (albeit using the Metier Tags as used to supply InterCatch) i.e. :

A comma separated (CSV) 'effort' file containing the following entries :

> ID, Country, Year, Quarter, Length disaggregated Metier Tag, Area, **KW_Days**[1], Days At Sea, No Vessels

1: KW_Days for all species including vessels targeting Crangon. Required so that the catchabilities of fleets are comparable.

A CSV 'catch' file containing the following entries :

> ID, Country, Year, Quarter, Length disaggregated Metier Tag, Area, Species, Landings (tonnes), Discards (tonnes), Value (average price*landings at first sale, expressed in Euros).

- Vessel length splits are only required for metier tags starting OTB or TBB.

Sums of effort and catch across metier tags disaggregated by vessel length should equal the corresponding totals submitted to Intercatch.

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[1] Also, in order to insure consistency and continuity with the data time series previously collected by WGMIXFISH.

Example:

If a nation submitted data to InterCatch according to TBB_DEF_>=120_0_0_all but this data comes from vessels of 24<40m and >=40m WGMIXFISH requests CSV files for entries of

TBB_DEF_>=120_0_0_24<40 and

TBB_DEF_>=120_0_0_>=40

The CSV files should be submitted electronically to

Clara Ulrich [clu@aqua.dtu.dk] -- Chair of WGNSSK

Steven Holmes [s.holmes@marlab.ac.uk] -- Chair of WGMIXFISH

11 Supporting Documentation and work to be undertaken after the data upload

Once data has been submitted to InterCatch a process of fill-ins will be undertaken by the respective stock coordinators for entries containing only bulk weight of landings and/or discards. **To aid this process countries are requested to complete a documentation file (EXCEL spreadsheet) in a format like that shown in Annex 2.**

The documentation spreadsheet should be submitted electronically to

Clara Ulrich [clu@aqua.dtu.dk] -- Chair of WGNSSK

Steven Holmes [s.holmes@marlab.ac.uk] -- Chair of WGMIXFISH

For InterCatch related questions contact: Henrik Kjems-Nielsen [henrikkn@ices.dk]

12 Conversions to InterCatch Format

A description of the InterCatch Exchange format can be downloaded at the InterCatch information webpage under 'Manuals':

http://www.ices.dk/datacentre/InterCatch/InterCatch.asp

A two page overview of the fields in the InterCatch commercial catch format can be found at the same page, again under 'Manuals' (just below the InterCatch Exchange format manual). From this page the valid codes can be seen.

To ease the process of converting the national data into the InterCatch format Andrew Campbell from Ireland has made a conversion tool 'InterCatchFileMaker', which converts data manually entered in the 'Exchange format spreadsheet' into a file in the InterCatch format. The conversion tool 'InterCatchFileMaker' can be downloaded at the InterCatch information page (the one above) under 'Program to convert to InterCatch file format'. The download includes a spreadsheet in which the landings and sampling data can be placed; the converter then converts the data in the spreadsheet into the InterCatch format.

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

Year of application	Regulation
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
2012	(EU) No 43/2012_Annex IIa (EU) No 44/2012_Annex IIa
2013	(EU) No 39/2013_Annex IIa (EU) No 40/2013_Annex IIa

Table 1.2.2, Mixed-fisheries advice North Sea. Effort reductions in 2013 compared to 2012, by EU-regulated fleet segment (Council Regulation (EC) Nos. 297/2013 and 39/2013), and the assumed reduction between 2013 and 2014 for the "Effort" scenario.

Gear description	Code	% effort reduction in 2013 compared to 2012	Assumed % effort reduction in 2014 compared to 2013
Bottom trawls and seines ≥100 mm	TR1	0%	46.0%
Bottom trawls and seines ≥70 mm and < 100 mm	TR2	0%	46.0%
Bottom trawls and seines ≥16 mm and < 32 mm	TR3	0%	0%
Beam trawls ≥120 mm	BT1	0%	0%
Beam trawls ≥80 mm and < 120 mm	BT2	0%	0%
Gillnets and entangling nets, excluding trammel nets	GN1	0%	0%
Trammelnets	TN1	0%	0%
Longlines	LL1	0%	0%
Non-regulated gear	None	0%	0%

Table 3.1.2.1: Summary of the 2014 landings 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/Functional Unit does not have a management plan the landings follow ICES advice.

Species	Management Plan / MSY approach for 2014			
	TAC	F / Harvest ratio	SSB 2015	Rational
Cod IIIa-IV-VIId	< 28 800 t	0.21	127 400 t	MP
Haddock IIIa-IV	< 40 639 t HC	0.33	200 000 t	MP
Plaice IV	< 111 631 t	0.26	737 017 t	MP
Sole IV	< 11 900 t	0.24	46 070 t	MP
Saithe IIIa-IV-VI	< 85 528 t	0.3	176 100 t	MP
Whiting IV-VIId	< 24 389 t	0.225	311 434 t	MP (modified)[1]
Sole VIId	< 3 251 t	0.33	10 951 t	MSY approach
Plaice VIId	< 3 925 t	0.28	9 916 t	MSY approach
Nephrops in Botney Gut (FU 5)	< 1 000 t	n/a	n/a	MSY approach
Nephrops in Farn Deeps (FU 6)	< 1 173 t	7.6	n/a	MSY approach
Nephrops Fladen Ground (FU 7)	< 8 959 t	10	n/a	MSY approach
Nephrops in Firth of Forth (FU 8)	< 1 417 t	16.7	n/a	MSY approach
Nephrops in Moray Firth (FU 9)	< 739 t	11.8	n/a	MSY approach
Nephrops in Noup (FU 10)	< 50 t	n/a	n/a	MSY approach
Nephrops in Norwegian Deep (FU 32)	< 715 t	n/a	n/a	MSY approach
Nephrops of Horn's Reef (FU 33)	< 1 100 t	n/a	n/a	MSY approach
Nehrops in Devil's Hole (FU 34)	< 600 t	n/a	n/a	MSY approach
Nephrops in Other rectangles (NEPOTH)	< 608 t*	n/a	n/a	
Nephrops in Division IIIa	< 4 080 t	7.9	n/a	MSY approach

*** Value adopted from no change in landings NEPOTH for 2012 minus FU 34 landings**

[1] Advice used management plan target F rescaled by the amount historical F results had been rescaled on average by a newly introduced assessment model.

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

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

Fleet	Metier	Effort	Catch
BE_Beam<24	BT2.4	300	1295
	BT2.7D	213	937
	OTH	10	3
BE_Beam>=24	BT1.4	953	3469
	BT2.4	961	3301
	BT2.7D	1248	1717
BE_Otter	OTH	135	296
	TR2.4	401	964
DK_Beam	BT1.3AN	125	450
	BT1.4	316	1014
DK_FDF	OTH	92	346
	TR1.3AN	257	2627
	TR1.4	1886	9678
	TR2.3AN	50	273
	TR2.4	53	102
DK_Otter<24	OTH	392	109
	TR1.3AN	175	1026
	TR1.4	560	3221
	TR2.3AN	2396	7811
	TR2.4	150	584
DK_Otter24-40	OTH	1067	156
	TR1.3AN	47	148
	TR1.4	886	3920
	TR2.3AN	223	605
	TR2.4	146	509
DK_Seine	TR1.3AN	270	3849
	TR1.4	227	2108
DK_Static	GN1.3AN	287	1047
	GN1.4	1317	4988
	OTH	6	37
DK_U10_OTB	OTH	8	51
	TR1.3AN	17	106
	TR2.3AN	30	126
EN_Beam	BT1.4	425	1328
	BT2.4	2491	7873
	BT2.7D	242	326
EN_FDF	OTH	36	188
	TR1.4	582	3454
EN_Otter<24	OTH	160	64
	TR1.4	201	1237
	TR2.4	1106	2830
EN_Otter>=40	OTH	46	9
	TR1.4	663	1608
EN_Otter24-40	OTH	547	753
	TR1.4	375	2348
EN_Static	LL1.4	15	110
	OTH	200	44
EN_U10	GN1.7D	583	287
	GT1.7D	471	306
	OTH	3199	464
	TR1.4	176	325
	TR1.7D	136	124
	TR2.4	550	1002
	TR2.7D	160	135
FR_Beam	BT2.7D	507	763
	OTH	38	78
FR_Nets	GT1.4	671	851
	GT1.7D	2312	2526
	OTH	166	113

Fleet	Metier	Effort	Catch
FR_OTH	OTH	6818	1152
	pelagic.4	1031	268
	pelagic.7D	1903	273
FR_Otter>=40	TR1.4	3473	9466
FR_Otter10-40	OTH	194	22
	TR2.4	893	2841
	TR2.7D	6096	7689
FR_U10m	OTH	69	4
	TR2.7D	114	202
GE_Beam>=24	BT2.4	1059	2750
GE_FDF	OTH	46	492
	TR1.4	289	3605
GE_Otter<24	OTH	9	36
	TR1.4	82	1157
	TR2.4	214	1486
GE_Otter>=40	OTH	8	81
	TR1.4	495	4228
GE_Otter24-40	OTH	38	233
	TR1.4	382	2605
	TR2.4	122	448
GE_Static	GN1.4	141	337
	OTH	17	175
NL_Beam<24	BT2.4	303	1940
	OTH	3200	5
NL_Beam>=40	BT1.4	925	3130
	BT2.4	18309	46428
	OTH	5	25
NL_Beam24-40	BT2.4	2827	8652
	OTH	927	23
NL_Otter	OTH	26	44
	TR1.4	1503	8402
	TR2.4	1084	5314
NL_Static	GN1.4	188	550
	OTH	20	83
NO_Otter<40	OTH	1875	763
	TR1.4	941	19413
	TR3.4	75	379
NO_Otter>=40	OTH	236	216
	TR1.4	3484	5527
NO_Static	GN1.4	701	5358
	LL1.4	752	1040
	OTH	5	214
OTH_OTH	OTH		
SC_FDF	TR1.4	2586	19568
SC_Otter<24	OTH	2	2
	TR1.4	2291	12218
	TR2.4	4570	14479
SC_Otter>=24	OTH	146	50
	TR1.4	4364	27832
	TR2.4	638	1279
SC_Static	LL1.4	223	511
	OTH	515	2
	pots.4	3712	100
SC_U10_OTB	TR1.4	20	70
	TR2.4	318	504
SW_Otter	OTH	3048	793
	TR1.4	178	1294
	TR2.3AN	516	1147
	tr2_grid.3AN	993	1124

Table 4.2.1.1: Baseline run outputs from the Fcube FLR package.

Management plan		COD	HAD	PLE4	POK	SOL4	WHG	PLE7D	SOL7D
2013	Fbar	0.39	0.18	0.23	0.37	0.24	0.15	0.29	0.46
	FmultVsF11	1	1	1	1.21	1	1	0.7	1
	landings	42222	39948	97688	100684	12757	17540	3000	4761
	ssb	72349	257734	663207	196237	50546	281593	7364	11428
2014	Fbar	0.2	0.32	0.26	0.3	0.24	0.22	0.28	0.33
	FmultVsF11	0.52	1.83	1.13	1.01	0.99	1.47	0.67	0.71
	landings	28041	40638	111630	85581	11900	24200	2961	3230
	ssb	86030	242849	735330	162125	48151	271526	8267	10167
2015	ssb	118399	201272	736798	176013	46073	311963	9728	10958

Management plan		NEP5	NEP6	NEP7	NEP8	NEP9	NEP10	NEP32	NEP33	NEP34	NEPOTH
2013	Harvest rate	0	0.17	0.05	0.25	0.14	0	0	0	0	0
	FmultVsF11	0	1	1	1	1	0	0	0	0	0
	landings	992	1190	9223	1383	740	50	700	1100	600	608
2014	Harvest rate	0	0.08	0.1	0.16	0.12	0	0	0	0	0
	FmultVsF11	0	0.48	1.96	0.66	0.86	0	0	0	0	0
	landings	1000	1190	9223	1383	740	50	700	1100	600	608

Table 4.2.1.2: Comparison between baseline run and ICES advice for finfish. Figures for 2013 compare results from the baseline run to the ICES intermediate year results. The baseline run uses the same assumptions for F in the intermediate year as the forecasts leading to ICES advice.

Management plan		COD	HAD	PLE4	POK	SOL4	WHG	PLE7D	SOL7D
2013	landings								
	Baseline	42222	39948	97688	100684	12757	17540	3000	4761
	ICES	40900	38693	97688	100684	12757	17466	3000	4752
	% difference	3.2 %	3.2 %	0.0 %	0.0 %	0.0 %	0.4%	0.0%	0.2%
2014	landings								
	Baseline	28041	40638	111630	85581	11900	24200	2961	3230
	ICES	28800	40639	111631	85581	11908	24389	3016	3251
	% difference	-2.6 %	0.0 %	0.0 %	0.0 %	-0.1 %	-0.8%	-1.8%	-0.6%

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 ICES approach for data-limited *Nephrops* stocks. 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.

Management plan		NEP5	NEP6	NEP7	NEP8	NEP9	NEP10	NEP32	NEP33	NEP34	NEPOTH
2014	landings										
	Baseline	1000	1190	9223	1383	740	50	700	1100	600	608
	ICES	1000	1173	8959	1400	739	50	700	1100	600	608
	% difference	0.0 %	1.4%	2.9 %	-1.2 %	0.1 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0%

Table 4.2.2.2.1. Results of Final Fcube runs.

	year	sce-rio	COD	HAD	PLE4	PLE7D	POK	SOL4	SOL7D	WHG	NEP5	NEP6	NEP7	NEP8	NEP9	NEP10	NEP32	NEP33	NEP34	NEPOTH	NEP TOT	
landings	**2013**	**baseline**	**42222**	**39948**	**97688**	**3000**	**100684**	**12757**	**4761**	**17540**	**1308**	**3250**	**6229**	**2763**	**1136**	**17**	**410**	**1434**	**788**	**1016**	**18351**	
Fbar	**2013**	**baseline**	**0.39**	**0.18**	**0.23**	**0.29**	**0.37**	**0.24**	**0.46**	**0.15**	**-**	**0.22**	**0.07**	**0.33**	**0.18**	**-**	**-**	**-**	**-**	**-**	**-**	
	2014	**baseline**	**0.20**	**0.32**	**0.26**	**0.28**	**0.30**	**0.24**	**0.33**	**0.22**	**-**	**0.08**	**0.10**	**0.16**	**0.12**	**-**	**-**	**-**	**-**	**-**	**-**	**A**
FmultVsF12	**2013**	**baseline**	**1.00**	**1.00**	**1.00**	**0.70**	**1.21**	**1.00**	**1.00**	**1.00**	**-**	**1.32**	**1.32**	**1.32**	**1.32**	**-**	**-**	**-**	**-**	**-**	**-**	
		sq_E	1.05	1.16	1.07	0.73	1.00	1.01	1.00	1.06	-	0.99	0.94	1.01	1.01	-	-	-	-	-	-	
	2014	**baseline**	**0.52**	**1.83**	**1.13**	**0.67**	**1.01**	**0.99**	**0.71**	**1.47**	**-**	**0.48**	**1.96**	**0.66**	**0.86**	**-**	**-**	**-**	**-**	**-**	**-**	
		cod	0.52	0.58	0.53	0.37	0.50	0.50	0.50	0.53	-	0.49	0.47	0.51	0.50	-	-	-	-	-	-	
		Ef_Mgt	0.56	0.41	0.83	0.59	0.73	0.99	0.89	0.43	-	0.34	0.28	0.35	0.31	-	-	-	-	-	-	**B**
		max	1.93	2.35	1.79	1.15	1.79	1.58	1.52	2.02	-	1.97	1.96	2.00	2.01	-	-	-	-	-	-	
		min	0.52	0.57	0.53	0.37	0.50	0.50	0.50	0.52	-	0.48	0.46	0.50	0.49	-	-	-	-	-	-	
		sq_E	1.05	1.16	1.07	0.73	1.00	1.01	1.00	1.06	-	0.99	0.94	1.01	1.01	-	-	-	-	-	-	
landings	**2013**	**baseline**	**42222**	**39948**	**97688**	**3000**	**100684**	**12757**	**4761**	**17540**	**1308**	**3250**	**6229**	**2763**	**1136**	**17**	**410**	**1434**	**788**	**1016**	**18351**	
		sq_E	43865	45846	103493	3130	85798	12842	4761	18469	962	2430	4417	2121	867	13	301	1054	579	747	13490	
	2014	**baseline**	**28041**	**40638**	**111630**	**2961**	**85581**	**11900**	**3230**	**24200**	**1000**	**1190**	**9223**	**1383**	**740**	**50**	**700**	**1100**	**600**	**608**	**16594**	
		cod	27567	13625	55102	1701	48359	6424	2365	9195	393	1216	2211	1062	434	20	275	432	236	239	6517	
		Ef_Mgt	29314	9746	82855	2605	68305	11869	3873	7560	252	842	1322	725	266	13	176	277	151	153	4175	**C**
		max	78729	49366	163655	4608	143439	17576	5858	31983	1594	4847	9223	4187	1731	80	1116	1754	957	969	26459	
		min	27332	13390	54880	1697	48050	6420	2359	9067	384	1190	2164	1039	425	19	269	423	231	234	6378	
		sq_E	49924	26258	104520	3171	89630	12040	4266	17758	785	2430	4417	2121	867	39	549	863	471	477	13019	
Ld_MgtPlan	**2014**	sq_E	27567	40638	111630	2927	87221	11900	3230	24052	1000	1190	9223	1383	740	50	700	1100	600	608	16594	**D**
ssb	**2013**	**baseline**	**72349**	**257734**	**663207**	**7364**	**196237**	**50546**	**11428**	**281593**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	
	2014	**baseline**	**86030**	**242849**	**735330**	**8267**	**162125**	**48151**	**10167**	**271526**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	
	2015	**baseline**	**118399**	**201272**	**736798**	**9728**	**176013**	**46073**	**10958**	**311963**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	
ssb	**2014**	sq_E	84373	237311	726382	8153	175059	48060	10167	270336	-	-	-	-	-	-	-	-	-	-	-	
	2015	cod	116438	227615	808146	10737	220911	51772	11845	330174	-	-	-	-	-	-	-	-	-	-	-	**E**
		Ef_Mgt	114641	232223	767586	9908	204306	46015	10299	332243	-	-	-	-	-	-	-	-	-	-	-	
		max	65054	185550	650750	8091	143575	40002	8271	301300	-	-	-	-	-	-	-	-	-	-	-	
		min	116680	227893	808471	10740	221170	51775	11852	330336	-	-	-	-	-	-	-	-	-	-	-	
		sq_E	93639	212663	736068	9392	186756	45835	9897	319332	-	-	-	-	-	-	-	-	-	-	-	
ssb_MgtPlan	**2015**	sq_E	116438	195752	725753	9615	188728	45982	10958	311357	-	-	-	-	-	-	-	-	-	-	-	**F**

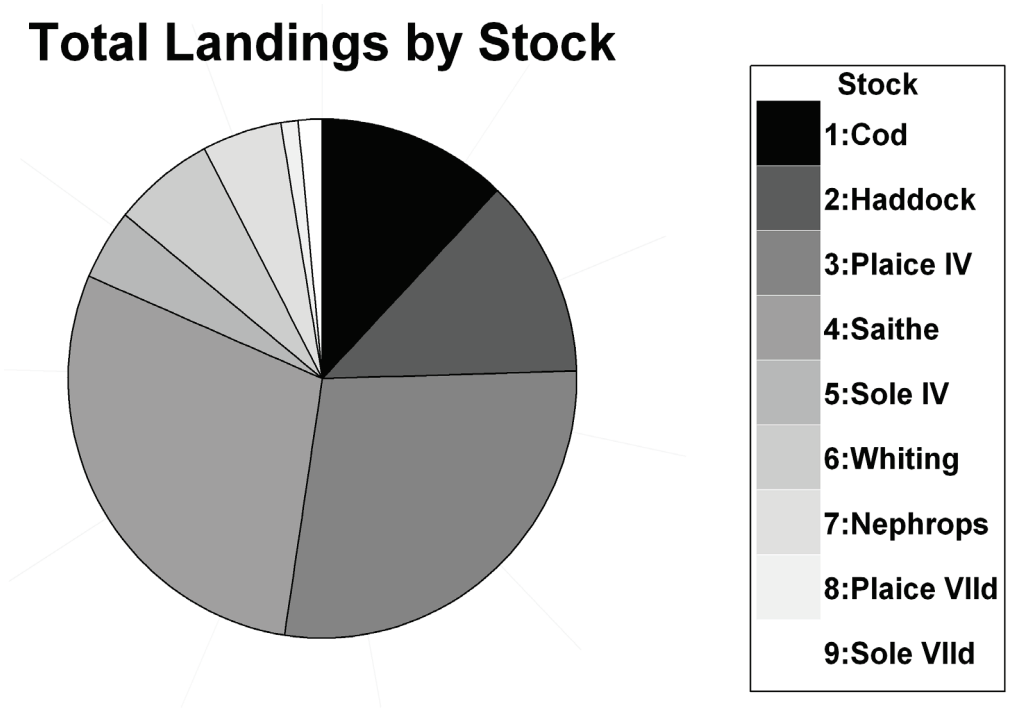

Figure 3.2.1.1. Distribution of landings of those stocks included in the mixed fisheries projections.

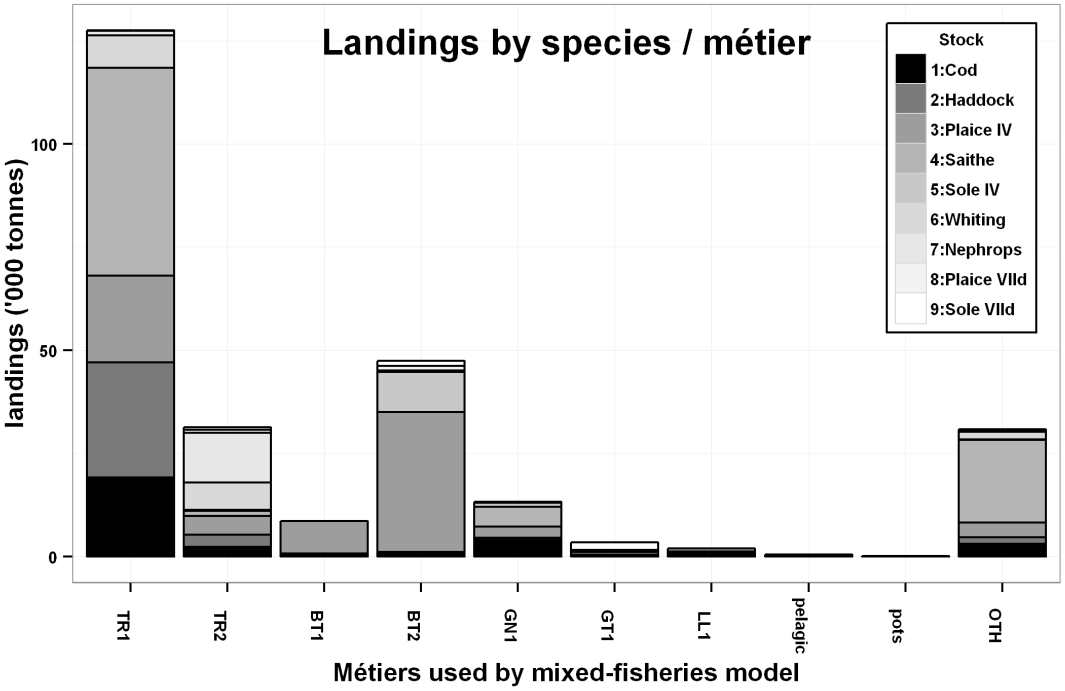

Figure 3.2.2.1 Landings distribution of species by metier with landings consisting of ≥1% of any of the stocks listed in 2012. Note: The "other" (OTH) displayed here is a mixed category consisting of (i) landings without corresponding effort (presented in 2012 as OTH), (ii) landings of any combination of fleet and metier with landings < 1% of any of the stocks listed in 2012, or (iii) remaining unallocated differences between total landings used in single-stock advice and mixed-fisheries advice, such as saithe landings in Subarea VI (not displayed in 2012).

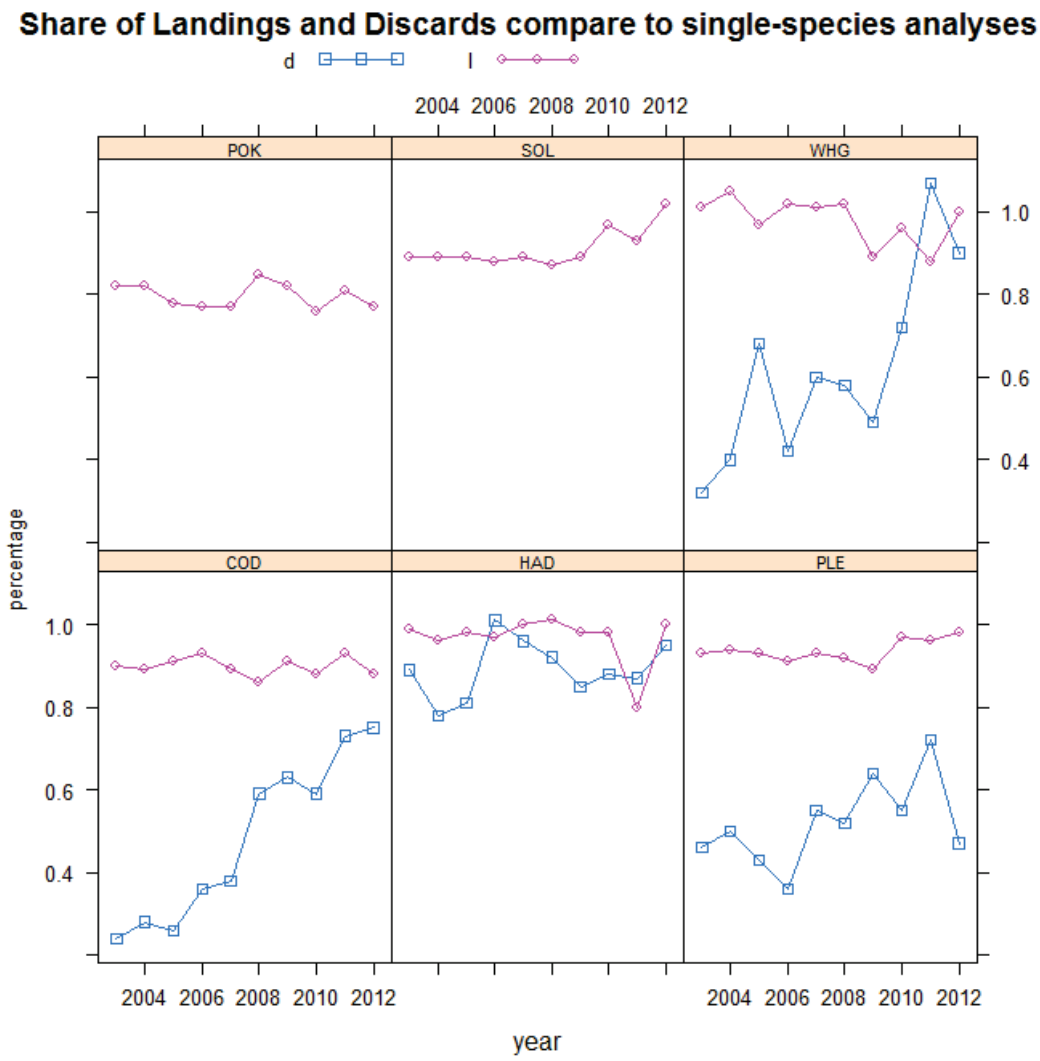

Figure 3.2.2.2. Ratio between the sum of landings and discards across fleets used in the MIXFISH analysis and the landings and discards estimated by the WGNSSK stock assessments.

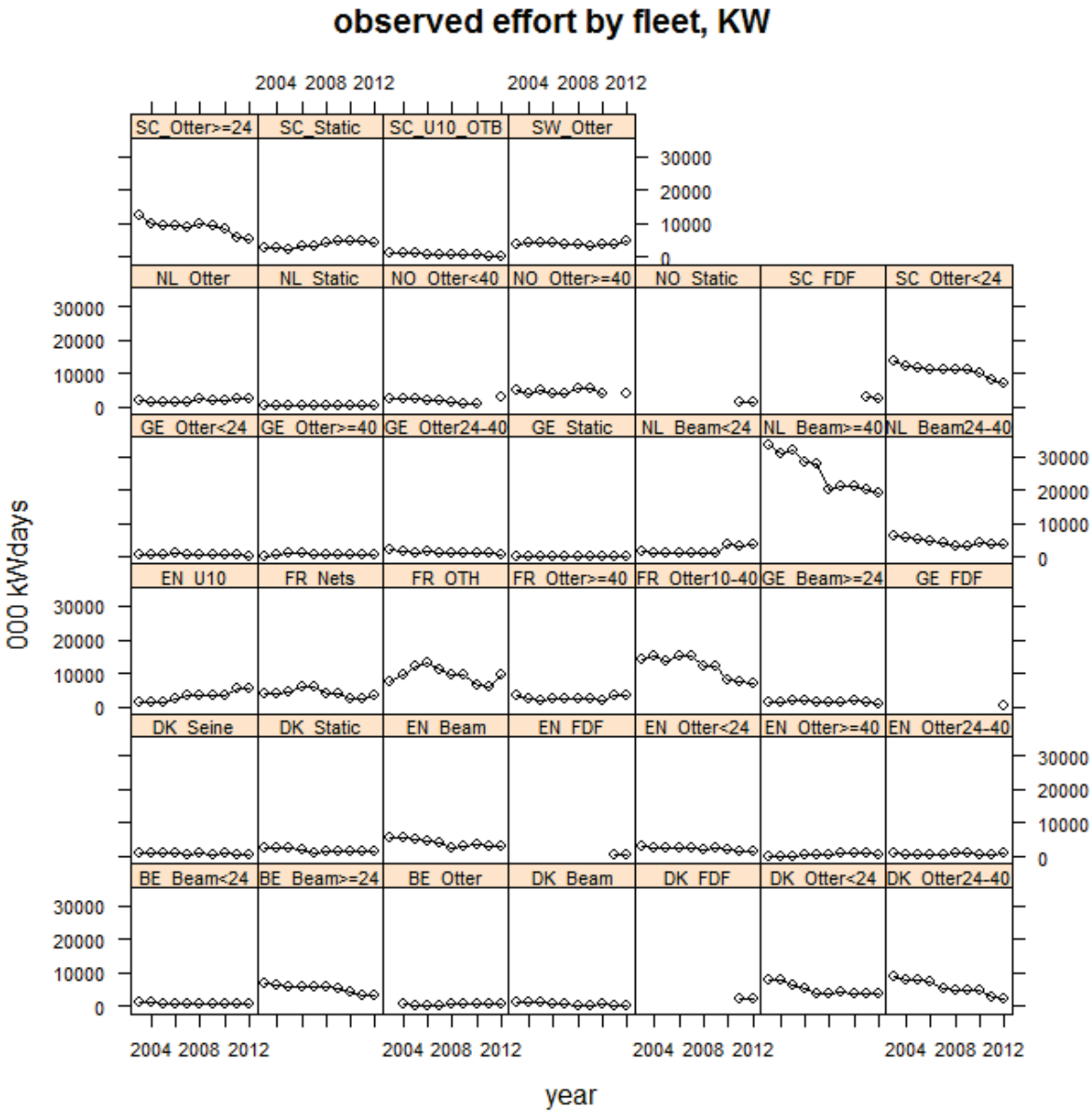

Figure 3.2.3.1 – Effort by fleet and year for the North Sea demersal fleets, in '000 KWdays. Data for French fleets from 2009 were not available.

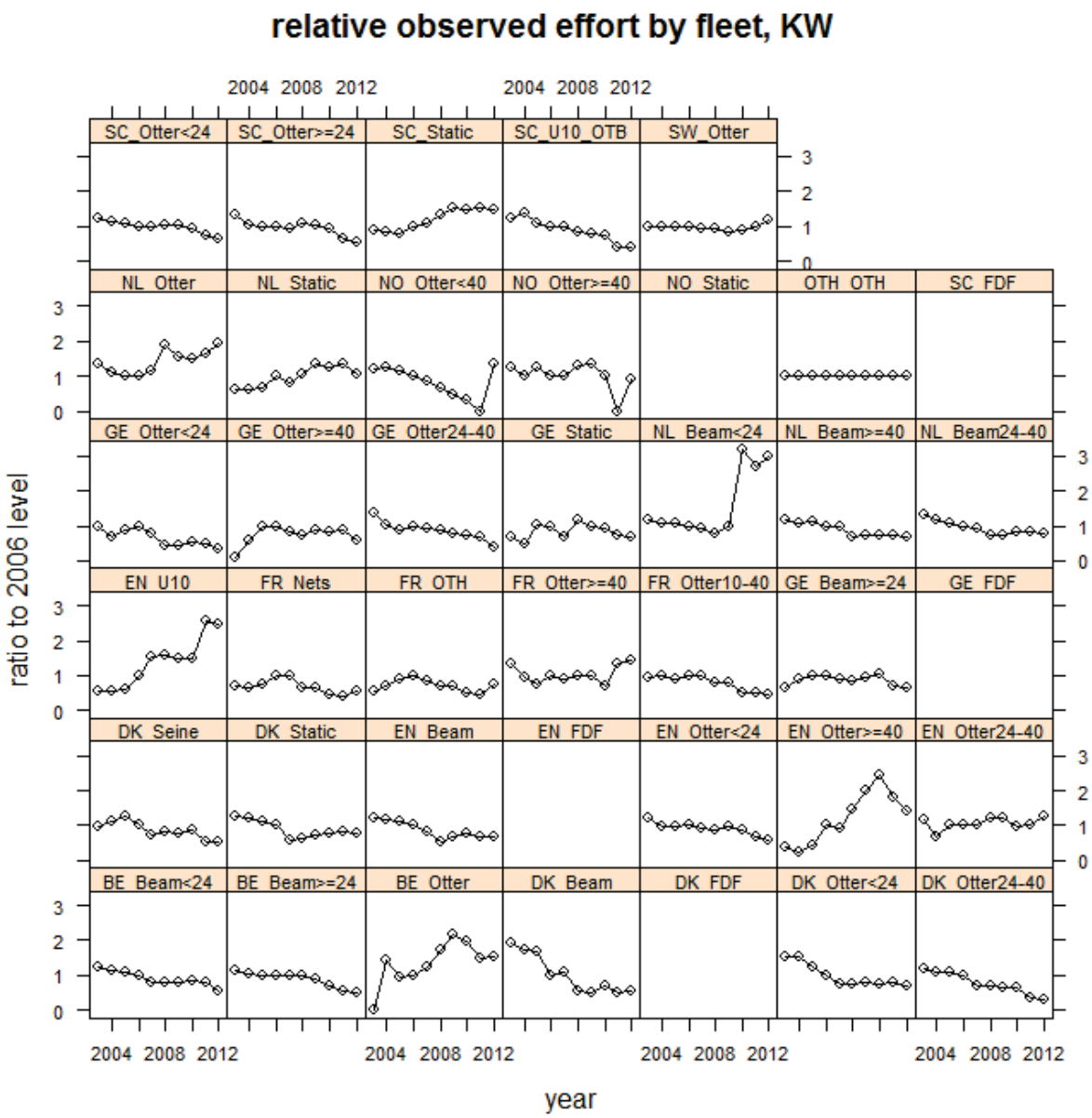

Figure 3.2.3.2 – Relative trends in effort (KW Days) by fleet and year for the North Sea demersal fleets. Data for French fleets from 2009 was not available.

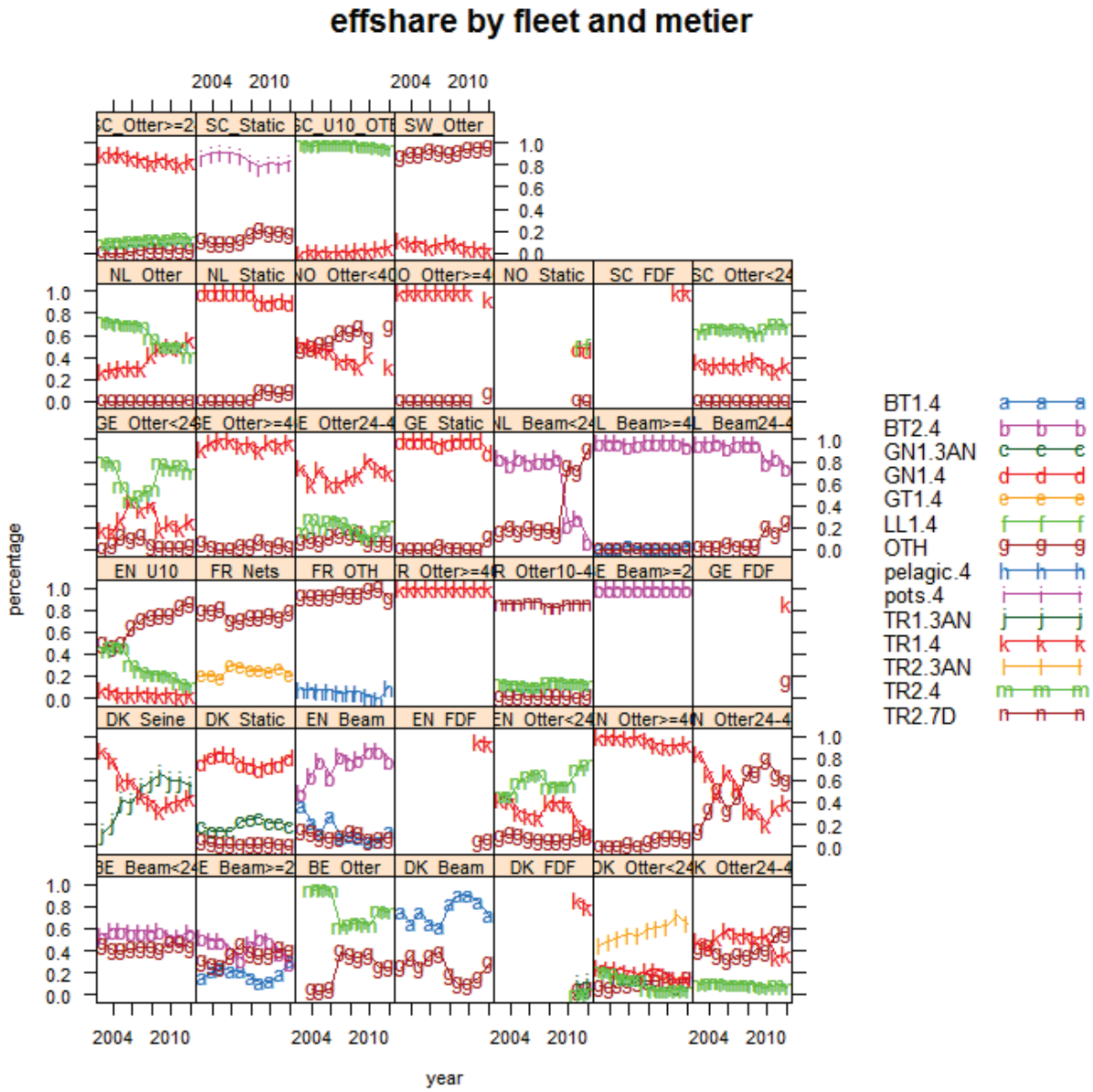

Figure 3.2.3.3 – Effort share (in proportion) by métier for each fleet.

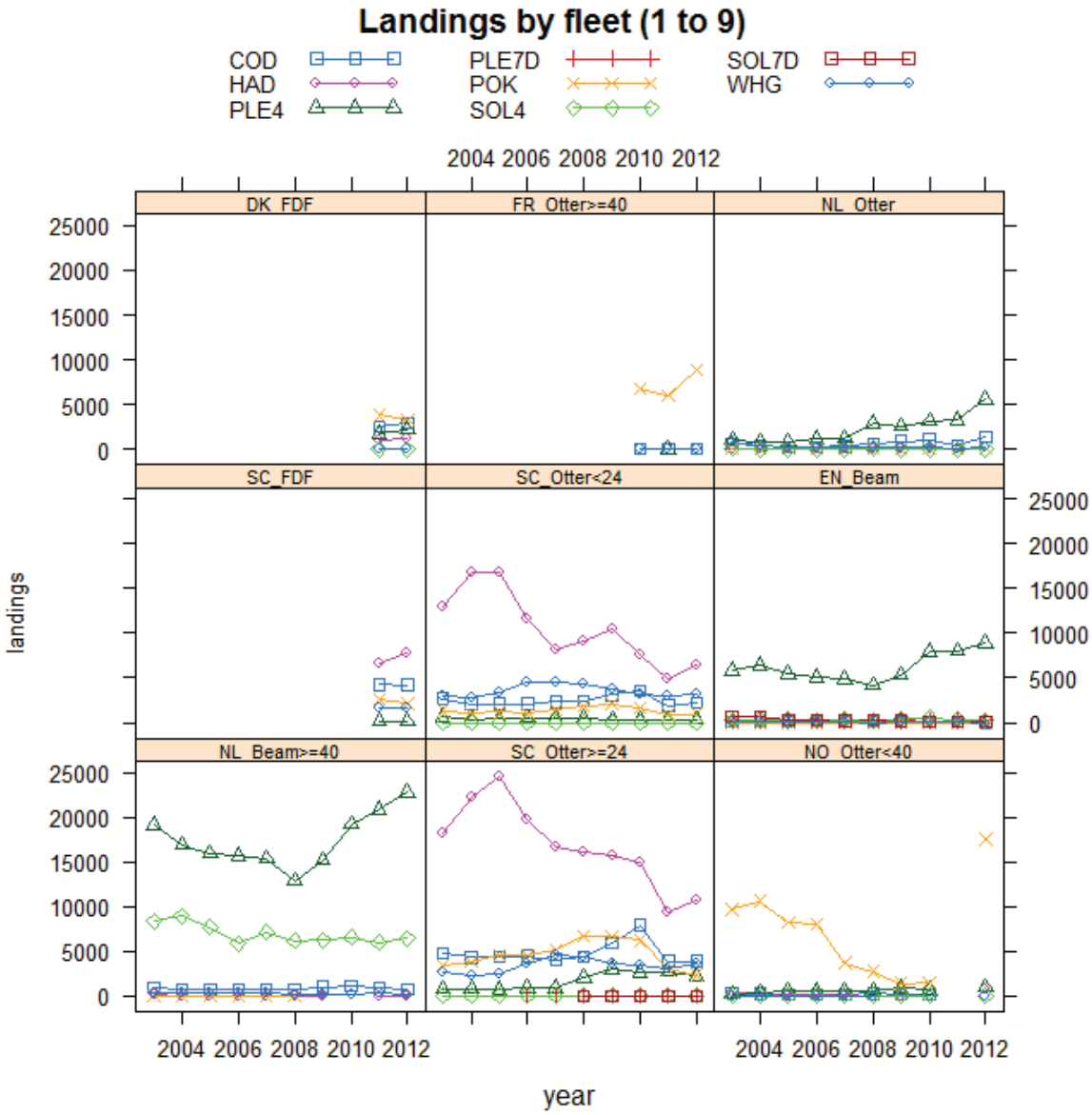

Figure 3.2.3.4. Landings by fleet, stock and year. Fleets are shown in decreasing groups of total landings and with different scales.

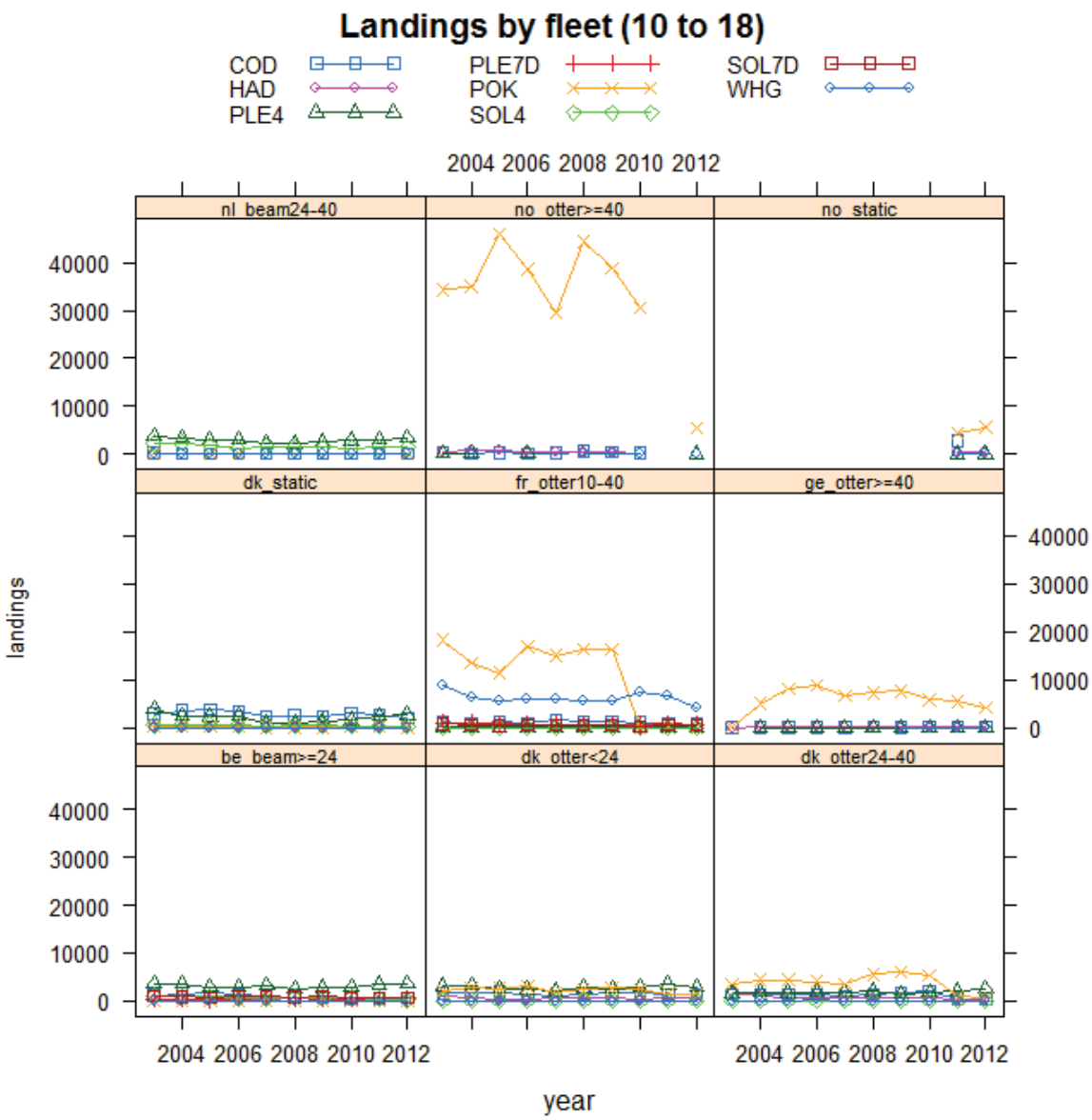

Figure 3.2.3.4 (cont). Landings by fleet, stock and year. Fleets are shown in decreasing groups of total landings and with different scales.

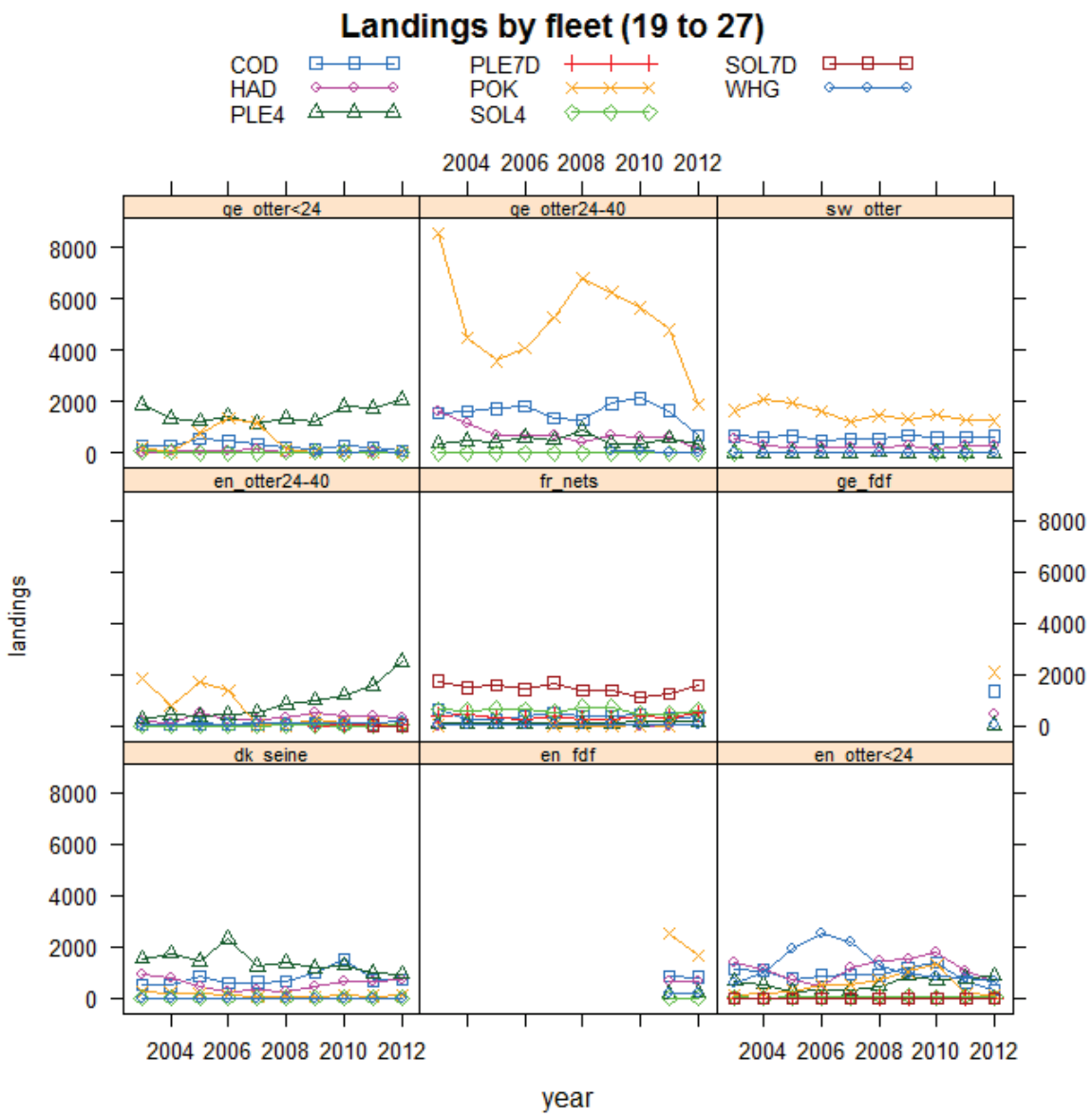

Figure 3.2.3.4 (cont). Landings by fleet, stock and year. Fleets are shown in decreasing groups of total landings and with different scales

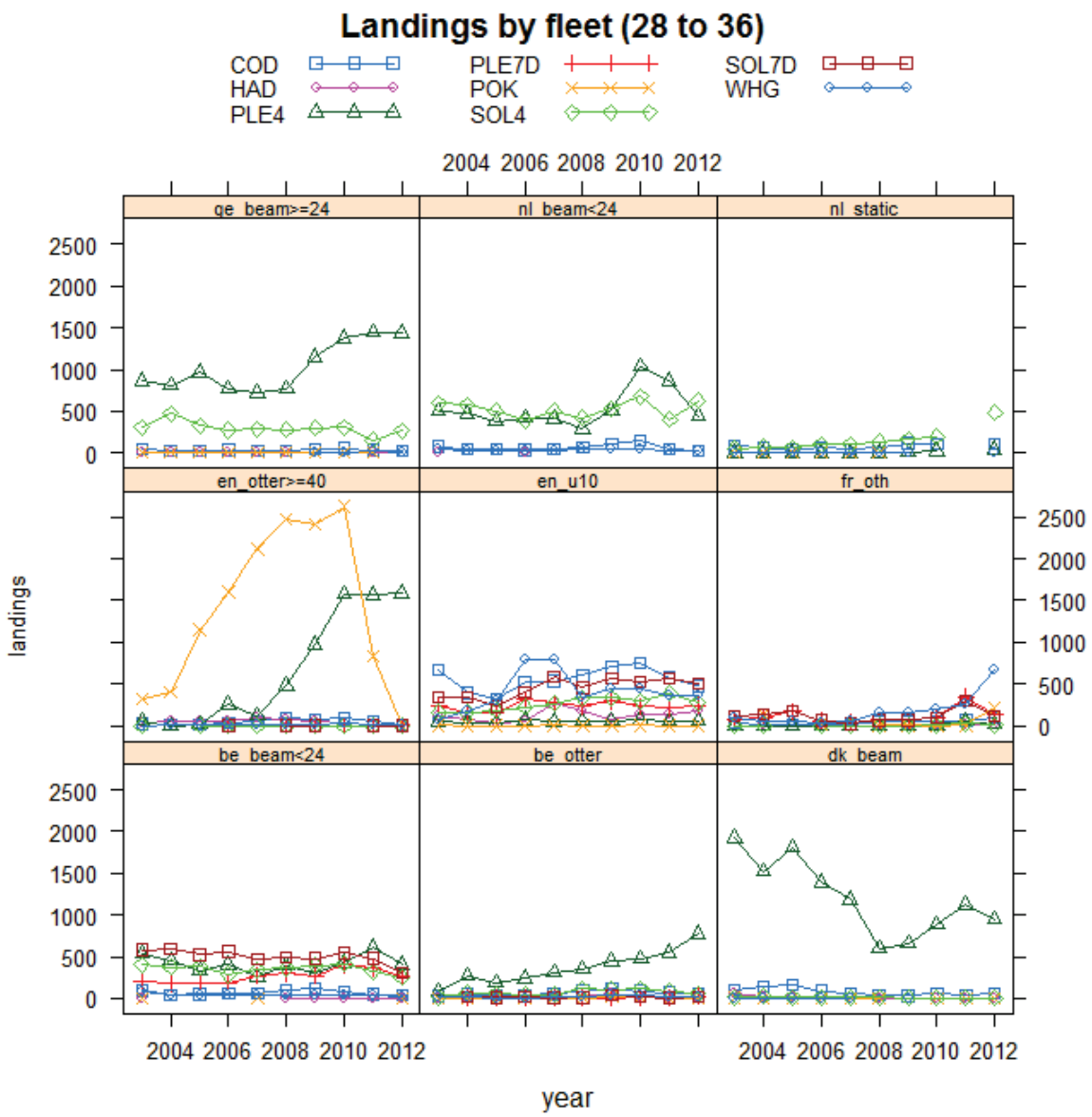

Figure 3.2.3.4 (cont). Landings by fleet, stock and year. Fleets are shown in decreasing groups of total landings and with different scales

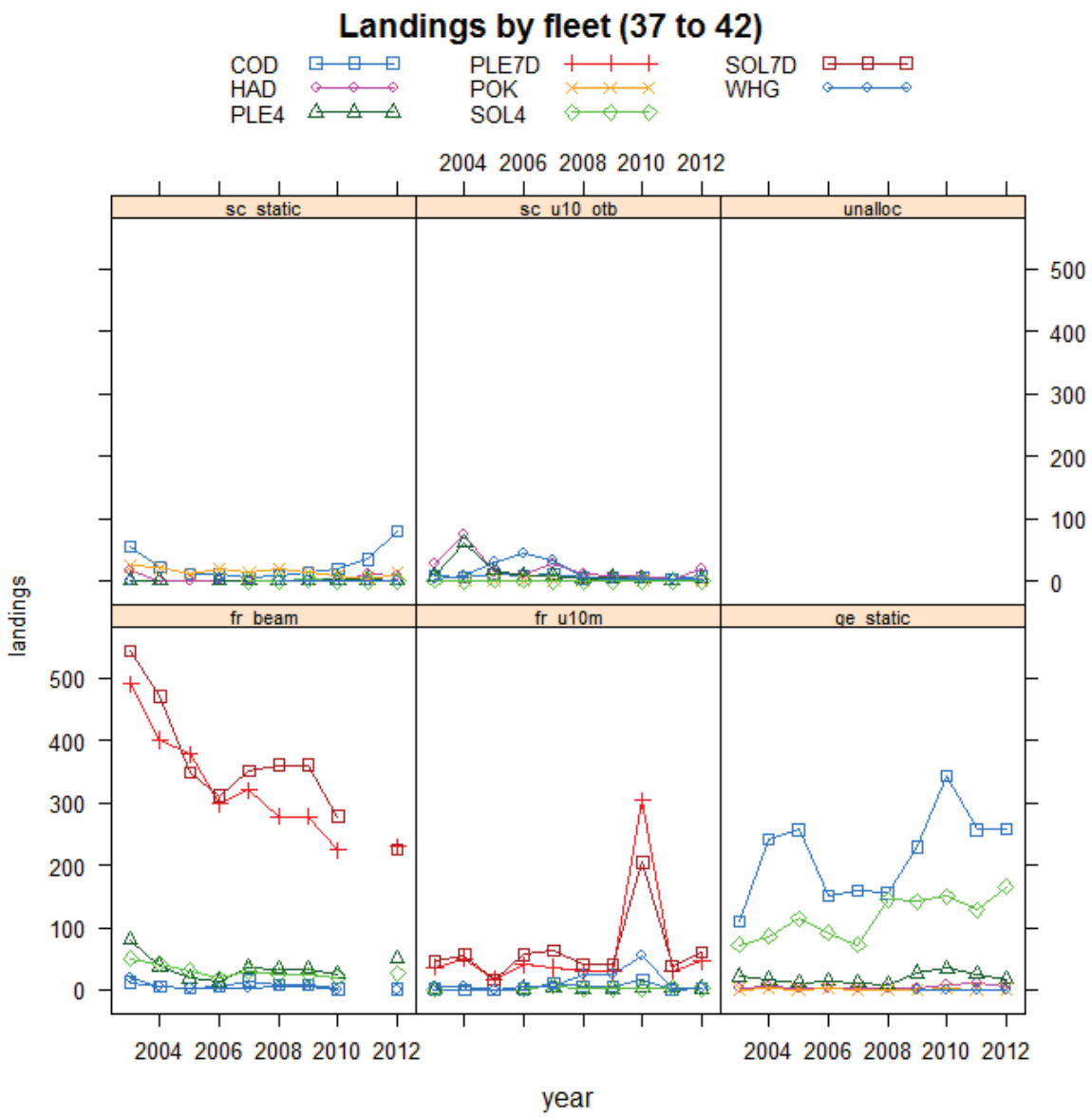

Figure 3.2.3.4 (cont). Landings by fleet, stock and year. Fleets are shown in decreasing groups of total landings and with different scales.

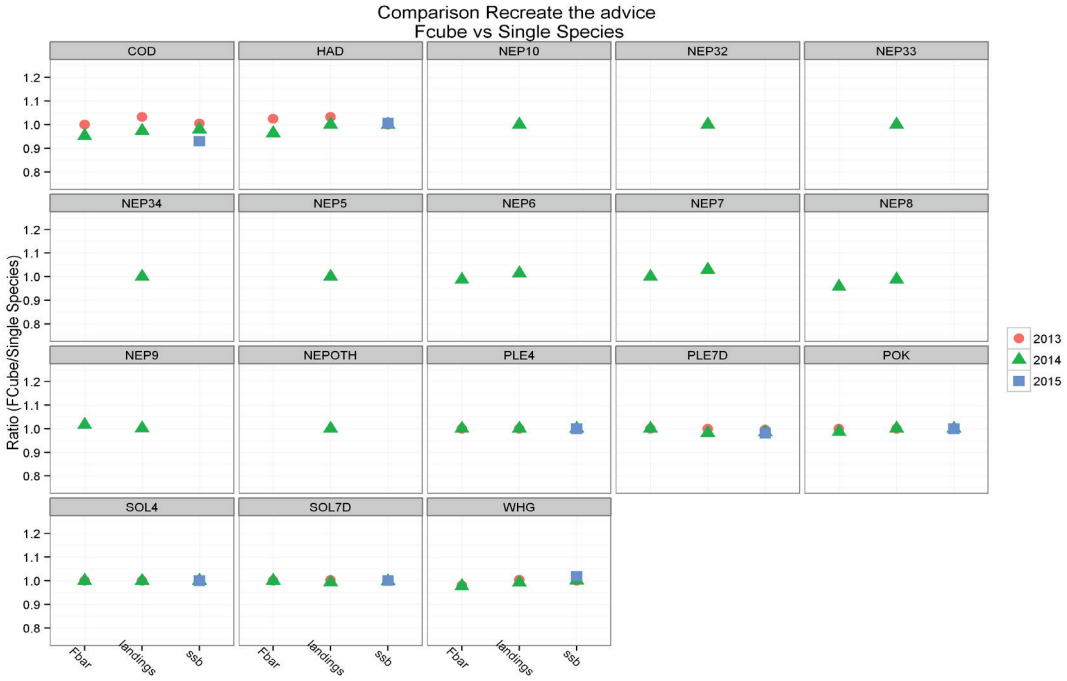

Figure 4.2.1.1 Difference in Fcube outcome from Single Species advice for Fbar (2013-2014), landings (2013-2014) and SSB (2014-2015). For *Nephrops* the harvest ratio (Fbar proxy) in the intermediate year (2013) may be quite different between the single species and the FCube baseline because the single species forecast uses an average harvest ratio over the last 3 years whereas the Fcube value is based on a share of the 2013 TAC applied to the abundance estimates in 2013 for that FU. This does not have a material impact on single species or FCube TAC year Fbar or TAC advice.

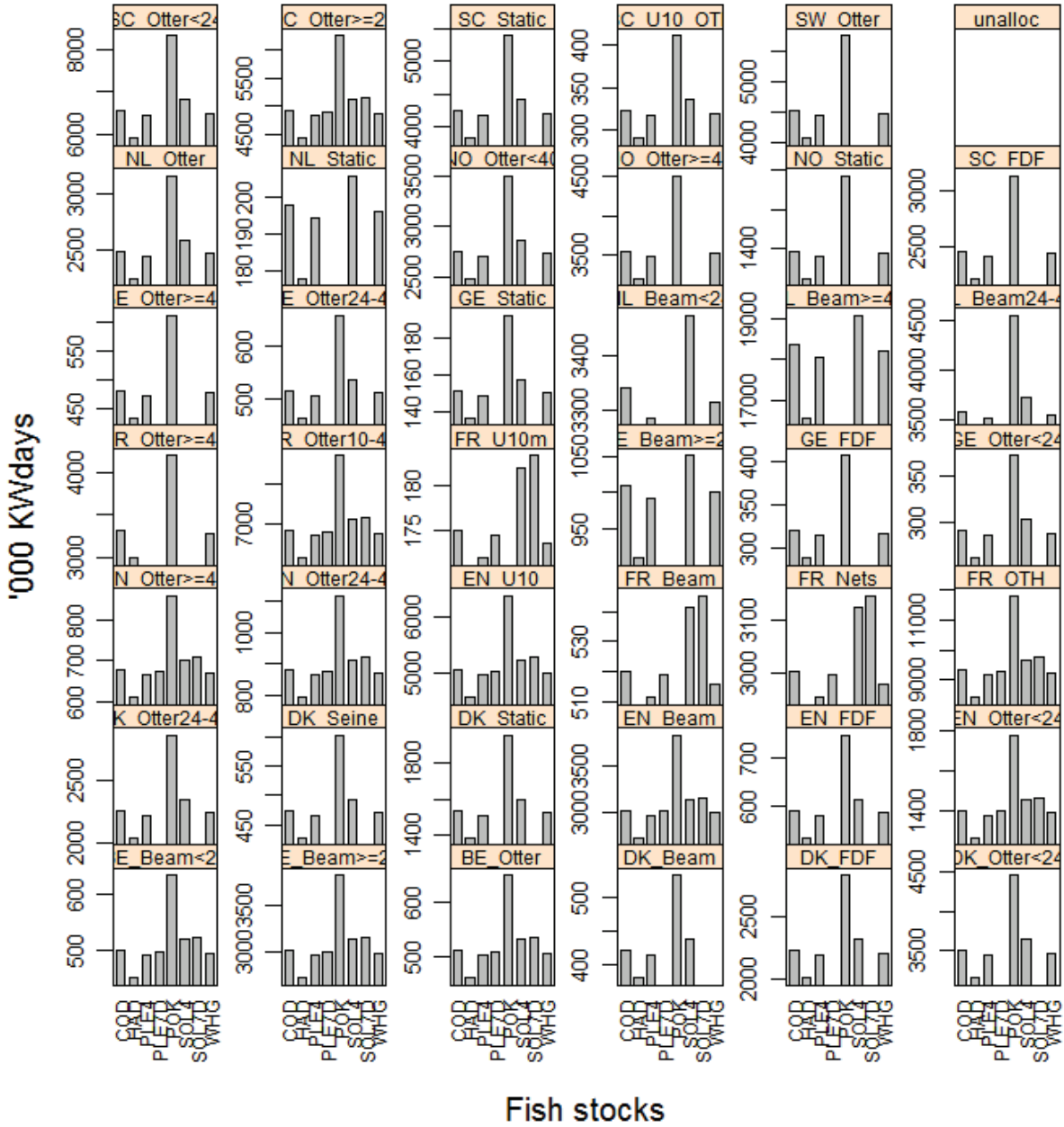

Figure 4.2.2.1.1. Intermediate year results. Single-Stock Target F in 2013; Fcube estimates of effort by fleet corresponding to the individual "quota share" (or partial target F) by stock in 2013. Finfish species.

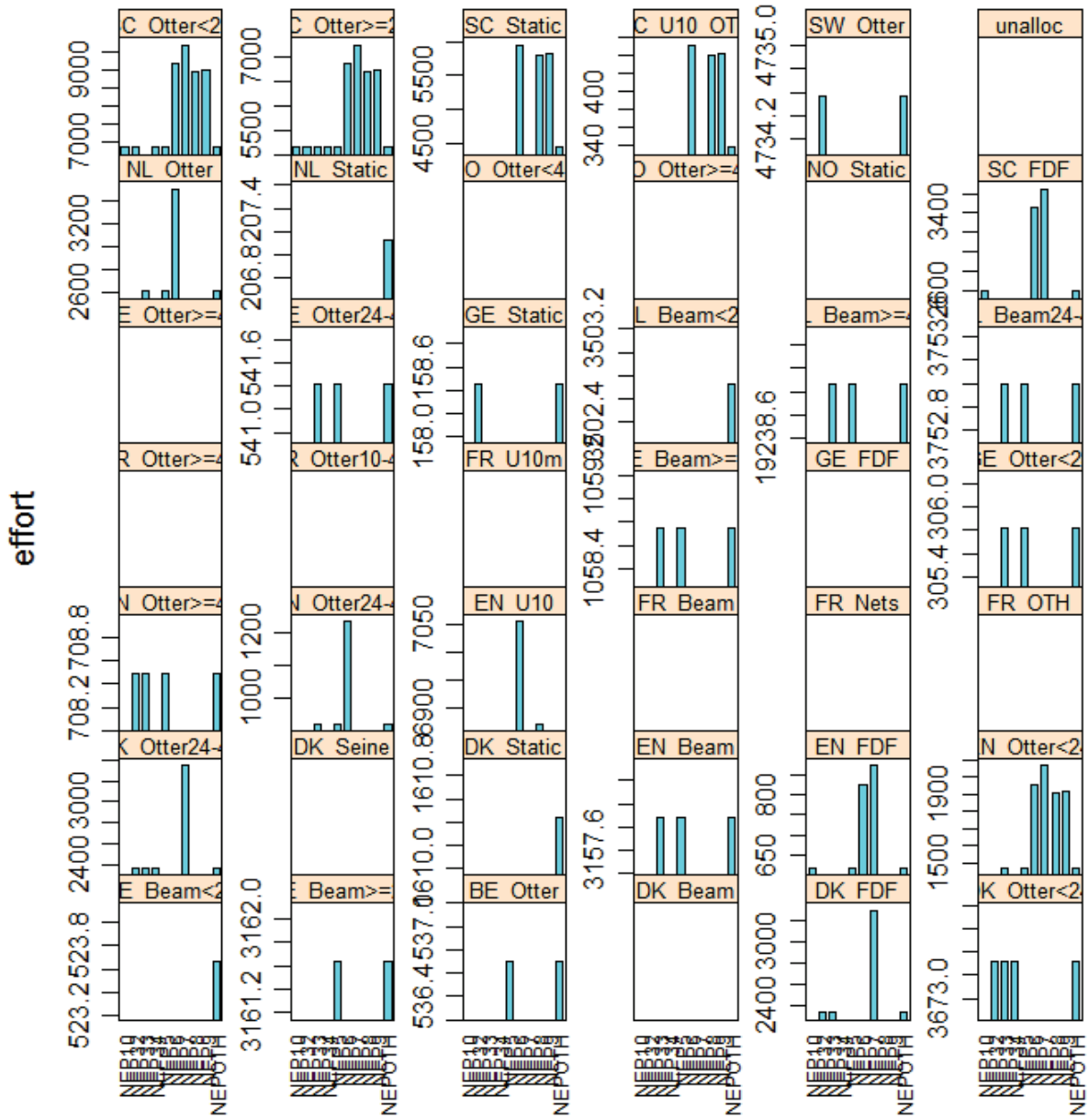

Figure 4.2.2.1.2. Intermediate year results. Single-Stock Target F in 2013; Fcube estimates of effort by fleet corresponding to the individual "quota share" (or partial target F) by stock in 2013. *Nephrops* FUs.

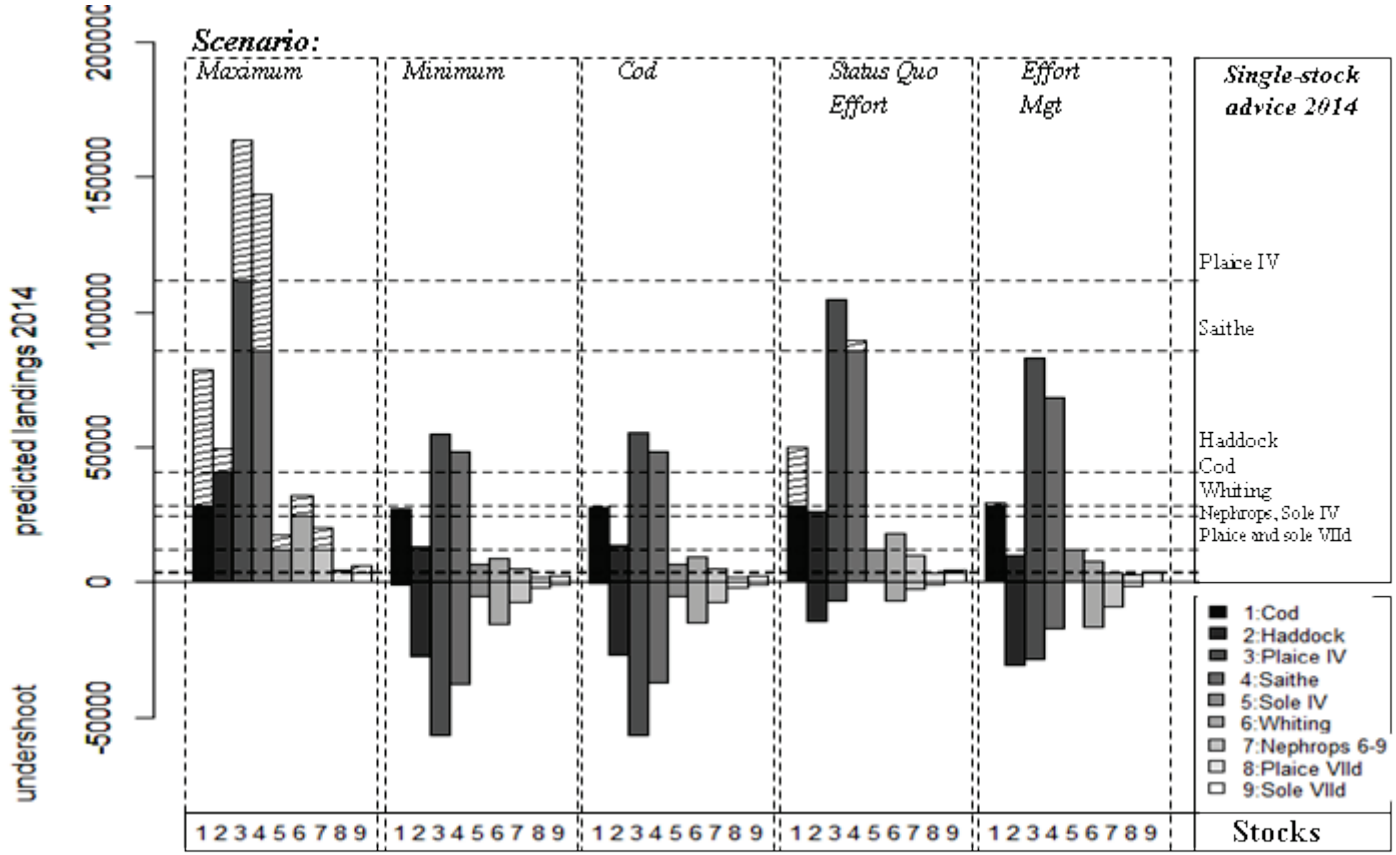

Figure 4.2.2.2.1 TAC year results (2014). Fcube estimates of potential landings by stock after applying the status quo effort scenario to all stocks in the intermediate year followed by the Fcube scenarios. Horizontal lines correspond to the TAC set by the single stock advice. Bars below the value of zero show the scale of undershoot (compared to the single species TAC) in cases where landings are predicted to be lower when applying the scenario.

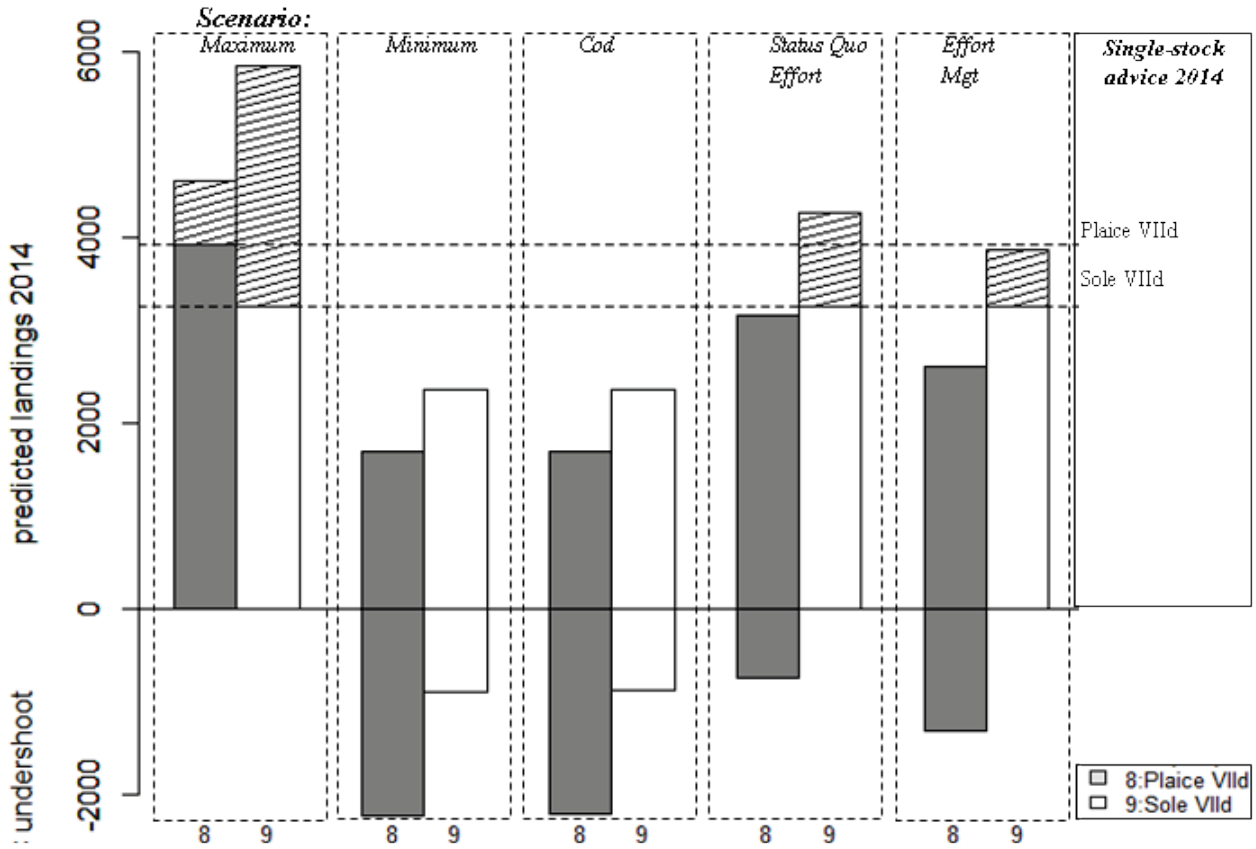

Figure 4.2.2.2.2 TAC year results for stocks in area 7d (2014). Fcube estimates of potential landings by stock after applying the status quo effort scenario to all stocks in the intermediate year followed by the Fcube scenarios. Horizontal lines correspond to the TAC set by the single stock advice. Bars below the value of zero show the scale of undershoot (compared to the single species TAC) in cases where landings are predicted to be lower when applying the scenario.

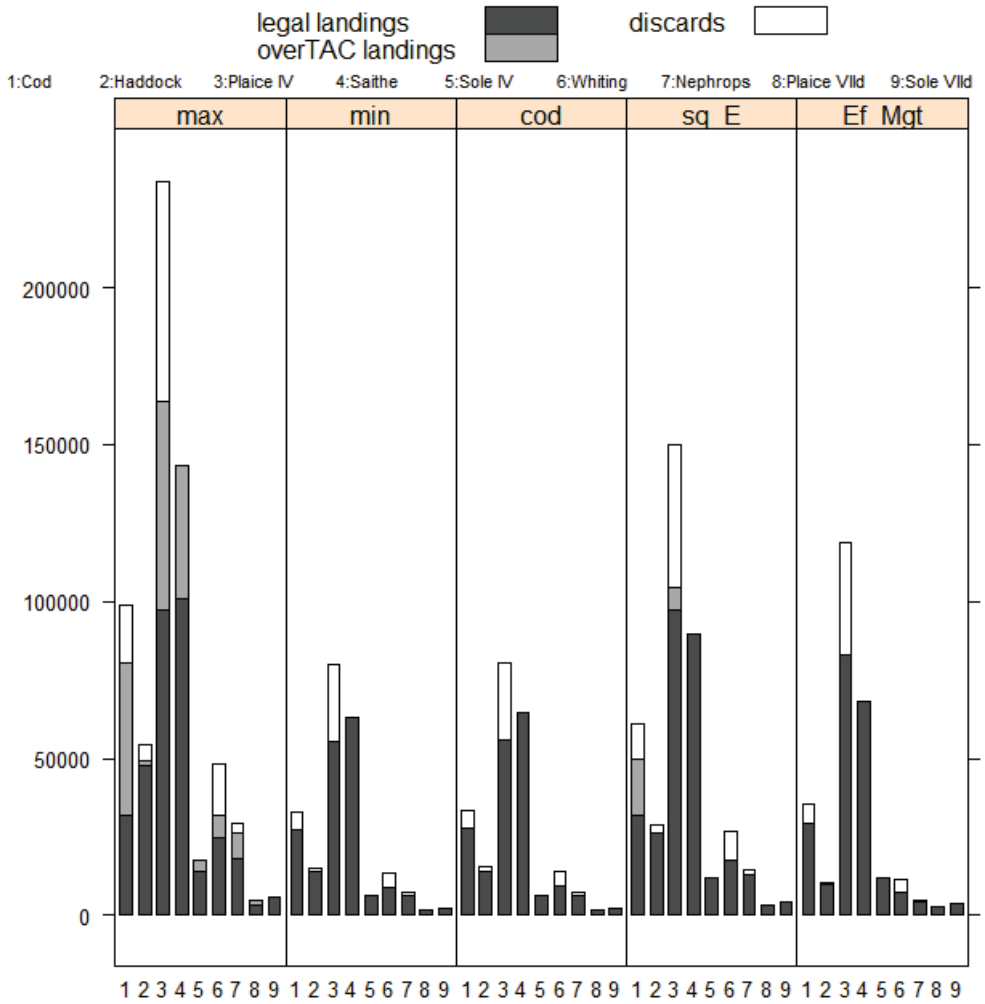

Figure 4.2.2.2.3. TAC year results (2014). Total estimated catches by stock and Fcube scenario in 2014. Bars represent from bottom to top: potential landings (as estimated from previous ratios of landings vs. discards) up to the advised single stock 2014 TAC; potential landings (as estimated from previous ratios of landings vs. discards) above the advised single stock 2014 TAC; discards.

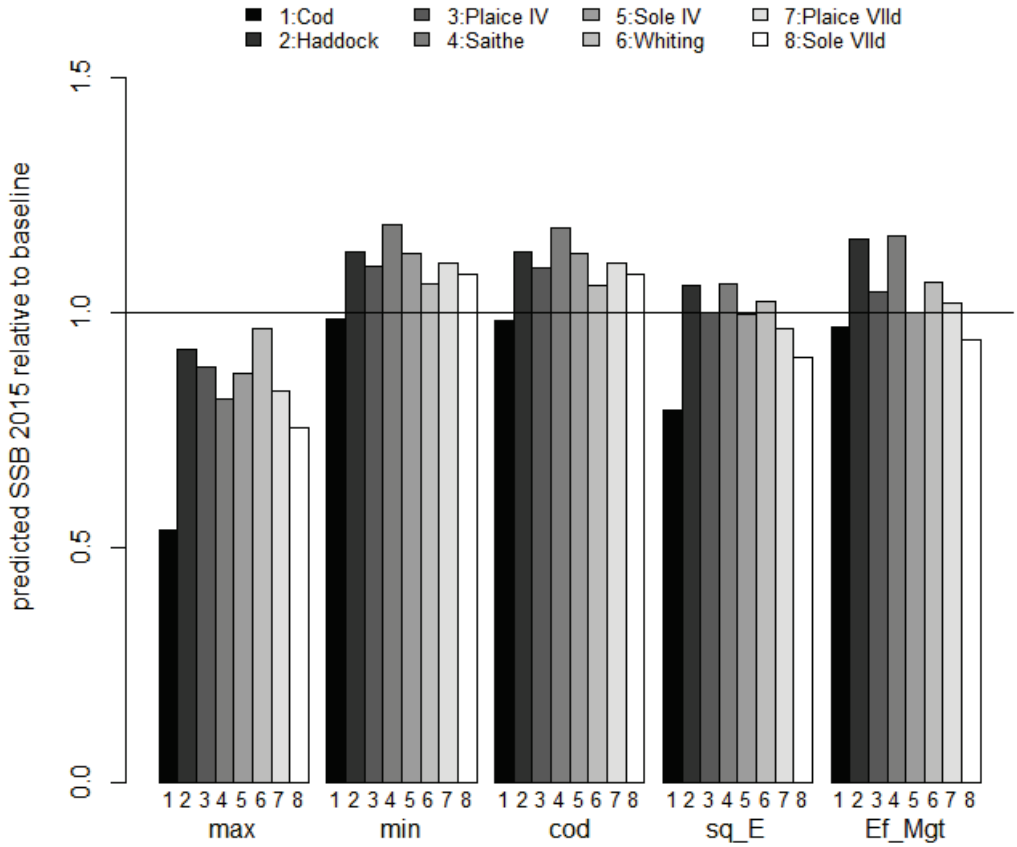

Figure 4.2.2.2.4. Estimates of potential SSB at the start of 2015 by stock after applying the mixed fisheries scenarios, expressed as a ratio to the single species advice forecast. Horizontal line corresponds to the SSB resulting from the single stock advice (at the start of 2015). Nephrops are not included as abundance is not forecast from the mixed fisheries model.

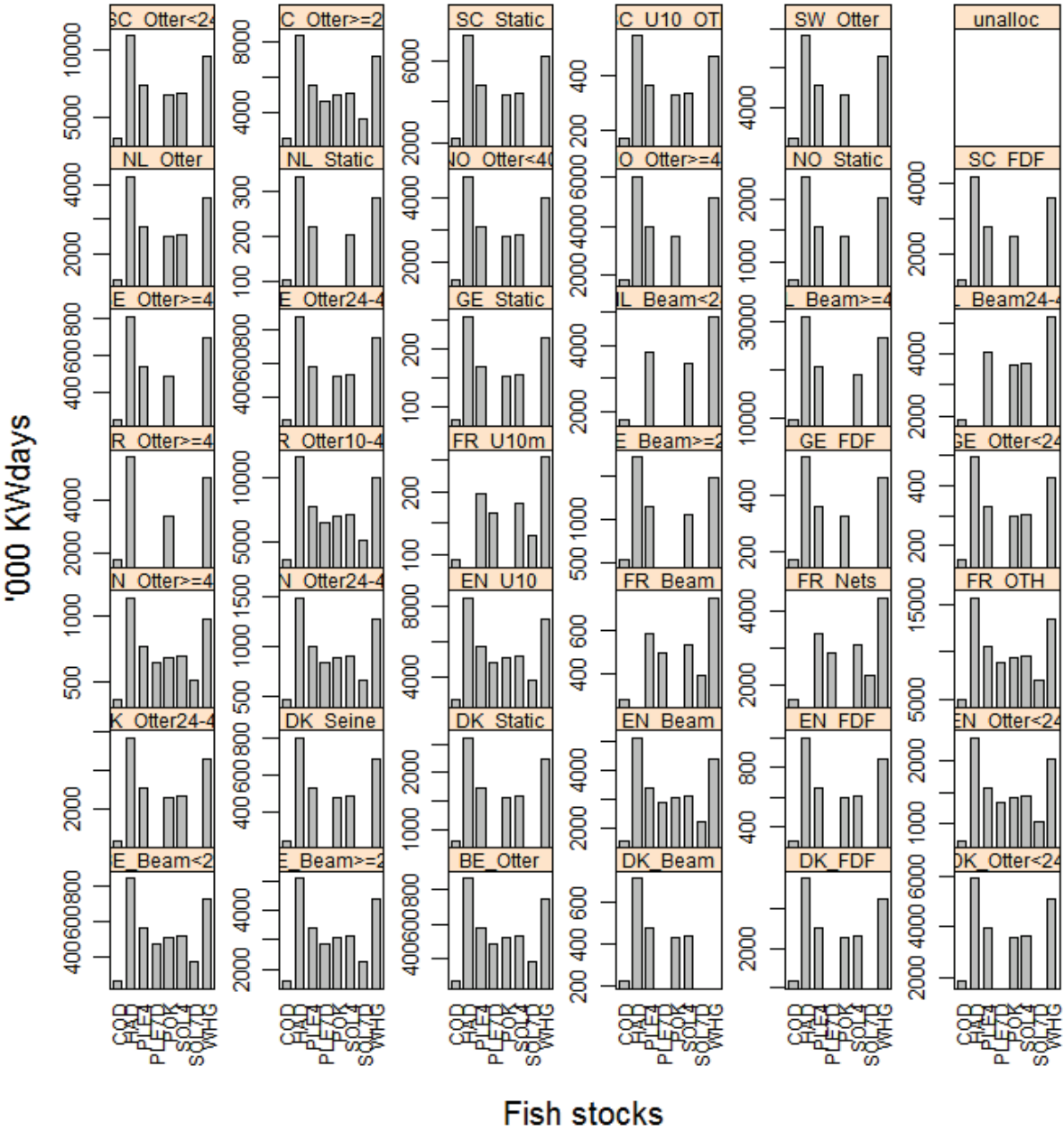

Figure 4.2.2.2.5. TAC year results (2014). Fcube estimates of effort by fleet corresponding to the individual "quota share" (or partial target F) by stock in 2014 (baseline run). Finfish species.

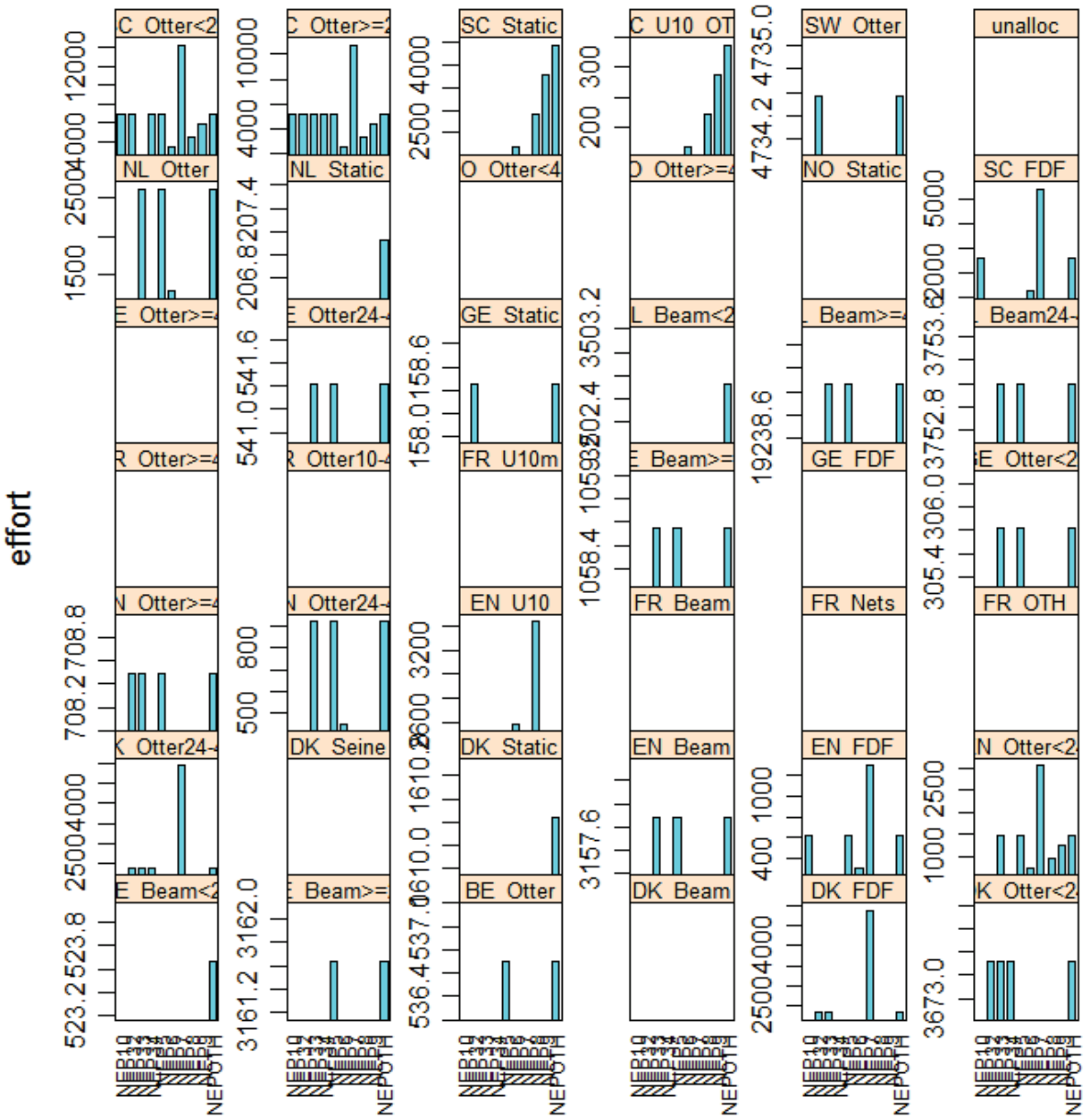

Figure 4.2.2.2.6. TAC year results (2014). Fcube estimates of effort by fleet corresponding to the individual "quota share" (or partial target F) by stock in 2014 (baseline run). ***Nephrops*** **FUs.**

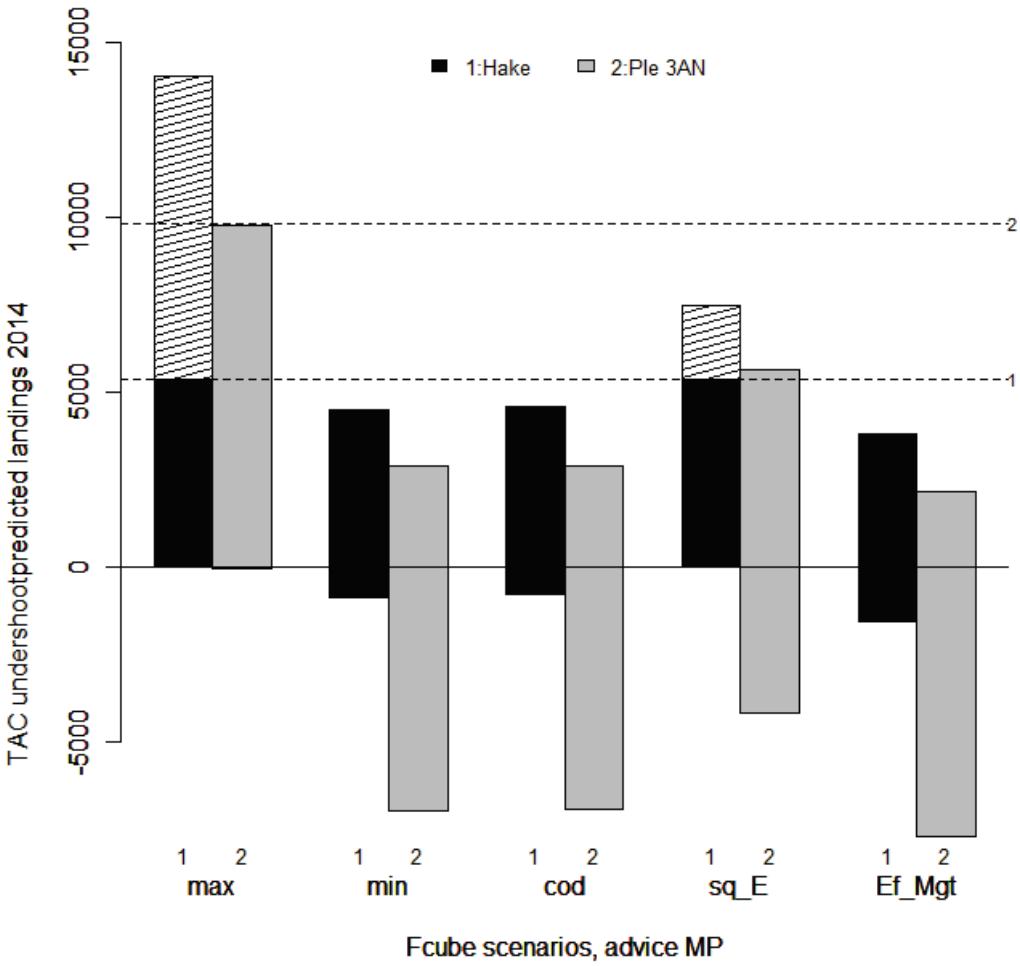

Figure 4.2.2.3.1. TAC year results. Estimates of potential landings by stock after applying the status quo effort scenario in the intermediate year followed by the Fcube scenarios. Stocks shown do not influence the mixed fisheries projections but potential landings are calculated using fleet effort results from the scenarios and the lpue of métiers from the final data year. Horizontal lines correspond to the TAC set by the single stock advice. Bars below the value of zero show the scale of undershoot (compared to the single species TAC) in cases where landings are predicted to be lower when applying the scenario.

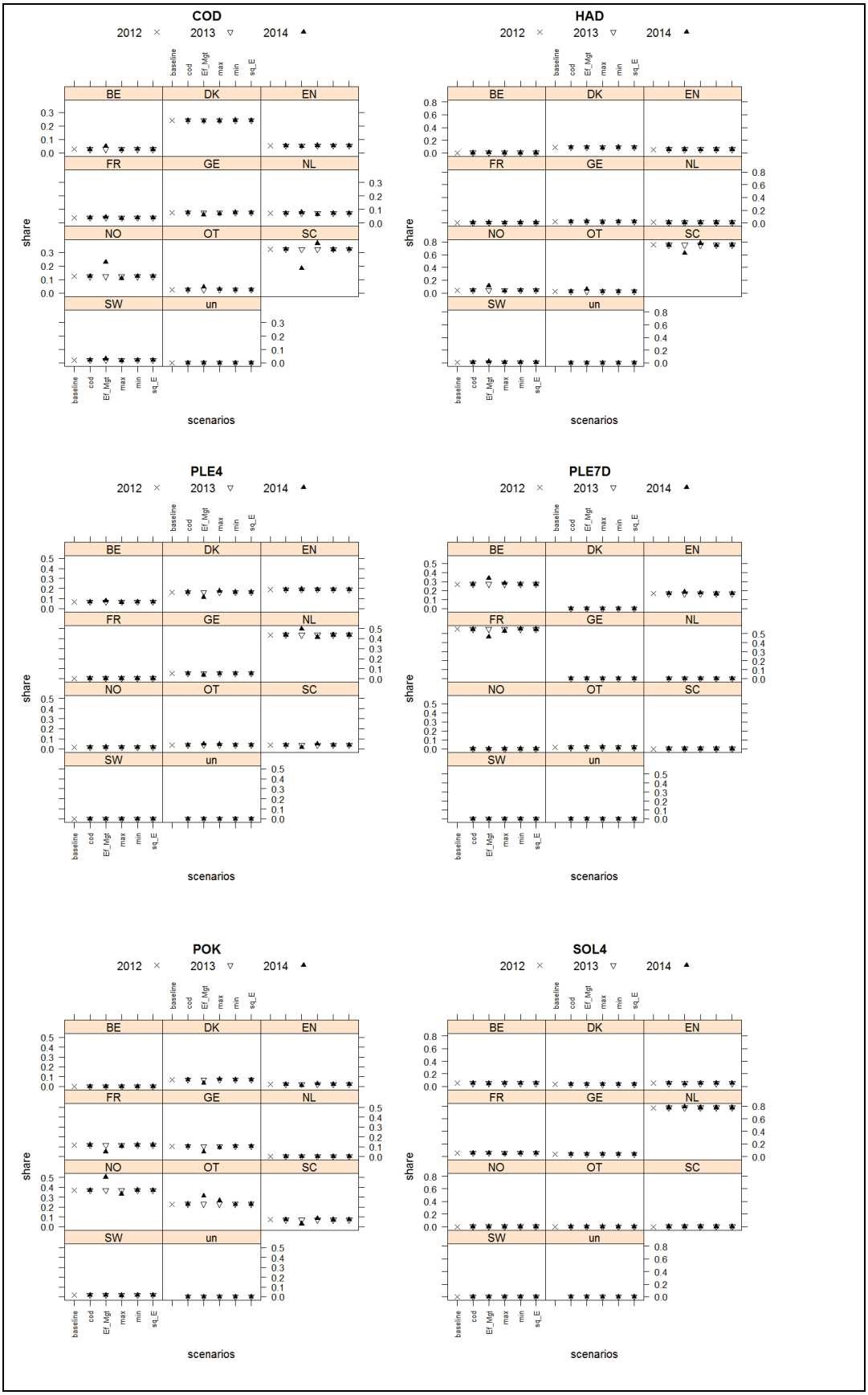

Figure 4.2.2.4.1: Test for relative stability. Changes of relative share of species' landings by country in 2013 and 2014 compared to the 2012 share, for the 'baseline' and 5 Fcube scenarios.

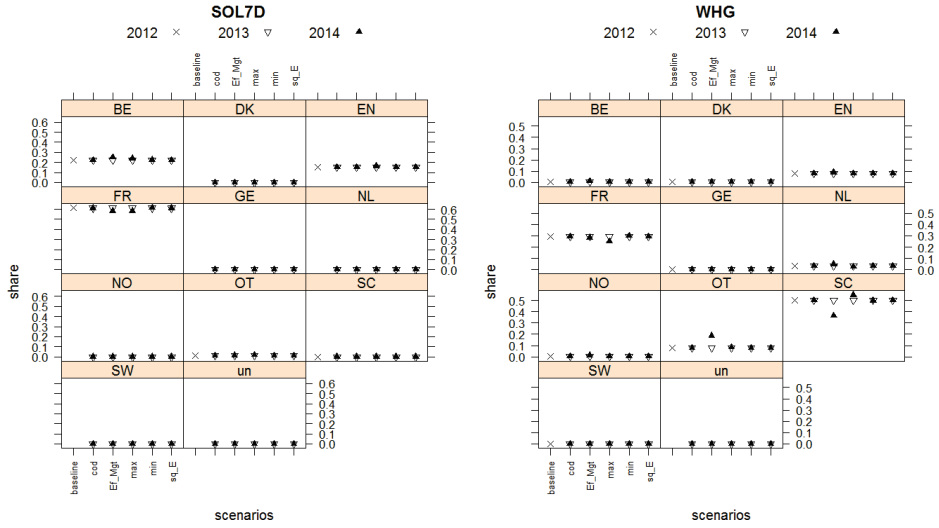

Figure 4.2.2.4 (cont): Test for relative stability. Changes of relative share of species' landings by country in 2013 and 2014 compared to the 2012 share, for the 'baseline' and 5 Fcube scenarios.

Annex 1: List of participants

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Annex 2: Specification of the ICES' data call

Following intercessional debate and a workshop held at WGMIXFISH 2011 data from WGMIXFISH 2012 was requested as part of a joint WGNSSK-WGMIXFISH data call issued formally under the EU data collection framework (DCF) regulations. This annex contains a summary of the considerations that influenced the design of the data call followed by a copy of the data call document issued by ICES for supply of 2012 data.

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.

Attention then switched to the DCF framework. 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. 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.

Following these considerations two different starting positions became clear, one being that data should be provided at the DCF metier level, the other 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. In turn this implies that data calls should simply request raised catch data, and only landings for those metiers not sampled (effort data would simply match these categories).

It was 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.

The data was to be submitted to InterCatch for safe storage and to allow allocations of discards and age distributions to unsampled metiers. To reduce the number of metiers forming the stock data the following was requested from contributing nations:

- A description of sampling designs.
- A mapping of metiers to samples.
- Likely categorisation (raised or unsampled).

After consideration of those metiers important to the North Sea demersal stocks a reduced set of 'metier-tags', using the DCF level 6 naming convention but often merging over metiers was defined in the data call.

During the data call design process it was realised national sampling schemes rarely distinguished between vessel length categories. Age specific raised data entered to InterCatch was therefore not disaggregated by vessel length category. WGMIXFISH, however, considers more realistic scenario results can be generated by taking account of vessel lengths, e.g. larger vessels using trawl gear may operate in a relatively clean saithe fishery further offshore while smaller vessels operate in a more mixed demersal fishery closer to home ports. As the mixed fishery projections currently base catchabilities on total weight of catch compared to fleet effort, vessel length specific data was requested specifically for WGMIXFISH (because of the way discards are raised in most countries this does mean that discards are allocated pro-rata across vessel length categories, i.e. discard proportions can only be assumed the same across vessel length categories).

DCF. 2010. Report of the Regional Coordination Meeting for the North Sea and Eastern Arctic (RCM NS&EA). Charlottenlund, Denmark, 17-21 May 2010.

Data call: Data submission for ICES working Groups WGNSSK & WGMIXFISH

Text in red bold (like this text) shows changes compared to last year's call.

Rationale

The mix fisheries advice to the EU and Norway regarding the species in the North Sea is elaborated on the basis of the best available survey and commercial data.

Scope of call

ICES Countries are requested to supply landings, discards, biological sample and effort data from 2012. This information should be according to one or more of the metiers listed in Annex 1. The minimum list of species for which data should be prepared according to Annex 1 is given below and in Appendix 8. The species should be reported for the areas in the area list below.

	Common species name	*Code*	*Scientific species name*
1	*Cod*	*COD*	*Gadus morhua*
2	*Common sole*	*SOL*	*Solea solea*
3	*Haddock*	*HAD*	*Melanogrammus aeglefinus*
4	*Plaice*	*PLE*	*Pleuronectes platessa*
5	*Saithe*	*POK*	*Pollachius virens*
6	*Whiting*	*WHG*	*Merlangius merlangus*
7	***Hake***	***HKE***	***Merluccius merluccius***
8	*Norway lobster*	*NEP*	*Nephrops norvegicus*
9	***Crangon or Brown Shrimp***	***CSH***	***Crangon crangon***

Area list

Area	*Area code*
North Sea (IV)	*IV*
Skagerrak (IIIaN)	*IIIaN*
Eastern Channel (VIId)	*VIId*

Deadline

22 March 2013.

Data to be reported

Landings, discards, sample and effort data from 2012 according to one or more of the metiers listed in Annex 1.

Additionally information by vessel length categories are also requested, please see section 'Aggregation vs. WGMIXFISH Requirements'.

Format to report

The InterCatch format should be used.

Additionally information by vessel length categories should be in comma separated (CSV) file, please see section 'Aggregation vs. WGMIXFISH Requirements'

How to report

The InterCatch formatted national data should be imported into InterCatch. Please use the following link: http://intercatch.ices.dk

Additionally information by vessel length categories should be electronically sent to:

Clara Ulrich [clu@aqua.dtu.dk] -- Chair of WGNSSK

Steven Holmes [s.holmes@marlab.ac.uk] -- Chair of WGMIXFISH

The entries in Annex 1 follow closely the naming convention used for the EU Data Collection Framework (DCF). An explanation of the elements of these metier tags follows:

1. *GEAR TYPE (gear types available under the DCF are shown in Appendix 1. Data can be aggregated over more than one category but in this case the most significant gear type is entered. The aggregations assumed in forming Annex 1 are also shown in Appendix 1)*
2. *METIER CODE (code conforming to target assemblage code of DCF, see Appendix 2. Data can be aggregated over more than one category but in this case the most significant metier code is entered)*
3. *MESH SIZE RANGE (mesh size ranges available under the DCF, see Appendix 3. Data can be aggregated over more than one category but in this case the most significant mesh size range is entered.* ***If for that gear type data has been aggregated over all ranges used by a nation an additional (to the DCF) entry "all" can be used****.)*
4. *SELECTIVITY DEVICE (types of selectivity device available under the DCF are shown in Appendix 4.)*
5. *SELECTIVITY DEVICE MESH SIZE (the actual mesh size of any selectivity device is entered.)*
6. *VESSEL LENGTH CLASS (Member states have indicated national sampling scheme designs do not take account of vessel lengths. Therefore only the non-standard entry of "all" is currently provided for in InterCatch.)*
7. *FULLY DOCUMENTED FISHERIES (If the metier tag defines a fully documented fishery add "_FDF" after length class – but see note below).*

An underscore separates these elements.

Note: DemHC and DemIBC have been replaced by MIS_MIS_0_0_0_HC and MIS_MIS_0_0_0_IBC respectively.

Note: Country and area are supplied to InterCatch separately. Country codes are as shown in Appendix 6. Area codes are as shown in Appendix 7. It is stressed that to reduce the number of entries required in InterCatch data is requested according to the areas shown in Appendix 7 and **not** according to finer spatial resolutions.

IMPORTANT:

- When uploading to InterCatch the year is the data year, which must be entered as **2012.**
- If discard data is unavailable there should be no entry for discards. A value of zero should only be entered when zero discards have been observed.

Effort Data

Effort is required in kWdays **for all species except Crangon. For Crangon the effort is required in horsepower-hours (hp-hrs).** Effort is recorded in position 11 of the InterCatch header information.

Fully Documented Fisheries

To prevent a requirement for large numbers of metier tags to be held within InterCatch metier tags for fully documented fisheries are added on a case by case basis. **FDF fisheries added to InterCatch in 2012 are shown in Annex 1.** If national data

submitters have a fully documented fishery for which there are landings and discard data, which is not shown in Annex 1 and which they wish to submit as a unique metier they should contact Henrik Kjems-Nielsen [henrikkn@ices.dk], the contact point for InterCatch.

Annex 3

Area	Gear type	Available metier tags For fully documented fisheries add "_FDF" after length class.
IIIaN (Skagerrak) Area Type = SubDiv		**TBB_CRU_16-31_0_0_all**
		TBB_DEF_90-99_0_0_all
		TBB_DEF_>=120_0_0_all
	Otter trawl	OTB_CRU_16-31_0_0_all
		OTB_CRU_32-69_0_0_all
		OTB_CRU_32-69_2_22_all
		OTB_CRU_70-89_2_35_all
		OTB_CRU_90-119_0_0_all **OTB_CRU_90-119_0_0_all_FDF**
		OTB_ DEF _>=120_0_0_all **OTB_ DEF _>=120_0_0_all_FDF**
	Seines	SDN_DEF_>=120_0_0_all **SDN_DEF_>=120_0_0_all_FDF**
		SSC_DEF_>=120_0_0_all **SSC_DEF_>=120_0_0_all_FDF**
	Gill, trammel, drift nets	GNS_DEF_100-119_0_0_all
		GNS_DEF_120-219_0_0_all **GNS_DEF_120-219_0_0_all_FDF**
		GNS_DEF_>=220_0_0_all
		GNS_DEF_all_0_0_all
		GTR_DEF_all_0_0_all
	Lines	LLS_FIF_0_0_0_all **LLS_FIF_0_0_0_all_FDF**
	Others (Human consumption)	**MIS_MIS_0_0_0_HC**
	Others (Industrial bycatch)	**MIS_MIS_0_0_0_IBC**

IV – (North Sea) Area type = SubArea & VIId (Eastern Channel) Area Type = SubDiv		**TBB_CRU_16-31_0_0_all**
		TBB_DEF_70-99_0_0_all
		TBB_DEF_>=120_0_0_all
	Otter trawl	OTB_CRU_16-31_0_0_all
		OTB_CRU_32-69_0_0_all
		OTB_SPF_32-69_0_0_all
		OTB_CRU_70-99_0_0_all **OTB_CRU_70-99_0_0_all_FDF**
		OTB_ DEF _>=120_0_0_all **OTB_ DEF _>=120_0_0_all_FDF**
	Seines	SDN_DEF_>=120_0_0_all **SDN_DEF_>=120_0_0_all_FDF**
		SSC_DEF_>=120_0_0_all **SSC_DEF_>=120_0_0_all_FDF**
	Gill, trammel, drift nets	GNS_DEF_100-119_0_0_all
		GNS_DEF_120-219_0_0_all **GNS_DEF_120-219_0_0_all_FDF**
		GNS_DEF_>=220_0_0_all
		GNS_DEF_all_0_0_all
		GTR_DEF_all_0_0_all
	Lines	LLS_FIF_0_0_0_all **LLS_FIF_0_0_0_all_FDF**
	Pots and Traps	FPO_CRU_0_0_0_all
	Others (Human consumption)	**MIS_MIS_0_0_0_HC**
	Others (Industrial bycatch)	**MIS_MIS_0_0_0_IBC**

Appendix 1 Gear coding (as defined under the DCF). Codes made available in the WGNSSK-WGMIXFISH data call are shown in the left hand column and are based on information from countries fishing in areas IIIaN, IV and VIId about significant fishing gears.

Code available in WGNSSK-WGMIXFISH data call	DCF code	Type of gear
TBB	TBB	Beam trawl
OTB	OTB	Bottom otter trawl
	OTT	Multi-rig otter trawl
	PTB	Bottom pair trawl
	OTM	Midwater otter trawl
	PTM	Midwater pair trawl
SSC	SSC	Fly shooting (Scottish) seine
	SPR	Pair seine
	PS	Purse seine
SDN	SDN	Anchored seine
	SB, SV	Beach and boat seine
GNS	GNS	Set gillnet
	GND	Driftnet
GTR	GTR	Trammel net
LLS	LHP	Pole lines
	LHM	Hand lines
	LLS	Set longlines
FPO	FPO	Pots and Traps
DemHC	FYK	Fyke nets
	FPN	Stationary uncovered pound nets
	DRB	Boat dredge
	HMD	Mechanised/ Suction dredge
	OTH	Other

Appendix 2 Target assemblage (metier code)

The codes in the table below are those permitted under the DCF.

Code	Definition
DEF	Demersal fish
CRU	Crustaceans
SPF	Small pelagic fish
LPF	Large pelagic fish
MOL	Molluscs
DWS	Deep-water species
FIF	Finfish
CEP	Cephalopods
CAT	Catadromous
GLE	Glass eel
MPD	Mixed pelagic and demersal fish
MDD	Mixed demersal and deepwater species
MCD	Mixed crustaceans and demersal fish
MCF	Mixed cephalopods and demersal fish

Appendix 3 Mesh size coding

Mesh size categories below are those permitted under the DCF. Data should be provided according to the categories below or aggregations of the categories below.

If data is aggregated over categories the most significant category is entered e.g. a mobile gear with mesh sizes covering 70-119 mm (combining 70-99, and 100-119) but 70-99mm is most significant receives code 70-99.

Gear type	Area	Code
Mobile gears	IIIaN (Skagerrak)	<16
		16-31
		32-69
		70-89
		90-119
		>=120
	IV & VIId (North Sea and Eastern Channel)	<16
		16-31
		32-69
		70-99
		100-119
		>=120
Passive gears	Whole of IIIaN, IV and VIId	10-30
		50-70
		90-99
		100-119
		120-219
		>=220

Appendix 4 Selectivity device

Selectivity devices are defined under the DCF as follows

Description	Code
None mounted	0
Exit window/selection panel	1
Grid	2
Unknown	3

Appendix 5 Vessel Length

Length categories permitted under the DCF are shown. For 2012 only the non-standard entry of "all" is currently provided for in InterCatch against vessel length. The option has been left open for length category specific metier tags to be added in future years.

DCF categories	
Vessel Length	Code
Under 10m	<10
10 to 12 m	10<12
≥ 12m <18m	12<18
≥ 18m < 24m	18<24
≥24m < 40m	24<40
≥ 40m	>=40

Appendix 6 Country coding (as used currently by InterCatch)

BE	Belgium
CA	Canada
DE	Germany
DK	Denmark
EE	Estonia
ES	Spain
FI	Finland
FO	Faroe Islands
FR	France
GG	UK (Channel Island Guernsey)
GL	Greenland
IE	Ireland
IM	UK (Isle of Man)
IS	Iceland
IT	Italy
JE	UK (Channel Island Jersey)
LT	Lithuania
LV	Latvia
NL	Netherlands
NO	Norway
PL	Poland
PT	Portugal
RU	Russia
SE	Sweden
UK	United Kingdom
UKE	UK (England)
UKN	UK(Northern Ireland)
UKS	UK(Scotland)
US	United States

Appendix 7 Area coding

Codes accepted by InterCatch. Overall the codes are unique to this exercise because of the desire to receive data on Nephrops by Functional Unit (FU).

Finfish and Crangon (or Nephrops if not possible to raise by Nephrops Functional Units)	Nephrops only		
	Functional Unit	InterCatch Code	Area Type Code
IIIaN (Skagerrak)	FU5[1]	IV5	Div
IV (ICES sub-area IV)	FU6	IVb6	SubDiv
VIId (ICES division VIId)	FU7	IVa7	SubDiv
	FU8	IVb8	SubDiv
	FU9	IVa9	SubDiv
	FU10	IVa10	SubDiv
	FU32[1]	IV32	Div
	FU33	IVb33	SubDiv
	FU34	IVb34	SubDiv
	Nephrops caught outside of FUs	IVnotFU	Div

1: FU5 is found in both ICES divisions IVb and IVc and FU32 is found in both ICES divisions IVa and IVb.

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
34	Devil's Hole	41-43 F0-F1	IV

Appendix 8.

Species for inclusion in WGNSSK-WGMIXFISH joint data call.

Whitefish species coding according to Council Regulation (EC) No. 2298/2003 and as used in InterCatch.

	Common name	***Code***	***Scientific name***
1	*Cod*	*COD*	*Gadus morhua*
2	*Common sole*	*SOL*	*Solea solea*
3	*Haddock*	*HAD*	*Melanogrammus aeglefinus*
4	*Plaice*	*PLE*	*Pleuronectes platessa*
5	*Saithe*	*POK*	*Pollachius virens*
6	*Whiting*	*WHG*	*Merlangius merlangus*
7	***Hake***	***HKE***	***Merluccius merluccius***
8	*Norway lobster*	*NEP*	*Nephrops norvegicus*
9	***Crangon or Brown Shrimp***	***CSH***	***Crangon crangon***

Annex 4

The documentation spreadsheet

Example of how to describe specific DCF categories contributing to supra-metiers uploaded to InterCatch

Metier code WGMIXFISH	Area	Vessel length classes	Gear types	Mesh size range	Description
OTB_CRU_70-99_0_0_all	4	<10 10<12 12<18 18<24 24<40 >=40	OTB OTT PTB SSC	70-99	Bottom trawls with mesh size >=70 & < 100 mm. No distinction between gear with or without selective devices. Notes NEP7 - majority of vessels 18<24 length with use of OTT gear. NEP8 & NEP9 - majority of vessels 12<18 length.
OTB_DEF_>=120_0_0_all	4	<10 10<12 12<18 18<24 24<40 >=40	OTB OTT PTB SSC	100-119 >=120	Bottom trawls with mesh size >=100mm. No distinction between gear with or without selective devices.
FPO_CRU_0_0_0_all	4	<10 10<12 12<18 18<24 24<40 >=40	FPO	na	Creels There are very small amounts of creel landings - no sampling. Mostly <10m vessels

Annex 5: Data issues for specific nations

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 2011 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

Landings and effort data for 2011 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. All the time series could not be resubmitted to fulfil the data request specification. However, the different fisheries (saithe fishery vs. fishery on cod and plaice) were taken into account using the vessel length class already available in previous data submission. Data for 2009 were not available for the meeting.

Germany

Landings and effort data for 2011 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. With otter trawls >=100mm different kinds of fisheries are conducted (saithe fishery vs. fishery on cod and plaice) that cannot be fully differentiated by the current DCF metiers and German sampling scheme. Value information was available for 2010 and 2011 data only.

The Netherlands

WGNSSK data to InterCatch were not disaggregated by métier, due to the non-availability of the breakdown of commercial categories by métier for 2011 data. Consequently, all Dutch data were reported as "DemHC" métier. The additional specific data to WGMIXFISH were provided in the same format as in previous years but not according to the DCF métiers. A significant mismatch in discards estimates was discovered between the sources of information, but this could not be solved at the time of the meeting.

Norway

From 2011 a new electronic logbook has been implemented in Norwegian fisheries for all vessels with total length over 15 m using a new database standard. The Norwegian data used for this advice have been provided without any reliable information on mesh size in any gear. Thereby, the Norwegian fleets could not be distinguished according to the specifications given in the data request, and no distinction could be made between TR1 and TR2 gears. All data back to 2003 have been mapped to the OTTER category divided in vessel size groups.

UK (England, Wales and Northern Ireland)

Data were provided for England, Wales and Northern Ireland for 2011 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. For the first time Fully Documented Fishery (FDF) vessels were recorded as a separate fleet both for landings and effort.

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 >= 27.432m, targeting demersal species)
- LTR: Light trawl (bottom trawls, boat length < 27.432m, 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 > 100mm were mapped to the DEF category. Vessels with OTTER gear with mesh < 100mm 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 and 2011 data discard fractions were available for the two categories

- TR1: Demersal otter and demersal seine gears with mesh >= 100mm
- TR2: Demersal otter and demersal seine gears with mesh >=70 & < 100mm

Again discards were not attached to beam trawl landings.

For 2012 data fully documented fishery (FDF) fleet data was raised separately.

The sampling of vessels <10m 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 < 10m to STECF. Discard estimates are therefore not estimated for vessels in the u12m category (2003-2010) or <10m (2011 onwards).

Annex 6: Comparison between MIXFISH and STECF data

Because of differences in the questions it needed to answer WGMIXFISH did not feel able to make use of the dataset provided to the STECF (STECF, 2012); see also Annex II.

The totals landed and effort employed by directly comparable categories should be the same between datasets but experience in WGMIXFISH shows that data compiled to different data calls can produce different totals. Discard data is only sampled for a fraction of national fleets. The way the discard data is raised within a nation can be affected by the grouping of vessels implied by a fleet specific data call. Additionally, once the 'raw' data is supplied a working group has choices whether to assign a discard rate (and associated discards) to unsampled fleets and if so how. It is known the assignment process for WGMIXFISH and STECF is different.

WGMIXFISH therefore undertook to compare the landings, effort and discards (after assignments) between comparable categories in the MIXFISH and STECF datasets. Because WGMIXFISH is held before finalisation of the STECF dataset the comparison was made using 2011 data

As expected, the largest differences between the data sets were found in the discard estimates. This could be the result of different rules for assigning discards to metiers where discard data is missing in the working groups but it could also be an effect of countries submitting different discard estimates to various working groups. There was not time to investigate the causes of any differences but it is hoped this work is the first step in establishing fully consistent data across working groups and it should merely be viewed as a starting point for a further discussion.

Gears, countries, species and areas, and level of aggregation, in the data used in the comparison:

Gear types: TR1 (trawls or seines with a mesh size >=100mm), TR2 (trawls or seines with a mesh size range of 70-99mm), TR2_grid (Nephrops trawls with a mesh size of 70-89mm and a sorting grid, only Swedish data in 3an), BT1 (Beam trawls with a mesh size >=120mm) and BT2 (Beam trawls with a mesh size range of 80-119mm).

Countries: Belgium (BE), Denmark (DK), England (EN), France (FR), Germany (GE), The Netherlands (NL), Scotland (SC) and Sweden (SW).

Areas: 3an (Skagerrak), 4 (North Sea) and 7d (Eastern Channel)

Species: Cod (COD) in all areas, haddock (HAD) in area 4 and 3an, Nephrops (NEP) in area 4, plaice (PLE) in area 4, saithe (POK) in area 4 and 3an, sole (SOL) in area 4 and whiting (WHG) in area 4 and 7d.

Year: 2011

STECF. 2012. Scientific, Technical and Economic Committee for Fisheries. Evaluation of Fishing Effort Regimes in European Waters (STECF-12-16).

Effort

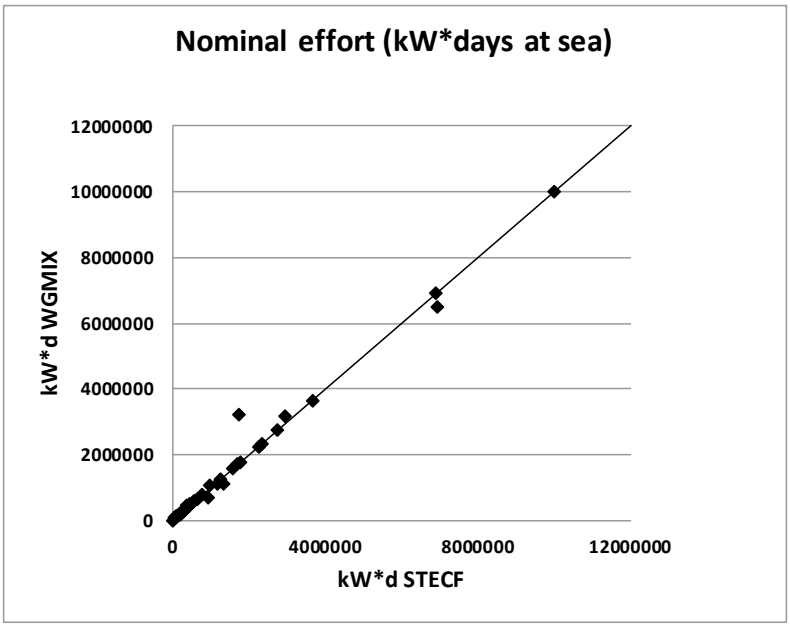

Figure. X.1 Scatter plot of all nominal effort data points used in the comparison except for one very high value.. One point represents one country´s data (kW*days at sea) by one gear (TR1, TR2, BT1 or BT2) in one area (Area 3an, 4 or 7d) in the STECF data base (x-axis) and the WGMIXFISH data (y-axis) in 2011. The removed value was 25778661 and 24094541 kWd in the STECF data base and WGMIXFISH data respectively. The line shows the 1:1 relation between x- and y-axis, for reference.

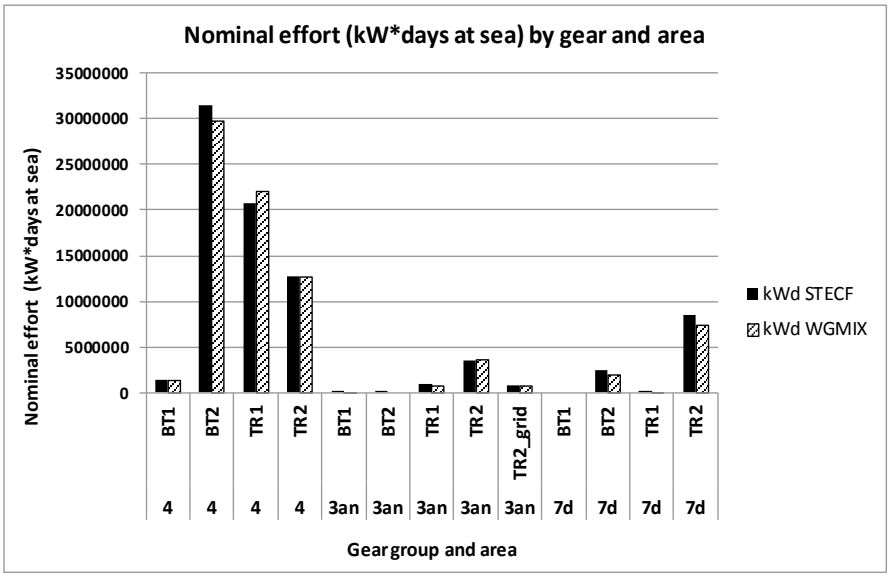

Figure X.2 Nominal effort (kW*days at sea) by gear type and area, all countries combined, in both the STECF data base and in the WGMIXFISH data for 2011.

Landings

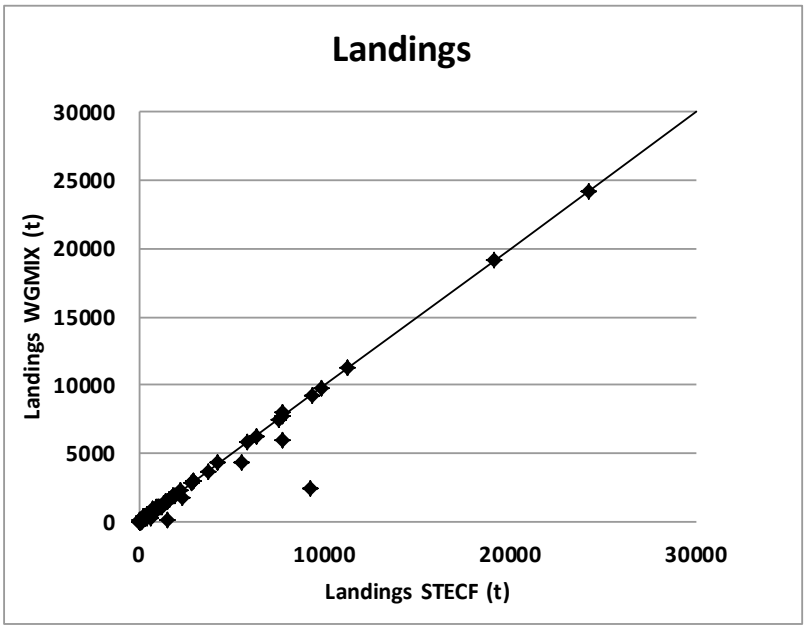

Figure X.3 Scatter plot of all landings data points used in the comparison. One point represents one country´s data (landings in tonnes) for one species by one gear (TR1, TR2, BT1 or BT2) in one area (Area 3an, 4 or 7d) in the STECF data base (x-axis) and the WGMIXFISH data (y-axis) for 2011. The line shows the 1:1 relation between x- and y-axis, for reference.

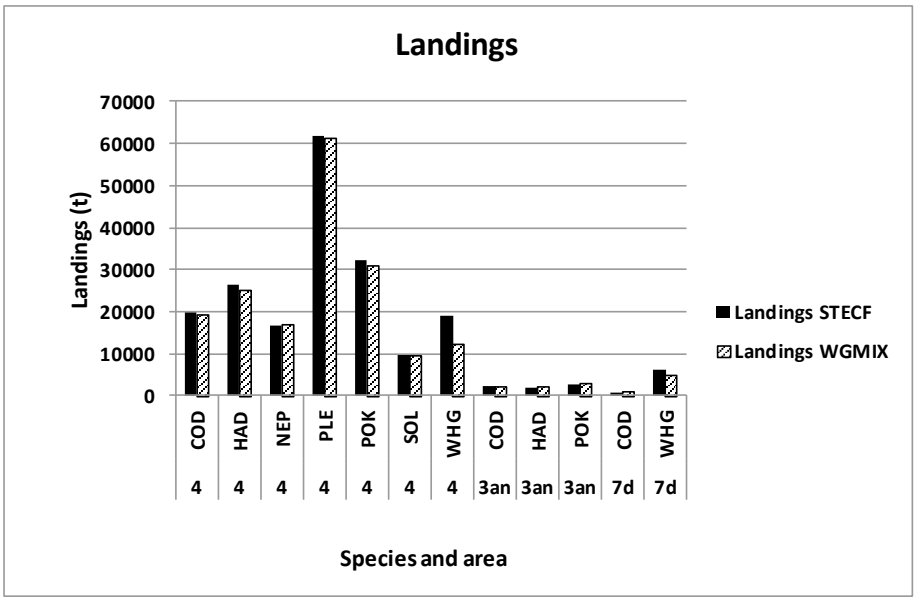

Figure X.4 Landings in tonnes by species and area, all gears (TR1, TR2, BT1, BT2) and all countries combined in the STECF data base and in the WGMIXFISH data for 2011. COD=cod, HAD=haddock, NEP=Nephrops, POK=saithe, SOL=sole, WHG=whiting.

Discards

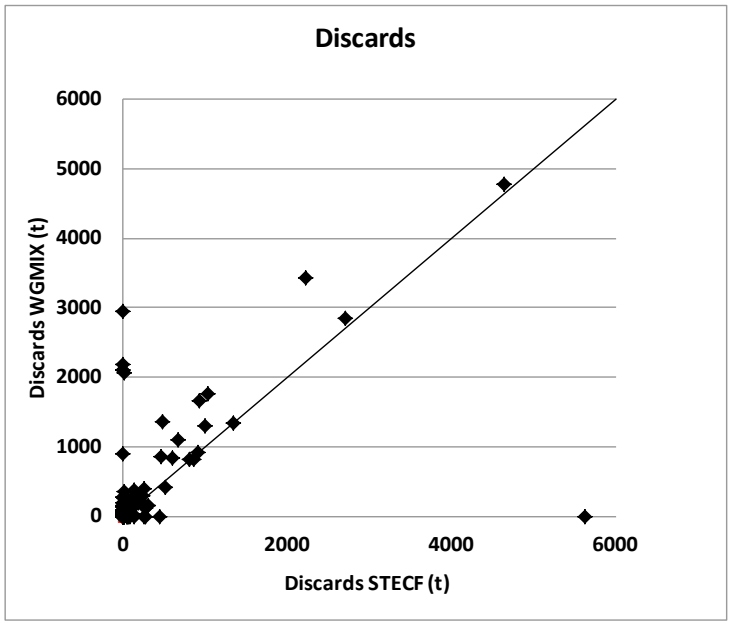

Figure X.5 Scatter plot of all discard data points used in the comparison except one very high value. One point represents one country´s data (discards in tonnes) for one species by one gear (TR1, TR2, BT1 or BT2) in one area (Area 3an, 4 or 7d) in the STECF data base (x-axis) and the WGMIXFISH data (y-axis) for 2011. The removed value was 19232 tonnes in the STECF data base and 22064 tonnes in WGMIXFISH data. The line shows the 1:1 relation between x- and y-axis, for reference.

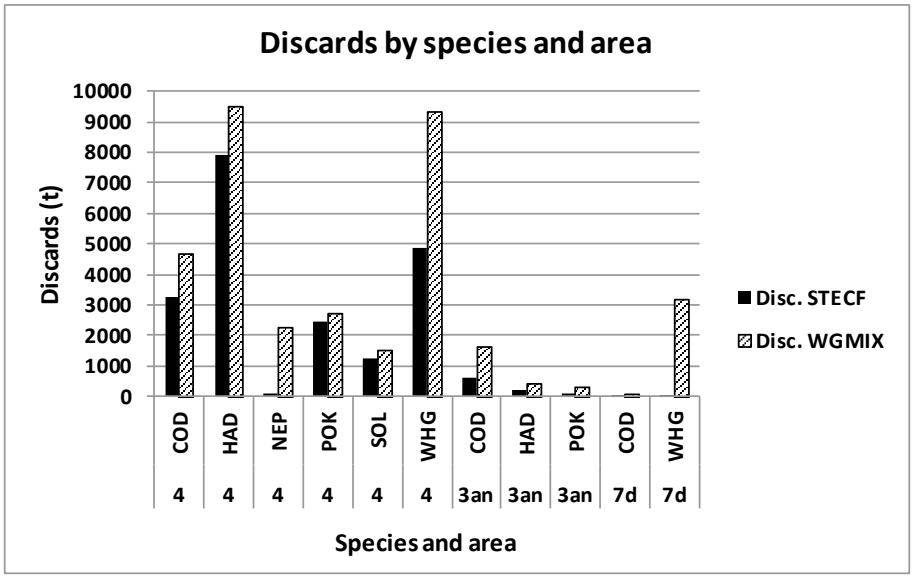

Figure X.6 Discards in tonnes by species and area, all gears (TR1, TR2, BT1, BT2) and all countries combined in the STECF data base and in the WGMIXFISH data for 2011. COD=cod, HAD=haddock, NEP=Nephrops, POK=saithe, SOL=sole, WHG=whiting. The discards of Plaice are not shown here due to the large amount. The discards of Plaice in area 4 were 27853 tonnes in the STECF data base and 29087 tonnes in the WGMIXFISH data.

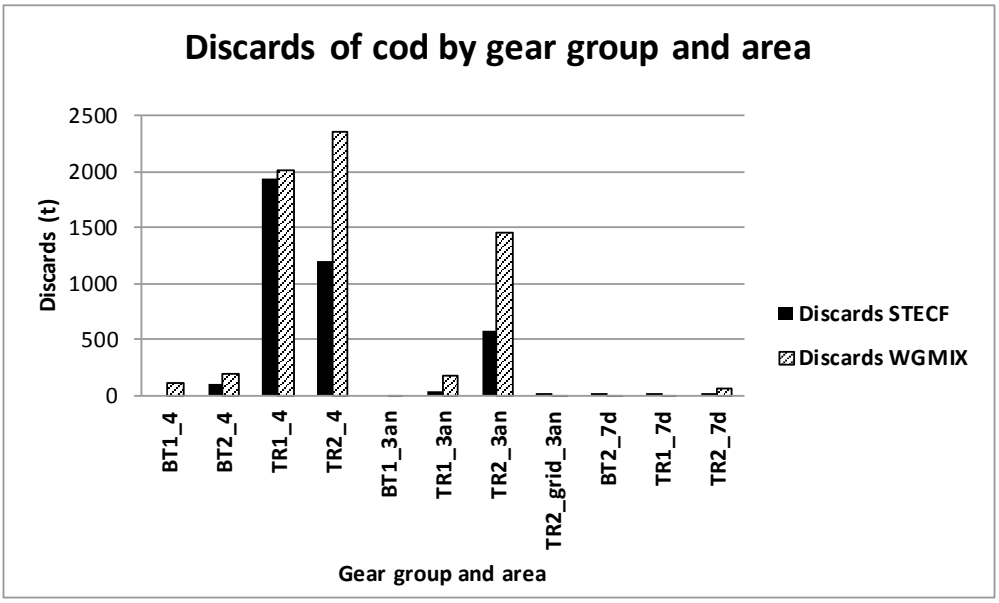

Figure X.7 Discards in tonnes of cod in area 4, 3an and 7d in the STECF data base and WGMIXFISH data 2011. The x-axis label is a combination of "Gear group_area".

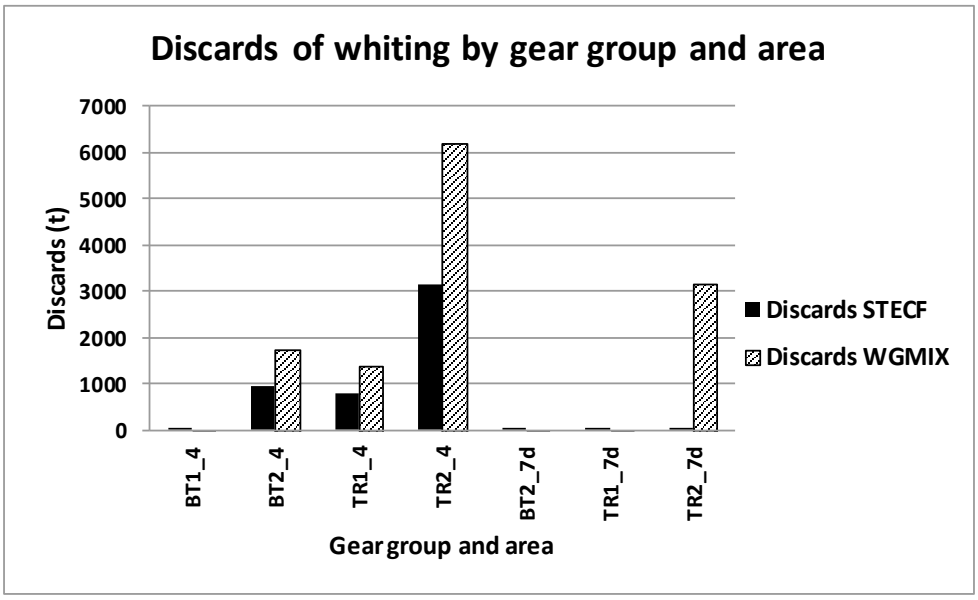

Figure X.8. Discards in tonnes of whiting in area 4 and 7d in the STECF data base and in the WGMIXFISH data base for 2011. The x-axis label is a combination of "Gear group_area".

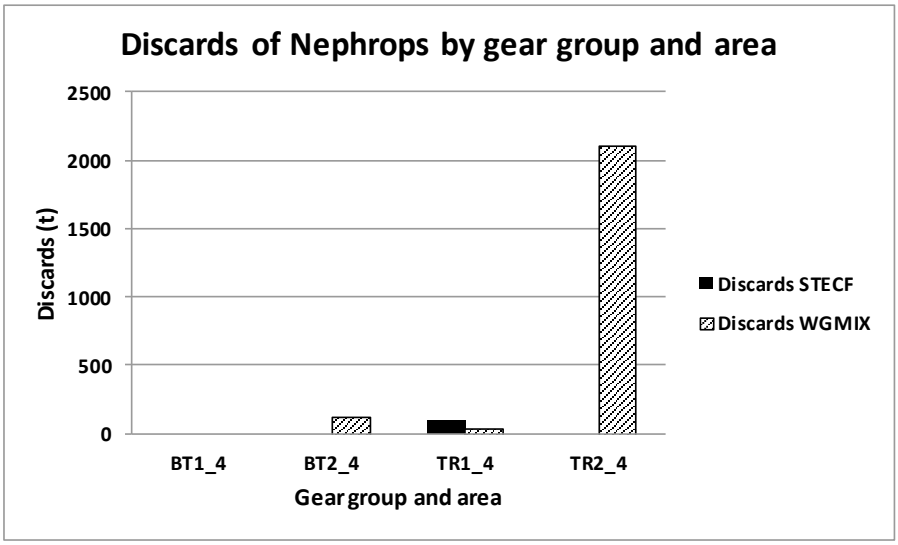

Figure X.9 Discards in tonnes of Nephrops in the STECF data base and in the WGMIXFISH data base for area 4 in 2011. The label is a combination of "Gear group_area".

Annex 7: Stock-based management plans

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 * (Precautionary spawning biomass level - spawning biomass) / (Precautionary spawning biomass level - 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 * (Precautionary spawning biomass level – spawning biomass) / (Precautionary spawning biomass level – 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 8: Recommendations

Recommendation	For follow up by:
1. ICES should send out a data call for WGNSSK, WGCSE and WGMIXFISH-NS (WGSAM) by end of February 2013 to be fullfilled four weeks before the start of WGNSSK (WGNSSK assessed stocks) and WGCSE (WGCSE assessed stocks) respectively.	ICES' secretariat
2. ICES and STECF liase in arranging expert group meetings for 2013 such that WGMIXFISH-NS can be held before ICES ADGNS and mixed fisheries forecast results incorporated into ICES June advice. Every effort be made to allow short gaps (in days) between the WGNSSK, WGCSE and WGMIXFISH.	ICES' secretariat and Commission through STECF
3. ICES data centre co-ordinate addition of non-EU data to the publically available spatial data resulting from the STECF 'effort meeting' data call (contact person Hans-Joachim Rätz, JRC).	ICES data centre
4. ICES data centre produce maps of the landings and effort data described under recommendation 3 to be hosted on the ICES website.	ICES data centre

Annex 9: Proposed ToR for 2014 WGMIXFISH Meeting

WGMIXFISH-NS – Working Group on Mixed Fisheries Advice for the North Sea

2013/#/ACOM## The **Working Group on Mixed Fisheries Advice for the North Sea** (WGMIXFISH-NS), chaired by Paul Dolder, UK, will meet at ICES Headquarters, ##–## May

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 WGNSSK in April 2014, and the management measures in place for 2015;

b) Update the mixed fisheries annex for the North Sea;

c) Produce a draft mixed-fisheries section for the ICES' advisory report 2014 that includes a dissemination of the fleet and fisheries data and forecasts ;

WGMIXFISH will report by ## ### 2014 for the attention of ACOM.

Supporting Information

Priority:	The work is essential for ICES to progress in the development of i capacity to provide advice on multi-species fisheries. Such advice necessary to fulfil the requirements stipulated in the MoUs betwee ICES and its client commissions.
Scientific justification and rel tion to action plan:	The issue of providing advice for mixed fisheries remains an importa one for ICES. The Aframe project, which started on 1 April 2007 ar finished on 31 march 2009 developed further methodologies for mixe fisheries forecasts. The work under this project included the develo ment and testing of the Fcube approach to modelling and forecasts. In 2008, SGMIXMAN produced an outline of a possible advisory form that included mixed fisheries forecasts. Subsequently, WKMIXFISH w tasked with investigating the application of this to North Sea advice f 2010. AGMIXNS further developed the approach when it met in N vember 2009 and produced a draft template for mixed fisheries advic WGMIXFISH has continued this work since 2010.
Resource requirements:	No specific resource requirements, beyond the need for members prepare for and participate in the meeting.
Participants:	Experts with qualifications regarding mixed fisheries aspects, fisheri management and modelling based on limited and uncertain data.
Secretariat facilities:	Meeting facilities, production of report.
Financial:	None
Linkages to advisory commi tee:	ACOM
Linkages to other committe or groups:	SCICOM through the WGMG. Strong link to STECF.
Linkages to other organiz tions:	This work serves as a mechanism in fulfilment of the MoU with EC ar fisheries commissions. It is also linked with STECF work on mixed fis eries.

North Sea Mixed Fisheries Annex

Mixed Fisheries Annex

Regional specific documentation of standard assessment procedures used by ICES.

Eco-Region	North Sea
Date:	Last updated May 2013
Revised by	WGMIXFISH-NS

A. General

A.1. Area definition

This mixed fisheries advice will consider finfish species in the ICES area IV, IIa, IIIa, VI and VIId and for *Nephrops norvegicus* in functional units FU5, FU6, FU7, FU8, FU9, FU10, FU32, FU33, FU34 and ICES' rectangles outside of these nine functional units – denoted FUOTH.

The species considered are part of the demersal mixed fisheries of the North Sea and eastern English channel, and are cod, haddock, whiting, saithe, plaice, sole and *Nephrops norvegicus*. There are nine *Nephrops* functional units in the North Sea, which are considered as separated stocks. However, only four of these can be assessed through fishery-independent abundance estimates from underwater video surveys, and these were kept as distinct stocks. These cover the stocks along the English and Scottish coast; i.e. FU 6 (Farn Deep), FU 7 (Fladen Ground), FU 8 (Firth of Forth) and FU 9 (Moray Firth). The five other functional units (FU 5, FU 10, FU 32, FU 33 and FU 34) have no independent abundance estimates.

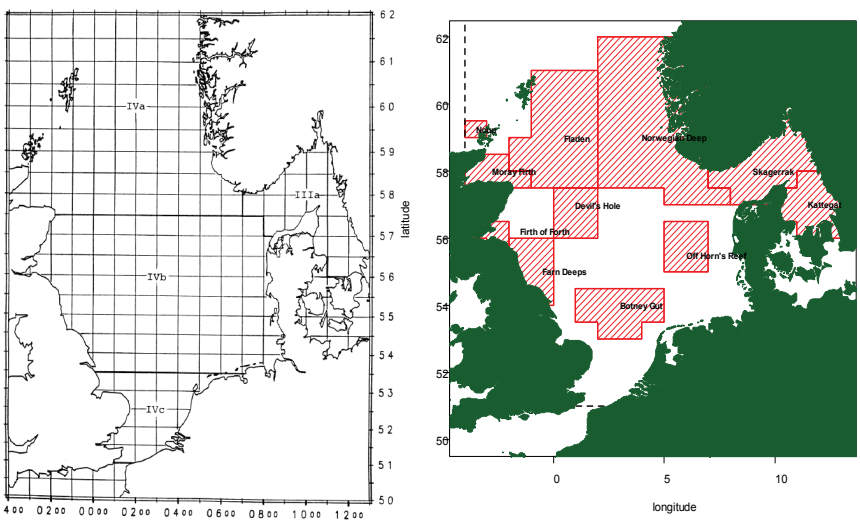

Figure xx.1 Area description for finfish advice and *Nephrops* Functional Units (FU) in the North Sea and Skagerrak/Kattegat region.

Table XX.1 *Nephrops* Functional Units (FU) in the North Sea.

FU no.	Name	ICES area	Statistical rectangles
5	Botney Gut - Silver Pit	IVb,c	36-37 F1-F4; 35F2-F3
6	Farn Deeps	IVb	38-40 E8-E9; 37E9
7	Fladen Ground	IVa	44-49 E9-F1; 45-46E8
8	Firth of Forth	IVb	40-41E7; 41E6
9	Moray Firth	IVa	44-45 E6-E7; 44E8
10	Noup	IVa	47E6
32	Norwegian Deep	IVa	44-52 F2-F6; 43F5-F7
33	Off Horn Reef	IVb	39-41E4; 39-41F5
34	Devil's Hole	IVb	41-43 F0-F1

Finfish stocks

Species	**ICES single stock advice area**
Cod	Subarea IV, Divison VIId and IIIa West (Skagerrak)
Haddock	Subarea IV (North Sea) and Division IIIa West (Skagerrak)
Whiting	IV and VIId
Saithe	Subarea IV, Division IIIa West (Skagerrak) and Subarea VI
Plaice	Sub-area IV
Sole	Sub-area IV
Plaice	Sub-area VIId
Sole	Sub-area VIId

Herring, mackerel and the industrial fisheries (sandeel, Norway pout and sprat) are not considered in a mixed fisheries advice context given the targeted nature of their fleets.

A.2. Fishery

Cod in IIIa – IV – VIId

Cod are caught by virtually all the demersal gears in Sub-area IV and Divisions IIIa (Skagerrak) and VIId, including otter trawls, beam trawls, seine nets, gill nets and lines. Most of these gears take a mixture of species. In some of them cod the fisheries are directed mainly towards cod (for example, some of the fixed gear fisheries), and in others considered to be a by-catch (for example in beam trawls targeting flatfish). An analysis of landings and estimated discards of cod by gear category (excluding Norwegian data) highlighted the following fleets as the most important in terms of cod for 2003-5 (accounting for close to 88% of the EU landings), listed with the main use of each gear (STECF SGRST-07-01):

- Otter trawl, ≥ 120 mm, a directed roundfish fishery by UK, Danish and German vessels.
- Otter trawl, 70-89mm, comprising a 70-79mm French whiting trawl fishery centered in the Eastern Channel, but extending into the North Sea, and an 80-89mm UK *Nephrops* fishery (with smaller landings of roundfish and angler-fish) occurring entirely in the North Sea.

- Otter trawl, 90-99mm, a Danish and Swedish mixed demersal fishery centered in the Skagerrak, but extending into the Eastern North Sea.
- Beam trawl, 80-89mm, a directed Dutch and Belgian flatfish fishery.
- Gillnets, 110-219mm, a targeted cod and plaice fishery.

For Norway in 2007, trawls (in the saithe fishery) and gillnets account for around 60% (by weight) of cod catches, with the remainder taken by other gears mainly in the fjords and on the coast, whereas in the Skagerrak, trawls and gillnets account for up to 90% of cod catches. The minimum catching size of cod for Norwegian vessels was increased to 40 cm in 2008.

ICES in 2009 (WGFTFB) has noted a change in effort from far sea fishing grounds in mixed fisheries due to increased fuel costs from 2008 to 2009. Probably there is a significant change in fishing pattern from area IV to Porcupine, Rockall and Celtic Sea.

With regard to trends in effort for these major cod fisheries since 2000, the largest changes in North Sea fisheries have involved an overall reduction in trawl effort and changes in the mesh sizes in use, due to a combination of decommissioning and days-at-sea regulations. For otter trawls, vessels are using either 120 mm+ (in the directed whitefish fishery), 100-119 mm in the Southern North Sea Plaice fishery, or 80-99 mm (primarily in the *Nephrops* fisheries and in a variety of mixed fisheries). The use of other mesh sizes largely occurs in the adjacent areas, with the 70-79 mm gear being used in the Eastern Channel/Southern North Sea Whiting fishery, and the majority of the landings by 90-99 mm trawlers coming from the Skagerrak. Higher discards are associated with these smaller mesh trawl fisheries, but even when these are taken into account, the directed roundfish fishery (trawls with ≥ 120 mm mesh) still has the largest impact of any single fleet on the cod stock, followed by the mixed demersal fishery (90-99 mm trawls) in the Skagerrak.

Apart from the technical measures set by the Commission, additional unilateral measures are in force in the UK, Denmark and Belgium. The EU minimum landing size (mls) is 35 cm, but Belgium operates a 40 cm mls, while Denmark operate a 35 cm mls in the North Sea and 30 cm in the Skagerrak. Additional measures in the UK relate to the use of square mesh panels and multiple rigs, restrictions on twine size in both whitefish and *Nephrops* gears, limits on extension length for whitefish gear, and a ban on lifting bags. The use of technical meaures in the UK *Nephrops* fishery has particularly increased in 2012 following an agreement at the 2011 December Council fisheries Council on a requirement for UK vessels to use highly selective gear for part of the year. In 2001, vessels fishing in the Norwegian sector of the North Sea had to comply with Norwegian regulations setting the minimum mesh size at 120 mm. Since 2003, the basic minimum mesh size for towed gears targeting cod is 120 mm.

Haddock in IIIa - IV

The largest proportion of the haddock stock is taken by the Scottish demersal whitefish fleet. This fleet is not just confined to the North Sea, as vessels will sometimes operate in Divisions VIa (off the west coast of Scotland) and VIb (Rockall): it is also a multi-species fishery that lands a number of species other than haddock.

Plaice in IV

Plaice is predominantly caught by beam trawlers in the central part of the North Sea and in a mixed fishery with sole in the southern North Sea, though significant quanities are also taken by a directed otter trawl fishery using 100-119 mm in the Southern North Sea. Technical measures applicable to the mixed flatfish beam trawl fishery

affect both sole and plaice. The minimum mesh size of 80 mm selects sole at the minimum landing size. However, this mesh size generates high discards of plaice which has a larger minimum landing size than sole. Recent discard estimates indicate fluctuations around 45% discards in catch by weight. Mesh enlargement would reduce the catch of undersized plaice, but would also result in loss of marketable sole. There has been increased use of new gears such as "SumWing" and electric "pulse trawls" which will increasely affect catchability and selectivity of plaice and sole. ICES considered that pulse trawls experienced lower catch rates (kg hr−1) of undersized sole and higher catch rates of marketable sole, compared to standard beam trawls (ICES, 2006). Plaice catch rates decreased for all size classes. In 2011, approximately 30 derogation licenses for pulse trawls were operational in the Netherlands, increasing to 42 in 2012. Debate is ongoing in the EU about extensions of an additional 42 derogation licenses as well as possible amendments to EU regulations that would permanently legalize the use of pulse gears for the whole fleet. The overall capacity and effort of North Sea beam trawl vessels has been substantially reduced since 1995, including the decommissioning of 25 vessels in 2008.

Saithe in IIIa – IV – VI

Saithe in the North Sea are mainly taken in a direct trawl fishery in deep water along the Northern Shelf edge and the Norwegian Trench. Norwegian, French, and German trawlers take the majority of the catches. In the first quarter of the year the fisheries are directed towards mature fish in spawning aggregations, while concentrations of immature fish (age 3-4) often are targeted during the rest of the year. In recent years the French fishery has deployed less effort along the Norwegian Trench, while the German and Norwegian fisheries have maintained their effort there. A small proportion of the total catch is taken in a limited purse seine fishery along the west coast of Norway targeting juveniles (age 2-4). In the Norwegian coastal purse seine fishery inside the 4 nm limit (south of 62°N), the minimum landing size is 32 cm. For other gears in the Norwegian zone (south of 62°N) the current minimum landing size is 40 cm, while in the EU zone it is 35 cm. In 2009 the landings were estimated to be around 105 000 t in Sub-area IV and Division IIIa, and 7 000 t in Sub-Area VI, which both are well below the TACs for these areas (125 934 and 13 066 t respectively). Significant discards are observed only in Scottish trawlers. However, as Scottish discarding rates are not considered representative of the majority of the saithe fisheries, these have not been used in the assessment.

Sole in IV

Sole are mainly caught in a mixed beam trawl fishery with plaice and other flatfish using 80 mm mesh in the southern North Sea. The minimum mesh size in the mixed beam trawl fishery in the southern North Sea means that large numbers of undersized plaice are discarded.

There is a directed fishery for sole by small inshore vessels using trammel nets and trawls, which fish mainly along the English coasts and possibly exploit different coastal populations. Sole represents the most important species for these vessels in terms of the annual value to the fishery. The fishery for sole by these boats occurs throughout the year with small peaks in landings in spring and autumn. In cold winters, sole are particularly vulnerable to the offshore beamers when they aggregate in localized areas of deeper water.

The minimum landing size for sole is 24 cm. Demersal gears permitted to catch sole are 80 mm for beam trawling and 90 mm for otter trawlers. Fixed nets are required to

use 100 mm mesh since 2002 although an exemption to permit 90 mm has been in force since that time.

Whiting in IV – VIId

For whiting, there are three distinct areas of major catch: a northern zone, an area off the eastern English coast; and a southern area extending into the English Channel. In the northern area, roundfish are caught in otter trawl and seine fisheries, currently with a 120 mm minimum mesh size. Some vessels operating to the east of this area are using 130 mm mesh. These are mixed demersal fisheries with more specific targeting of individual species in some areas and/or seasons. Cod, haddock and whiting form the predominant roundfish catch in the mixed fisheries, although there can be important bycatches of other species, notably saithe and anglerfish in the northern and eastern North Sea and of *Nephrops* in the more offshore *Nephrops* grounds. Minimum mesh size in *Nephrops* trawls is 80 mm but a range of larger mesh sizes are also used when targeting *Nephrops*. Whiting is becoming a more important species for the Scottish fleet, with many vessels actively targeting whiting and Scottish single seiners have been working closer to shore to target smaller haddock and whiting. The derogation in the EU effort management scheme allowing for extra days fishing by vessels using 90 mm mesh gears with a 120 mm square mesh panel close to the codend (a configuration which releases cod) has so far, been taken up by few vessels. Recent fuel price increases and a lack of quota for deepwater species has resulted in some vessels formerly fishing in deepwater and along the shelf edge to move into the northern North Sea with the shift in fishing grounds likely to result in a change in the species composition of their catches from monkfish to roundfish species including whiting.

Whiting are an important component in the mixed fishery occurring along the English east coast. Industry reports suggest better catch rates here than are implied by the overall North Sea assessment. There has been a displacement of some French vessels steaming from Boulogne-sur-Mer from their traditional grounds in the southern North Sea and English Channel where they have reported very low catch rates during the past two years.

Whiting are a bycatch in some *Nephrops* fisheries that use a smaller mesh size, although landings are restricted through bycatch regulations. They are also caught in flatfish fisheries that use a smaller mesh size. Industrial fishing with small meshed gear is permitted, subject to bycatch limits of protected species including whiting. Regulations also apply to the area of the Norway pout box, preventing industrial fishing with small meshes in an area where the bycatch limits are likely to be exceeded.

WGFTFB (2008) reported use of bigger meshes in the top panel of beam trawler gear by Belgium vessels with an expected reduction in by-catch of roundfish species, especially haddock and whiting. Fluctuations in fuel costs can cause changes in fishing practices. WGFTFB (2008) reported a shift for Scottish vessels from using 100 mm-110 mm for whitefish on the west coast ground (Area VI) to 80 mm prawn codends in the North Sea (area IV), with increased fuel costs considered the major driver.

Nephrops

Nephrops is caught in a mixed fishery which takes a catch consisting of haddock, whiting, cod, anglerfish and megrim as well as *Nephrops*. Most of the catch (approx 21 of 25 thousand tons) is taken by UK. Days at sea limits apply to *Nephrops* trawlers when

using mesh sizes 70-99 mm and in 2009, under the Scottish Conservation Credits Scheme (CCS), the number of days available to Scottish vessels is the same as 2008 and 2007.

A small but increasing proportion of the landings from Subarea IV are taken from statistical rectangles outside the defined *Nephrops* FUs. An example is the Scottish fishery at the Devil's hole which a few boats normally fishing the Fladen grounds prosecute for a few months at the end of the year.

Plaice in VIId

Plaice is mainly caught in 80 mm beam-trawl (Belgian and English) fisheries for sole or in mixed demersal fisheries using otter trawls (mainly French). There is also a directed fishery during parts of the year by inshore trawlers and netters. Fisheries operating on the spawning aggregation in the beginning of the year catch plaice that originate from the North Sea, Divisions VIId and VIIe components. Since the 80 mm mesh size does not match the minimum landing size for plaice (27 cm), a large number of undersized plaice are discarded.

Sole in VIId

Sole is mainly caught in 80 mm beam-trawl fisheries with plaice or in mixed demersal fisheries using otter trawls and gill/trammel nets. There is also a directed fishery during parts of the year by inshore trawlers and netters on the English and French coasts.

A.3. Ecosystem aspects

These are described in the North Sea ecosystem overview in the ICES advisory report.

B. Data

The mixed fisheries assessment is based on catch and effort data that were compiled mostly on the basis of the data collected in annual ICES data calls and data collected by STECF for the evaluation of the effort regime. The data structured by fleets and métiers were used as inputs, together with WGNSSK single-stock data and advice, in the integrated Fcube framework.

The assessment data for the different stocks is taken from the ICES Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak (WGNSSK). For whiting, the industrial bycatch component is 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 cod assessment is performed with SAM, which assumes a "catch multiplier" between 1993 and 2005. The reported landings from the different fleets were raised to an "overall landings" estimates using the catch multiplier from the assessment. This multiplier was applied to all fleets.

For *Nephrops* the data collected at ICES and at STECF level until 2009 were not compatible due to differences in aggregation levels. In order to be able to collate both assessment and fleet related data a specific ICES data call was issued for this stock in

2010. This information covers catches and effort exerted by *Nephrops* functional unit so that stock assessments (analytical for FU's 6-9 and trends based for others) can be incorporated into Fcube.

C. Assessment methodology

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.

Model used:

Fcube

The Fcube model is presented and described in Ulrich *et al.* (2006; 2008; 2009). The basis of the model is to estimate the potential future levels of effort by 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 is in return used to estimate landings and catches by fleet and stock, using standard forecasting procedures.

Partial fishing mortality *F* and catchability *q* by fleet *Fl*, métier *m* and stock *St* from observed landings *LND*, effort *E* and fishing mortality *Fbar* are estimated for year Y:

$$F(Fl,m,St,Y) = Fbar(St,Y) * \frac{LND(Fl,m,St,Y)}{LNDtot(St,Y)} \quad (1)$$

$$q(Fl,m,St,Y) = F(Fl,m,St,Y) / E(Fl,m,Y) \quad (2)$$

To estimate future parameters value $q(Fl,m,St,Y+1)$ at year *Y+1* an average over recent years can be used. Alternatively, the user may choose to vary the value of q, if evidence exists of e.g. significant technical creep, or of a change in selectivity due to a change in mesh size.

The observed distribution of effort by fleet across métiers is estimated:

$$Effshare(Fl,m,Y) = E(Fl,m,Y) / E(Fl,Y) \quad (3)$$

As with catchability, the simplest approach to the forecast effort distribution $Effshare(Fl,m,Y+1)$ would be to estimate it from an average of past observed ef-

fort allocation. Alternatively, a more complex approach such as a behaviour algorithm could be used if available.

These variables are then used for the forecast estimates of catchability by stock for each fleet. This catchability cannot be directly estimated from observed data, as it is linked to the flexibility of the fleet. While catchability by métier is assumed to be measurable as being linked to the type of fishing, the resulting catchability by fleet varies with the time spent in each métier. The catchability of a fleet is thus equal to the average catchability by métier weighted by the proportion of effort spent in each métier for the fleet:

$$q(Fl, St, Y+1) = \sum_m q(Fl, m, St, Y+1) * Effshare(Fl, m, Y+1) \qquad (4)$$

A TAC is usually set in order to achieve a specific fishing mortality. This might be a particular short-term target, such as Fpa, or specific reduction in F as part of a longer-term management plan. This intended F is converted into forecast effort by fleet. This step is rather hypothetical, in that it introduces the concept of "Stock dependent fleet effort". The "stock-dependent fleet effort" is the effort corresponding to a certain partial fishing mortality on a given stock, disregarding all other activities of the fleet. The total intended fishing mortality *Ftarget(St)* is first divided across fleet segments (partial fishing mortalities) through coefficients of relative fishing mortality by fleet. These coefficients are fixed quota shares estimated from observed landings. In principle, these reflect the rigid sharing rules resulting from the principle of relative stability, combined with national processes of quota allocation across fleets. The simplest approach is thus to estimate these from observed mean proportions of landings by fleet. The resultant partial fishing mortalities are subsequently used for estimating the stock-dependent fleet effort:

$$F(Fl, St, Y+1) = Ft\arg et(St, Y+1) * QuotaShare(Fl, St) \qquad (5)$$
$$E(Fl, St, Y+1) = F(Fl, St, Y+1) / q(Fl, St, Y+1)$$

The final input required is the effort by each fleet during the forecast year. It is unlikely that the effort corresponding to each single-species TAC will be the same across fleets, and it is equally possible that factors other than catching opportunities could influence the amount of effort exerted by a given fleet. Rather than assume a single set of fleet efforts, the approach used in practice with Fcube has been to investigate a number of different scenarios about fleet effort during the forecast period. The user can thus explore the outcomes of a number of options or rules about fleet behaviour (e.g. continue fishing after some quotas are exhausted) or management scenarios (e.g. all fisheries are stopped when the quota of a particular stock is reached).

$$E_{Fl,Y} = rule(E_{Fl,St1,Y}, E_{Fl,St2,Y}, E_{Fl,St3,Y} \ldots)$$

For example, if one assumes that fishermen continue fishing until the last quota is exhausted, effort by fleet will be set at the maximum across stock-dependent effort by fleet ("max" option). Overquota catches of species which quota were exhausted before this last one, are assumed to be discarded.

$$E(Fl, Y+1) = MAX_{St}[E(Fl, St1, Y+1), E(Fl, St2, Y+1), \ldots] \qquad (6)$$

As a contrast, a more conservative option would be to assume that the fleets would stop fishing when the first quota is exhausted, and thus would set their effort at the minimum across stocks ("min" option). Alternatively, management plans for a particular stock could be explored, with the fleets setting their effort at the level for this

stock ("stock_name" option). Different rules could also be applied for the various fleets.

The following options are explored:

4) **min**: The underlying assumption is that fishing stops when the catch for the first quota species meets the upper limit corresponding to single stock exploitation boundary for agreed management plan or in relation to precautionary limits.

5) **max**: The underlying assumption is that fishing stops when the last quota species is fully utilised with respect to the upper limit corresponding to single stock exploitation boundary for agreed management plan or in relation to precautionary limits.

6) **cod**: The underlying assumption is that all fleets set their effort at the level corresponding to their cod quota share, regardless of other stocks.

7) **sq_E**: The effort is set as equal to the effort in the most recently recorded year for which there is landings and discard data.

8) **Ef_Mgt**: The effort in métiers using gear controlled by the EU effort management regime have their effort adjusted according to the regulation (see Council Regulation (EC) No 1342/2008).

All scenarios will be run with two advice approaches, Fmsy transition and management plan. For stocks where a management plan does not exist, the advice according to the latest commission communication on TAC setting is used.

Finally, this resulting effort by fleet is distributed across métiers, and corresponding partial fishing mortality is estimated.

$$E(Fl,m,Y+1) = E(Fl,Y+1) * Effshare(Fl,m,Y+1) \qquad (7)$$
$$F(Fl,m,St,Y+1) = q(Fl,m,St,Y+1) * E(Fl,m,Y+1)$$

Partial fishing mortalities are summed by stock, and then used in standard forecast procedures similar to the ones used in the traditional single-species short-term advice. Corresponding landings are estimated and compared with the single-species TAC.

Software used:

The Fcube model has been coded as a method in R (R Development Core Team, 2008), as part of the FLR framework (Kell et al., 2007, www.flr-project.org). Input data are in the form of FLFleets and FLStocks objects from the FLCore 2.2 package, and two forecast methods were used, stf() from the FLAssess (version 1.99-102) and fwd() from the Flash (version 2.0.0) packages. As such, the input parameterisation as well as the stock projections are made externally using existing methods and packages, while only steps 4 to 6 are internalised in the method, thus keeping full transparency and flexibility in the use of the model.

D. Short-Term Projection methodology

Model used: Overview of software used by WGNSSK.

Species	Assessment	Forecast
HADDOCK IV, IIIa and VIIb	FLR 2x, FLXSA	MFDP
COD IV, IIIa and VIIb	Stochastic B-ADAPT	Stochastic B-ADAPT
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
NEPHROPS UWTV	none	None
PLAICE VIId	FLR 2.x, FLXSA	FLR 2.x, FLSTF
SOLE VIId	FLR 2.x, FLXSA	FLR 2.x, FLSTF

In the mixed-fisheries runs, all forecasts were done with the same FLR forecasts method (see section C).

For every scenario, the following output is generated per stock:

	Description	Landings	F mult	SSB
Baseline forecast for current year	Applying single species forecast assumptions to last year's data (current year – 1)*	Current yr	Current yr	1st Jan TAC yr
Baseline forecast for TAC year	Applying single species HCRs** to current year results*	TAC yr	TAC yr	1st Jan TAC yr + 1
Current year Fcube results	Applying Fcube to last year's data	Current yr	Current yr	1st Jan TAC yr
Fcube estimate of catches in TAC year	Applying Fcube on current year Fcube results	TAC yr	TAC yr	1st Jan TAC yr + 1
TAC advice results (incl mgt plans)	Applying single species HCRs** to current year Fcube results	TAC yr	TAC yr	1st Jan TAC yr + 1

*** For the Baseline runs, a forecast was run for each stock separately following the same settings as in the ICES single species forecast.**

**** Harvest Control Rules – either from single species management plans or with reference to the F_{MSY} transition approach. Where HCRs according to these approaches were not available values according to the precautionary approach were used.**

The following overview table will be produced to be able to judge the relevance of the different scenarios:

		COD HAD PLE POK SOL WHG NEP5 NEP6 NEP7 NEP8 NEP9 NEP10 NEP32 NEP33
Current year	Fbar FmultVsF(cur-1) Landings SSB	
Current year+1	Fbar FmultVsF(cur-1) Landings SSB	
Current year+2	SSB	

G. Biological Reference Points

The biological reference points that are used are the same values as referred to in the single stock advisory reports.

H. Other Issues

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I. References

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