

Cod (*Gadus morhua*) in subdivisions 22–24, western Baltic stock (western Baltic Sea)

ICES advice on fishing opportunities

ICES advises that when the EU multiannual plan (MAP) is applied, total catches in 2020 that correspond to the F ranges in the plan are between 5205 tonnes and 11006 tonnes. According to the MAP, catches higher than those corresponding to F_{MSY} (7245 tonnes) can only be taken under conditions specified in the MAP, whilst the entire range is considered precautionary when applying the ICES advice rule. Assuming recreational catches at recent average this implies commercial catches between 3065 tonnes and 5105 tonnes.

Stock development over time

The spawning-stock biomass (SSB) has been fluctuating around the limit reference point (B_{Lim}) since 2009, but has increased in the last two years and is presently above B_{Lim} and close to $MSY B_{trigger}$. The fishing mortality (F) is above F_{MSY} , although a large decrease in F has occurred in later years. Recruitment (R) has been low since 1999; recruitment in 2017 (the 2016 year class) is estimated to be above average in this period. The recruitments in 2018 and 2019 (age 1) are the lowest in the time series.

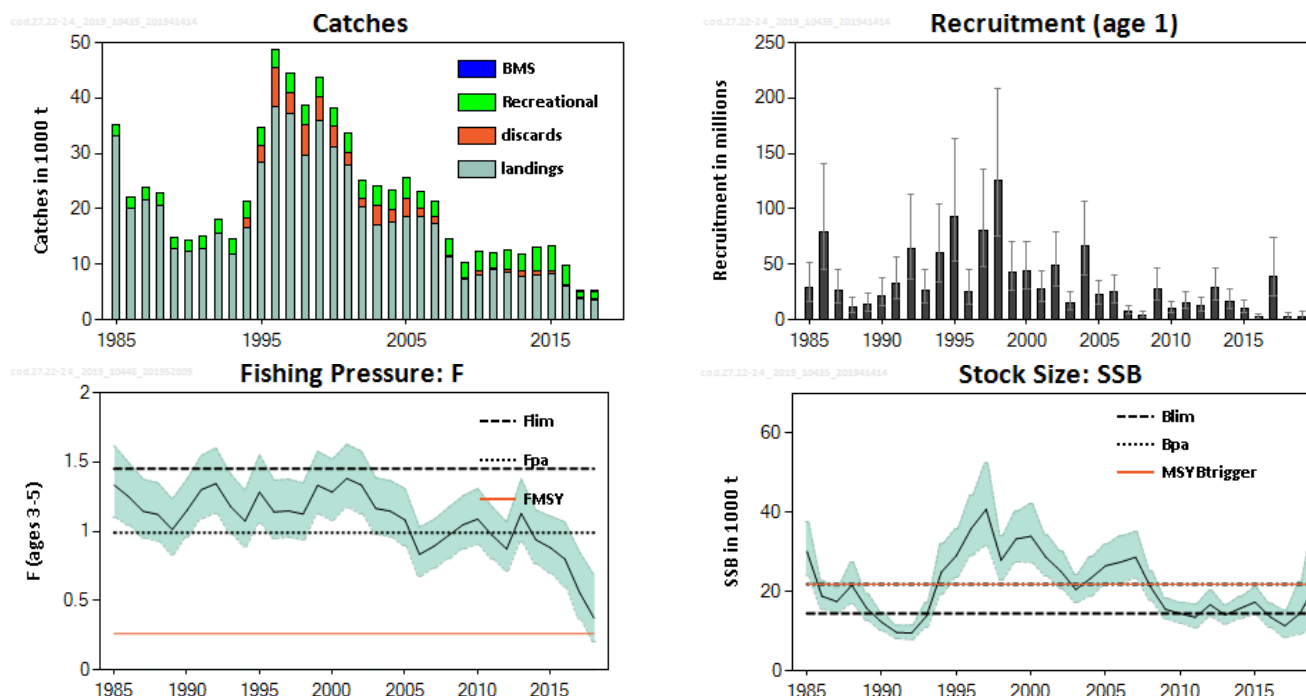


Figure 1 Cod in subdivisions 22–24, western Baltic stock. Summary of the stock assessment. Recruitment, F, and SSB have confidence intervals (95%) in the plot. The EU landing obligation entered into force in 2015; therefore, BMS landings (fish below the minimum conservation reference size [MCRS]) have been included since 2017.

Stock and exploitation status

ICES assesses that fishing pressure on the stock is above F_{MSY} and below F_{pa} and F_{lim} ; while spawning stock size is below $MSY B_{trigger}$ and between B_{pa} and B_{lim} .

Table 1 Cod in subdivisions 22–24, western Baltic stock. State of the stock and fishery relative to reference points.

		Fishing pressure			Stock size					
		2016	2017	2018	2017	2018	2019			
Maximum sustainable yield	F_{MSY}	✗	✗	✗	$MSY B_{trigger}$	✗	✗	✗	Above	Below trigger
Precautionary approach	F_{pa}, F_{lim}	✓	✓	✓	B_{pa}, B_{lim}	✗	○	○	Harvested sustainably	Increased risk
Management plan	F_{ranges}	✗	✓	✓	$MSY B_{trigger}$	✗	✗	✗	Within range	Below trigger

Catch scenarios

Table 2 Cod in subdivisions 22–24, western Baltic stock. Assumptions made for the interim year and in the forecast. Weights are in tonnes. Recruitment is in thousands.

Variable	Value	Notes
$F_{ages\ 3-5}$ (2019)	0.33	Based on catch constraint in 2019
SSB (2020)	29613	Based on catch constraint in 2019
$R_{age\ 1}$ (2019)	2226	From the assessment
$R_{age\ 1}$ (2020)	11659	Sampled from the last ten years*
$R_{age\ 1}$ (2021)	11622	Sampled from the last ten years*
Total catch (2019)	7988	Commercial + recreational catches.
Commercial catches (2019)	5848	Calculated as the 2019 TAC (9515 tonnes) plus an assumed discard ratio as in 2018 (4.2%), and accounting for the proportion of western Baltic cod in commercial catches in subdivisions 22–24 in 2018 (59%).
Recreational catches (2019)	2140	Average over 3 years (2016–2018)

* Recruitment is randomly resampled from the last ten years' assessment estimates and the median of these random draws is used. This will vary slightly every time this is done.

Table 3 Cod in subdivisions 22–24, western Baltic stock. Annual catch scenarios. All weights are in tonnes.

Basis	Total catch *	Recreational catch	Commercial catch	F_{total} (2020)	$F_{commercial}$ (2020)	SSB (2021)	% SSB change ***	% Advice change ^
ICES advice basis								
EU MAP**: F_{MSY}	7245	2140	5105	0.26	0.18	32310	10	-52
F = Proposed $F_{MSY\ lower}$ ^^	5205	2140	3065	0.18	0.11	34657	18	-43
F = Proposed $F_{MSY\ upper}$ ^^	11006	2140	8866	0.43	0.35	27251	-7	-54
Other scenarios								
F_{MSY}	7245	2140	5105	0.26	0.18	32310	10	-52
Zero commercial catch	2140	2140	0	0.07	0	38560	32	-86
$F = F_{pa}$	19551	2140	17411	0.99	0.88	16350	-44	30
$F = F_{lim}$	23904	2140	21764	1.45	1.32	11054	-62	59
SSB (2021) = B_{lim}	20972	2140	18832	1.11	1.00	14500	-51	40
SSB (2021) = B_{pa}	15148	2140	13008	0.66	0.57	21876	-25	0.85
SSB (2021) = $MSY\ B_{trigger}$	15148	2140	13008	0.66	0.57	21876	-25	0.85
$F = F_{2019}$	9089	2140	6949	0.34	0.26	29818	2	-39

* Includes commercial and recreational catch.

** EU Multi-Annual Plan for the Baltic Sea (EU, 2016a).

*** SSB 2021 relative to SSB 2020.

^ Total catch in 2020 relative to total catch corresponding to the advice for 2019 (15 021 t, MAP F_{MSY}), including commercial and recreational catch.

^^ Total catch in 2020 relative to total catch corresponding to the advice for 2019 for $F_{MSY\ lower}$ (9094 t, MAP $F_{MSY\ lower}$), including commercial and recreational catch.

^^^ Total catch in 2020 relative to total catch corresponding to the advice for 2019 for $F_{MSY\ upper}$ (23 992 t, MAP $F_{MSY\ upper}$), including commercial and recreational catch.

Last year's estimation of the large 2016 year class has been revised down by 54%. This year class is the most important year class contributing to the catch and the revised estimate is largely responsible for the 52% decrease in the 2020 catch advice.

Basis of the advice

Table 4 Cod in subdivisions 22–24, western Baltic stock. The basis of the advice.

Advice basis	EU Baltic multiannual plan.
Management plan	The EU multiannual plan (MAP) in place for stocks in the Baltic Sea includes cod (EU, 2016a). The advice, based on the F_{MSY} ranges, is considered precautionary.

Quality of the assessment

The estimate of the abundance of the 2016 year class has been revised significantly downwards in the updated assessment. The SSB development is very dependent on this year class (because the younger and older year classes are very low in abundance). A survey observation of the 2016 year class in 2018 was lower than expected, which explains the downward revision in SSB.

In 2018 the recreational catches included in the stock assessment constituted 30% of the total catches. The uncertainty around recreational catches is considered higher than in commercial catches. In addition, the catches in the recreational fishery are difficult to quantify in the intermediate year. It is also difficult to partition catches between commercial and recreational in the forecast.

In Subdivision 24 catches of cod are a mixture of eastern and western Baltic cod stocks, which is variable temporally and spatially and over size groups. A method to split the catches into the two stocks is applied each year which is based on data most years but which is also interpolated for years with no observations. This introduces uncertainty in the allocation of catches to the stock.

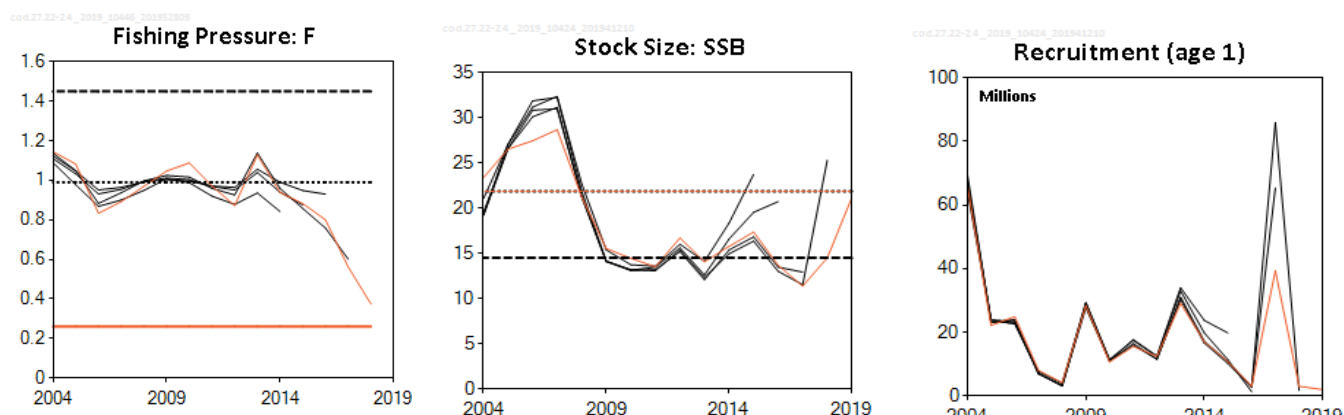


Figure 2 Cod in subdivisions 22–24, western Baltic stock. Historical assessment results (multi-year recruitment estimates included). The stock was benchmarked in 2019 (ICES, 2019a).

Issues relevant for the advice

The reference points were re-estimated and changed at the stock benchmark in 2019 (ICES, 2019a). B_{lim} was revised downwards from 27 400 t to 14 500 t (47%), based on new information on the productivity of the stock at low biomasses. F_{MSY} and the lower and upper range were also re-estimated and the ranges narrowed. In this case there was no change to F_{MSY} (0.26), but the $F_{MSY\ lower}$ is changed from 0.15 to 0.18, and $F_{MSY\ upper}$ is changed from 0.45 to 0.43.

The increase of SSB in the forecast is mainly due to one strong year class (the 2016 year class). Fishing mortality in 2018 was still above F_{MSY} . The 2016 year class will account for the majority of the predicted catches in 2020 (72%) and SSB in 2021 (71%) (Figure 3). Additionally, the 2017 and 2018 year classes are historically low. If no stronger year classes occur in the coming years this will lead to a rapid decline of the stock. ICES therefore suggests to use the $F_{MSY\ lower}$ value in the MAP when setting the TAC.

The SSB in 2020 is predicted to be above $MSY\ B_{trigger}$. In this situation, catch scenarios applicable under the MAP correspond to fishing mortalities between F_{lower} and F_{upper} . However, according to the MAP, catches corresponding to F higher than F_{MSY} can only be taken under conditions specified in the MAP.

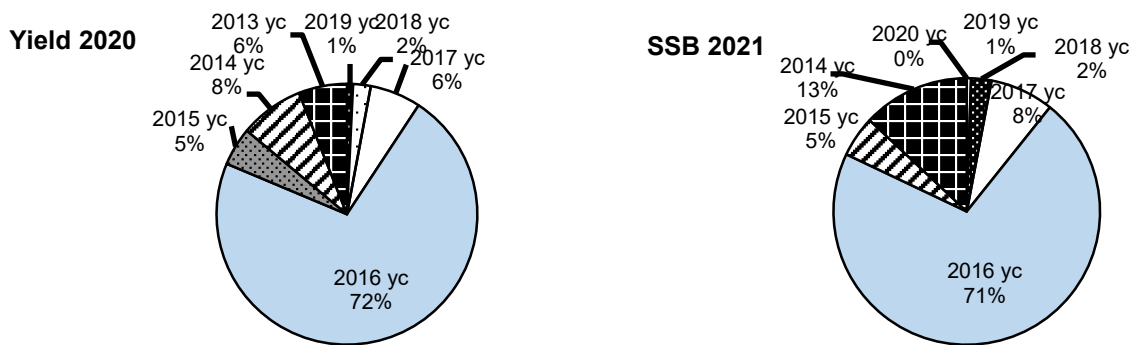


Figure 3 Cod in subdivisions 22–24, western Baltic stock. Relative predicted distribution of year classes in the yield 2020 and spawning-stock biomass 2021.

Landings of fish below the minimum conservation reference size (MCRS, 35 cm) are very low in the management area (24 t below minimum size [BMS] reported in 2018). Discarding still takes place despite the fact that the landing obligation has been in place since 2015. The estimated amount of discards is 157 tonnes in 2018 (approximately 4.2%), based on observer data. ICES understands that this is not in accordance with the current regulations.

A spawning closure was introduced in 2016 (no directed cod fishing in February and March; EU, 2015, 2016b, 2017) and covered the peak spawning time; between 2016 and 2018 both a very large and a historically low recruitment were produced with a similar spawning stock size (Eero *et al.*, 2019). The span of years implemented for the closure was too short to evaluate its impact. In 2019 no spawning closure was implemented.

A mixture of eastern (EB) and western Baltic (WB) cod stocks is caught in the western Baltic management area (subdivisions 22–24). The assessment and this advice is for the western Baltic cod stock.

Recreational catches of cod in the western Baltic management area are considered to consist exclusively of WB cod. A bag-limit was introduced for the first time in 2017 (EU, 2016b) due to the poor stock status and this has led (*inter alia*) to a drop in the recreational catches in 2017 and 2018 (1315 tonnes and 1600 tonnes, respectively). For 2019 the bag limit has been increased, from 5 to 7 fish per day per angler. The impact on the recreational catches in 2019 is unknown and the recreational catch value used for the intermediate year (2140 t) is based on a 3-year mean. The recreational catch in 2020 will depend on a management decision on the regulations for the recreational fishery. In the absence of other information the recreational catch assumed in the forecast has been kept constant.

To derive a management area-based total for commercial cod catch for the western and eastern Baltic areas (subdivisions 22–24 and 25–32) in line with ICES advice for the two cod stocks, ICES considers that the following issues should be taken into account:

1. The distribution area of the WB cod stock is subdivisions 22–24. The proportions of the WB cod stock commercial catch taken in subdivisions 22–23 and Subdivision 24 have been quite stable since 1994, amounting to 76% and 24%, respectively, on average in the most recent three years (Table 6).
2. The distribution area of the EB cod stock is subdivisions 24 and 25–32.
3. Commercial fishing in subdivisions 22–23 will provide a catch of the WB cod stock only.
4. Commercial fishing in subdivisions 25–32 will provide a catch of the EB cod stock only.
5. Commercial fishing in Subdivision 24 will provide a mixed catch of the EB and WB cod stocks. In the most recent three years, the ratio EB cod / WB cod commercial catch in Subdivision 24 has been 2.90 (Table 6).
6. In an area that includes two stocks of a species, the species TAC should be set such that the risk of overexploitation of the weakest stock is minimized.

The European Commission has requested ICES to provide information on catch opportunities by management area consistent with the stock advice, assuming a *status quo* distribution of the fisheries on subareas and stocks (option A in Table 5). There could be other allocation schemes, but such schemes are not known to ICES.

One example (Option A in Table 5) assumes that the geographical distribution of the commercial catch in 2020 remains as outlined in point 1 above and with average recreational catch in 2020, in which case the distribution of a commercial catch of 5105 t of WB cod will be 3880 t in subdivisions 22–23 and 1225 t in Subdivision 24. However, catches in Subdivision 24 should be zero in order to comply with the zero catch advised for EB cod. With a *status quo* effort in subdivisions 22–23, this would result in a TAC of 3880 t for the western management area which can only be fished in subdivisions 22–23. Alternatively, the implied commercial catch (5105 t) could be taken entirely in subdivisions 22–23. This would represent an increase of effort in this area which is considered the main spawning grounds for WB cod. This may negatively affect the spawning success of WB cod due to disturbance (though the effects on recruitment cannot be quantified). Given this circumstance the reintroduction of a temporal fishery closure during spawning time could be considered.

Option B (Table 5) assumes that the geographical distribution of the commercial catch in 2020 remains as outlined in point 1 above and with average recreational catch in 2020, which means the distribution of a commercial catch of 5105 t of WB cod will be 3880 t in subdivisions 22–23 and 1225 t in Subdivision 24. Under these circumstances the additional amount of EB cod fished in Subdivision 24 is estimated to be 3555 t, assuming the same ratio between EB cod and WB cod as observed on average during 2016–2018 in the commercial catches (i.e. 2.90, see point 5 above). This would result in a TAC of 8660 t for the western management area which could be taken across the entire western Baltic management area. This option is not in line with the catch advice for EB cod.

Figure 4 provides a graphic presentation of how to arrive at area-based TACs from the ICES stock advice.

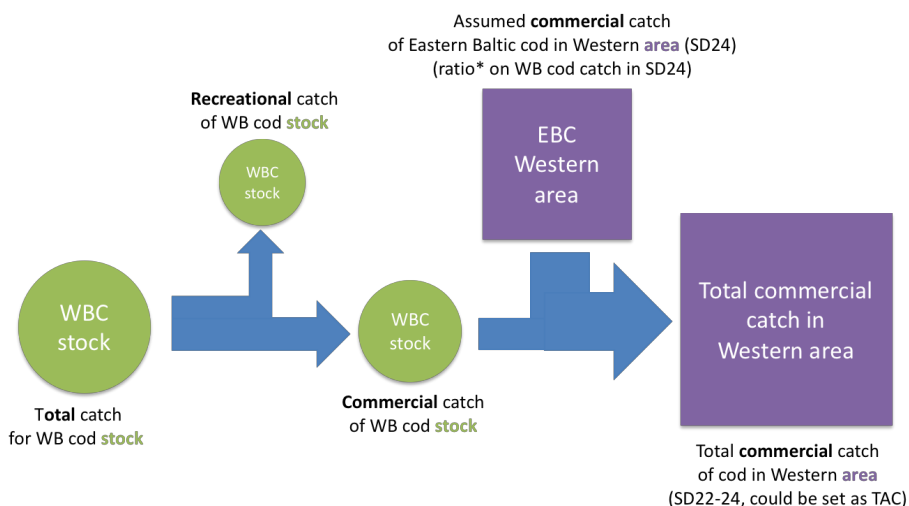


Figure 4 Cod in subdivisions 22–24, western Baltic cod. Illustration of calculations to obtain area TACs for western and eastern Baltic cod from ICES stock-based catch advice, taking into account stock mixing in Subdivision 24 and recreational catches for the western stock.

Table 5 Cod in subdivisions 22–24, western Baltic stock. The scenarios illustrate the implications of zero catch advice for eastern Baltic cod on the commercial catch by management area, assuming a recreational catch of 2140 tonnes in 2020. Weights are in tonnes.

Area	Commercial catch WB cod stock			Commercial catch EB cod stock			Commercial catch of cod by management area (TAC)			
	A	B	C	D	E	F	G		H	
	Advice Total	SDs 22–23	SD 24	Total	SD 24	SDs 25–32	SDs22–24	% TAC change (SDs 22–24)*	SDs 25–32	% TAC change (SDs 25–32)**
a. Status quo distribution, with no catch of EB cod in the Western Baltic management area										
Calculation		= A × 0.76 [^]	= A × 0.24 [^]		= C × 2.90 ^{^^}	= D – E	= B + C + E		= F	
EU MAP: F _{MSY}	5105	3880	0	0	0	0	3880	-59	0	-100
F=MAP F _{MSY} lower	3065	2329	0	0	0	0	2329	-76	0	-100
b. Status quo distribution, with catch of EB cod in the Western Baltic management area										
Calculation		= A × 0.76 [^]	= A × 0.24 [^]		= C × 2.90 ^{^^}	= D – E	= B + C + E		= F	
EU MAP: F _{MSY}	5105	3880	1225	-	3555	-	8660	-9	-	-
F=MAP F _{MSY} lower	3065	2329	736	-	2134	-	5199	-45	-	-

* Compared to the 2019 TAC for subdivisions 22–24 (9515 tonnes).

** Compared to the 2019 TAC for subdivisions 25–32 (29 912 tonnes).

[^] Average proportions of the WB cod stock commercial catch that has been caught in subdivisions 22–23 and Subdivision 24 in the most recent three years (2016–2018; Table 6).

^{^^} The EB cod catch / WB cod commercial catch ratio observed in Subdivision 24 in the most recent three years (2016–2018; Table 6).

Table 6 Cod in subdivisions 22–24, western Baltic stock. Catches (tonnes) used in the stock assessments of the western (WB) and eastern (EB) Baltic cod stocks in the western Baltic management area.

Year	WB cod stock					EB cod stock			Management area SDs 22–24				EBC/ WBC stock commercial catch in SD 24
	Landings	Discards	Recreational catch	Proportion* of discards	Proportion* of comm. catch in SD 24	Landings in SD 24	Discards in SD24	% of catch in SD 24	Total landings	Discards	Recreational catch	total catch	
1985	33188		2075		0.29	6971		2.11	40159		2075	42234	0.71
1986	20088		2078		0.36	6604		2.51	26692		2078	28770	0.93
1987	21692		2081		0.37	6874		3.08	28566		2081	30647	0.86
1988	20672		2082		0.47	8487		4.03	29159		2082	31241	0.87
1989	12795		2083		0.49	5721		3.04	18516		2083	20599	0.92
1990	12237		2085		0.49	5543		3.39	17780		2085	19865	0.92
1991	12931		2087		0.32	3762		2.92	16693		2087	18780	0.92
1992	15672		2420		0.19	2324		3.93	17996		2420	20416	0.76
1993	11815		2752		0.27	3885		6.92	15700		2752	18452	1.20
1994	16642	1614	3088	0.09	0.41	6551	621	6.52	23193	2235	3088	28516	0.97
1995	28310	3016	3417	0.10	0.29	5585	668	5.40	33895	3684	3417	40996	0.68
1996	38505	6868	3419	0.15	0.32	10040	1116	8.16	48545	7984	3419	59948	0.77
1997	37077	3981	3420	0.10	0.33	6547	641	7.24	43624	4623	3420	51666	0.53
1998	29634	5575	3410	0.16	0.37	4582	631	6.96	34216	6206	3410	43833	0.40
1999	35934	4378	3416	0.11	0.32	6221	599	8.35	42155	4978	3416	50549	0.52
2000	31132	3738	3432	0.11	0.32	6316	1209	7.32	37448	4947	3432	45827	0.68
2001	27781	2449	3427	0.08	0.36	7794	389	7.99	35574	2838	3427	41840	0.75
2002	20410	1395	3437	0.06	0.31	5060	562	7.51	25470	1957	3437	30864	0.84
2003	17205	3473	3448	0.17	0.34	5729	862	8.44	22934	4336	3448	30718	0.95
2004	17686	2189	3445	0.11	0.27	5309	188	7.30	22995	2377	3445	28817	1.04
2005	18493	3265	3771	0.15	0.42	6064	1729	12.08	24557	4994	3771	33322	0.86
2006	18503	1686	2923	0.08	0.27	6767	144	8.97	25270	1831	2923	30024	1.28
2007	17384	1325	2782	0.07	0.35	8792	875	14.95	26176	2200	2782	31158	1.46
2008	11302	336	3039	0.03	0.31	8811	787	17.27	20112	1123	3039	24274	2.66
2009	7313	351	2648	0.05	0.42	8284	464	14.46	15597	815	2648	19060	2.75
2010	8007	838	3367	0.09	0.36	6049	533	10.90	14055	1371	3367	18793	2.08
2011	9107	299	2595	0.03	0.24	7545	482	12.90	16652	781	2595	20029	3.59
2012	8622	370	3661	0.04	0.31	8469	536	13.43	17091	905	3661	21657	3.28
2013	7697	1007	3106	0.12	0.29	5359	1243	15.36	13056	2250	3106	18413	2.62

* Version 2: header corrected.

ICES Advice 2019 – cod.27.22-24 – <https://doi.org/10.17895/ices.advice.4746>

ICES advice, as adopted by its advisory committee (ACOM), is developed upon request by ICES clients (European Union, NASCO, NEAFC, and Norway).

Year	WB cod stock					EB cod stock			Management area SDs 22–24				EBC/ WBC stock commercial catch in SD 24
	Landings	Discards	Recreational catch	Proportion* of discards	Proportion* of comm. catch in SD 24	Landings in SD 24	Discards in SD24	% of catch in SD 24	Total landings	Discards	Recreational catch	total catch	
2014	8083	837	4044	0.09	0.33	5455	1298	14.91	13538	2135	4044	19716	2.30
2015	8390	432	4568	0.05	0.29	5029	930	11.92	13419	1361	4568	19348	2.35
2016	6122	143	3505	0.02	0.31	4541	306	12.95	10663	449	3505	14617	2.53
2017	3861	180	1315	0.04	0.20	1994	238	7.21	5855	417	1315	7587	2.79
2018	3555	157	1600	0.04	0.21	2284	311	12.01	5839	469	1600	7907	3.39

Reference points

Table 7 Cod in subdivisions 22–24, western Baltic stock. Reference points, values, and their technical basis. Weights in tonnes.

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY B_{trigger}	21 876	B_{pa}	ICES (2019a)
	F_{MSY}	0.26	Stochastic simulations with segmented regression stock–recruitment relationship.	ICES (2019a)
Precautionary approach	B_{lim}	14 500	Average of lowest SSB in years with above average recruitment (1991, 1993, 2003, 2016).	ICES (2019a)
	B_{pa}	21 876	$1.4 \times B_{\text{lim}}$	ICES (2019a)
	F_{lim}	1.45	Equilibrium scenarios with stochastic recruitment: F value corresponding to 50% probability of ($SSB < B_{\text{lim}}$).	ICES (2019a)
	F_{pa}	0.99	$F_{\text{lim}} \times e^{-1.645\sigma}$; $\sigma = 0.25$	ICES (2019a)
Management plan	MSY B_{trigger}	21 876	MSY B_{trigger}	ICES (2019a)
	B_{lim}	14 500	B_{lim}	ICES (2019a)
	MAP F_{MSY}	0.26	F_{MSY}	ICES (2019a)
	Target range $F_{\text{MSY upper}}$ to F_{MSY}	0.26–0.43	Consistent with the ranges resulting in no more than 5% reduction in long-term yield compared with MSY.	ICES (2019a)
	Target range F_{MSY} to $F_{\text{MSY lower}}$	0.18–0.26	Consistent with the ranges resulting in no more than 5% reduction in long-term yield compared with MSY.	ICES (2019a)

Basis of the assessment

Table 8 Cod in subdivisions 22–24, western Baltic stock. Basis of the assessment and advice.

ICES stock data category	1 (ICES, 2018).
Assessment type	Age-based analytical assessment SAM (ICES, 2019b) that uses catches (landings, discards, and recreational catch) in the model and in the forecast.
Input data	Commercial catches (landings, age distributions from catch sampling) and recreational catch (Germany, Sweden, and Denmark). Annual stock separation key (from commercial catches) to split catches in Subdivision 24 into eastern and western Baltic cod, derived from otolith shape analyses combined with genetics (this key is available for 19 of the 34 years in the present time-series). The allocation of catches to stock for the remaining years was performed by interpolation. Three survey indices (FEJUCS (age 0), BITS-Q1, and BITS-Q4); annual maturity data from BITS-Q1 surveys. Natural mortalities for age 1 derived from multispecies assessment, unchanged since 1996.
Discards and bycatch	Included in the assessment since 1994, data series from the main fleets.
Indicators	None.
Other information	Benchmarked in 2019 (ICES, 2019a). The basis for the assessment changed in 2015 to being for the western Baltic cod stock, whereas assessments in earlier years were for the area of subdivisions 22–24.
Working group	Baltic Fisheries Assessment Working Group (WGBFAS)

Information from stakeholders

There is no additional available information.

History of the advice, catch, and management

Table 9 Cod in subdivisions 22–24, western Baltic stock. ICES advice and official landings. All weights are in tonnes.

Year	ICES advice	Total catch from the stock corresponding to the advice	Commercial catch corresponding to advice*	Agreed TAC**	ICES estimated total commercial landings subdivisions 22–24 (eastern and western Baltic cod stocks)
1987	TAC		9000		28566
1988	TAC		16000		29159
1989	TAC		14000	220000	18516
1990	TAC		8000	210000	17780
1991	TAC		11000	171000	16693
1992	Substantial reduction in F		-	100000	17996
1993	F at lowest possible level		-	40000	21228
1994	TAC		22000	60000	30695
1995	30% reduction in fishing effort from 1994 level		-	120000	33895
1996	30% reduction in fishing effort from 1994 level		-	165000	50845
1997	Fishing effort should not be allowed to increase above the level of recent years		-	180000	43624
1998	20% reduction in F from 1996		35000	160000	34216
1999	At or below F_{sq} with 50% probability		38000	126000	42155
2000	Reduce F by 20%		44600	105000	38347
2001	Reduce F by 20%		48600	105000	34244
2002	Reduce F to below 1.0		36300	76000	24158
2003	Reduce F to below 1.0		***22600 or 28800	75000	24624
2004	Reduce F to below 1.0		< 29600	29600	20854
2005	Reduce F to below 0.92		< 23400	24700	22045
2006	Management plan		< 28400	28400	22751
2007	Keep SSB at B_{pa}		< 20500	26700	23736
2008	Rebuild SSB to B_{pa}		< 13500	19200	20082
2009	Rebuild SSB to B_{pa}		< 13700	16300	15549
2010	Management plan		< 17700	17700	14120
2011	See scenarios		-	18800	16332
2012	Management plan		21300	21300	17072
2013	Management plan		20800	20000	12968
2014	Management plan		17037	17000	13538
2015	MSY approach		8793	15900	13418
2016	MSY approach (F = 0.23)	≤ 7797		12720	10629
2017	MSY approach (F = 0.15)	≤ 3475	≤ 917	5597	5865^
2018	MAP F ranges: F_{lower} to F_{MSY} adjusted by $SSB_{2018}/MSY B_{trigger}$ (F = 0.11–0.188)	3130–5295	1376–3541	5597	5850^
2019	MAP range: $F_{MSY} F_{lower}$ to F_{upper} (F = 0.15–0.45)	9094–23992	5867–22238	9515	
2020	MAP range: $F_{MSY} F_{lower}$ to F_{upper} (F = 0.18–0.43)	5205–11006			

* Values since 2016 are for the western Baltic cod stock only, whereas in earlier years they are for the area of subdivisions 22–24 and include a fraction of the eastern Baltic cod stock.

** Included in TAC for total Baltic, until and including 2003.

*** Two options based on implementation of the adopted mesh regulation.

^ Including BMS.

History of the catch and landings

Table 10 Cod in subdivisions 22–24, western Baltic stock. Catch distribution in 2018 as estimated by ICES.

Catch (2018)	Commercial landings		Commercial discards	Recreational catch
	active gears 56%	passive gears 44%		
5312 t	3555 t		157 t	1600 t

Table 11 Cod in subdivisions 22–24, western Baltic management area. History of commercial catch; both the official and ICES estimated values are presented by area. The table includes landings of the western Baltic cod stock as well as of the eastern Baltic cod stock in Subdivision 24. All weights are in tonnes.

Year	Total for management area							
	Human consumption landings (HC)				BMS	Discards	Unalloc.	Total catch
	22	23	24	HC (SDs 22–24)				
1992	9887	2739	5370	17996				17996
1993	7296	1275	7129	15700			5528	21228
1994	8229	1628	13336	23193		2235	7502	32930
1995	16936	3158	13801	33895		3684		37579
1996	21417	4031	23097	48545		7984	2300	58829
1997	21966	2663	18995	43624		4623		48247
1998	15093	3074	16049	34216		6207		40423
1999	20409	3521	18225	42155		4978		47133
2000	18934	3149	16264	38347		4947		43294
2001	14976	2817	16451	34244		2839		37083
2002	11968	2409	9781	24158		1958		26116
2003	9573	1925	13127	24624		4336		28960
2004	9091	2320	9430	20841		2377	13	23231
2005	8729	2621	10686	22036		4994	9	27039
2006	9979	1914	10858	22751		1831		24582
2007	7840	2713	13183	23736		2199		25935
2008	5687	2139	12256	20082		1123		21205
2009	3451	839	11259	15549		815		16364
2010	3925	1179	9016	14120		1371		15491
2011	5493	1198	9641	16332		780		17112
2012	4896	1123	11053	17072		905		17977
2013	4675	960	7333	12968		2250		15218
2014	4316	1361	7862	13538		2135		15673
2015	4994	1232	7193	13419		1361		14780
2016	3193	1123	6313	10629	34	449		11112
2017	2195	941	2697	5833	32	421		6286
2018	2014	870	2942	5826	24	476		6326

Table 12 Cod in subdivisions 22–24, western Baltic management area. History of commercial landings for human consumption presented by area for each country participating in the fishery. The table includes landings of the western Baltic cod stock as well as of the eastern Baltic cod stock in Subdivision 24. All weights are in tonnes.

Year	Denmark			Finland 24	Germany			Estonia 22 24	Lithuania 24	Latvia 24	Poland 24	Sweden			Total				
	22	23	22+24		Dem.Rep.*	FRG						22	23	22+24	22	23	24	Unalloc.	Grand total
					22+24	22	22+24												
1965			19457		9705		13350						2182	27867		17007		44874	
1966			20500		8393		11448						2110	27864		14587		42451	
1967			19181		10007		12884						1996	28875		15193		44068	
1968			22593		12360		14815						2113	32911		18970		51881	
1969			20602		7519		12717						1413	29082		13169		42251	
1970			20085		7996		14589						1289	31363		12596		43959	
1971			23715		8007		13482						1419	32119		14504		46623	
1972			25645		9665		12313						1277	32808		16092		48900	
1973			30595		8374		13733						1655	38237		16120		54357	
1974			25782		8459		10393						1937	31326		15245		46571	
1975			23481		6042		12912						1932	31867		12500		44367	
1976		712	29446		4582		12893						1800	33368	712	15353		49433	
1977		1166	27939		3448		11686					550	1516	29510	1716	15079		46305	
1978		1177	19168		7085		10852					600	1730	24232	1777	14603		40612	
1979		2029	23325		7594		9598					700	1800	26027	2729	16290		45046	
1980		2425	23400		5580		6657					1300	2610	22881	3725	15366		41972	
1981		1473	22654		11659		11260					900	5700	26340	2373	24933		53646	
1982		1638	19138		10615		8060					140	7933	20971	1778	24775		47524	
1983		1257	21961		9097		9260					120	6910	24478	1377	22750		48605	
1984		1703	21909		8093		11548					228	6014	27058	1931	20506		49495	
1985		1076	23024		5378		5523					263	4895	22063	1339	16757		40159	
1986		748	16195		2998		2902					227	3622	11975	975	13742		26692	
1987		1503	13460		4896		4256					137	4314	12105	1640	14821		28566	
1988		1121	13185		4632		4217					155	5849	9680	1276	18203		29159	
1989		636	8059		2144		2498					192	4987	5738	828	11950		18516	
1990		722	8584		1629		3054					120	3671	5361	842	11577		17780	
1991		1431	9383				2879					232	2768	7184	1663	7846		16693	
1992		2449	9946				3656					290	1655	9887	2739	5370		17996	
1993		1001	8666				4084					274	1675	7296	1275	7129	5528	21228	
1994		1073	13831				4023					555	3711	8229	1628	13336	7502	30695	
1995		2547	18762	132			9196			15		611	2632	16936	3158	13801		33895	
1996		2999	27946	50			12018		50	32		1032	4418	21417	4031	23097	2300	50845	

Year	Denmark			Finland	Germany			Estonia		Lithuania	Latvia	Poland	Sweden			Total								
	22	23	22+24		24	Dem.Rep.*	FRG		22				24	24	24	24	22	23	22+24	22	23	24	Unalloc.	Grand total
						22+24	22	22+24																
1997		1886	28887	11			9269		6			263		777	2525	21966	2663	18995		43624				
1998		2467	19192	13			9722		8		13	623		607	1571	15093	3074	16049		34216				
1999		2839	23074	116			13224		10		25	660		682	1525	20409	3521	18225		42155				
2000		2451	19876	171			11572		5		84	926		698	2564	18934	3149	16264		38347				
2001		2124	17446	191			10579		40		46	646		693	2479	14976	2817	16451		34244				
2002		2055	11657	191			7322				71	782		354	1727	11968	2409	9781		24158				
2003		1373	13275	59			6775				124	568		551	1899	9573	1925	13127		24624				
2004		1927	11386				4651				221	538		393	1727	9091	2320	9430	13	20854				
2005		1902	9867	2			7002	72	67		476	1093		720	835	8729	2621	10686	9	22045				
2006		1899	9761	242			7516		91		586	801			1855	9979	1914	10858		22751				
2007		2169	8975	220			6802		69		273	2371		534	2322	7840	2713	13183		23736				
2008		1612	8582	159			5489		134		30	1361		525	2189	5687	2139	12256		20082				
2009		567	7871	259			4020		194		23	529		269	1817	3451	839	11259		15549				
2010		689	6849	203			4250			9	159	319		490	1151	3925	1179	9016		14120				
2011		783	7799	149			4521				24	487		414	2153	5493	1198	9641		16332				
2012		733	8381	260			4522		3		11	818		390	1955	4896	1123	11053		17072				
2013		580	6566	50			3237				128	708		380	1317	4675	960	7333		12968				
2014	2206	795	6804	7			2109				39	854	1	565	1231	4316	1361	7862		13538				
2015	2781	738	6623	28			2213				7	755		493	1858	4994	1232	7193		13418				
2016	1576	675	4881	29			1617					657	1	448	1550	3193	1123	6313		10629				
2017 **	1167	506	2352				1029							435	352	2196	941	2714		5852				
2018 **	1010	475	2238	0.5			1008							395	467	2018	870	2962		5850				

* Includes landings from October to December 1990 of Federal Republic of Germany.

** Including landings of Below Minimum Conservation Reference size (BMS) from logbooks

Summary of the assessment

Table 13 Cod in subdivisions 22–24, western Baltic stock. Assessment summary. Weights are in tonnes. Recruitment in thousands. High and Low refer to 95% confidence intervals.

Year	Recruitment (Age 1)	Recruitment High	Recruitment Low	Stock size: SSB	SSB High	SSB Low	Landings	Discards	Recreational	F (ages 3–5)	F High	F Low
1985	28685	51446	15994	30167	37625	24187	33188		2075	1.33	1.62	1.10
1986	79493	140449	44993	18852	22728	15637	20088		2078	1.25	1.50	1.04
1987	25929	45037	14928	17492	21054	14533	21692		2081	1.14	1.38	0.95
1988	11334	19924	6447	21628	27473	17027	20672		2082	1.12	1.35	0.93
1989	13917	24189	8007	15794	19521	12778	12795		2083	1.01	1.23	0.83
1990	21545	37430	12402	12279	14823	10171	12237		2085	1.15	1.38	0.96
1991	32863	57065	18925	9710	11511	8190	12931		2087	1.30	1.55	1.09
1992	64599	112999	36929	9547	11573	7876	15672		2420	1.34	1.60	1.13
1993	26179	45686	15001	13817	17329	11017	11815		2752	1.18	1.41	0.98
1994	59916	104602	34320	24937	32116	19363	16642	1614	3088	1.07	1.29	0.89
1995	93089	163896	52872	29086	35817	23619	28310	3016	3417	1.28	1.55	1.06
1996	25133	44868	14078	35958	44366	29144	38505	6868	3419	1.14	1.37	0.95
1997	80526	135323	47918	40762	52501	31648	37077	3981	3420	1.15	1.38	0.96
1998	125200	208514	75175	27947	34119	22892	29634	5575	3410	1.12	1.35	0.94
1999	43392	70377	26754	33310	40304	27530	35934	4378	3416	1.33	1.58	1.12
2000	44495	71021	27876	33990	42214	27368	31132	3738	3432	1.28	1.52	1.08
2001	27508	44421	17035	28683	34315	23976	27781	2449	3427	1.38	1.63	1.17
2002	48892	79090	30224	25137	30341	20826	20410	1395	3437	1.33	1.58	1.13
2003	15230	24734	9377	20519	24356	17287	17205	3473	3448	1.16	1.39	0.98
2004	66051	106615	40920	23390	28904	18927	17686	2189	3445	1.15	1.37	0.96
2005	22142	35566	13785	26537	32041	21979	18493	3265	3771	1.08	1.31	0.90
2006	24905	40422	15345	27471	34089	22137	18503	1686	2923	0.83	1.03	0.67
2007	7986	12866	4956	28691	35102	23451	17384	1325	2782	0.89	1.08	0.73
2008	4090	7206	2322	21230	25250	17849	11302	336	3039	0.97	1.17	0.80
2009	28372	46557	17291	15546	18367	13157	7313	351	2648	1.05	1.25	0.87
2010	10620	17061	6610	14459	17318	12073	8007	838	3367	1.09	1.31	0.90
2011	15517	25133	9580	13529	16869	10851	9107	299	2595	0.97	1.18	0.80
2012	12418	19867	7762	16711	20358	13717	8622	370	3661	0.87	1.07	0.71
2013	29082	47030	17984	14076	16715	11853	7697	1007	3106	1.13	1.38	0.92
2014	17003	27514	10507	15775	18818	13224	8083	837	4044	0.94	1.15	0.77
2015	10697	17354	6593	17368	21114	14286	8390	432	4568	0.88	1.11	0.70
2016	2996	5103	1759	13679	17060	10967	6122	143	3505	0.80	1.07	0.60
2017	39319	73594	21007	11374	15296	8458	3861**	180	1315	0.56	0.85	0.37
2018	2946	6266	1385	14509	22544	9338	3555**	157	1600	0.37	0.69	0.20
2019	2226*	7079*	682*	21297	38450	11129						

*Output from SAM analysis based on survey data.

**Includes BMS

Sources and references

Eero, M., Hinrichsen, H., Hjelm, J., Huwer, B., Hüsey, K., Köster, F. W., Margonski, P., Plikshs, M., Storr-Paulsen, M., and Zimmermann, C. 2019. Designing spawning closures can be complicated: Experience from cod in the Baltic Sea. *Ocean and Coastal Management*, 169: 129–136. <https://doi.org/10.1016/j.ocecoaman.2018.12.018>.

EU. 2015. COUNCIL REGULATION (EU) 2015/2072 of 17 November 2015 fixing for 2016 the fishing opportunities for certain fish stocks and groups of fish stocks applicable in the Baltic Sea and amending Regulations (EU) No 1221/2014 and (EU) 2015/104. *Official Journal of the European Union*, L 302. 10 pp. <http://data.europa.eu/eli/reg/2015/2072/oj>.

EU. 2016a. Regulation (EU) 2016/1139 of the European Parliament and of the Council of 6 July 2016 establishing a multiannual plan for the stocks of cod, herring and sprat in the Baltic Sea and the fisheries exploiting those stocks, amending Council Regulation (EC) No 2187/2005 and repealing Council Regulation (EC) No 1098/2007. Official Journal of the European Union, L 191. 15 pp. <http://data.europa.eu/eli/reg/2016/1139/oj>.

EU. 2016b. COUNCIL REGULATION (EU) 2016/1903 of 28 October 2016 fixing for 2017 the fishing opportunities for certain fish stocks and groups of fish stocks applicable in the Baltic Sea and amending Regulation (EU) 2016/72. Official Journal of the European Union, L 295. 10 pp. <http://data.europa.eu/eli/reg/2016/1903/oj>.

EU. 2017. COUNCIL REGULATION (EU) 2017/1970 of 27 October 2017 fixing for 2018 the fishing opportunities for certain fish stocks and groups of fish stocks applicable in the Baltic Sea and amending Regulation (EU) 2017/127. Official Journal of the European Union, L 281. 10 pp. <http://data.europa.eu/eli/reg/2017/1970/oj>.

ICES. 2018. Advice basis. *In* Report of the ICES Advisory Committee, 2018. ICES Advice 2018, Book 1, Section 1.2. <https://doi.org/10.17895/ices.pub.4503>.

ICES. 2019a. Benchmark Workshop on Baltic Cod Stocks (WKBALTCOD2), 4–8 February 2019, ICES Headquarters, Copenhagen, Denmark. ICES Scientific Reports, 1:9. 310 pp. <https://doi.org/10.17895/ices.pub.4984>.

ICES. 2019b. Report of the Baltic Fisheries Assessment Working Group (WGBFAS), 8–15 April 2019, ICES Headquarters, Copenhagen, Denmark. ICES Scientific Reports, 1:20. 651 pp. <https://doi.org/10.17895/ices.pub.5256>

Recommended citation: ICES. 2019. Cod (*Gadus morhua*) in subdivisions 22-24, western Baltic stock (western Baltic Sea). *In* Report of the ICES Advisory Committee, 2019, cod.27.22-24, <https://doi.org/10.17895/ices.advice.4746>