

EU standing request on catch scenarios for zero-TAC stocks; cod (*Gadus morhua*) in divisions 7.e–k (Celtic Sea)

Service summary

Cod (*Gadus morhua*) in divisions 7.e–k is a target species in the EU multiannual management plan (EU MAP; EU, 2019). The zero-catch advice provided by ICES for this stock is based on precautionary considerations. The mixed-fisheries analysis shows that cod is caught in most mixed fisheries in the Celtic Sea with other species for which non-zero catches are advised. The present technical service provides illustrative catch scenarios consistent with the lower F_{MSY} range for haddock and the reduced F_{MSY} advised for whiting as detailed below.

For cod in divisions 7.e–k:

- 1498 tonnes are estimated to be caught when haddock is fished at F_{MSY} ; this would result in a cod spawning-stock biomass (SSB) of 1262 tonnes in 2023;
- 1109 tonnes are estimated to be caught when haddock is fished at $F_{MSY \text{ lower}}$; this would result in a cod SSB of 1812 tonnes in 2023;
- 1321 tonnes are estimated to be caught when haddock is fished midway between F_{MSY} and $F_{MSY \text{ lower}}$; this would result in a cod SSB of 1509 tonnes in 2023;
- 814 tonnes are estimated to be caught when whiting is fished at the reduced F_{MSY} advised (i.e. $F_{MSY} \times SSB_{2021}/MSY_{Btrigger}$); this would result in a cod SSB of 2242 tonnes in 2023.

The haddock $F_{MSY \text{ lower}} - F_{MSY}$, haddock $F_{MSY \text{ lower}}$ and whiting reduced F_{MSY} scenarios result in an increase in cod SSB relative to 2022 (1354 tonnes). All scenarios result in an SSB below B_{lim} (4200 tonnes) in 2023.

It is not possible to provide catch scenarios that include changes in the fishing pattern. The above scenarios assume a fixed fishing pattern in 2022 [based on average (2018–2020)]. Future changes in the fishing pattern depend on management measures and the response of the fishery, which cannot be predicted by ICES.

Since cod are bycaught in mixed fisheries, a specific monitoring TAC would likely not be required for this stock.

Request

EU DGMARE has requested ICES to evaluate the following:

For by-catch and for target stocks where ICES is advising zero TACs, but the stock is caught in demersal mixed-fisheries with other species where non-zero catches are advised, where possible ICES will provide the EU with illustrative catch scenarios that are consistent with the advice for the main target species in the fishery. This may involve carrying out mixed fisheries forecast or providing F -multipliers consistent with the advice for the target stocks or where forecasts are not possible the catch scenario should be based the best available scientific information.

Where the zero TAC advice is given for a target stock subject to a MAP the catch scenarios for the zero TAC stock should include scenarios consistent the F_{MSY} range in the target stock (e.g., F_{MSY} , $F_{MSY \text{ Lower}}$ and intermediate values) and quantify the corresponding changes in biomass. Where possible, F scenarios that give, a stable biomass and increasing biomass (if F_{MSY} ranges do not) should also be provided.

Where possible ICES should provide catch scenarios which include changes in fishing pattern if they considered likely by ICES.

For stocks which are typically not caught in mixed fisheries (e.g., herring) but where ICES is advising zero TACs and where a monitoring fishery would be useful to monitor stock development, where possible ICES will provide catch scenarios for a monitoring TAC. This should be the minimum level of catches needed to provide sufficient data for ICES to continue providing scientific advice on the state of this stock.

Basis of the advice

This technical service was completed using ICES data sources and, where available, the results of both single-species and mixed-fisheries forecasts.

In the operational mixed-fisheries model for cod.27.7e–k, the catch of cod in 2022 and SSB in 2023 were explored under different F scenarios for the target stocks taking account of mixed fisheries technical interactions. This model assumes that fishing patterns remain fixed in 2022, and changes in selectivity are not explicitly modelled.

To explore the impact of fishing haddock at F_{MSY} , $F_{MSY \text{ lower}}$, and an intermediate value and fishing whiting at the reduced F_{MSY} a number of additional mixed-fisheries scenarios were carried out. These are explained in Table 1.

Table 1 Mixed-fisheries scenarios considered for this request.

Scenarios	Explanation
Haddock F_{MSY}	All fleets set their effort corresponding to that which is required to catch their haddock stock share ($F = 0.353$), regardless of other catches. Note: this scenario differs from the “Haddock MSY approach” scenario presented in the mixed fisheries advice sheet which results in an $F = 0.374$ in 2022
Haddock $F_{MSY \text{ lower}}$	All fleets set their effort corresponding to that which is required to catch their haddock stock share, where the haddock TAC is set according to the EU MAP $F_{MSY \text{ lower}}$ ($F = 0.221$), regardless of other catches.
Haddock $F_{MSY \text{ lower}} - F_{MSY}$	All fleets set their effort corresponding to that which is required to catch their haddock stock share, where the haddock TAC is set according to the intermediate point ($F = 0.0287$) between $F_{MSY \text{ lower}}$ ($F = 0.221$) and F_{MSY} ($F = 0.353$), regardless of other catches.
Whiting reduced F_{MSY}	All fleets set their effort corresponding to that required to catch their whiting stock share ($F = 0.228 = F_{MSY} \times SSB_{2022} / MSY_{B_{trigger}}$), regardless of other catches.

Results

When considering the mixed-fisheries technical interactions in the Celtic Sea, cod, haddock, and whiting are closely linked in demersal mixed fisheries. Those catch scenarios with haddock as the main target species are considered the most relevant for Celtic Sea cod. The whiting reduced F_{MSY} scenario is more restrictive than the haddock $F_{MSY \text{ Lower}}$ scenario.

The forecasted projections from these scenarios result in different catch advice for catching cod (cod.27.7e–k), haddock (had.27.7b–k), whiting (whg.27.7b–ce–k), Norway lobster (FUs 16, 17, 19, 20–21, 22, and outside FUs), sole (sol.27.7fg), white anglerfish (*Lophius piscatorius*, mon.27.78abd), and megrim (*Lepidorhombus whiffiagonis*, meg.27.7b–k8abd); these vary to differing degrees from the single-species stock advice (Table 2). The resulting SSB in 2023, for the different species under the different scenarios, is shown in Table 3, and the projected fishing mortality in 2022 is shown in Table 4.

Quality considerations

The intermediate year (2021) assumptions for the single stock advice for some stocks differs with the mixed-fisheries scenarios where the intermediate year assumption used status quo fishing effort (average 2018–2020). This leads to slightly different projections of catch in 2022 and SSB in 2023 with the same fishing mortality for haddock and whiting in particular.

Table 2 Mixed-fisheries advice in the Celtic Sea. Catch (in tonnes) by stock for requested mixed-fisheries scenario 2022, in absolute values.

Stock	Single-stock catch advice (2022)	Catch per mixed-fisheries scenario (2022)			
		Haddock F_{MSY}	Haddock $F_{MSY \text{ lower}}$	Haddock $F_{MSY \text{ lower}} - F_{MSY}$	Whiting F_{MSY}
cod.27.7e-k	0	1498	1109	1321	814
had.27.7b-k	15946	15166	10053	12671	6979
meg.27.7b-k8abd	22964	19907	14856	17407	12121
mon.27.78abd	34275	28513	20489	24566	15389
sol.27.7fg	1337	570	363	467	303
whg.27.7b-ce-k	4452	8813	5992	7463	4167
nep.fu.16	2804	2050	1284	1667	849
nep.fu.17	360	183	115	149	80
nep.fu.19	407	220	138	179	100
nep.fu.2021	1978	1774	1111	1443	839
nep.fu.22	1257	1285	804	1045	565
nep.out.7	150	134	84	109	59

Table 3 Mixed-fisheries advice in the Celtic Sea. Spawning-stock biomass (in tonnes) by stock for requested mixed-fisheries scenario 2023, in absolute values.

Stock	Single-stock advice SSB (2023)	Spawning-stock biomass (2023)			
		Haddock F_{MSY}	Haddock $F_{MSY \text{ lower}}$	Haddock $F_{MSY \text{ lower}} - F_{MSY}$	Whiting F_{MSY}
cod.27.7e-k	3449	1262	1812	1509	2242
had.27.7b-k	56747	55101	60639	57785	63977
meg.27.7b-k8abd	138512	148089	153417	150725	156305
mon.27.78abd	82203	85773	91363	88519	94934
sol.27.7fg	5719	6552	6770	6660	6834
whg.27.7b-ce-k	37372	32924	35249	34025	36791

Legend

	SSB ₂₀₂₃ > B _{pa} or MSY B _{trigger}
	SSB ₂₀₂₃ > B _{iim} , no B _{pa} defined
	SSB ₂₀₂₃ > B _{iim} , < B _{pa}
	SSB ₂₀₂₃ < B _{iim}

Table 4 Mixed-fisheries advice in the Celtic Sea. Fishing mortality in 2022 by stock for requested mixed-fisheries scenarios in absolute values.

Stock	Single-stock F advice (2022)	Fishing mortality per mixed-fisheries scenario (2022)			Whiting F_{MSY}
		Haddock F_{MSY}	Haddock $F_{MSY\ lower}$	Haddock $F_{MSY\ lower} - F_{MSY}$	
cod.27.7e-k	0.000	1.174	0.74	0.957	0.493
had.27.7b-k	0.353	0.353	0.221	0.287	0.149
meg.27.7b-k8abd	0.191	0.159	0.116	0.138	0.094
mon.27.78abd	0.28	0.229	0.16	0.194	0.118
sol.27.7fg	0.251	0.099	0.062	0.08	0.051
whg.27.7b-ce-k	0.228	0.549	0.344	0.447	0.228
nep.fu.16	0.062	0.045	0.028	0.037	0.019
nep.fu.17	0.052	0.028	0.017	0.022	0.012
nep.fu.19	0.058	0.036	0.022	0.029	0.016
nep.fu.2021	0.06	0.057	0.036	0.046	0.027
nep.fu.22	0.085	0.092	0.058	0.075	0.04

Legend	
	$F_{2022} \leq F_{MSY}$
	$F_{2022} > F_{MSY}, < F_{pa}$
	$F_{2022} > F_{pa}, < F_{lim}$
	$F_{2022} > F_{lim}$

Sources and references

EU. 2019. Regulation (EU) 2019/472 of the European Parliament and of the Council of 19 March 2019 establishing a multiannual plan for stocks fished in the Western Waters and adjacent waters, and for fisheries exploiting those stocks, amending Regulations (EU) 2016/1139 and (EU) 2018/973, and repealing Council Regulations (EC) No 811/2004, (EC) No 2166/2005, (EC) No 388/2006, (EC) No 509/2007 and (EC) No 1300/2008. Official Journal of the European Union, L 83: 1–17. <http://data.europa.eu/eli/reg/2019/472/oj>.

ICES. 2021. Celtic Seas ecoregion – Fisheries overview. In Report of the ICES Advisory Committee, 2021. ICES Advice 2021, Section 7.2. <https://doi.org/10.17895/ices.advice.9098>.

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