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Monitoring the performance of the Common Fisheries Policy (STECF-15-04)

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This report was reviewed by the STECF by written procedure in March 2015

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Abstract

An ad hoc Expert Group on 'Monitoring the performance of the Common Fisheries Policy' composed of JRC experts was held on 10-11th February 2015 at JRC, Ispra, Italy. The ad hoc report was finalized and subsequently reviewed by the STECF by written procedure in March 2015.

TABLE OF CONTENTS

Monitoring the performance of the Common Fisheries Policy (STECF-15-04).....	4
Background.....	4
Terms of reference	4
STECF response.....	5
CONTACT DETAILS OF STECF MEMBERS AND ADHOC EXPERT GROUP.....	6
Report to the STECF.....	10

**SCIENTIFIC, TECHNICAL AND ECONOMIC COMMITTEE FOR FISHERIES
(STECF)**

**MONITORING THE PERFORMANCE OF THE COMMON FISHERIES POLICY
(STECF-15-04)**

The STECF review and adoption of the report of the ad hoc Expert group to monitor the performance of the Common Fisheries Policy was undertaken during March 2015.

BACKGROUND

Article 50 of the Common Fisheries Policy (CFP; Regulation (EU) No 1380/2013 of the European Parliament and of the Council of 11 December 2013) stipulates:

“The Commission shall report annually to the European Parliament and to the Council on the progress on achieving maximum sustainable yield and on the situation of fish stocks, as early as possible following the adoption of the yearly Council Regulation fixing the fishing opportunities available in Union waters and, in certain non-Union waters, to Union vessels.”

To facilitate such a report, in October 2014, the Commission requested the STECF to review and advise on suitable metrics and indicators. Based on the STECF Report (STECF 14-23), the Commission requested that an ad hoc Expert Group be convened to address the following Terms of Reference and prepare a report for review by the STECF.

TERMS OF REFERENCE

1. Determine, on the basis of the most recent available fish stock assessments, a list of fish stocks for monitoring the past performance of the Common Fisheries Policy according to the following criteria:
 - a. Quantitative assessments as used in the provision of formal quantitative advice on fishing mortality with respect to F_{msy} .
 - b. Stocks in European Union waters, shared stocks which are jointly managed by the EU with nearby states, and stocks in international waters or third country waters that are fished by the EU and managed by an RFMO where the EU is a member of the decision making body.
2. For stocks within the sampling frame defined above, calculate the following **annual** quantities as far back in time as the data remain representative.
 - a. Number of stocks where fishing mortality exceeds F_{msy}
 - b. Number of stocks where fishing mortality is equal to or less than F_{msy}

- c. Number of stocks outside safe biological limits
- d. Number of stocks inside safe biological limits
- e. Number of stocks for which the state of the stock is unknown with respect to safe biological limits
- f. The arithmetic average value of F/F_{msy}

For the purposes of this term of reference, "outside safe biological limits" means that SSB is less than B_{pa} (where B_{pa} is defined), OR F is greater than F_{pa} (where F_{pa} is defined) for the year in question.

Estimates should be provided separately for the Baltic Sea, the North Sea, Western Waters, for each area covered by RFMOs other than NEAFC. Parameter f should also be reported for the combined area of the Baltic Sea, North Sea and Western Waters. The list of stocks should be provided together with a mention of whether the stock is fished above or below F_{msy} .

- 3. For the purpose of assessing changes over time in the coverage of advice on TACs with respect to scientific advice concerning the northeast Atlantic:
 - a. define a sampling frame based on a large subset of TACs of EU interest that is stable over time;
 - b. assess the number and proportion of those TACs that are subject to scientific advice concerning:
 - i. the fishing mortality compared to F_{msy} ;
 - ii. the state with respect to safe biological limits, as defined above.

For the purposes of this exercise, a group of TACs covering one biological stock should be counted once only. For a TAC which covers several stocks, the biological state of the most abundant stock (by comparison with other stocks over an extended and representative period) should be taken into account.

The Commission services will provide STECF with an initial analysis for the purposes of the assessment under point 3.

STECF RESPONSE

STECF reviewed the Report of the ad hoc Expert group noting that each of the elements of the terms of Reference to the STECF has been adequately and appropriately addressed. STECF notes that in its Report, the ad hoc Expert Group has provided source code in 'R' which will make future reporting on the performance of the CFP semi-automatic. The Report is logically presented and the data and STECF concludes that all of the data and information presented in the report can be used by the Commission as a basis to fulfil its obligations under Article 50 of the Common Fisheries Policy (Regulation (EU) No 1380/2013 of the European Parliament and of the Council of 11 December 2013) for stocks in the ICES area, for which the EU fixes fishing opportunities.

CONTACT DETAILS OF STECF MEMBERS AND ADHOC EXPERT GROUP

1 - Information on STECF members and invited experts' affiliations is displayed for information only. In some instances the details given below for STECF members may differ from that provided in Commission COMMISSION DECISION of 27 October 2010 on the appointment of members of the STECF (2010/C 292/04) as some members' employment details may have changed or have been subject to organisational changes in their main place of employment. In any case, as outlined in Article 13 of the Commission Decision (2005/629/EU and 2010/74/EU) on STECF, Members of the STECF, invited experts, and JRC experts shall act independently of Member States or stakeholders. In the context of the STECF work, the committee members and other experts do not represent the institutions/bodies they are affiliated to in their daily jobs. STECF members and invited experts make declarations of commitment (yearly for STECF members) to act independently in the public interest of the European Union. STECF members and experts also declare at each meeting of the STECF and of its Expert Working Groups any specific interest which might be considered prejudicial to their independence in relation to specific items on the agenda. These declarations are displayed on the public meeting's website if experts explicitly authorized the JRC to do so in accordance with EU legislation on the protection of personnel data. For more information: <http://stecf.jrc.ec.europa.eu/adm-declarations>

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REPORT TO THE STECF

**AD HOC EXPERT GROUP on
Monitoring the Performance of the Common Fisheries
Policy**

Ispra, Italy, 10-11 February 2015

This report does not necessarily reflect the view of the STECF and the European Commission and in no way anticipates the Commission's future policy in this area

Report of the ad hoc Expert Group on monitoring the performance of the Common Fisheries policy

Iago Mosqueira, Ernesto Jardim, Finlay Scott, John Casey, Chato Osio

JRC Ispra (IT), 10 June, 2015

Abstract

Following the recommendations of STECF EWG 14-20 on Reporting needs on fishery resources under new CFP, an ad-hoc working group has produced an analysis to generate the requested indices of performance for 2013. Calculations were carried out using publicly available datasets of stock assessment results, which at this point limits the scope to those stocks for which scientific advice is provided by ICES.

Contents

1	Terms of reference	2
2	Participants	2
2.1	Observers	3
3	Data and methods	3
3.1	Data sources	3
3.2	Methods	3
4	Findings in relation to each of the items in the Terms of Reference	3
4.1	ToR 1: Determination of the sampling frame	3
4.2	ToR 2: Indicators of management performance	4
4.3	ToR 3: Indicators of changes in advice coverage	10
5	Status across all stocks in 2013	11
6	Appendix A: Source code	14
6.1	Data loading and transformation	14
6.2	ToR 1	16
6.3	ToR 2	17
6.4	ToR 3	19
6.5	Stock table	19
7	Appendix B: Stocks in ICES dataset	21
	References	24

1 Terms of reference

1. Determine, on the basis of the most recent available fish stock assessments, a list of fish stocks for monitoring the past performance of the Common Fisheries Policy according to the following criteria:
 - a. Quantitative assessments as used in the provision of formal quantitative advice on fishing mortality with respect to F_{msy} .
 - b. Stocks in European Union waters, shared stocks which are jointly managed by the EU with nearby states, and stocks in international waters or third country waters that are fished by the EU and managed by an RFMO where the EU is a member of the decision making body.
2. For stocks within the sampling frame defined above, calculate the following **annual** quantities as far back in time as the data remain representative.
 - a. Number of stocks where fishing mortality exceeds F_{msy} ¹
 - b. Number of stocks where fishing mortality is equal to or less than F_{msy} ²
 - c. Number of stocks outside safe biological limits
 - d. Number of stocks inside safe biological limits
 - e. The arithmetic average value of F/F_{msy}
 - f. Number of stocks for which the state of the stock is unknown with respect to safe biological limits

For the purposes of this term of reference, “outside safe biological limits” means that SSB is less than B_{pa} (where B_{pa} is defined), OR F is greater than F_{pa} (where F_{pa} is defined) for the year in question. Estimates should be provided separately for the Baltic Sea, the North Sea, Western Waters, for each area covered by RFMOs other than NEAFC. Parameter f should also be reported for the combined area of the Baltic Sea, North Sea and Western Waters. The list of stocks should be provided together with a mention of whether the stock is fished above or below F_{msy} .

3. For the purpose of assessing changes over time in the coverage of advice on TACs with respect to scientific advice concerning the northeast Atlantic:
 - a. define a sampling frame based on a large subset of TACs of EU interest that is stable over time;
 - b. assess the number and proportion of those TACs that are subject to scientific advice concerning:
 - i. the fishing mortality compared to F_{msy} ;
 - ii. the state with respect to safe biological limits, as defined above.

For the purposes of this exercise, a group of TACs covering one biological stock should be counted once only. For a TAC which covers several stocks, the biological state of the most abundant stock (by comparison with other stocks over an extended and representative period) should be taken into account. The Commission services will provide STECF with an initial analysis for the purposes of the assessment under point 3.

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¹Including, for short-lived species managed according to a biomass-escapement strategy, the number of stocks where the resulting biomass was less than the escapement biomass corresponding to MSY fishing.

²Including, for short-lived species managed according to a biomass-escapement strategy, the number of stocks where the resulting biomass was equal to or higher than the escapement biomass corresponding to MSY fishing.

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2.1 Observers

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3 Data and methods

3.1 Data sources

Calculation of the various indicators could at this point only be carried out for the areas for which advice is being provided by ICES. For other areas, a dataset could not be compiled due to the non-availability of an organized publicly available dataset of stock assessment results.

3.1.1 ICES

Results of quantitative stock assessments, including the adopted fishing mortality and biomass reference points, carried out by ICES were retrieved from the [relevant section of the ICES website](#) on 23 February 2015. Stock assessment results for *Nephrops* stocks, not currently included in that dataset, were provided in a similar format by ICES. Data for the IVa-VIa stock of Megrim were extracted from the relevant ICES report <http://www.ices.dk/sites/pub/Publication%20Reports/Advice/2014/2014/meg-4a6a.pdf>. These were not present in the ICES dataset as the assessment was carried out in 2013, but it was then subsequently used to provide advice in 2014.

This dataset was complemented with a list of the ecoregion each stock falls into, provided directly by ICES (see Table 7). Stocks “of interest to the EU” were then selected from this dataset.

Advice was provided and available from ICES for 96 stocks (see Appendix B). Of those, 62 were selected as (1) advice included a quantitative stock assessment in 2013 that was used for providing advice and (2) were deemed of ‘EU relevance’ by DG MARE.

3.2 Methods

Data was transformed, plotted and analysed using the R statistical language, version 3.1.2 (R Core Team 2014). Source code for the complete analysis is available in Appendix A.

4 Findings in relation to each of the items in the Terms of Reference

4.1 ToR 1: Determination of the sampling frame

The sampling frame determined under this ToR will be used for the computation of the indicators requested under ToR 2. Using the most recent fish stock assessment reports provided by ICES, stocks were chosen for inclusion in the indicators if:

- an estimate of the ratio of F to F_{MSY} is available, which was interpreted as evidence that a quantitative stock assessment is available and had been accepted for the provision of formal quantitative advice to the European Commission with respect to F_{MSY} .

- the stock had been identified together with DG MARE as of *EU relevance* for the monitoring of the implementation of the CFP.

The number of stocks thus included varies along the time series depending on the starting point of the stock assessment. All included stock assessments, 62 in total, go back to 1999 at least (Figure 1).

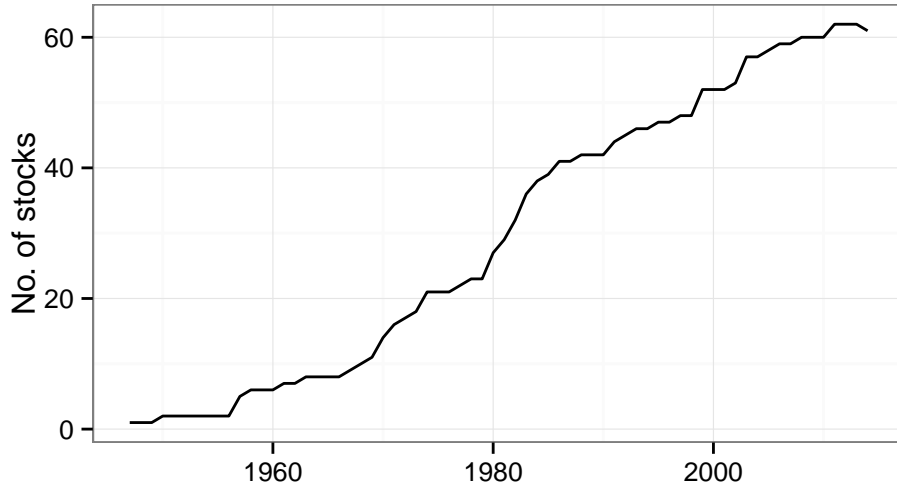


Figure 1: No. of stocks in the ICES area for which estimates of F/F_{MSY} are available by year, and considered relevant for the monitoring of the CFP performance.

4.2 ToR 2: Indicators of management performance

Estimates of relative stock status were only considered for the 2003 - 2013 period, as the first date marks the start of the previous CFP European Commission (2002) and the later is the last year for which abundance and fishing mortality estimates are available from the 2014 stock assessment dataset.

For ToRs 2a to 2d two plots, showing the time series for the whole ICES area and for the four regions, and a table with the exact counts for each region and for all combined, are presented.

4.2.1 ToR 2.a: Number of stocks where fishing mortality exceeds F_{MSY}

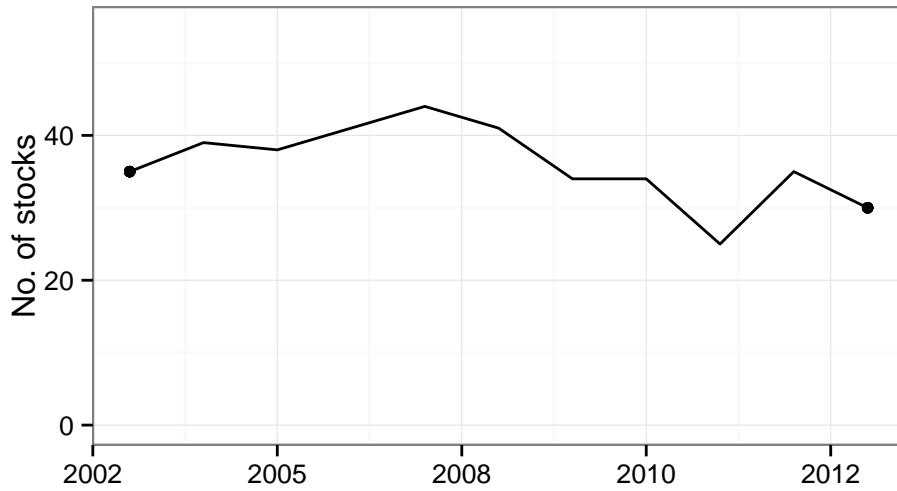


Figure 2: Number of stocks where fishing mortality (F) exceeds fishing mortality at MSY (F_{MSY}) by year.

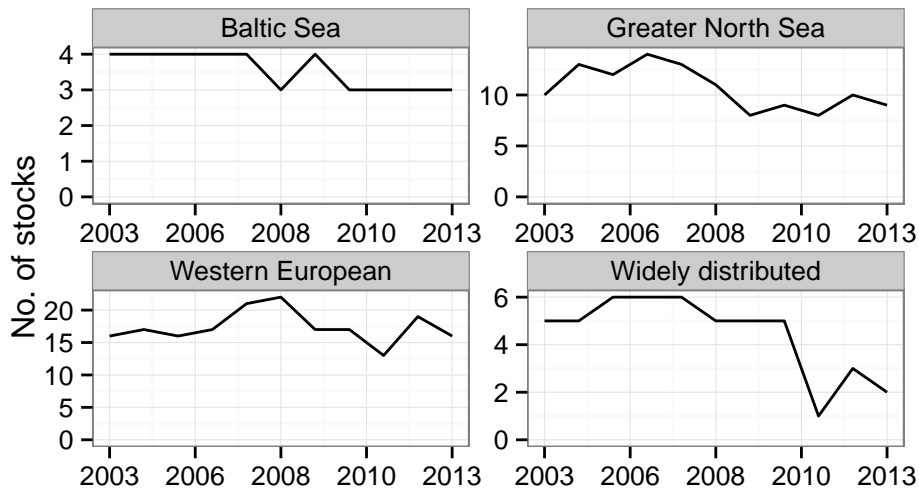


Figure 3: Number of stocks where fishing mortality (F) exceeds fishing mortality at MSY (F_{MSY}) by region.

Table 1: Number of stocks where fishing mortality (F) exceeds fishing mortality at MSY (F_{MSY}) by region.

Region	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
All	35	39	38	41	44	41	34	34	25	35	30
Baltic Sea	4	4	4	4	4	3	4	3	3	3	3
Greater North Sea	10	13	12	14	13	11	8	9	8	10	9
Western European	16	17	16	17	21	22	17	17	13	19	16
Widely distributed	5	5	6	6	6	5	5	5	1	3	2

4.2.2 ToR 2.b: Number of stocks where fishing mortality is equal to or less than F_{MSY}

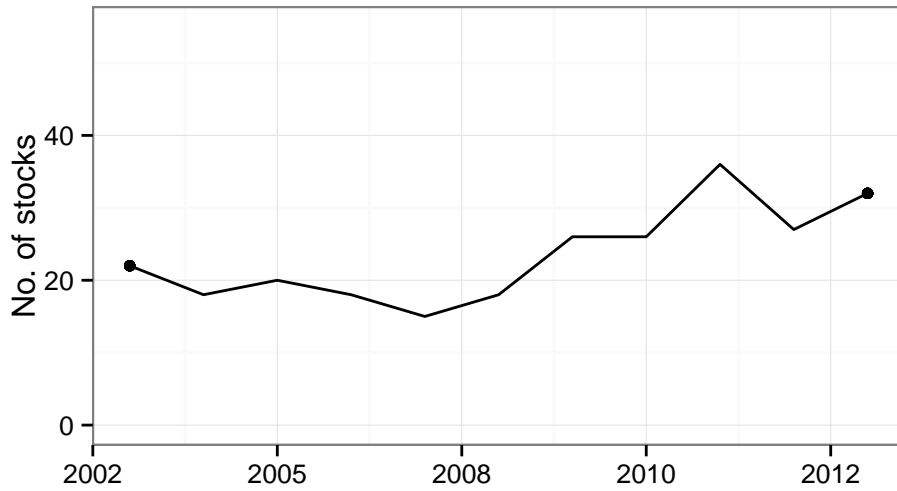


Figure 4: Number of stocks where fishing mortality (F) does not exceed fishing mortality at MSY (F_{MSY}) by year.

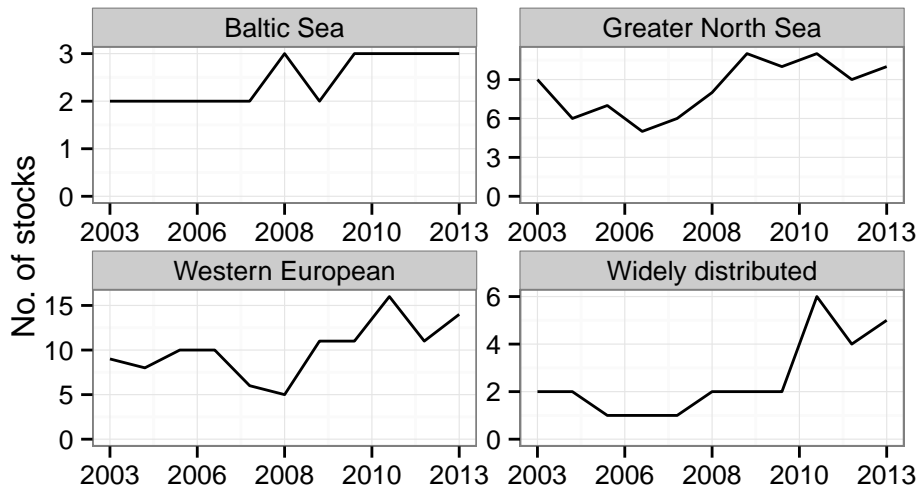


Figure 5: Number of stocks where fishing mortality (F) does not exceed fishing mortality at MSY (F_{MSY}) by year and region.

Table 2: Number of stocks where fishing mortality (F) does not exceed fishing mortality at MSY (F_{MSY}) by region.

Region	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
All	22	18	20	18	15	18	26	26	36	27	32
Baltic Sea	2	2	2	2	2	3	2	3	3	3	3
Greater North Sea	9	6	7	5	6	8	11	10	11	9	10
Western European	9	8	10	10	6	5	11	11	16	11	14
Widely distributed	2	2	1	1	1	2	2	2	6	4	5

4.2.3 ToR 2.c: Number of stocks outside safe biological limits



Figure 6: Number of stocks outside safe biological limits by year.

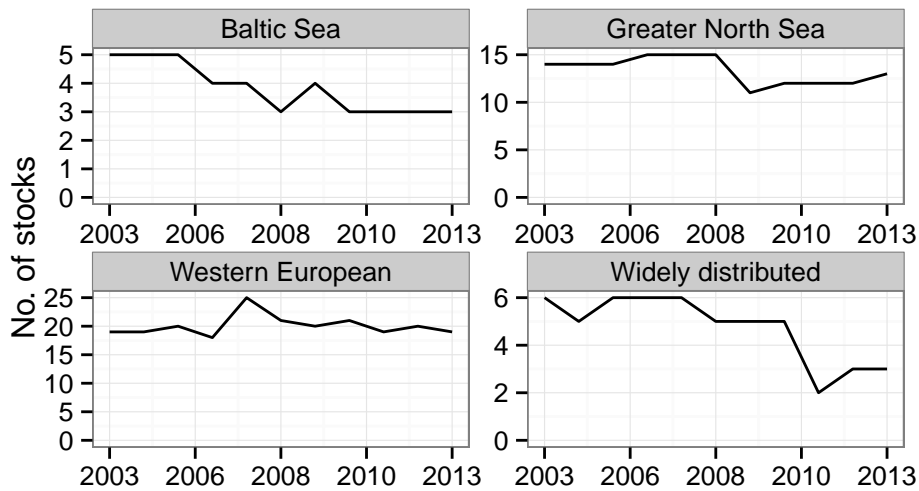


Figure 7: Number of stocks outside safe biological limits by year and region.

Table 3: Number of stocks outside safe biological limits by region and for the whole ICES area. Outside safe biological limits means that SSB is less than B_{pa} (where B_{pa} is defined), or F is greater than F_{pa} (where F_{pa} is defined).

Region	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
All	44	43	45	43	50	44	40	41	36	38	38
Baltic Sea	5	5	5	4	4	3	4	3	3	3	3
Greater North Sea	14	14	14	15	15	15	11	12	12	12	13
Western European	19	19	20	18	25	21	20	21	19	20	19
Widely distributed	6	5	6	6	6	5	5	5	2	3	3

4.2.4 ToR 2.d: Number of stocks inside safe biological limits

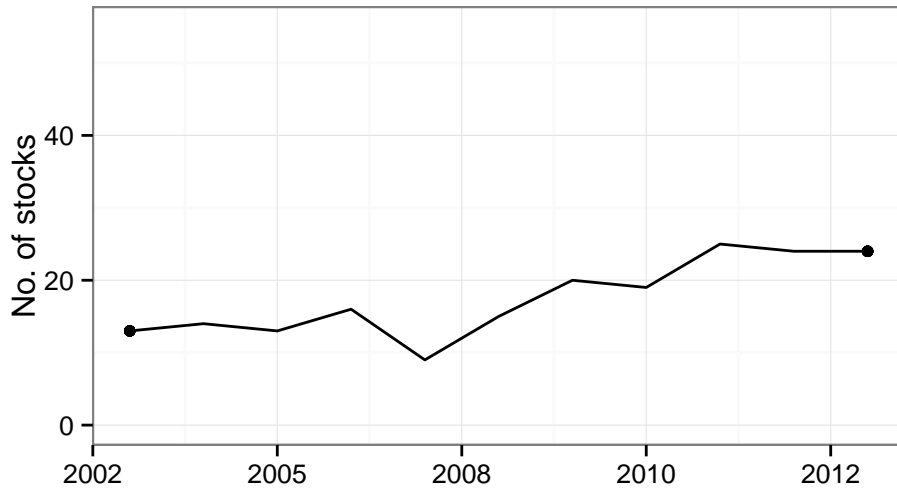


Figure 8: Number of stocks inside safe biological limits by year.

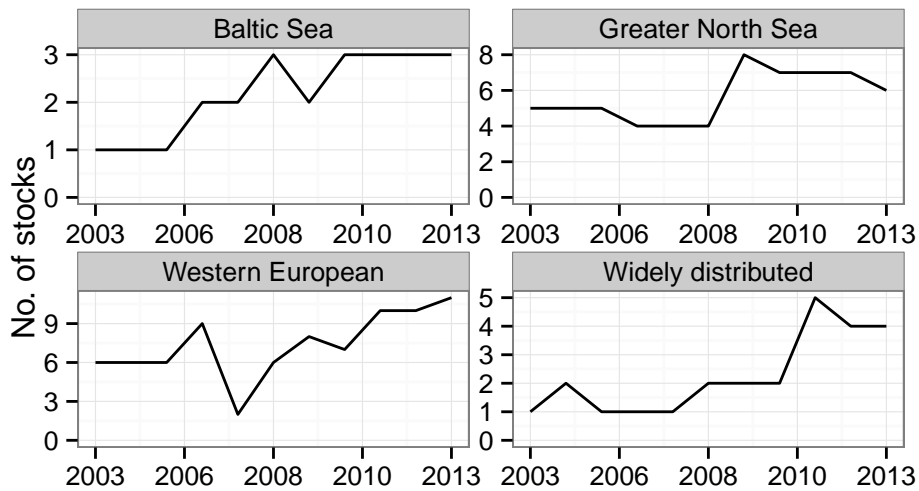


Figure 9: Number of stocks inside safe biological limits by year and region.

Table 4: Number of stocks inside safe biological limits by region and for the whole ICES area. Inside safe biological limits means that SSB is greater than Bpa (where Bpa is defined), and F is less than Fpa (where Fpa is defined).

Region	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
All	13	14	13	16	9	15	20	19	25	24	24
Baltic Sea	1	1	1	2	2	3	2	3	3	3	3
Greater North Sea	5	5	5	4	4	4	8	7	7	7	6
Western European	6	6	6	9	2	6	8	7	10	10	11
Widely distributed	1	2	1	1	1	2	2	2	5	4	4

4.2.5 ToR 2.e: Arithmetic mean value of F/F_{MSY}

For this indicator only stocks not managed under escapement strategies were included. *Nephrops* stocks, for which fishing mortality was reported as a harvest rate, were also excluded, as values could not be directly combined. Harvest rate, defined as a proportion of the biomass (or numbers) being caught, has a non-linear relationship with fishing mortality, defined as an instantaneous rate, so should not be combined linearly.

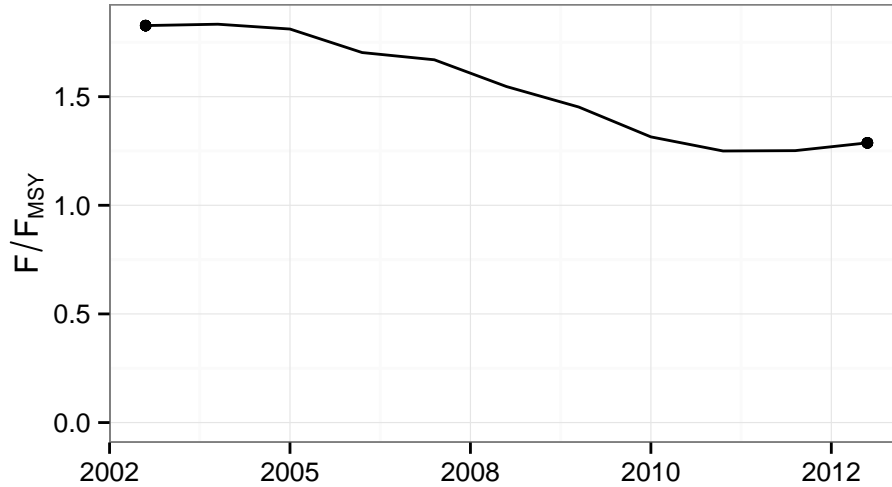


Figure 10: Arithmetic mean value of the F/F_{MSY} ratio by year.

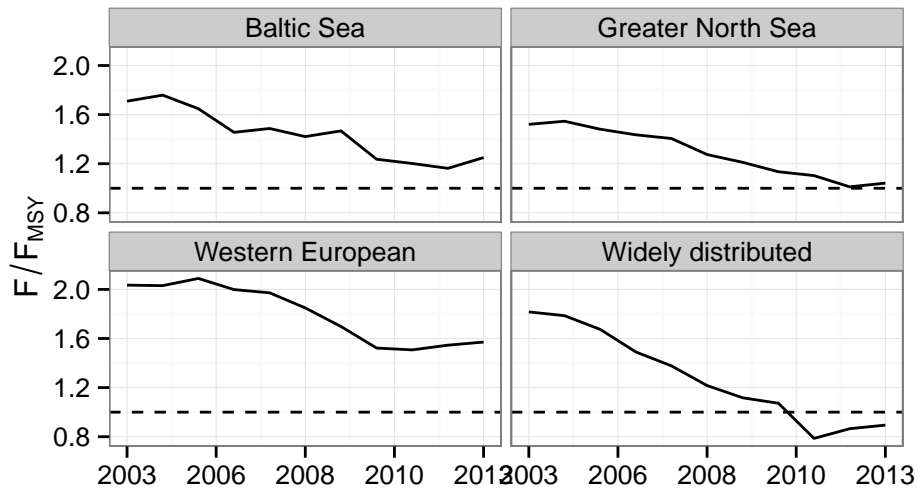


Figure 11: Arithmetic mean value of the F/F_{MSY} ratio by year and region.

Table 5: Arithmetic mean value of the F/F_{MSY} ratio by year and region.

Region	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
All	1.83	1.83	1.81	1.70	1.67	1.55	1.45	1.31	1.25	1.25	1.29
Baltic Sea	1.71	1.76	1.65	1.46	1.49	1.42	1.47	1.24	1.20	1.16	1.25
Greater North Sea	1.52	1.55	1.48	1.44	1.41	1.27	1.21	1.13	1.10	1.01	1.04
Western European	2.03	2.03	2.09	2.00	1.97	1.85	1.70	1.52	1.51	1.55	1.57
Widely distributed	1.82	1.79	1.67	1.49	1.38	1.22	1.12	1.07	0.79	0.87	0.89

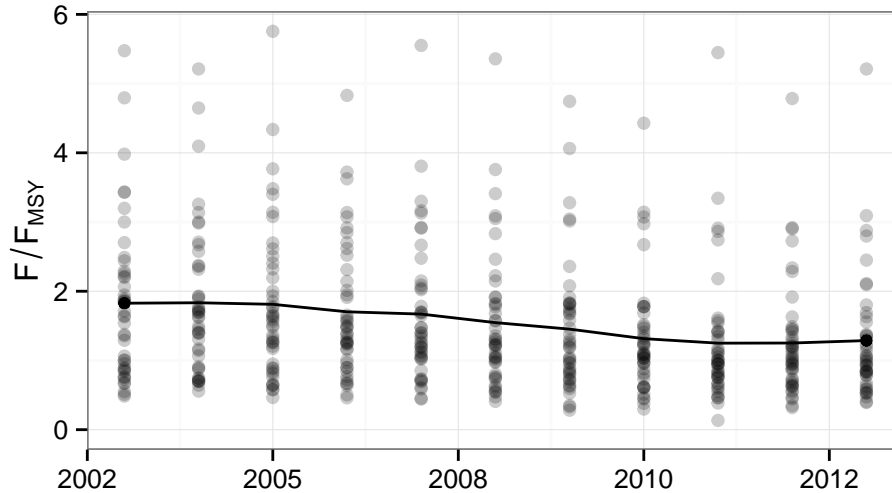


Figure 12: Scatterplot of F/F_{MSY} values and arithmetic mean by year.

4.2.6 ToR 2.f: Number of stocks for which the state of the stock is unknown with respect to safe biological limits

At this point this indicator could not be calculated as the initial sampling frame is already limited to stocks for which quantitative advice is available. The status of the stock with respect to biomass levels is thus also known.

4.3 ToR 3: Indicators of changes in advice coverage

The sampling frame for this indicator was provided by MARE by selecting a subset of stocks comparable to those used in the calculation of CFP performance in previous years. This analysis is only computed on the current ICES dataset, which does not reflect the advice given in previous years. For example, if a stock was newly assessed in 2014, with data going back to 1999, the indicator computed from this dataset will be updated for the whole 1999-2013 period. A complete calculation of the advice coverage indicator would require the corresponding stock assessment dataset for previous years, which was outside the scope of this analysis.

Table 6: Number of stocks for which estimates exist of fishing mortality (F) over fishing mortality at MSY (F_{MSY}), and of biomass level against a safe biological limit, and corresponding proportions of all stocks in the sampling frame.

Indicator	Number	Proportion
Stocks with F/F_{MSY} estimate	53	56 %
Stocks with biomass estimate	56	59 %

5 Status across all stocks in 2013

Table 7: Stock status for all stocks in the sampling frame in 2013. Columns refer to stock description, value of the F_{2013}/F_{MSY} ratio (*F ind*), F_{2013} lower than F_{MSY} (*F status*), and whether the stock is inside safe biological limits (*SBL*). Inside safe biological limits means that SSB is greater than Bpa (where Bpa is defined), and F is less than Fpa (where Fpa is defined).

Region	Stock	F ind	F status	SBL
Baltic Sea	Cod in Subdivisions 22-24 (Western Baltic Sea)	3.09		
	Herring in Subdivisions 25 - 29 (excluding Gulf of Riga) and 32	0.47	•	•
	Herring in Subdivision 30 (Bothnian Sea)	0.59	•	•
	Herring in Division IIIa and Subdivisions 22 - 24 (Western Baltic spring spawners)	1.30		
	Herring in Subdivision 28.1 (Gulf of Riga)	0.84	•	•
	Sprat in Subdivisions 22 - 32 (Baltic Sea)	1.20		
	Cod in Subarea IV (North Sea). Division VIII (Eastern Channel) and IIIa West (Skagerrak)	2.09		
	Haddock in Subarea IV and Divisions IIIa West and VIa (North Sea. Skagerrak and West of Scotland)	0.52	•	•
	Herring in Subarea IV and Divisions IIIa and VIII (North Sea autumn spawners)	0.79	•	•
	Nephrops in Farn Deepes (FU 6)	2.69		•
	Nephrops in Fladen Ground (FU 7)	0.30	•	•
	Nephrops in Firth of Forth (FU 8)	0.96	•	•
	Nephrops in Moray Firth (FU 9)	0.49	•	•
	Norway Pout in Subarea IV (North Sea) and IIIa (Skagerrak - Kattegat) - Autumn assessment	0.90	•	•
	Northern shrimp (<i>Pandalus borealis</i>) in Divisions IIIa West and IVa East (Skagerrak and Norwegian Deepes)	0.63	•	•
	Plaice Subarea IV (North Sea)	0.84	•	•
	Saithe in Subarea IV (North Sea) Division IIIa West (Skagerrak) and Subarea VI (West of Scotland and Rockall)	1.00		
	Sandeel in the Dogger Bank area (SA 1)	1.35		
	Sandeel in the South Eastern North Sea (SA 2)	1.34		
Sandeel in the Central Eastern North Sea (SA 3)	4.10			
Western European	Sole in Division VIII (Eastern Channel)	1.63		
	Sole in Division VIIe (Western Channel)	0.93	•	•
	Sole in Division IIIa and Subdivisions 22-24 (Skagerrak. Kattegat. and the Belts)	1.29		
	Sole in Subarea IV (North Sea)	1.05		
	Sprat in Subarea IV (North Sea)	0.68	•	•
	Black-bellied anglerfish (<i>Lophius budegassa</i>) in Divisions VIIIc and IXa	0.54	•	•
	White anglerfish (<i>Lophius piscatorius</i>) in Divisions VIIIc and IXa	0.95	•	•
	Cod in Divisions VIIe-k (Celtic Sea cod)	1.38		
	Cod in Division VIIa (Irish Sea)	2.88		
	Cod in Division VIa (West of Scotland)	5.21		
	Haddock in Divisions VIIb.c.e-k	2.80		
	Haddock in Division VIIb (Rockall)	1.23		
	Herring in Division VIIa South of 52° 30' N and VIIg.h.j.k (Celtic Sea and South of Ireland)	0.84	•	•
	Herring in Division VIIa North of 52° 30' N (Irish Sea)	0.93	•	•
	Herring in Division VIa (North)	1.07		
	Hake in Division VIIIc and IXa (Southern stock)	2.45		
	Horse mackerel (<i>Trachurus trachurus</i>) in Division IXa (Southern stock)	0.40	•	•
	Megrim (<i>Lepidorhombus spp.</i>) in Divisions IVa and VIa	1.36		•
	Four-spot megrim (<i>Lepidorhombus boscii</i>) in Divisions VIIIc and IXa	2.11		
Megrim (<i>Lepidorhombus whiffiagonis</i>) in Divisions VIIIc and IXa	0.78	•	•	

Continued on next page

Region	Stock	F ind	F status	SBL
	Nephrops in North Minch (FU 11)	0.92	•	•
	Nephrops in South Minch (FU 12)	0.66	•	•
	Nephrops in the Firth of Clyde (FU 13)	0.90	•	•
	Nephrops in the Sound of Jura (FU 13)	0.19	•	•
	Nephrops in Irish Sea East (FU 14)	0.69	•	•
	Nephrops in Irish Sea West (FU 15)	1.17	•	•
	Nephrops on Porcupine Bank (FU 16)	0.52	•	•
	Nephrops on the Aran Grounds (FU 17)	2.16	•	•
	Nephrops off the southeastern and southwestern coasts of Ireland (FU 19)	1.36	•	•
	Nephrops in the Smalls (FU 22)	0.87	•	•
	Plaice in Division VIIe (Western Channel)	1.14	•	•
	Sole in Divisions VIIIa.b (Bay of Biscay)	1.80	•	•
	Sole in Divisions VIII. g (Celtic Sea)	1.69	•	•
	Sole in Division VIIa (Irish Sea)	1.03	•	•
	Whiting in Division VIIe-k	0.83	•	•
	Blue ling (Molva dypterygia) in Subdivision Vb. and Subareas VI and VII	0.58	•	•
	Herring in Subareas I. II. V and Divisions IVa and XIVa (Norwegian spring-spawning herring)	0.98	•	•
	Hake in Division IIIa. Subareas IV. VI and VII and Divisions VIIIa.b.d (Northern stock)	1.56	•	•
	Horse mackerel (Trachurus trachurus) in Divisions IIa. IVa. Vb. VIIa-c. e-k. VIII (Western stock)	1.35	•	•
	Mackerel in the Northeast Atlantic (combined Southern. Western and North Sea spawning components)	0.87	•	•
	Roundnose grenadier (Coryphaenoides ruppenstris) in Subareas VI and VII. and Divisions Vb and XIIb	0.39	•	•
	Blue whiting in Subareas I-IX. XII and XIV (Combined stock)	0.54	•	•
Widely distributed				

6 Appendix A: Source code

6.1 Data loading and transformation

```
library(dplyr)
library(reshape2)
library(ggplot2)
theme_set(theme_bw())
library(knitr)
opts_chunk$set(echo=FALSE, message=FALSE, warning=FALSE, fig.width=5, fig.height=3, fig.pos='H')
library(xtable)
# SET UP relative data folder
ddir <- '../data/'

# so = ICES source stock assessment output database
so <- read.csv("../data/ices/20150223/StockAssessmentGraphs_2015223gbj1z5bakko2audzwbfskn.csv")

# sf = sampling frame
sf <- read.csv("../data/samplingFrame.csv")

# ne = Nephrops data
ne <- read.csv("../data/ices/20150227/nephrops.csv")
# HACK nep-13 to be split in a and b
ne$FishStock <- as.character(ne$FishStock)
ne$FishStock[ne$StockDescription == 'Nephrops in the Firth of Clyde (FU 13)'] <- "nep-13a"
ne$FishStock[ne$StockDescription == 'Nephrops in the Sound of Jura (FU 13)'] <- "nep-13b"

so <- rbind(so, ne)

# add ne
# spp, sppName, FishStock,
sfne <- ne[,c("SpeciesName", "SGName", "FishStock")]
names(sfne) <- c("spp", "sppName", "FishStock")
sfne$category <- 'D'
sfne$shared <- ""
sfne$TACunit <- ""
sfne$sftACind <- TRUE
sf <- rbind(sf, sfne[c(1,4,5,2,6,3,7)])

# meg
# me* = megrins
meg <- read.csv("../data/ices/20150227/megrin/meg-4a6a.csv")

megdf <- so[1:29,]
megdf[, 'FishStock'] <- "meg-4a6a"
megdf$AssessmentKey <- NA
megdf$AssessmentYear <- '2014'
megdf$Year <- meg$Year
megdf$StockDescription <- "Megrin (Lepidorhombus spp.) in Divisions IVa and VIa"
megdf$SpeciesName <- "Lepidorhombus"
megdf$SGName <- "Megrims"
megdf$Report <- "http://www.ices.dk/sites/pub/Publication%20Reports/Advice/2014/2014/meg-4a6a.pdf"
```



```

megdf[,c("Low_Recruitment", "Recruitment", "High_Recruitment", "Low_TBiomass", "High_TBiomass", "Low_SSI", "High_SSI", "UnitOfRecruitment")] <- 'NA'

megdf[,"TBiomass"] <- megdf$Biomass
megdf[,"Landings"] <- megdf$Landings
megdf[,"Catches"] <- megdf$Catch
megdf[,"Discards"] <- megdf$Discards

##
#megdf[,c("IBC", "Unallocated_Removals", "YieldSSB", "Low_F", "F", "High_F", "F_Landings", "F_Discards")]

so <- rbind(so, megdf)

# sf3 = sampling frame w/TAC
sf3 <- sf[sf$sfTACind,]
sf3 <- unique(sf3[,c("FishStock", "sfTACind", "category", "shared")])

# sr = stock regions
sr <- read.csv("../data/stocksRegions.csv")

# qa = with quantitative advice
qa <- read.csv("../data/qa.csv")
# EUwaters = ecoregions
EUwaters <- c("Baltic Sea Ecoregion",
             "Bay of Biscay and the Iberian Coast Ecoregion",
             "Celtic Seas Ecoregion", "Greater North Sea Ecoregion",
             "Widely distributed and migratory stocks", "Western European Waters")
# sampling frame for ToR 3: stock to be used for TAC indicator
sfTACind.n <- sum(sf3$sfTACind)
so <- merge(so, sf3, all=TRUE)
so$sfTACind[is.na(so$sfTACind)] <- FALSE

# Blim as Bref if Bpa doesn't exist
so$Bref <- so$Blim
so$Bref[!is.na(so$Bpa)] <- so$Bpa[!is.na(so$Bpa)]

# regions (merge BoB with CS) + external sfFind (by ken)
so <- merge(so, sr[,c("FishStock", "ICES.Book", "eurelevant")], all=TRUE)
so$reg <- as.character(so$ICES.Book)
so$reg[so$reg %in% c("Celtic Seas Ecoregion",
                  "Bay of Biscay and the Iberian Coast Ecoregion",
                  "Bay of Biscay and Iberian Sea")] <- "Western European Waters"

# escapement strategy
so <- merge(so, qa[,c("FishStock", "escapement")], all=TRUE)
so$escapement[is.na(so$escapement)] <- FALSE

# SUBSET
sa <- select(so, Year, FishStock, Landings, Catches, Discards, SSB, F, Bref,
            FMSY, sfTACind, reg, escapement, eurelevant, TypeStock)
names(sa) <- c("y", "stk", "L", "C", "D", "SSB", "F", "Bref", "Fref", "sfTACind",
             "reg", "escapement", "eurelevant", "type")

```

```

# COMPUTE F/Fref | year + FishStock
sa <- mutate(sa, indF = F / Fref, indB=SSB/Bref)

# ADD meg ratios
sa[sa$stk == "meg-4a6a",'F'] <- meg$F.FMSY
sa[sa$stk == "meg-4a6a",'Fref'] <- 1

sa[sa$stk == "meg-4a6a",'SSB'] <- meg$B.BMSY
sa[sa$stk == "meg-4a6a",'Bref'] <- 1

sa$indF[is.infinite(sa$indF)] <- NA
sa$indB[is.infinite(sa$indB)] <- NA

# in case of escapement strategy MSY evaluated by SSB ~ Blim/Bpa/etc
sa$indF[sa$escapement] <- sa$Bref[sa$escapement]/sa$SSB[sa$escapement]

# COMPUTE SBL | year + FishStock
sa$SBL <- apply(sa,1, function(x)
  !as.logical(sum(x["F"] > x["Fref"] | x["SSB"] < x["Bref"], na.rm=TRUE)))

# if both are NA SBL must be NA
sa$SBL[is.na(sa$indF) & is.na(sa$indB)] <- NA
# ToR 1.a (id quantitative assessments as those stocks that have F
# and Fmsy estimates in 2013 and not relative)
df0 <- subset(sa, y==2013)[,c("stk", "indF", "type")]
df0 <- transform(df0, qa = indF>0 & type!="Relative")
df0$qa[is.na(df0$qa)] <- FALSE
sa <- merge(sa, df0[,c("stk", "qa")])

# ToR 1.b (add to external definition those stocks that are relevant to the EU, external file)
sa <- transform(sa, eurelevant = as.logical(eurelevant))

# Find sampling frame
v0 <- with(sa, qa & eurelevant)
v0[is.na(v0)] <- FALSE
sa$sfFind <- v0

# remove some stocks
# cod-2532, FMSY estimate not used for advice
# nep-32:
# Nop-34-june: keep october SA
sa$sfFind[sa$stk %in% c("nep-32", "Nop-34-june", "cod-2532")] <- FALSE

# final table
samplingFrames <- unique(sa[,c("stk", "sfTACind", "sfFind")])

```

6.2 ToR 1

```

ggplot(sa[sa$sfFind,] %>% group_by(year=y) %>% summarise(stk=length(stk)),
  aes(x=year, y=stk)) + geom_line() + ylab("No. of stocks") + xlab("")

```

6.3 ToR 2

```
# remove some stocks and years
sf2 <- with(sa, sfFind & y >= 2003 & y < 2014)
```

6.3.1 ToR 2a

```
fInda <- rbind_list(
  # find by year
  sa[sf2,] %>% group_by(year=y) %>% summarise(Region='ALL', N=sum(indF>1, na.rm=TRUE)),
  # find by region
  sa[sf2,] %>% group_by(Region=reg, year=y) %>% summarise(N=sum(indF>1, na.rm=TRUE))

fInda$Region <- factor(fInda$Region, levels=sort(unique(fInda$Region)),
  labels=c('All', 'Baltic Sea', 'Greater North Sea', 'Western European',
  'Widely distributed'))

ggplot(filter(fInda, Region=='All'), aes(x=year, y=N)) + geom_line() +
  expand_limits(y=0) + geom_point(aes(x=2003, y=N[1])) +
  geom_point(aes(x=2013, y=N[length(N)]), size=2) +
  ylab("No. of stocks") + xlab("") + ylim(c(0,55))
ggplot(filter(fInda, Region != 'All'), aes(x=year, y=N)) + geom_line() +
  facet_wrap(~Region, scales='free') +
  ylab("No. of stocks") + xlab("") +
  scale_x_continuous(breaks = seq(2003, 2013, length=5)) + ylim(0, NA)
kable(dcast(filter(fInda, year > 2002), Region~year, value.var='N'),
  caption = "Number of stocks where fishing mortality ($F$) exceeds fishing mortality at MSY ($F_{MSY}$")
```

6.3.2 ToR 2b

```
fIndb <- rbind_list(
  # find by year
  sa[sf2,] %>% group_by(year=y) %>% summarise(Region='ALL',
  N=sum(indF<=1, na.rm=TRUE)),
  # find by region
  sa[sf2,] %>% group_by(Region=reg, year=y) %>% summarise(N=sum(indF<=1,
  na.rm=TRUE)))

fIndb$Region <- factor(fInda$Region, levels=sort(unique(fInda$Region)),
  labels=c('All', 'Baltic Sea', 'Greater North Sea', 'Western European',
  'Widely distributed'))

ggplot(filter(fIndb, Region=='All'), aes(x=year, y=N)) + geom_line() +
  expand_limits(y=0) + geom_point(aes(x=2003, y=N[1])) +
  geom_point(aes(x=2013, y=N[length(N)]), size=2) +
  ylab("No. of stocks") + xlab("") + ylim(c(0,55))
ggplot(filter(fIndb, Region != 'All'), aes(x=year, y=N)) + geom_line() +
  facet_wrap(~Region, scales='free') +
  ylab("No. of stocks") + xlab("") +
```

```

scale_x_continuous(breaks = seq(2003, 2013, length=5)) + ylim(0, NA)
kable(dcast(filter(fIndb, year > 2002), Region~year, value.var='N'),
caption = "Number of stocks where fishing mortality ($F$) does not exceed fishing mortality at MSY ($F_{MSY}$)")

```

6.3.3 ToR 2c

```

fIndc <- rbind_list(
  # find by year
  sa[sf2,] %>% group_by(year=y) %>% summarise(Region='ALL',
    N=sum(!SBL, na.rm=TRUE)),
  # find by region
  sa[sf2,] %>% group_by(Region=reg, year=y) %>% summarise(N=sum(!SBL,
    na.rm=TRUE)))

fIndc$Region <- factor(fInda$Region, levels=sort(unique(fInda$Region)),
  labels=c('All', 'Baltic Sea', 'Greater North Sea', 'Western European',
  'Widely distributed'))

ggplot(filter(fIndc, Region=='All'), aes(x=year, y=N)) + geom_line() +
  expand_limits(y=0) + geom_point(aes(x=2003, y=N[1])) +
  geom_point(aes(x=2013, y=N[length(N)]), size=2) +
  ylab("No. of stocks") + xlab("") + ylim(c(0,55))
ggplot(filter(fIndc, Region != 'All'), aes(x=year, y=N)) + geom_line() +
  facet_wrap(~Region, scales='free') +
  ylab("No. of stocks") + xlab("") +
  scale_x_continuous(breaks = seq(2003, 2013, length=5)) + ylim(0, NA)
kable(dcast(filter(fIndc, year > 2002), Region~year, value.var='N'),
caption = "Number of stocks outside safe biological limits by region and for the whole ICES area. On")

```

6.3.4 ToR 2d

```

fIndd <- rbind_list(
  # find by year
  sa[sf2,] %>% group_by(year=y) %>% summarise(Region='ALL',
    N=sum(SBL, na.rm=TRUE)),
  # find by region
  sa[sf2,] %>% group_by(Region=reg, year=y) %>% summarise(N=sum(SBL,
    na.rm=TRUE)))

fIndd$Region <- factor(fInda$Region, levels=sort(unique(fInda$Region)),
  labels=c('All', 'Baltic Sea', 'Greater North Sea', 'Western European',
  'Widely distributed'))

ggplot(filter(fIndd, Region=='All'), aes(x=year, y=N)) + geom_line() +
  expand_limits(y=0) + geom_point(aes(x=2003, y=N[1])) +
  geom_point(aes(x=2013, y=N[length(N)]), size=2) +
  ylab("No. of stocks") + xlab("") + ylim(c(0,55))
ggplot(filter(fIndd, Region != 'All'), aes(x=year, y=N)) + geom_line() +
  facet_wrap(~Region, scales='free') +

```

```

ylab("No. of stocks") + xlab("") +
scale_x_continuous(breaks = seq(2003, 2013, length=5)) + ylim(0, NA)
kable(dcast(filter(fIndd, year > 2002), Region~year, value.var='N'),
caption = "Number of stocks inside safe biological limits by region and for the whole ICES area. Insi

```

6.3.5 ToR 2e

```

idx <- seq(1, dim(sa)[1]) %in% grep("nep-*", sa$stk, invert=TRUE)
fInde <- rbind_list(
  # find by year
  sa[sf2 & !sa$escapement & idx,] %>% group_by(year=y) %>% summarise(Region='ALL',
    F=mean(indF, na.rm=TRUE)),
  # find by region
  sa[sf2 & !sa$escapement & idx,] %>% group_by(Region=reg,
    year=y) %>% summarise(F=mean(indF, na.rm=TRUE)))

fInde$Region <- factor(fInde$Region, levels=sort(unique(fInde$Region)),
  labels=c('All', 'Baltic Sea', 'Greater North Sea', 'Western European',
    'Widely distributed'))

ggplot(filter(fInde, Region=='All'), aes(x=year, y=F)) + geom_line() +
  expand_limits(y=0) + geom_point(aes(x=2003, y=F[1])) +
  geom_point(aes(x=2013, y=F[length(F)]), size=2) +
  ylab(expression(F/F[MSY])) + xlab("")
ggplot(filter(fInde, Region != 'All'), aes(x=year, y=F)) + geom_line() +
  facet_wrap(~Region) +
  ylab(expression(F/F[MSY])) + xlab("") +
  geom_hline(aes(yintercept=1), linetype=2) +
  scale_x_continuous(breaks = seq(2003, 2013, length=5))
kable(dcast(filter(fInde, year > 2002), Region~year, value.var='F'), digits=2,
caption = "Arithmetic mean value of the  $F/F_{MSY}$  ratio by year and region.")

```

6.4 ToR 3

```

sf3 <- with(sa, sfTACind & y == 2013)

with(sa[sf3,], tapply(indF, y, function(x) sum(!is.na(x))))
round(with(sa[sf3,], tapply(indF, y, function(x) sum(!is.na(x))/sfTACind.n)), 2)

with(sa[sf3,], tapply(SBL, y, function(x) sum(!is.na(x))))
round(with(sa[sf3,], tapply(SBL, y, function(x) sum(!is.na(x))/sfTACind.n)), 2)

```

6.5 Stock table

```

# indF>1, SBL, indF
dat <- sa[sf2,] %>% filter(y==2013) %>% select(c(reg, stk, indF, SBL))

```

```

tab <- merge(dat, unique(so[,c(1, 5)]), by.x="stk", by.y='FishStock')
tab$Flim <- ifelse(tab$indF<=1, '$\\bullet$', "")
tab$SBL <- ifelse(tab$SBL, '$\\bullet$', "")
tab <- tab[, c(2,5,3,6,4)]

tab <- tab[order(tab$reg),]
tab[duplicated(tab$reg),'reg'] <- ""
tab$reg <- factor(tab$reg, labels=c('', 'Baltic Sea', 'Greater North Sea', 'Western European',
  'Widely distributed'))

names(tab) <- c("Region", "Stock", "F ind", "F status", "SBL")
#tab <- xtable(tab, caption="Stock status for all stocks in the sampling frame in 2013. Columns refer t
tab <- xtable(tab)

addtorow <- list()
addtorow$pos <- list()
addtorow$pos[[1]] <- c(0)
addtorow$command <- c(paste("\\hline \n",
  "\\endhead \n",
  "\\hline \n",
  "{\\footnotesize Continued on next page} \n",
  "\\endfoot \n",
  "\\endlastfoot \n",sep=""))

print(tab, type='latex', include.rownames=FALSE, floating=FALSE, floating.environment='longtable',
  tabular.environment="longtable", booktabs=TRUE, sanitize.text.function=function(x){x},
  comment=FALSE, add.to.row = addtorow)

```

7 Appendix B: Stocks in ICES dataset

Stock code	Stock name
anb-8c9a	Black-bellied anglerfish (<i>Lophius budegassa</i>) in Divisions VIIIc and IXa
ane-bisc	Anchovy in Subarea VIII (Bay of Biscay)
anp-8c9a	White anglerfish (<i>Lophius piscatorius</i>) in Divisions VIIIc and IXa
bli-5b67	Blue ling (<i>Molva dypterygia</i>) in Subdivision Vb. and Subareas VI and VII
boc-nea	Boarfish in the Northeast Atlantic
bss-47	European seabass in Divisions IVbc.VIIa and VIId-h (Irish Sea. English Channel and southern North Sea)
cap-icel	Capelin in Subareas V. XIV and Division IIa west of 5°W (Iceland-East Greenland-Jan Mayen area)
cod-2224	Cod in Subdivisions 22-24 (Western Baltic Sea)
cod-347d	Cod in Subarea IV (North Sea). Division VIId (Eastern Channel) and IIIa West (Skagerrak)
cod-7e-k	Cod in Divisions VIIe-k (Celtic Sea cod)
cod-arct	Cod in Subareas I and II (Northeast Arctic cod)
cod-farp	Cod in Subdivision Vb1 (Faroe Plateau)
cod-iceg	Cod in Division Va (Icelandic cod)
cod-iris	Cod in Division VIIa (Irish Sea)
cod-scow	Cod in Division VIa (West of Scotland)
had-346a	Haddock in Subarea IV and Divisions IIIa West and VIa (North Sea. Skagerrak and West of Scotland)
had-7b-k	Haddock in Divisions VIIb.c.e-k
had-arct	Haddock in Subareas I and II (Northeast Arctic)
had-faro	Haddock in Division Vb
had-iceg	Haddock in Division Va (Icelandic haddock)
had-iris	Haddock in Division VIIa (Irish Sea)
had-rock	Haddock in Division VIb (Rockall)
her-2532-gor	Herring in Subdivisions 25 - 29 (excluding Gulf of Riga) and 32
her-30	Herring in Subdivision 30 (Bothnian Sea)
her-31	Herring in Subdivision 31 (Bothnian Bay)
her-3a22	Herring in Division IIIa and Subdivisions 22 - 24 (Western Baltic spring spawners)
her-47d3	Herring in Subarea IV and Divisions IIIa and VIId (North Sea autumn spawners)
her-irls	Herring in Division VIIa South of 52° 30' N and VIIg.h.j.k (Celtic Sea and South of Ireland)
her-irlw	Herring in Divisions VIa (South) and VIIb.c
her-nirs	Herring in Division VIIa North of 52° 30' N (Irish Sea)
her-noss	Herring in Subareas I. II. V and Divisions IVa and XIVa (Norwegian spring-spawning herring)
her-riga	Herring in Subdivision 28.1 (Gulf of Riga)
her-vasu	Herring in Division Va (Icelandic summer-spawners)
her-vian	Herring in Division VIa (North)
hke-nrtn	Hake in Division IIIa. Subareas IV. VI and VII and Divisions VIIa.b.d (Northern stock)
hke-soth	Hake in Division VIIIc and IXa (Southern stock)
hom-soth	Horse mackerel (<i>Trachurus trachurus</i>) in Division IXa (Southern stock)
hom-west	Horse mackerel (<i>Trachurus trachurus</i>) in Divisions IIa. IVa. Vb. VIa. VIIa-c. e-k. VIII (Western stock)
lin-icel	Ling (<i>Molva molva</i>) in Division Va
mac-nea	Mackerel in the Northeast Atlantic (combined Southern. Western and North Sea spawning components)
meg-4a6a	Megrim (<i>Lepidorhombus</i> spp.) in Divisions IVa and VIa

Stock code	Stock name
mgb-8c9a	Four-spot megrim (<i>Lepidorhombus boscii</i>) in Divisions VIIIc and IXa
mgw-78	Megrim (<i>Lepidorhombus whiffiagonis</i>) in Divisions VIIb-k and VIIa.b.d
mgw-8c9a	Megrim (<i>Lepidorhombus whiffiagonis</i>) in Divisions VIIIc and IXa
nep-11	Nephrops in North Minch (FU 11)
nep-12	Nephrops in South Minch (FU 12)
nep-13a	Nephrops in the Firth of Clyde (FU 13)
nep-13b	Nephrops in the Sound of Jura (FU 13)
nep-14	Nephrops in Irish Sea East (FU 14)
nep-15	Nephrops in Irish Sea West (FU 15)
nep-16	Nephrops on Porcupine Bank (FU 16)
nep-17	Nephrops on the Aran Grounds (FU 17)
nep-19	Nephrops off the southeastern and southwestern coasts of Ireland (FU 19)
nep-22	Nephrops in the Smalls (FU 22)
nep-3	Nephrops in Division IIIa
nep-6	Nephrops in Farn Deep (FU 6)
nep-7	Nephrops in Fladen Ground (FU 7)
nep-8	Nephrops in Firth of Forth (FU 8)
nep-9	Nephrops in Moray Firth (FU 9)
Nop-34-june	Norway Pout in Subarea IV (North Sea) and IIIa (Skagerrak - Kattegat) - Summer assessment
nop-34-oct	Norway Pout in Subarea IV (North Sea) and IIIa (Skagerrak - Kattegat) - Autumn assessment
pan-barn	Northern shrimp (<i>Pandalus borealis</i>) in Subareas I and II (Barents Sea)
pan-sknd	Northern shrimp (<i>Pandalus borealis</i>) in Divisions IIIa West and IVa East (Skagerrak and Norwegian Deep)
ple-2123	Plaice in Subdivisions 21, 22, and 23 (Kattegat, Belts, and Sound)
ple-7h-k	Plaice in Divisions VIIh-k (Southwest of Ireland)
ple-celt	Plaice in Divisions VIIf, g (Celtic Sea)
ple-eche	Plaice in Division VIId (Eastern Channel)
ple-echw	Plaice in Division VIIe (Western Channel)
ple-iris	Plaice in Division VIIa (Irish Sea)
ple-nsea	Plaice Subarea IV (North Sea)
rng-5b67	Roundnose grenadier (<i>Coryphaenoides rupestris</i>) in Subareas VI and VII, and Divisions Vb and XIIb
sai-3a46	Saithe in Subarea IV (North Sea) Division IIIa West (Skagerrak) and Subarea VI (West of Scotland and Rockall)
sai-arct	Saithe in Subareas I and II (Northeast Arctic)
sai-faro	Saithe in Division Vb (Faroe Saithe)
sai-icel	Saithe in Division Va (Icelandic saithe)
san-ns1	Sandeel in the Dogger Bank area (SA 1)
san-ns2	Sandeel in the South Eastern North Sea (SA 2)
san-ns3	Sandeel in the Central Eastern North Sea (SA 3)
sar-soth	Sardine in Divisions VIIIc and IXa
smr-5614	Golden Redfish (<i>Sebastes norvegicus</i>) in Subareas V, VI, XII and XIV
sol-7h-k	Sole in Divisions VIIh-k (Southwest of Ireland)
sol-bisc	Sole in Divisions VIIa.b (Bay of Biscay)
sol-celt	Sole in Divisions VIIf, g (Celtic Sea)
sol-eche	Sole in Division VIId (Eastern Channel)
sol-echw	Sole in Division VIIe (Western Channel)
sol-iris	Sole in Division VIIa (Irish Sea)
sol-kask	Sole in Division IIIa and Subdivisions 22-24 (Skagerrak, Kattegat, and the Belts)
sol-nsea	Sole in Subarea IV (North Sea)

Stock code	Stock name
spr-2232	Sprat in Subdivisions 22 - 32 (Baltic Sea)
spr-nsea	Sprat in Subarea IV (North Sea)
tur-nsea	Turbot in Subarea IV
usk-icel	Tusk in Division Va and Subarea XIV
whb-comb	Blue whiting in Subareas I-IX, XII and XIV (Combined stock)
whg-47d	Whiting Subarea IV (North Sea) and Division VIIId (Eastern Channel)
whg-7e-k	Whiting in Division VIIe-k
whg-scow	Whiting in Division VIa (West of Scotland)

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