

EU request to provide the F_{MSY} range for whiting in Subarea 4 and Division 7.d (North Sea and eastern English Channel)

Advice summary

ICES advises that the precautionary range of F_{MSY} values for whiting in Subarea 4 and Division 7.d (North Sea and eastern English Channel) goes from an $F_{MSY\ lower}$ of 0.140 to $F_{MSY\ upper}$ of 0.150. The current F_{MSY} is 0.150.

Request

ICES is requested to provide plausible values around F_{MSY} (range for F_{MSY}) for whiting in Subarea 4 and Division 7.d (North Sea and eastern English Channel).

Elaboration on the advice

The F_{MSY} ranges ($F_{MSY\ lower}$, $F_{MSY\ upper}$) are derived to deliver no more than a 5% reduction in long-term yield compared with the maximum sustainable yield (MSY). This approach has previously been applied in the ICES advice on MSY ranges for stocks in the Baltic Sea and North Sea (ICES, 2015a) and in EU Western waters (ICES, 2016a).

To be consistent with the ICES precautionary approach, $F_{MSY\ upper}$ is capped, so that the probability of the spawning–stock biomass (SSB) $< B_{lim}$ is no more than 5%. To derive the value of the cap on $F_{MSY\ upper}$, the ICES MSY advice rule (AR) is used, which requires a linear reduction of F towards zero when SSB is below MSY $B_{trigger}$. In this case, the probability of no more than 5% that SSB $< B_{lim}$ capped both the F_{MSY} and $F_{MSY\ upper}$.

As a result, the F_{MSY} range for whiting in Subarea 4 and Division 7.d (North Sea and eastern English Channel) spans from an $F_{MSY\ lower}$ of 0.140 to an $F_{MSY\ upper}$ of 0.150, with the current $F_{MSY} = 0.150$.

The evaluation is based on long-term yield and is adequate to estimate F_{MSY} under current biological conditions of growth, maturity, recruitment, and natural mortality. As the environment changes and species adapt, the values may need to be revised to reflect changing conditions. Exploitation pattern is based on estimates from recent years.

It should be noted that: (1) yield will fluctuate around an average, and (2) the estimated average yield is based on single-species considerations and may not hold in an ecosystem context.

Basis of the advice

Background

The EU institutions are currently negotiating a long-term management plan for the demersal fisheries in the North Sea. According to Art. 10 of Regulation (EU) 1380/2013 on the Common Fisheries Policy (EU, 2013), a multiannual plan shall include quantifiable targets, a time frame to reach the targets, and safeguards to ensure that the quantifiable targets are met. F_{MSY} ranges are required for key stocks in these demersal fisheries, including whiting, as part of these management plans.

Whiting has recently undergone an inter-benchmark process (ICES, 2016b) which tested the impact of updated estimates of natural mortality (from multi-species analysis) on the whiting assessment, and whether the management strategy used previously for advice was precautionary. New reference points were estimated at this inter-benchmark using EqSim, the standard ICES software for estimating reference points. In order to fulfil this request, the F_{MSY} range had to be extracted from the aforementioned analysis, following ICES guidelines.

Results and conclusions

Analyses using EqSim without the ICES advice rule were used to produce the initial F_{MSY} and F_{MSY} range ($F_{MSY\ lower}$ and $F_{MSY\ upper}$). The initial estimate of F_{MSY} exceeded F_{pa} (0.28), so F_{MSY} was capped at F_{pa} .

Using B_{pa} as MSY $B_{trigger}$ and the advice rule that includes MSY $B_{trigger}$, F_{MSY} and the F_{MSY} range were estimated and compared to $F_{P,0.5}$. Because $F_{P,0.5}$ (0.150) was below both the $F_{MSY upper}$ and F_{MSY} (capped at F_{pa}), and no values in the F_{MSY} range can exceed $F_{P,0.5}$, $F_{MSY upper}$ and F_{MSY} were both capped by $F_{P,0.5}$.

Following the guidelines of WKMSYREF4 (ICES, 2015b), $F_{MSY lower}$ was redefined as the lower fishing mortality providing 95% of the yield at $F_{P,0.5}$ ($F_{P,0.5 lower}$). The F_{MSY} range is given in Table 1.

Table 1 F_{MSY} range.

Reference point	Value	Technical basis
$F_{MSY lower}$	0.140	$F_{P,0.5 lower}$ (EqSim)
$F_{MSY upper}$	0.150	$F_{P,0.5}$ with advice rule (EqSim)

Methods

An EqSim analysis was conducted for North Sea whiting following the same protocol set up by WKMSYREF4 (ICES, 2015b). Settings used were as follows (ICES, 2016b):

- Recruitment: short time-series (2004–2014). The short time-series only includes recent recruitment that appears to be at a consistently lower level than in the period prior to 2004. This short time-series is currently considered more likely to represent recruitment in the medium-term future. The underlying recruitment model was assumed to be a segmented regression with the breakpoint at 172 741 tonnes = $B_{lim} = B_{loss}$ (SSB in 2007 in the 2016 assessment).
- Assessment and advice error: this is characterized by a CV ($F_{cv} = 0.212$) and autocorrelation ($F_{phi} = 0.423$). These values are default values (ICES, 2014; 2015b).
- MSY $B_{trigger}$ was set to $B_{pa} = B_{lim} \times \exp(1.645 \times 0.2) \approx 1.4 \times B_{lim}$.
- Values up to the lower 5th percentile of the stochastic recruitment were not used in the simulation.
- Exploitation pattern, together with other biological parameters (mean weights, maturity and natural mortality) were resampled with replacement from the ten most recent years (2005–2014).

The estimates originally produced at the inter-benchmark are given in Table 2.

Table 2 Reference points, values, and their technical basis, from the inter-benchmark (ICES, 2016b).

Framework	Reference point	Value	Technical basis
MSY approach	MSY $B_{trigger}$	241 837 t	B_{pa}
	F_{MSY}	0.150	EqSim analysis based on recruitment period 2004–2014 (= $F_{P,0.5}$ with advice rule)
Precautionary approach	B_{lim}	172 741 t	B_{loss} (SSB in 2007, as estimated in the 2016 assessment)
	B_{pa}	241 837 t	$B_{lim} \times \exp(1.645 \times 0.2) \approx 1.4 \times B_{lim}$
	F_{lim}	0.39	EqSim analysis based on recruitment period 2004–2014
	F_{pa}	0.28	$F_{lim} \times \exp(-1.645 \times 0.2) \approx F_{lim} \div 1.4$

Sources and references

EU. 2013. EU Regulation No. 1380/2013 of the European Parliament and of the Council of 11 December 2013 on the Common Fisheries Policy, amending Council Regulations (EC) No 1954/2003 and (EC) No 1224/2009 and repealing Council Regulations (EC) No 2371/2002 and (EC) No 639/2004 and Council Decision 2004/585/EC. Official Journal of the European Union, L 354/22. 40 pp. <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32013R1380&from=EN>.

ICES. 2014. Report of the Joint ICES–MYFISH Workshop to consider the basis for F_{MSY} ranges for all stocks (WKMSYREF3), 17–21 November 2014, Charlottenlund, Denmark. ICES CM 2014/ACOM:64. 147 pp.

ICES. 2015a. EU request to ICES to provide F_{MSY} ranges for selected North Sea and Baltic Sea stocks. In Report of the ICES Advisory Committee, 2015. ICES Advice 2015, Section 6.2.3.1.

ICES. 2015b. Report of the Workshop to consider F_{MSY} ranges for stocks in ICES categories 1 and 2 in Western Waters (WKMSYREF4), 13–16 October 2015, Brest, France. ICES CM 2015/ACOM:58: 183 pp.

ICES. 2016a. EU request to ICES to provide F_{MSY} ranges for selected stocks in ICES subareas 5 to 10. In Report of the ICES Advisory Committee, 2016. ICES Advice 2016, Section 5.4.1.

ICES. 2016b. Report of the Inter-Benchmark Protocol for Whiting in the North Sea (IBP Whiting), By correspondence, March 2016. ICES CM 2016/ACOM:48: 119 pp.

Annex

Figures for EqSim results

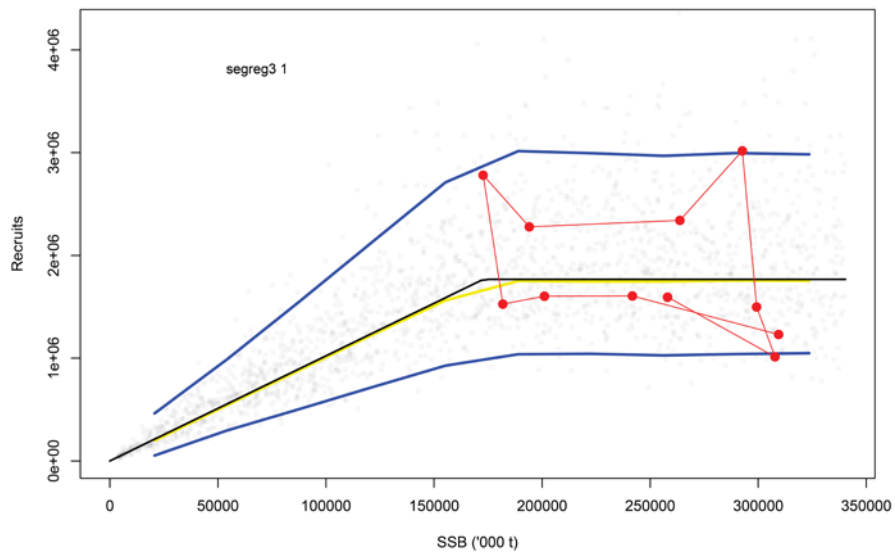


Figure 1 Stock–recruitment relationship for the recruitment period 2004–2014 used in EqSim. Segmented regression with breakpoint $B_{lim} = B_{loss} = 172\,741$ tonnes.

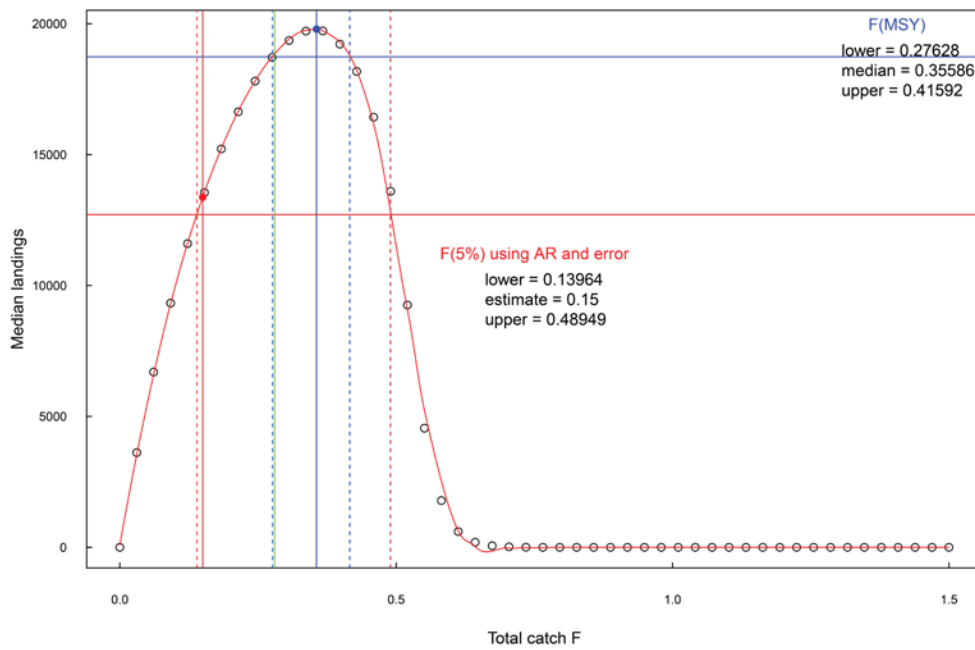


Figure 2 Median yield curve that includes error, but no advice rule. Estimates (vertical solid lines) with upper and lower ranges (vertical dashed lines) are shown for the initial calculation of F_{MSY} in blue and $F(5\%) = F_{P,0.5}$ in red. $F_{pa} = 0.28$ is indicated in green. The solid circles indicate the median yield from the initial F_{MSY} (uncapped; blue) and $F_{P,0.5}$ (red). The horizontal lines are 95% of these values and where the lines intersect the yield curve gives the upper and lower range of F_{MSY} (uncapped) and $F_{P,0.5}$. The advised F_{MSY} and $F_{MSY upper}$ are represented by the solid vertical red line and the $F_{MSY lower}$ is represented by the left-most dashed vertical red line. Note that the $F_{P,0.5}$ estimate includes both error and the advice rule, but the corresponding range is based on the median yield curve shown that includes error, but not the advice rule.