

Cod (*Gadus morhua*) in subdivisions 24–32, eastern Baltic stock (eastern Baltic Sea)

ICES advice on fishing opportunities

ICES advises that when the precautionary approach is applied, there should be zero catch in 2020. This advice applies to all catches from the stock in subdivisions 24–32.

Stock development over time

The spawning stock biomass (SSB) has been declining since 2015 and is estimated to be below B_{lim} in the last 2 years. Fishing mortality (F) has declined since 2012; the value estimated for 2018 is the lowest recorded. Recruitment (R) has been declining since 2012, and the recruitment in 2017 is estimated to be the lowest in the time series.

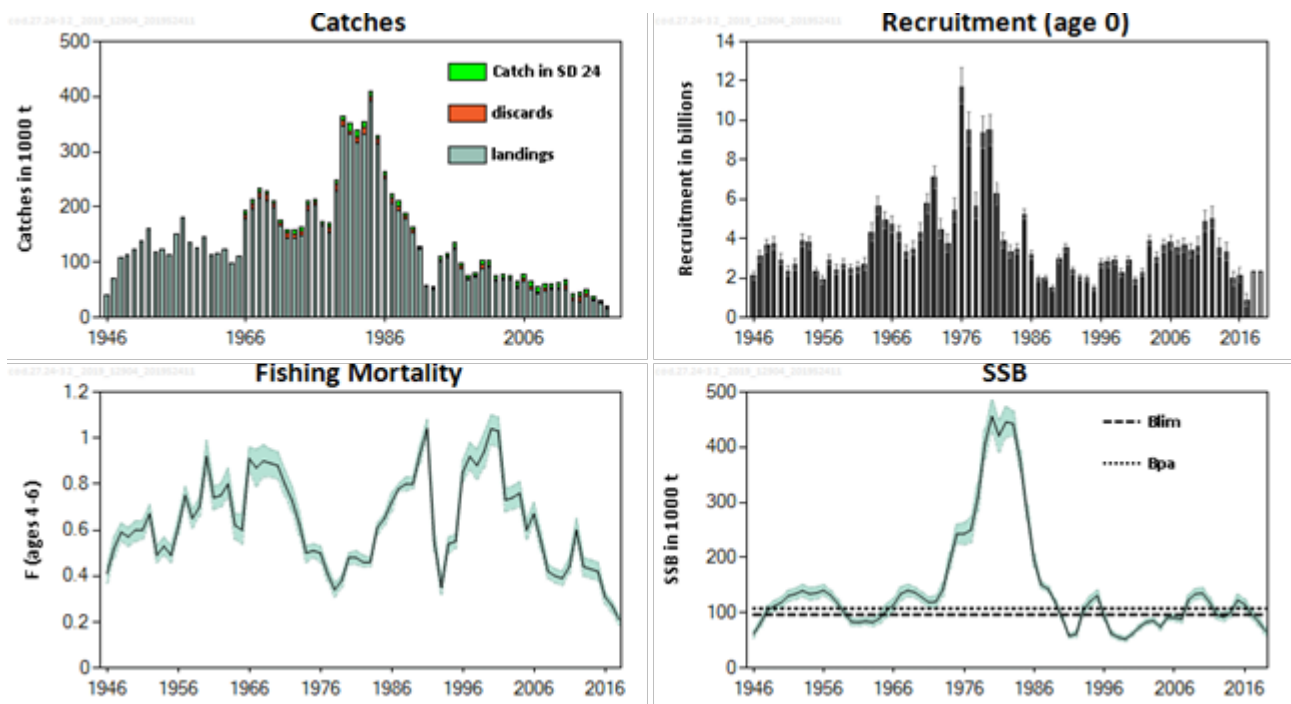


Figure 1 Cod in subdivisions 24–32, eastern Baltic stock. Summary of the stock assessment. R, F, and SSB (spawning stock biomass at the spawning time) have confidence intervals (90%) in the plot. Assumed R values are unshaded. The EU landing obligation entered into force in 2015; therefore, landings since 2015 include fish above and below the minimum conservation reference size (MCRS).

Stock and exploitation status

ICES assesses that spawning stock size is below B_{lim} and B_{pa} . Fishing pressure reference points are not defined, and neither is the stock status relative to these.

Table 1 Cod in subdivisions 24–32, eastern 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}	?	?	?	?	?	?	Undefined
Precautionary approach	F_{pa}, F_{lim}	?	?	?	?	?	?	Reduced reproductive capacity
Management plan	F_{MGT}	—	—	—	—	—	—	Not applicable

Catch scenarios

Table 2 Cod in subdivisions 24–32, eastern 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 4–6} (2019)	0.21	Assumed to be equal to F in 2018.
SSB (2019)	66 412	From assessment.
R _{age 0} (2018–2021)	2 35 8730	Average of 2013–2017.
M _{ages 4–6} (2019–2021)	0.69	Natural mortality estimated by the assessment in 2018.
Total catch (2019)	18 904	Based on assumption of F in 2019 = F in 2018.

Table 3 Cod in subdivisions 24–32, eastern Baltic stock. Annual catch scenarios. All weights are in tonnes.

Basis	Total catch (2020)	F (2020)	SSB (2020)	SSB (2021)	Probability of SSB (2021) > B _{Lim} (%)	% SSB change	% Advice change
F = 0	0	0	64 981	73 447	< 0.01	13	-100
F = 0.05	4195	0.05	63 213	70 069	< 0.01	11	-75
F = 0.5 × F (2018)	7735	0.10	61 737	67 337	< 0.01	9	-54
F = F (2018)	14 762	0.21	58 782	62 364	< 0.01	6	-12

The basis for the advice has changed from trends based assessment to an analytical assessment (Category 3 to Category 1). The advice is now zero, based on an absolute estimate of stock size which is expected to remain below B_{Lim}.

Basis of the advice

Table 4 Cod in subdivisions 24–32, eastern Baltic stock. The basis of the advice.

Advice basis	Precautionary approach
Management plan	This stock is shared between the EU and Russia. An EU multiannual plan (MAP) that includes cod is in place for stocks in the Baltic Sea (EU, 2016) but F _{MSY} ranges are not available for this stock. Russia does not have a management plan for this stock.

Quality of the assessment

The estimated decline in growth and increase in natural mortality are in line with biological knowledge on the stock. The exact values for growth parameters estimated for recent years are uncertain, however, because of imprecise age information. This is also affecting the values for natural mortality estimates, because in the assessment model growth and natural mortality are related. The results of the stock assessment in terms of SSB and F, however, were found to be robust in spite of these uncertainties (ICES, 2019a).

In the forecast, the slight increase in SSB from 2020 to 2021 in all catch scenarios (Table 3) may be optimistic. The SSB in the forecast years is greatly influenced by the assumption on recruitment in 2018 (average of age 0 over the last 5 years), as SSB is dominated by small cod (from these recruitments). This assumed recruitment is higher than that observed in the past 3 years.

Issues relevant for the advice

The poor status of the Eastern Baltic cod is largely driven by biological changes in the stock during the last decades. Growth, condition (weight at length), and size at maturation have substantially declined (Figure 2). These developments indicate that the stock is distressed and is expected to have reduced reproductive potential. Natural mortality has increased, and is estimated to be considerably higher than the fishing mortality in recent years. The size of the largest fish in the population has shown a decline since 1990 (Figure 2).

The changes in maturity over time mean the development of the exploitable stock size is not consistently represented by SSB, especially in recent years (Figure 3). This implies that the SSB now includes small cod that were not part of SSB in earlier years. The biomass of commercial sized cod (>= 35 cm) is presently at the lowest level observed since the 1950s.

The low growth, poor condition, and high natural mortality of cod are related to changes in the ecosystem, which include the following:

- i) Poor oxygen conditions that can affect cod directly by altering metabolism and indirectly from a shortage of benthic prey, while also affecting the survival of offspring,
- ii) Low availability of fish prey in the main distribution area of cod. This is because sprat and herring are more northerly distributed in recent years and are overlapping less with the distribution of the cod stock,
- iii) High levels of parasite infestations; this is related to an increased abundance of grey seals.

These drivers are interrelated, and the relative effect on the cod stock is unclear.

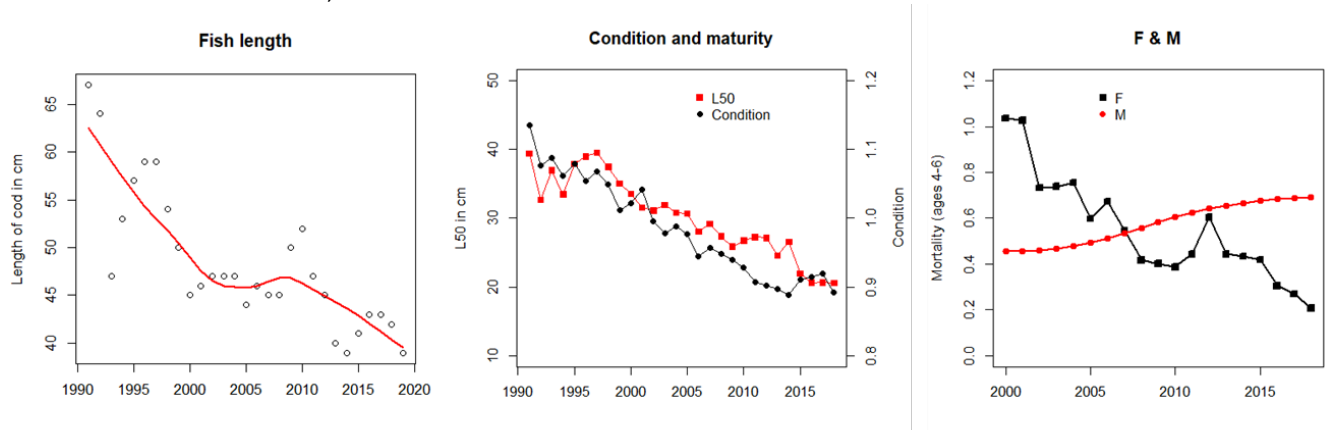


Figure 2 Cod in subdivisions 24–32, eastern Baltic stock . Left panel: Indicator of size structure of the stock (length at the 95th percentile of the length distribution, data from BITS-Q1 survey). Middle panel: length at which half of the stock has become mature (L_{50}) and condition (weight at length) of 40–60 cm cod (data from BITS-Q1 survey). Right panel: Fishing mortality (F) and natural mortality (M) for ages 4–6, estimates in stock assessment.

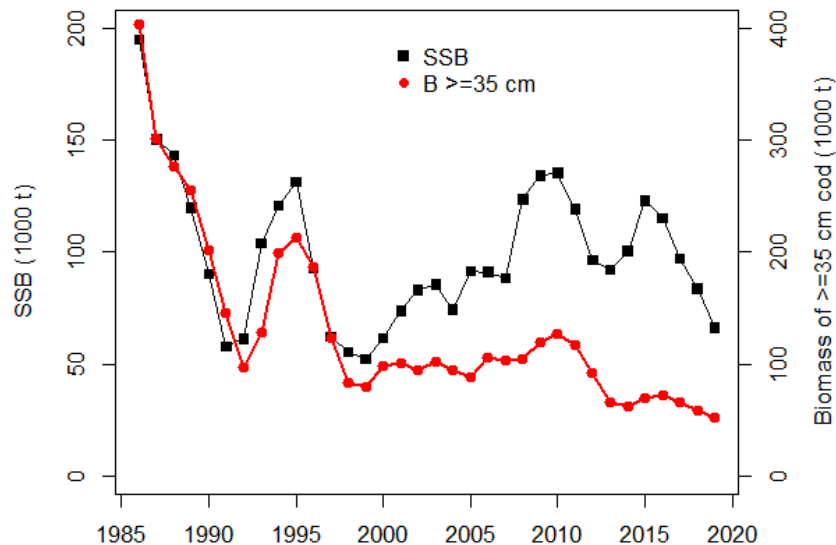


Figure 3 Cod in subdivisions 24–32, eastern Baltic stock. Spawning stock biomass at the spawning time and biomass of commercial sized cod (≥ 35 cm in length) in the beginning of the year.

The concept of F_{MSY} assuming long-term equilibrium is not considered appropriate for this stock presently, due to a large decline in productivity in later years. At the present low productivity the stock is estimated to remain below B_{lim} in the medium-term (2024), even at no fishing. Furthermore, fishing at any level will target the remaining few commercial sized (≥ 35 cm) cod; this will deteriorate the stock structure further, and reduce its reproductive potential.

There are preliminary indications (from larval surveys) that the 2018 year-class may be among the weakest on record. This can, however, only be verified in the assessment model after the year-class has been observed in the trawl surveys (firstly

in Q4, 2019). In the current forecast the recruitment is, therefore, assumed to be the average of 5 previous years. Assuming this average recruitment (age 0) in 2018, the SSB in the short term will remain below B_{lim} .

For this stock the EC has requested that ICES provide advice for 2020 based on the precautionary approach.

Cod is both targeted and taken as a by-catch in fisheries in subdivisions 24–32. Fifteen métiers were found to have significant landings of cod in 2018. Two of these métiers accounted for 82% of the total cod landings.

The eastern Baltic cod (EB) stock is mainly distributed and caught in the eastern Baltic cod management area (subdivisions [SDs] 25–32), but it is also distributed and caught mixed with western Baltic (WB) cod in SD 24; this is part of the western Baltic management area (SDs 22–24). The assessment and this advice is for the eastern Baltic cod stock in the entire area of distribution (SDs 24 and 25–32).

The European Commission has requested that ICES provide information on catch opportunities by management area consistent with the stock advice. Assuming a *status quo* distribution of the fisheries in subareas and mixing of stocks; the zero catch advice for EB cod would imply a closure of the mixing area (SD 24) to protect EB cod (option A in Table 5 in ICES, 2019b). Due to a mixed fisheries for EB and WB cod in SD 24 it would be expected that 3555 tonnes of EB cod would be caught in SD 24 in 2020, when commercial catch of 5105 tonnes is taken from the WB cod stock (see option B in Table 5 in ICES, 2019b).

Discarding, which ICES understands not to be in accordance with the current regulations, still takes place despite the fact that the landing obligation has been in place since 2015. Landings of fish below the minimum conservation reference size (MCRS; 35 cm) are very low (108 t reported in 2018), compared to the discards (3103 tonnes in 2018) in the management area of SD 25–32. The estimated discard amount in 2018 (approximately 16% of the total catch) was based on observer data, but this is considered to be an underestimate. The available information from the fisheries and observers suggests that modifications to the selectivity properties of the gear takes place, leading to a higher proportion of smaller fish being caught.

Reference points

Table 4 Cod in subdivisions 24–32, eastern Baltic stock. Reference points, values, and their technical basis.

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY $B_{trigger}$	Undefined		ICES (2019a)
	FMSY	Undefined		ICES (2019a)
Precautionary approach	B_{lim}	96 550 t	SSB in 2012 which produced the last strong year-class, in the recent period of low productivity.	ICES (2019c)
	B_{pa}	108 035 t	$B_{lim} \times \exp(1.645 \times \sigma)$, where $\sigma = 0.07$	ICES (2019c)
	F_{lim}			
Management plan	F_{pa}			
	SSB_{mgt}			
	F_{mgt}			

Basis of the assessment

Table 5 Cod in subdivisions 24–32, eastern Baltic stock. Basis of the assessment and advice.

ICES stock data category	1 (ICES, 2018).
Assessment type	Age-length based analytical assessment with Stock Synthesis model (ICES, 2019a).
Input data	Commercial catches (international landings, length distributions from catch sampling). Tuning indices include two trawl survey indices (BITS-Q1 and BITS-Q4); indices of spawning stock biomass and larval abundance from ichthyoplankton surveys; and five historical cpue indices. Maturity and weight at length are from BITS-Q1 surveys (regularly updated). Age-length keys (annual) are from BITS-Q1 and BITS-Q4 surveys. 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.
Discards and bycatch	Discard estimates are available from observer programs and included in the catch data.
Indicators	Condition (weight at length), size at maturation, size structure of the stock
Other information	This stock was benchmarked in 2019 (WKBALTCOD2; ICES, 2019a).
Working group	Baltic Fisheries Assessment Working Group (WGBFAS).

Information from stakeholders

There is no additional information available.

History of the advice, catch, and management

Table 6 Cod in subdivisions 24–32, eastern Baltic stock. ICES advice, TACs, ICES landings, and ICES catches. All weights are in tonnes.

Year	ICES advice	Catches corresp. to advice	Landings corresp. to advice	Agreed TAC	ICES landings (subdivisions 25–32)	ICES eastern Baltic stock catches (subdivisions 24 and 25–32)
1987	Reduce towards F_{max}		245000		207000	223295
1988	TAC		150000		194000	210527
1989	TAC		179000	220000*	179000	188361
1990	TAC		129000	210000*	153000	163276
1991	TAC		122000	171000*	123000	129020
1992	Lowest possible level		-	100000*	55000**	59110
1993	No fishing		0	40000*	45000**	56154
1994	TAC		25000	60000*	100856**	109984
1995	30% reduction in fishing effort from 1994 level		-	120000*	107718**	115843
1996	30% reduction in fishing effort from 1994 level		-	165000*	124189	136788
1997	20% reduction in fishing mortality from 1995 level		130000	180000*	88600	99251
1998	40% reduction in fishing mortality from 1996 level		60000	140000*	67428	74940
1999	Proposed F_{pa} (= 0.6)		88000	126000*	72995	81653
2000	40% reduction in F from 1996–1998 level		60000	105000*	89289**	102833
2001	Fishing mortality of 0.30		39000	105000*	91328**	102402
2002	No fishing		0	76000*	67740**	74824

Year	ICES advice	Catches corresp. to advice	Landings corresp. to advice	Agreed TAC	ICES landings (subdivisions 25–32)	ICES eastern Baltic stock catches (subdivisions 24 and 25–32)
2003	70% reduction in F		See option table	75000	69476**	78093
2004	90% reduction in F		< 13000	45400	68578**	75276
2005	No fishing		0	42800	55032**	64495
2006	Develop management plan		< 14900	49200	65532**	77086
2007	No fishing		0	44300	50843**	64656
2008	No fishing		0	42300***	42235**	55578
2009	Limit (total) landings to 48 600 t		≤ 48600	49380***	48439**	60513
2010	Follow management plan		56800	56100***	50277	60400
2011	See scenarios		-	64500***	50368	62245
2012	Follow management plan		74200	74200***	51225	67024
2013	Follow management plan		65900	68700***	31355	42977
2014	Follow management plan		70301	73400***	28909	45289
2015	20% reduction in catches	29085		55800***	38079	50008
2016	Precautionary approach^	≤ 29220		46900***	29313	37438
2017	Precautionary approach^	≤ 26994		36957***	25496	30965
2018	Precautionary approach^	≤ 26071		34288***	15907	21605
2019	Precautionary approach^	≤ 16685		29912***		
2020	Precautionary approach^	0				

* For the total Baltic Sea until and including 2003.

** The reported landings in 1992–1995 and 2000–2009 are likely to be minimum estimates because of incomplete reporting.

*** TAC is for SDs 25–32 and is calculated as EU + Russian autonomous quotas.

^ ICES gives stock-based advice (for the eastern Baltic cod stock).

History of the catch and landings

Table 7 Cod in subdivisions 24–32, eastern Baltic stock. Catch distribution by fleet in 2018 as estimated by ICES.

Catch (2018)	Landings		Discards
	Active gears 83%	Passive gears 17%	
21 605 tonnes	18 202 tonnes*		3403 tonnes

Table 8 Cod in subdivisions 24–32, eastern Baltic stock. History of ICES estimates of landings, discards, and catch by area. Weights are in tonnes. Landings obligation is in place since 2015, though landings below minimum conservation reference size (BMS) were only possible to separate since 2017.

Year	Eastern Baltic cod stock in subdivisions 25–32					Eastern Baltic cod stock in Subdivision 24				Eastern Baltic cod stock in subdivisions 24 and 25–32
	Unallocated*	Discards	Landings BMS	Total landings	Catch	Discards	Landings BMS	Total landings	Catch	Total catch
1966		8735		177318	186053			6624	6624	192677
1967		11733		195446	207179			6899	6899	214078
1968		9700		216353	226053			8614	8614	234667
1969		10654		212160	222814			5980	5980	228794
1970		7625		198451	206076			5720	5720	211796
1971		5426		164840	170266			6586	6586	176852
1972		8490		143833	152323			7307	7307	159630
1973		7491		143164	150655			7320	7320	157975
1974		7933		147815	155748			6923	6923	162671
1975		9576		194649	204225			5676	5676	209901
1976		4341		203303	207644			6972	6972	214616
1977		2978		164792	167770			6643	6643	174413
1978		9875		154009	163884			6553	6553	170437
1979		14576		227699	242275			7745	7745	250020
1980		8544		347619	356163			7721	7721	363884
1981		6185		331642	337827			13759	13759	351586
1982		11548		316052	327600			12239	12239	339839
1983		10998		332148	343146			9853	9853	352999
1984		8521		391952	400473			8709	8709	409182
1985		8199		315083	323282			6971	6971	330253
1986		3848		252558	256406			6604	6604	263010
1987		9340		207081	216421			6874	6874	223295
1988		7253		194787	202040			8487	8487	210527
1989		3462		179178	182640			5721	5721	188361
1990		4187		153546	157733			5543	5543	163276
1991		2741		122517	125258			3762	3762	129020
1992		1904		54882	56786			2324	2324	59110
1993	18978	1558		50711	52269			3885	3885	56154
1994	44000	1956		100856	102812	621		6551	7172	109984
1995	18993	1872		107718	109590	668		5585	6253	115843
1996	10815	1443		124189	125632	1116		10040	11156	136788
1997**		3462		88600	92062	641		6547	7189	99251
1998		2299		67428	69727	631		4582	5213	74940
1999		1838		72995	74833	599		6221	6820	81653
2000	23118	6019		89289	95308	1209		6316	7525	102833
2001	23677	2891		91328	94219	389		7794	8183	102402
2002	17562	1462		67740	69202	562		5060	5622	74824
2003	22147	2024		69477	71501	862		5729	6592	78093
2004	19563	1201		68578	69779	188		5309	5497	75276
2005	14991	1670		55032	56702	1729		6064	7793	64495
2006	17836	4644		65531	70175	144		6767	6911	77086
2007	12418	4146		50843	54989	875		8792	9667	64656
2008	2673	3746		42234	45980	787		8811	9598	55578
2009	3189	3328		48438	51766	464		8284	8747	60513
2010		3543		50276	53819	533		6049	6581	60400
2011		3850		50368	54218	482		7545	8027	62245
2012		6795		51225	58020	536		8469	9004	67024
2013		5020		31355	36375	1243		5359	6602	42977
2014		9627		28909	38536	1298		5455	6753	45289
2015***		5970		38079	44049	930		5029	5959	50008
2016		3279		29313	32591	306		4541	4847	37438
2017		3238	179	25496	28734	227	22	2004	2231	30965
2018		3103	108	15907	19010	300	15	2295	2595	21605

* ICES estimates. No information available for years prior to 1993.

** For 1997 landings were not officially reported – estimated by ICES.

*** The catch allocation between landings and discards in Russian data for 2015 was revised during WGBFAS 2018.

Table 9 Cod in subdivisions 24–32, eastern Baltic stock. History of ICES estimates of landings of cod caught in the eastern Baltic management area (SDs 25–32) by country. Weights are in tonnes.

Year	Denmark	Estonia	Finland	German Dem.Rep.	Germany Fed. Rep.	Latvia	Lithuania	Poland	Russia	Sweden	USSR	Faroe Islands*	Norway	Unallocated**	Total
1966	37070		26	10589	12831			56007		22525	38270				177318
1967	39105		27	21027	12941			56003		23363	42980				195446
1968	44109		70	24478	16833			63245		24008	43610				216353
1969	44061		58	25979	17432			60749		22301	41580				212160
1970	42392		70	18099	19444			68440		17756	32250				198451
1971	46831		53	10977	16248			54151		15670	20910				164840
1972	34072		76	4055	3203			57093		15194	30140				143833
1973	35455		95	6034	14973			49790		16734	20083				143164
1974	32028		160	2517	11831			48650		14498	38131				147815
1975	39043		298	8700	11968			69318		16033	49289				194649
1976	47412		287	3970	13733			70466		18388	49047				203303
1977	44400		310	7519	19120			47702		16061	29680				164792
1978	30266		1437	2260	4270			64113		14463	37200				154009
1979	34350		2938	1403	9777			79754		20593	75034	3850			227699
1980	49704		5962	1826	11750			123486		29291	124350	1250			347619
1981	68521		5681	1277	7021			120901		37730	87746	2765			331642
1982	71151		8126	753	13800			92541		38475	86906	4300			316052
1983	84406		8927	1424	15894			76474		46710	92248	6065			332148
1984	90089		9358	1793	30483			93429		59685	100761	6354			391952
1985	83527		7224	1215	26275			63260		49565	78127	5890			315083
1986	81521		5633	181	19520			43236		45723	52148	4596			252558
1987	68881		3007	218	14560			32667		42978	39203	5567			207081
1988	60436		2904	2	14078			33351		48964	28137	6915			194787
1989	57240		2254	3	12844			36855		50740	14722	4520			179178
1990	47394		1731		4691			32028		50683	13461	3558			153546
1991	39792	1810	1711		6564	2627	1865	25748	3299	36490		2611			122517
1992	18025	1368	485		2793	1250	1266	13314	1793	13995		593			54882
1993	8000	70	225		1042	1333	605	8909	892	10099		558		18978	50711
1994	9901	952	594		3056	2831	1887	14335	1257	21264		779		44000	100856
1995	16895	1049	1729		5496	6638	4513	25000	1612	24723		777	293	18993	107718
1996	17549	1338	3089		7340	8709	5524	34855	3306	30669		706	289	10815	124189
1997	9776	1414	1536		5215	6187	4601	31396	2803	25072		600			88600
1998	7818	1188	1026		1270	7765	4176	25155	4599	14431					67428
1999	12170	1052	1456		2215	6889	4371	25920	5202	13720					72995
2000	9715	604	1648		1508	6196	5165	21194	4231	15910				23118	89289
2001	9580	765	1526		2159	6252	3137	21346	5032	17854				23677	91328
2002	7831	37	1526		1445	4796	3137	15106	3793	12507				17562	67740
2003	7655	591	1092		1354	3493	2767	15374	3707	11297				22147	69476
2004	7394	1192	859		2659	4835	2041	14582	3410	12043				19563	68578
2005	7270	833	278		2339	3513	2988	11669	3411	7740				14991	55032

Year	Denmark	Estonia	Finland	German Dem.Rep.	Germany Fed. Rep.	Latvia	Lithuania	Poland	Russia	Sweden	USSR	Faroe Islands*	Norway	Unallocated**	Total
2006	9766	616	427		2025	3980	3200	14290	3719	9672				17836	65532
2007	7280	877	615		1529	3996	2486	8599	3383	9660				12418	50843
2008	7374	841	670		2341	3990	2835	8721	3888	8901				2673	42235
2009	8295	623			3665	4588	2789	10625	4482	10182				3189	48439
2010	10739	796	826		3908	5001	3140	11433	4264	10169					50277
2011	10842	1180	958		3054	4916	3017	11348	5022	10031					50368
2012	12102	686	1405		2432	4269	2261	14007	3954	10109					51225
2013	6052	249	399		541	2441	1744	11760	2870	5299					31355
2014	6035	166	350		676	1999	1088	11026	3444	4125					28908
2015	9526	183	388		1477	2873	1845	12896	3845	4438					37471
2016	6756	2	57		918	2656	1637	9583	3392	3995					28996
2017***	6140	1	191		347	2079	1726	6484	4124	4405					25496
2018***	2684	1	53		241	1253	694	5695	3376	1912					15907

* Landings for 1997 were not officially reported – estimated by ICES.

** Working group estimates. No information was available for years prior to 1993.

*** Includes landings below minimum conservation reference size (BMS)

Summary of the assessment

Table 10 Cod in subdivisions 24–32, eastern Baltic stock. Assessment summary. Weights are in tonnes. Recruitment in thousands. High and Low refer to 90% confidence intervals.

Year	Recruitment (Age 0)	Recruitment High	Recruitment Low	SSB	SSB High	SSB Low	Biomass fish ≥35 cm	Landings	Discards	Catch in SD 24	Fishing Mortality (Ages 4–6)	F High	F Low
1946	2109470	2351897	1892032	61032	67254	54810	88546	40985			0.41	0.44	0.37
1947	3075600	3369000	2807752	80827	87908	73747	121360	71831			0.52	0.57	0.48
1948	3643690	3967079	3346663	104117	112350	95884	173014	107104			0.59	0.63	0.55
1949	3728870	4055845	3428255	112508	121886	103130	191757	112735			0.57	0.61	0.53
1950	2923360	3214031	2658977	118593	128263	108923	200271	124509			0.60	0.64	0.55
1951	2335760	2600280	2098149	130709	140518	120900	220236	137815			0.60	0.64	0.56
1952	2679670	2968355	2419061	134205	144261	124149	241683	161103			0.67	0.71	0.63
1953	3887270	4229044	3573117	140002	150884	129120	232491	118132			0.49	0.53	0.46
1954	3778630	4105845	3477492	134379	145712	123046	229839	123947			0.53	0.57	0.49
1955	2309850	2560935	2083383	135899	146993	124805	218977	114415			0.49	0.53	0.46
1956	1918400	2140731	1719160	140676	150485	130867	241281	151985			0.61	0.65	0.58
1957	2922130	3184153	2681669	132041	140515	123567	253188	181366			0.75	0.79	0.71
1958	2416930	2656565	2198912	116992	124960	109024	217397	136301			0.65	0.69	0.61
1959	2681360	2931288	2452742	98892	105954	91830	184707	126033			0.70	0.74	0.66
1960	2448600	2702672	2218413	83536	90033	77039	170684	145408			0.92	0.99	0.85
1961	2520880	2811069	2260648	82647	89015	76280	150566	112034			0.74	0.79	0.69
1962	2710610	3056445	2403906	84913	91457	78370	155405	115553			0.75	0.80	0.70
1963	4306660	4757072	3898894	82716	90071	75361	157186	123047			0.80	0.87	0.74
1964	5619930	6091271	5185061	89835	99255	80415	152364	97788			0.62	0.67	0.56
1965	4895850	5357517	4473965	104057	116407	91707	169631	109809			0.60	0.67	0.54
1966	4707040	5150635	4301649	114848	126236	103460	212016	177318	8735	6624	0.91	0.96	0.85
1967	4265740	4668333	3897866	134457	146605	122309	246973	195446	11733	6899	0.87	0.95	0.79
1968	3321710	3674398	3002875	140536	151510	129562	272703	216353	9700	8614	0.90	0.97	0.83
1969	3475080	3845647	3140221	137015	146370	127660	269425	212160	10654	5980	0.89	0.95	0.83
1970	4321810	4763697	3920913	128210	137261	119159	255446	198451	7625	5720	0.88	0.94	0.82
1971	5740720	6272778	5253791	119046	128719	109373	228546	164840	5426	6586	0.80	0.86	0.75
1972	7096840	7700504	6540499	119948	130641	109255	215283	143833	8490	7307	0.73	0.79	0.68
1973	4461290	4965083	4008615	141644	153908	129380	232562	143164	7491	7320	0.63	0.68	0.58
1974	3764010	4245173	3337383	193900	208433	179367	291235	147815	7933	6923	0.50	0.53	0.46
1975	5415340	6032384	4861413	243042	260065	226019	389860	194649	9576	5676	0.51	0.54	0.48
1976	11703100	12643018	10833058	242977	262872	223082	424661	203303	4341	6972	0.50	0.53	0.46
1977	9515160	10402233	8703734	249828	272622	227034	402171	164792	2978	6643	0.41	0.44	0.38
1978	5641130	6343737	5016341	309156	334248	284064	424270	154009	9875	6553	0.34	0.37	0.31
1979	9368790	10206393	8599926	406198	432839	379557	585281	227699	14576	7745	0.38	0.40	0.35
1980	9465070	10254342	8736548	455714	484284	427144	737313	347619	8544	7721	0.48	0.50	0.45

Year	Recruitment (Age 0)	Recruitment High	Recruitment Low	SSB	SSB High	SSB Low	Biomass fish ≥35 cm	Landings	Discards	Catch in SD 24	Fishing Mortality (Ages 4–6)	F High	F Low
1981	6245350	6853783	5690930	420481	449652	391310	712814	331642	6185	13759	0.48	0.51	0.45
1982	3877950	4303711	3494309	445574	472970	418178	697094	316052	11548	12239	0.46	0.49	0.44
1983	3332100	3663719	3030497	442740	465473	420007	736043	332148	10998	9853	0.46	0.48	0.44
1984	3483050	3757618	3228544	376271	393710	358832	712637	391952	8521	8709	0.61	0.63	0.58
1985	5229470	5508395	4964669	281995	295206	268784	553571	315083	8199	6971	0.65	0.67	0.62
1986	3178550	3389150	2981036	194991	206398	183584	403618	252558	3848	6604	0.72	0.76	0.68
1987	1986310	2139460	1844123	150537	157056	144018	302259	207081	9340	6874	0.78	0.80	0.77
1988	2008900	2149616	1877395	143167	148833	137501	277108	194787	7253	8487	0.80	0.83	0.77
1989	1482210	1603937	1369721	119913	124898	114928	255274	179178	3462	5721	0.80	0.83	0.78
1990	2967870	3167913	2780459	90482	95190	85774	201719	153546	4187	5543	0.93	0.97	0.89
1991	3513340	3728575	3310530	58079	61575	54582	145533	122517	2741	3762	1.04	1.08	1.00
1992	2381410	2553086	2221278	61425	67583	55267	96715	54882	1904	2324	0.55	0.60	0.51
1993	2012460	2162820	1872553	103948	113907	93989	128392	50711	1558	3885	0.35	0.38	0.32
1994	1974440	2118900	1839829	120851	130879	110823	199231	100856	1956	7172	0.54	0.57	0.50
1995	1495420	1626966	1374510	131360	140447	122273	212606	107718	1872	6253	0.55	0.58	0.52
1996	2765040	2981724	2564103	92747	99470	86024	187162	124189	1443	11156	0.85	0.90	0.81
1997	2788990	3022713	2573339	62171	67348	56993	123828	88600	3462	7189	0.92	0.98	0.86
1998	2868790	3108539	2647532	55596	60274	50917	83838	67428	2299	5213	0.88	0.95	0.82
1999	2243800	2476055	2033330	52238	56659	47817	80201	72995	1838	6820	0.94	1.02	0.87
2000	2885960	3122516	2667325	61539	65919	57158	98041	89289	6019	7525	1.04	1.10	0.97
2001	1876050	2053193	1714190	73925	78840	69011	100305	91328	2891	8183	1.03	1.09	0.96
2002	2267010	2460733	2088538	83271	88549	77993	94141	67740	1462	5622	0.73	0.78	0.68
2003	3897490	4181222	3633012	85560	90843	80277	101644	69477	2024	6592	0.74	0.79	0.69
2004	3039520	3305145	2795242	74394	79633	69155	94622	68578	1201	5497	0.76	0.81	0.70
2005	3646660	3974500	3345863	91596	97514	85678	87859	55032	1670	7793	0.60	0.64	0.56
2006	3783560	4135714	3461391	91172	97442	84902	105375	65531	4644	6911	0.67	0.72	0.63
2007	3526730	3878546	3206827	88455	95154	81755	103832	50843	4146	9667	0.55	0.59	0.51
2008	3643680	4023534	3299687	123707	132586	114828	104579	42234	3746	9598	0.42	0.45	0.39
2009	3372720	3762733	3023132	134370	143982	124758	119758	48438	3328	8747	0.40	0.43	0.37
2010	3626620	4061591	3238232	135445	145138	125752	127392	50276	3543	6581	0.39	0.42	0.36
2011	4850080	5404446	4352578	119244	128095	110393	117123	50368	3850	8027	0.44	0.48	0.41
2012	5028940	5613813	4505002	96551	104327	88774	92534	51225	6795	9004	0.60	0.65	0.55
2013	3554820	4032115	3134024	92070	99659	84481	66310	31355	5020	6602	0.44	0.48	0.40
2014	3305570	3771888	2896903	100548	108754	92342	62179	28909	9627	6753	0.43	0.47	0.39
2015	1963560	2340884	1647057	123082	132971	113193	69294	38079	5970	5959	0.42	0.46	0.38
2016	2125790	2571903	1757058	115368	124621	106115	71863	29313	3279	4847	0.31	0.33	0.28
2017	843912	1186953	600013	97284	105274	89295	66405	25496	3238	2231	0.27	0.29	0.24
2018	2358730*			83754	91067	76440	58403	15907	3103	2595	0.21	0.23	0.187

Year	Recruitment (Age 0)	Recruitment High	Recruitment Low	SSB	SSB High	SSB Low	Biomass fish ≥ 35 cm	Landings	Discards	Catch in SD 24	Fishing Mortality (Ages 4–6)	F High	F Low
2019	2358730*			66412	73877	58947	51620						

*Average of 2013–2017.

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