

ECOREGION North Sea
STOCK Mixed-fisheries advice for Subarea IV (North Sea) and Divisions IIIa North (Skagerrak) and VIIId (Eastern Channel)

Scenarios for 2014

Mixed-fisheries considerations are based on the single-stock assessments combined with knowledge on the species composition in catches in the North Sea, Skagerrak, and Eastern English Channel fisheries. Five example scenarios of fishing opportunities considering mixed fisheries are presented, taking into account the single-stock advice for fisheries catching cod, haddock, whiting, saithe, plaice, sole, and *Nephrops*. Without specific mixed-fisheries management objectives, ICES cannot recommend specific scenario(s).

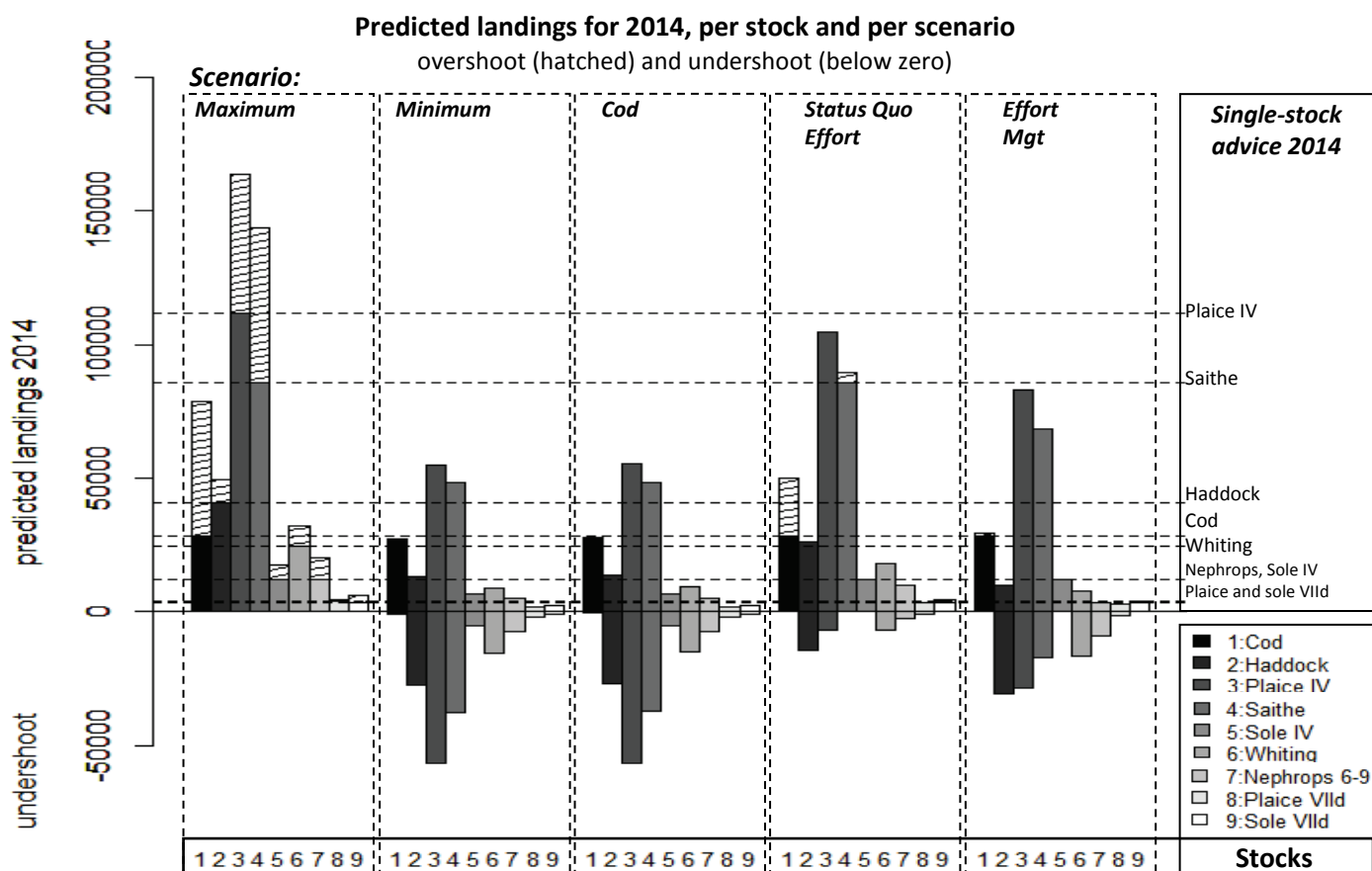
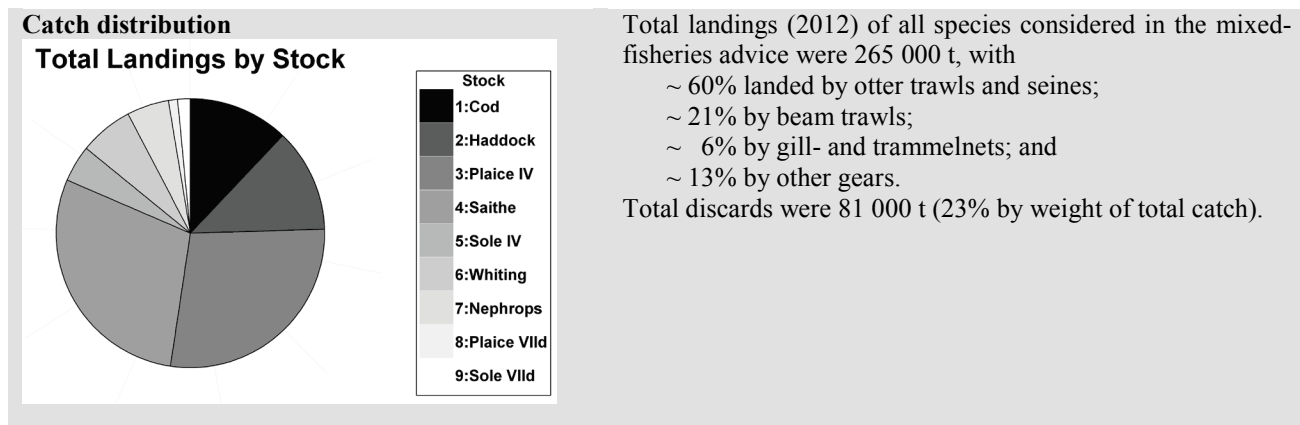


Figure 6.3.2.1 North Sea mixed-fisheries projections. Estimates of potential landings (in tonnes) by stock and by scenario. Horizontal lines correspond to the single-stock landings advice for 2014. Bars below the value of zero show undershoot (compared to single-stock advice) where landings are predicted to be lower when applying the scenario. Hatched columns represent landings in overshoot of the single-stock advice. Details for Division VIIId stocks are shown in Figure 6.3.2.2.

	Scenarios
Max	“Maximum” : Fishing stops when all stocks considered have been caught up to the ICES single-stock advice. This option causes overfishing of the single-stock advice possibilities of most stocks.
Min	“Minimum” : Fishing stops when the catch for any one of the stocks considered meets the single-stock advice. This option is the most precautionary option, causing underutilization of the single-stock advice possibilities of other stocks.
Cod	“Cod management plan” : All fleets set their effort corresponding to their cod quota share, regardless of other catches.
Sq_E	‘Status quo effort’ : The effort is set equal to the effort in the most recently recorded year for which landings and discard data are available.
Ef_Mgt	“Effort management” : The effort in métiers using gear controlled by the EU effort management regime (EC 1342/2008) have their effort adjusted assuming a 46% reduction for TR1 and TR2 between 2013 and 2014 (see Table 6.3.2.3).

The fisheries

Fleet and métier categories used in the mixed-fisheries analysis are based on the EU data collection framework (DCF) level 6 categories, but merging over DCF categories has been performed to (a) reflect national sampling schemes, and (b) aggregate over “small” métiers (a métier failing to catch at least 1.0% in 2012 of at least one of the stocks considered). Fleet categories are consistent with the EU annual economic report (AER) database and métiers are made consistent with the categories specified in the cod long-term management plan.



Quality considerations

Mixed-fisheries projections build on single-stock assessments, most of which are of high quality and precision. Single-stock forecasts are also reproduced independently as part of the mixed-fisheries analyses, allowing additional quality control of both processes.

The quality of data has improved in 2012 and 2013 because of the ICES data call merging data needs and ensuring common data storage for single-stock assessment and mixed-fisheries forecasts. Mixed-fisheries analysis and projections critically rely on data being available on time to allow sufficient quality checking and preparation. Some data were submitted after the start of the meeting, which limited the possibilities for additional data investigations.

Scientific basis

Assessment type	F-Cube (FLR).
Input data	Assessments on the relevant stocks in the North Sea fisheries working group (WGNSSK ; ICES, 2013c), catch and effort by fleet and métiers.
Discards and bycatch	Included as in the single-stock assessments.
Indicators	None.
Other information	This assessment was presented for the first time in 2012. In 2013, plaice and sole in the eastern English Channel were added. Exploratory investigations were undertaken for hake in Subarea IV and plaice in Division IIIa. As any scenario results in trade-offs between different fisheries that are informed by more than scientific considerations, no one scenario is presented as advice. The scenarios indicate which stocks will limit, and thus influence the fisheries most.
Working group report	WGMIXFISH (ICES, 2013b).

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Reference points

The reference points for the various stocks can be found in the single-stock advice sheets (ICES, 2013a).

Outlook for 2014

Mixed-fisheries advice considers the implications of mixed fisheries under current TAC and effort regimes, taking into account the fishing pattern and catchability of the various fleets. The outcome of the mixed-fisheries modelling was consistent with the catch proportion by country in 2012.

In the “Minimum” scenario, the most limiting stocks are cod and *Nephrops* (FU6) for fleets representing 70% and 30% of the effort in 2012 respectively. In the “Maximum” scenario, the least limiting stocks are haddock, *Nephrops* (FU 7), and whiting for fleets representing 68%, 22%, and 10% of the effort in 2012, respectively. 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 ICES single-stock advice for demersal stocks in 2014 (ICES, 2013a) is based on existing management plans and the maximum sustainable yield (MSY) approach, the precautionary approach, or ICES approach to data-limited stocks.

Basis: single-stock SSBs at the end of 2012 and assumptions on F in 2013 and SSB at the start of 2014. Fishing patterns and catchability in 2013 and 2014 were assumed to remain as in 2012. *Status quo* effort (Sq_E scenario) is assumed to take place in 2013.

Stock	Single-stock landings advice 2014*	Landings per mixed-fisheries scenario 2014				
		“Max”	“Min”	“Cod”	“Sq_E”	“Ef_Mgt”
Cod IIIaN, IV, VIId	28.800	78.729	27.332	27.567 ¹	49.924	29.314
Haddock IIIaN, IV	40.639	49.366	13.390	13.625	26.258	9.746
Plaice IV	111.631	163.655	54.880	55.102	104.520	82.855
Saithe IIIaN, IV, VI	85.581	143.439	48.050	48.359	89.630	68.305
Sole IV	11.900	17.576	6.420	6.424	12.040	11.868
Whiting IV, VIId	24.389	31.983	9.067	9.195	17.758	7.560
<i>Nephrops</i> FU 5	1.000	1.594	0.384	0.393	0.785	0.252
<i>Nephrops</i> FU 6	1.173	4.847	1.190	1.216	2.430	0.842
<i>Nephrops</i> FU 7	8.959	9.223	2.164	2.211	4.417	1.322
<i>Nephrops</i> FU 8	1.417	4.187	1.039	1.062	2.121	0.725
<i>Nephrops</i> FU 9	0.739	1.731	0.425	0.434	0.867	0.266
<i>Nephrops</i> FU 10	0.050	0.080	0.019	0.020	0.039	0.013
<i>Nephrops</i> FU 32	0.715	1.116	0.269	0.275	0.549	0.176
<i>Nephrops</i> FU 33	1.100	1.754	0.423	0.432	0.863	0.277
<i>Nephrops</i> FU 34	0.600	0.957	0.231	0.236	0.471	0.151
<i>Nephrops</i> other IV	0.608	0.969	0.234	0.239	0.477	0.153
Plaice VIId	3.925	4.608	1.697	1.701	3.171	2.605
Sole VIId	3.251	5.858	2.359	2.365	4.266	3.873

Weights in thousand tonnes.

* Advised landings no more than the indicated value.

¹ The cod scenario is intended to match the cod single-species advice exactly. This is not possible because different models are used. The difference is considered small enough not to affect the general conclusions.

Mixed-fisheries catch options can take specific management priorities into account. Scenario results show that it is often not possible to achieve all management objectives simultaneously. For instance, if rebuilding of the cod stock is the major objective, this could mean that the TAC for other species in the mixed fisheries cannot be fully utilized. In contrast to single-stock advice there is therefore no single recommendation, but a range of plausible options. ICES single-stock advice provides TACs expected to keep a species above a biomass regarded as safe for the stock, to return a species to a safe biomass within a precautionary time-frame, or to meet some desired fishing mortality. To be consistent with these biological objectives a scenario is necessary that delivers the SSB and/or F objectives of the single-stock advice for all stocks considered simultaneously.

This document presents five example scenarios out of which the “minimum” scenario meets this outcome. However, the “minimum” scenario (and to a large extent the “cod” scenario this year) assumes that fleets would stop fishing when their first quota share is exhausted, regardless of the actual importance of this quota share, thus leading to a distorted perception of plausible fleet behaviour. It is included only to demonstrate the lower bound of potential fleet effort and stock catches.

In addition to the “minimum” scenario a “maximum” scenario is included. This is to demonstrate the upper bound of potential fleet effort and stock catches but, through assuming all fleets continue fishing until all their quotas are exhausted irrespective of the economic viability of such actions, this is also considered a scenario with low plausibility. Currently three intermediate scenarios are included, reflecting basic current management measures and also the *status quo* option. ICES has not conducted work to assess which of these scenarios may represent the most likely outcome.

Additional considerations

Management considerations

ICES provides five example scenarios. Alternative scenarios taking account of other specific management objectives can be considered. The option to manage all fisheries based on single-species F_{MSY} was studied (ICES, 2012) and, as a proof of concept, preliminary work on MSY-based medium-term projections was performed. As expected, the successive application of the “cod” scenario lead all species to be fished at or below F_{MSY} (cod continues to be the most limiting, or “choke” species in terms of effort required to catch available quota) by 2015. None of the five scenarios presented are aimed at achieving MSY for all stocks in 2015. Finding the optimal scenario would imply prioritization of management objectives and redesigning of harvest control rules for integrated management at the regional level.

In previous mixed-fisheries projections the assumptions of the example scenarios were applied in both the intermediate and advice years. This year the procedure was changed so that *status quo* effort was applied in the intermediate year and the assumptions of the scenarios only in the advice year. The decision was influenced by the fact that no changes in effort caps were implemented under the cod long-term management plan in 2013. ICES also found that assumptions of *status quo* effort better reflect the assumptions made for the intermediate year in most single-species forecasts of the stocks considered.

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.

Spatial and temporal changes in where and when métiers exert their fishing effort have an influence on the species composition of the catch and will change the ability of vessels to target (spatially) the different species. Further investigations are required to be able to include spatial decoupling between species in the scenarios.

The “cod” scenario reflects the target fishing mortality as set for the cod management plan, and the results present fishing opportunities for other stocks in a mixed-fisheries context. Similar scenarios based on the management plans for the other finfish stocks could be provided by ICES, but the “cod” scenario is considered here because cod has generally been the limiting species since the beginning of mixed-fisheries analysis in 2006.

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 métiers 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 F s) 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.

The “effort management” scenario presents the expected outcome if the nominal effort reductions stipulated in the effort management plans were translated in full into actual effort cuts and if there existed a 1:1 relationship between fleet effort and mean F . For 2014, effort reductions are only applied to TR1 and TR2 gear types (based on the EU cod management plan). The data used for the mixed-fisheries projections show that effort reductions to date have been less than those stipulated for overall effort by fleet in the fishing opportunities regulations, and studies have indicated linkages between effort and F that change depending on fleet and species. Equally, the projections assume that the

relative catchability of different species by fleets and métiers remains constant and cannot take account of changing vessel behaviour in 2013 and 2014 because of e.g. real-time closures or technical measures. Contrary to the effort management regulations in 2013, no reduction in effort was applied between 2012 and 2013. The effort reduction from 2013 to 2014 was assumed to be 46%, which is in line with the required reduction in F based on Council Regulation (EC) 1342/2008, Art. 8.4.b.

Mixed-fisheries results for *Nephrops* are displayed combined for several functional units 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.

Newly added to the list of stocks are sole and plaice in the Eastern English Channel. They have low landings compared to other stocks and the results for these stocks are presented in detail in Figure 6.3.2.2. 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.

Species involved

The species considered here as part of the demersal mixed fisheries are cod, haddock, whiting, saithe, plaice, sole, and *Nephrops*. Pelagic stocks (herring, mackerel) are not included as they are taken by fisheries subject to little technical interaction.

Species	ICES single-stock advice area	Management area	Management plan ref(s)
Cod	Subarea IV and Divisions VIId and IIIa West (Skagerrak)	<ul style="list-style-type: none"> • EU TAC Skagerrak • EU TAC Division VIId • Subarea IV; EC waters of Division IIa; that part of Division IIIa not covered by the Skagerrak and Kattegat 	<ul style="list-style-type: none"> • EU and Norway management plan • Council Reg (EC) 1342/2008
Haddock	Subarea IV and Division IIIa West (Skagerrak)	<ul style="list-style-type: none"> • EU TAC Division IIIa, EC waters of Divisions IIIb, IIIc, and IIId • Subarea IV; EC waters of Division IIa 	<ul style="list-style-type: none"> • EU and Norway management plan
Whiting	Subarea IV and Division VIId (advice includes human consumption and industrial landings)	<ul style="list-style-type: none"> • Subarea IV • EU TAC Subarea VII 	<ul style="list-style-type: none"> • EU and Norway management plan
Saithe	Subarea IV, Division IIIa West (Skagerrak), and Subarea VI	<ul style="list-style-type: none"> • Division IIIa and Subarea IV; EC waters of Divisions IIa, IIIb, IIIc, and IIId • Subarea VI; EC waters of Division Vb; EC and international waters of Subareas XII and XIV 	<ul style="list-style-type: none"> • EU and Norway management plan
Plaice	Subarea IV	<ul style="list-style-type: none"> • Subarea IV; EC waters of Division IIa; that part of Division IIIa not covered by the Skagerrak and the Kattegat 	<ul style="list-style-type: none"> • Council Reg (EC) No. 676/2007
Sole	Subarea IV	<ul style="list-style-type: none"> • EC waters of Subareas II and IV 	<ul style="list-style-type: none"> • Council Reg (EC) No. 676/2007
<i>Nephrops</i>	Functional units (FUs) in Subarea IV: 5, 6, 7, 8, 9, 10, 32, 33, 34, and other areas outside FUs	<ul style="list-style-type: none"> • EU: TAC for Subarea IV • Norway: no TAC 	<ul style="list-style-type: none"> • n/a
<i>Plaice</i>	Division VIId	<ul style="list-style-type: none"> • Divisions VIId and VIIE 	<ul style="list-style-type: none"> • n/a
<i>Sole</i>	Division VIId	<ul style="list-style-type: none"> • Division VIId 	<ul style="list-style-type: none"> • n/a

Data and methods

The projections made use of data requested as part of an ICES data call issued formally under the EU Data Collection Framework (DCF) regulations. This has allowed a greater consistency between catch totals supplied to ICES. To allow

consideration of fleets defined by length categories, separate data files containing total weight of landings and discards and effort in kW-days by fleet and métier were also requested.

All analyses were conducted using the Fcube method (Ulrich *et al.*, 2011).

Uncertainties in the assessment

This analysis relies on the quality of the single-stock assessments and forecasts, which is generally good for the stocks considered. In addition there is some uncertainty related to the assumptions on the relationship between effort and fishing mortality, and to the *status quo* assumptions in the intermediate year.

The quality of data had improved in 2012 because of the ICES data call, merging data needs and ensuring common data storage for single-stock assessment and mixed-fisheries forecasts. In 2013 additional work was performed that further improved consistency and transparency of data collection and processing. Some issues still remain in reaching full consistency between input data for single-stock and for mixed-fisheries advice, not least for saithe (as illustrated in Figure 6.3.2.4 by the relatively high proportion of landings allocated to the “other” (OTH) category). This category includes some Norwegian landings without corresponding effort, some preliminary French data not fully processed in logbooks at the time of data extraction, and the landings in West of Scotland). But this is not considered to affect the general patterns of the results presented.

Sources

- ICES. 2012. Report of the Working Group on Mixed Fisheries Advice for the North Sea (WGMIXFISH), 27–31 August 2012, ICES Headquarters, Copenhagen, Denmark. ICES CM 2012/ACOM:74. 75 pp.
- ICES. 2013a. ICES Report of the ICES Advisory Committee, 2013. ICES Advice, 2013, [Book 6](#).
- ICES. 2013b. Report of the Working Group on Mixed-Fisheries Advice for the North Sea (WGMIXFISH), 20–24 May 2013. ICES CM 2013/ACOM:22.
- ICES. 2013c. Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak (WGNSSK), 24–30 April 2013. ICES CM 2013/ACOM:13.
- Ulrich, C., Reeves, S. A., Vermard, Y., Holmes, S., and Vanhee, W. 2011. Reconciling single-species TACs in the North Sea demersal fisheries using the Fcube mixed-fisheries advice framework. *ICES Journal of Marine Science*, 68: 1535–1547.

Predicted landings for 2014, per stock in VIId and per scenario
Detail from figure 1

overshoot (hatched) and undershoot (below zero)

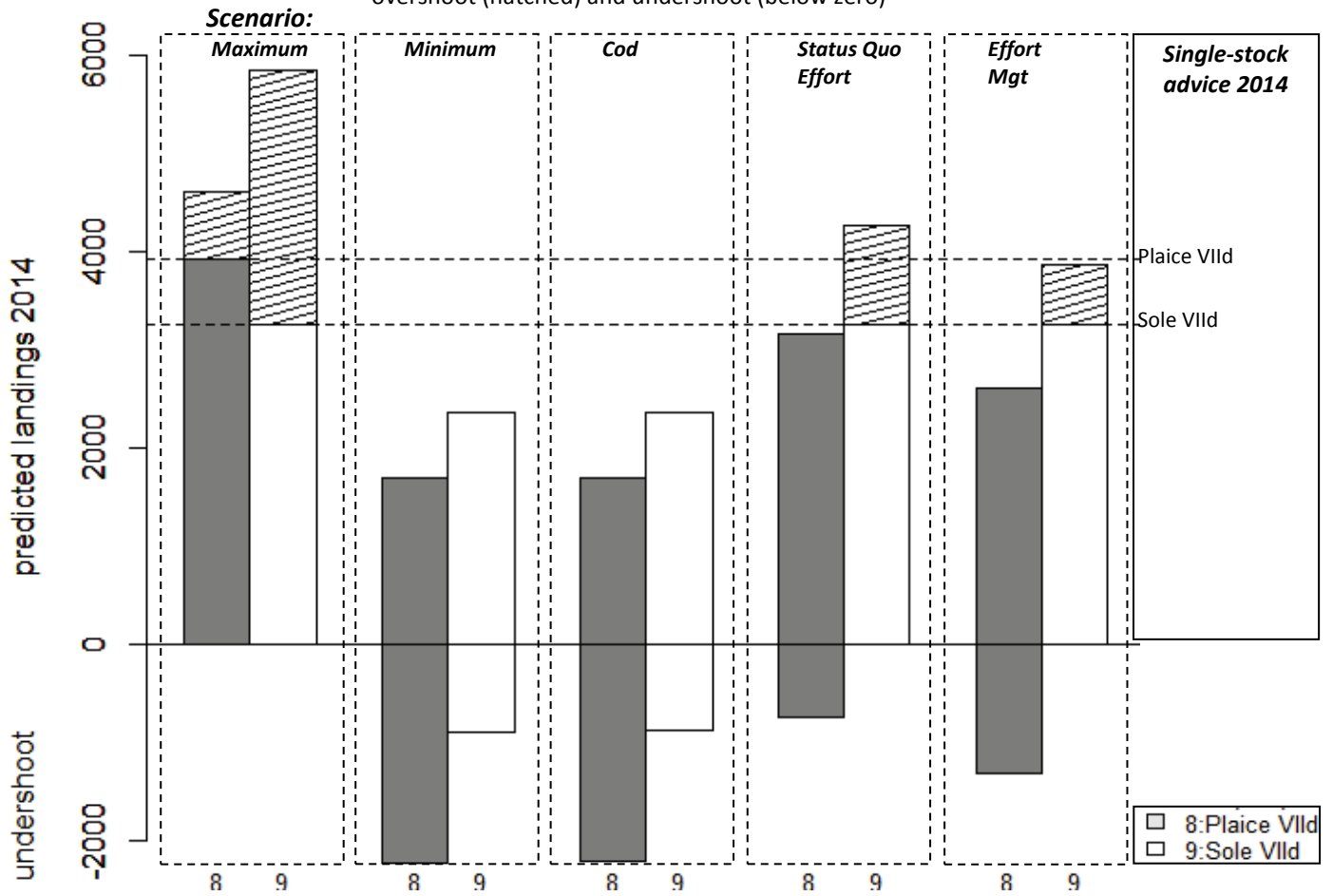


Figure 6.3.2.2

Mixed-fisheries projections for stocks in Division VIId (detail from Figure 6.3.2.1). Estimates of potential landings (in tonnes) by stock and by scenario. Horizontal lines correspond to the single-stock advice for 2014. Bars below the value of zero show the scale of undershoot (compared to single-stock advice) in cases where landings are predicted to be lower when applying the scenario. Hatched columns represent landings in overshoot of the single-stock advice.

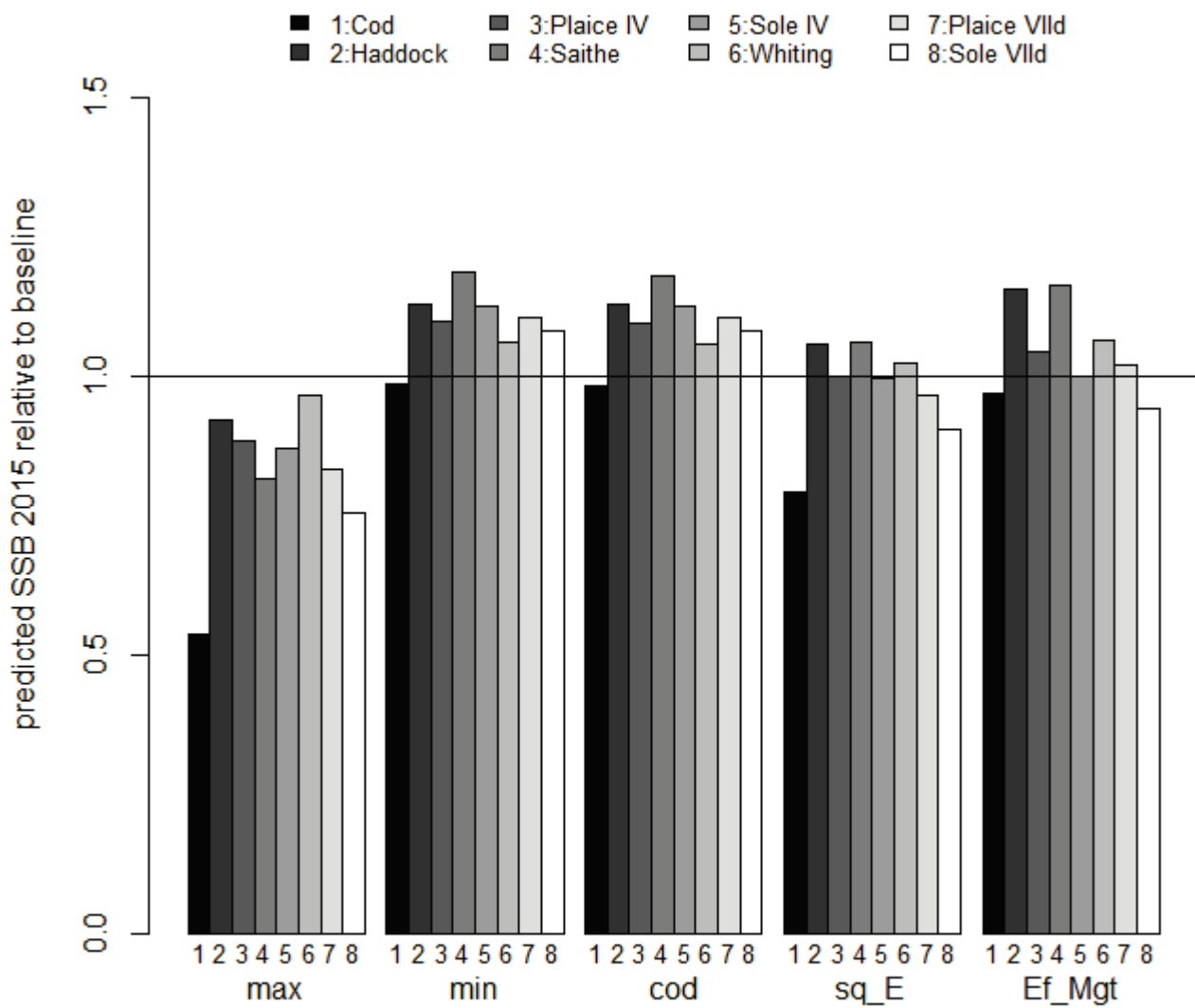


Figure 6.3.2.3

Mixed-fisheries advice in the North Sea. Estimates of potential SSB at the start of 2015 by stock after applying the mixed-fisheries scenarios, expressed as a ratio to the single-stock 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.

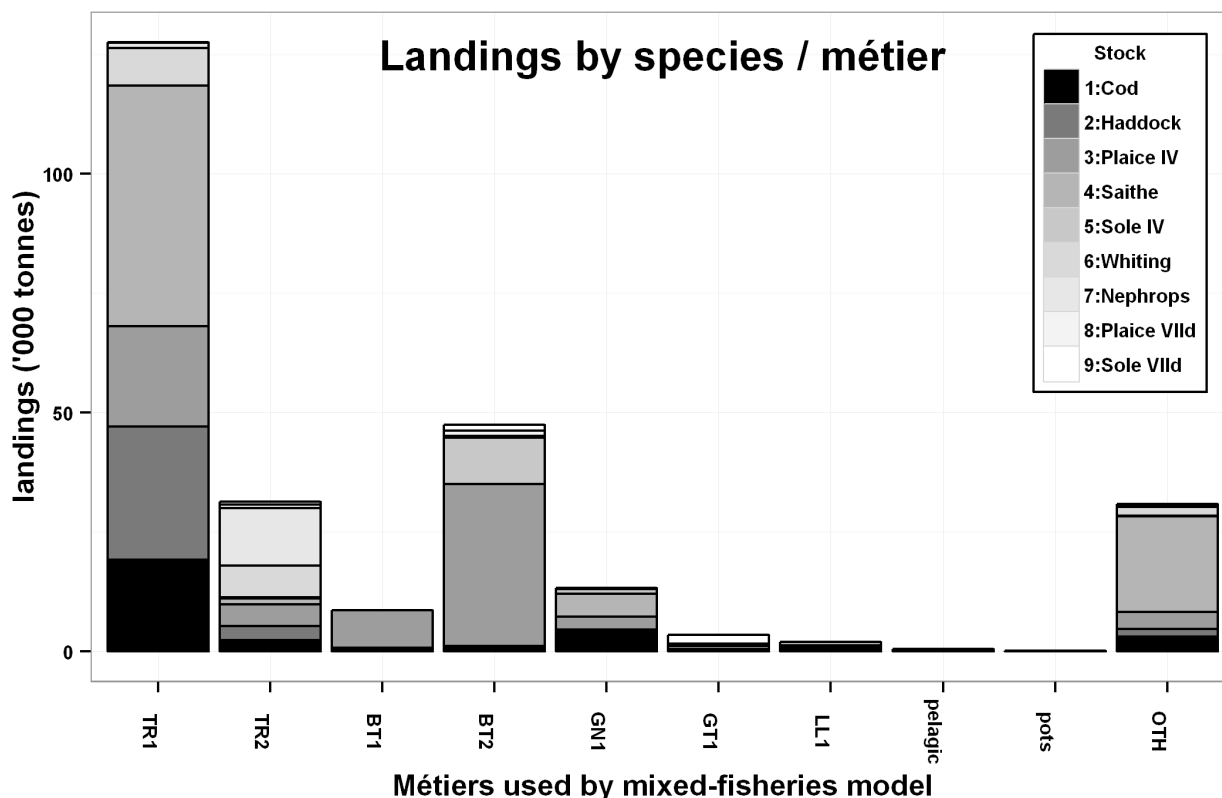


Figure 6.3.2.4 Mixed-fisheries advice in the North Sea. Landings distribution of species by métier with landings consisting of $\geq 1\%$ of any of the stocks 1–9 (see Figure 6.3.2.1) in 2012 (list of métiers available in Table 6.3.2.2). Note: The “other” (OTH) displayed here is a mixed category consisting of (i) landings without corresponding effort (presented in 2012 as OTH), (ii) landings of any combination of fleet and métier with landings $< 1\%$ of any of the stocks 1–9 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).

Table 6.3.2.1 Mixed-fisheries advice in the North Sea. SSB results from single-stock advice and different mixed-fisheries scenarios (see Figure 6.3.2.3). *Nephrops* are not included as abundance is not forecasted from the mixed-fisheries model. SSB for plaice in Division VIIId is not included because the assessment is relevant for trends only.

Stock	Single-stock advice SSB result in 2015	SSB resulting from mixed-fisheries scenario 2015				
		“Max”	“Min”	“Cod”	“SQ_E”	“Eff_mgt”
Cod	127 400	65 054	116 680	116 438	93 639	114 641
Haddock	200 000	185 550	227 893	227 615	212 663	232 223
Plaice IV	737 017	650 750	808 471	808 146	736 068	767 586
Saithe	176 100	143 575	221 170	220 911	186 756	204 306
Sole IV	46 070	40 002	51 775	51 772	45 835	46 015
Whiting	311 434	301 300	330 336	330 174	319 332	332 243
Sole VIIId	10 951	8 271	11 852	11 845	9 897	10 299
<i>legend</i>						
	<i>SSB 2015 > B_{pa} or MSY B_{trigger}</i>					
	<i>SSB 2015 > B_{lim}</i>					
	<i>SSB 2015 < B_{lim}</i>					
	<i>No reference points defined</i>					

Weights in thousand tonnes.

Table 6.3.2.2

Mixed-fisheries advice North Sea. Métier categories used in the mixed-fisheries analysis.

Mixed-fisheries metiers	Gear	Mesh size
TR1	Otter trawl or demersal seine	≥100 mm
TR2	Otter trawl or demersal seine	≥70 mm and < 100 mm
BT1	Beam trawl	≥120 mm
BT2	Beam trawl	≥80 mm and < 120 mm
GN1	Gillnets	All possible mesh sizes
GT1	Trammelnets	All possible mesh sizes
LL1	Longlines	n.a.
Pelagic	Pelagic trawl or seine	
Pots	Pots	n.a.
OTH	Any gear type	

Table 6.3.2.3

Mixed-fisheries advice North Sea. Effort reductions in 2013 compared to 2012, by EU-regulated fleet segment (Council Regulation (EC) Nos. 297/2013 and 43/2012), 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 trammelnets	GN1	0%	0%
Trammelnets	TN1	0%	0%
Longlines	LL1	0%	0%
Non-regulated gear	None	0%	0%