

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

ICES stock advice

ICES advises that when the precautionary approach is applied, catches in 2018 for the eastern Baltic cod stock should be no more than 26 071 tonnes. This advice applies to all catches from the stock in subdivisions 24–32.

Stock development over time

The stock size indicator has decreased between 2011 and 2014, with an increase in 2015–2016, followed by a 45% decline in 2017. The index for small cod has continuously declined from its highest value (in 2013) in the available time-series. There has been a steep decline in the harvest rate between 2004 and 2009, followed by a slight increase until 2015 and a decline in 2016.

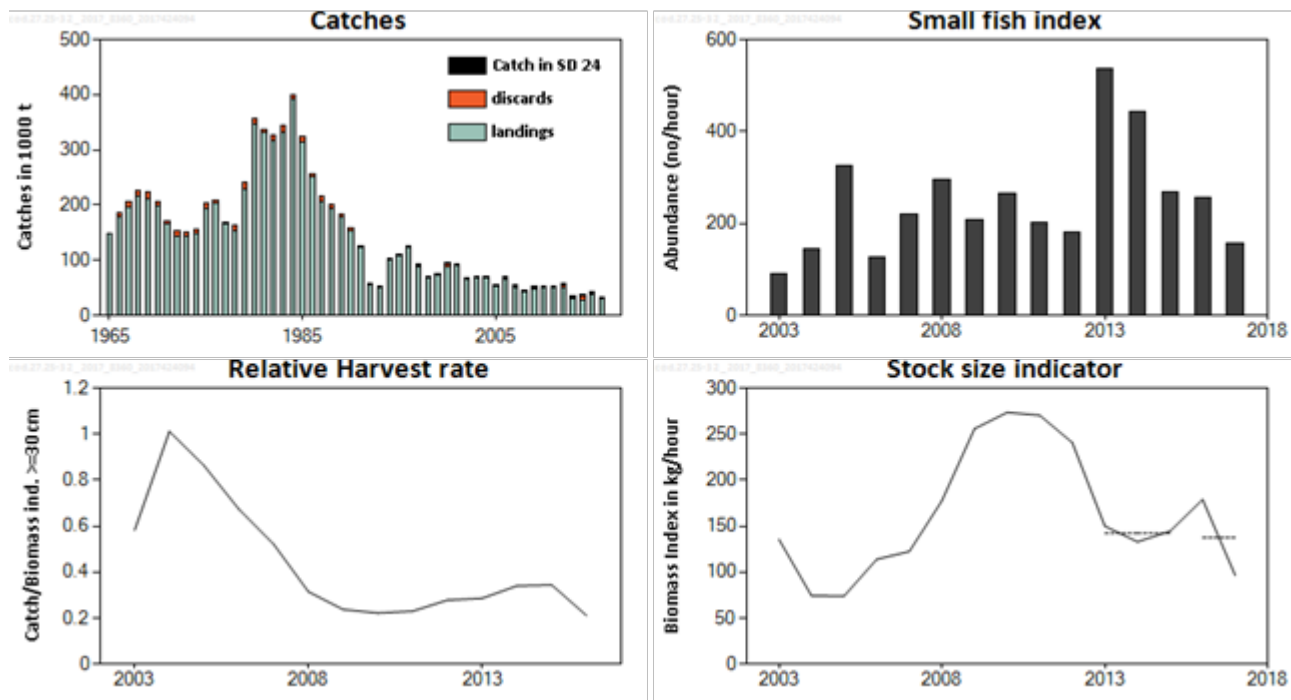


Figure 1 Cod in subdivisions 24–32, eastern Baltic stock. Upper left panel: catches in subdivisions 24–32 (in thousand tonnes), divided into ICES estimated landings and discards, and catches of the eastern Baltic cod stock taken in Subdivision 24. The EU landing obligation started in 2015; landings in 2015–2016 include fish above and below the minimum conservation reference size (MCRS). Upper right panel: small fish index (combined abundance index, in number per hour, of cod < 30 cm, from the Baltic International Trawl Survey (BITS) in quarters 1 and 4 in subdivisions 25–28). Lower left panel: relative harvest rate (catches of the eastern Baltic cod stock/stock size indicator). Lower right panel: stock size indicator (combined biomass index, in kg per hour, of cod ≥ 30 cm, from the Baltic International Trawl Survey (BITS) in quarters 1 and 4 in subdivisions 25–28). The dashed lines in the relative SSB plot indicate the average values of the respective years.

* Version 2: Title corrected

Stock and exploitation status

Table 1 Cod in subdivisions 24–32, eastern Baltic stock. State of the stock and fishery relative to reference points. The status evaluation is based on reference point proxies (ICES, 2017a).

		Fishing pressure			Stock size		
		2014	2015	2016	2015	2016	2017
Maximum sustainable yield	$F_{MSY\ proxy}$	✘	✘	✘ Above	$MSY\ B_{trigger\ proxy}$	✔	✔ Above trigger
Precautionary approach	F_{pa}, F_{lim}	?	?	?	B_{pa}, B_{lim}	✔	✔ Above possible reference points
Management plan	F_{MGT}	-	-	- Not applicable	SSB_{MGT}	-	- Not applicable

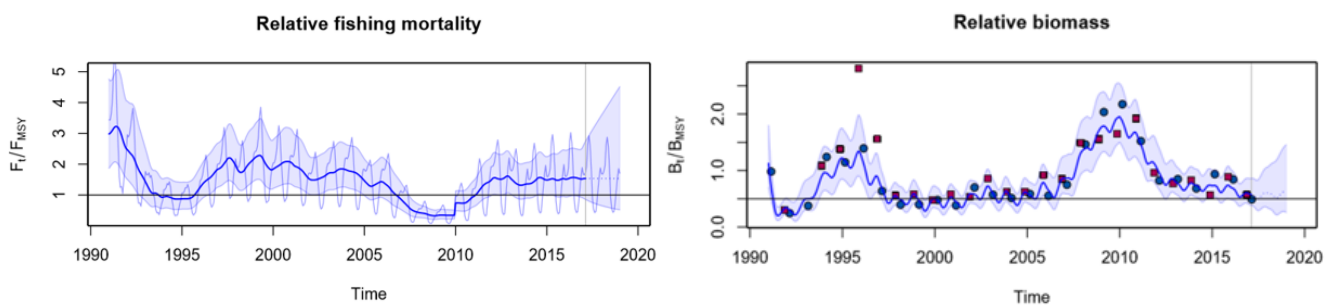


Figure 2 Cod in subdivisions 24–32, eastern Baltic stock. SPiCT model results used for the evaluation of the stock and exploitation status (the proxy F_{MSY} and $MSY\ B_{trigger}$ are represented by horizontal lines in the left and right panels, respectively).

Catch options

The ICES framework for category 3 stocks was applied (ICES, 2012). A combined length-based biomass index from the BITS (Q1 and Q4) was used as the index of stock development. The index is based on the average of quarter 1 and quarter 4 shifted one year forward.

The advice is based on a comparison of the two latest index values (index A) with the three preceding values (index B), multiplied by the latest catch advice. The index is estimated to have decreased by less than 20% and thus the uncertainty cap was not applied to calculate the catch advice. The fishing mortality is estimated to be above the F_{MSY} proxy and the stock size is estimated to be above the $MSY\ B_{trigger}$ proxy (based on analysis with the SPiCT model). The precautionary buffer was applied in 2015 (ICES, 2015a) and, therefore, it is not applied this year.

Table 2 Cod in subdivisions 24–32, eastern Baltic stock. The basis for the catch options.*

Index A (2016, 2017)		138
Index B (2013, 2014, 2015)		142
Index ratio (A/B)		0.97
Uncertainty cap	Not applied	-
Advised catch for 2017		26 994 tonnes
Precautionary buffer	Not applied	-
Catch advice**		26 071 tonnes

* The figures in the table are rounded. Calculations were done with unrounded inputs and computed values may not match exactly when calculated using the rounded figures in the table.

** [recent advised catch] × [index ratio].

Basis of the advice

Table 3 Cod in subdivisions 24–32, eastern Baltic stock. The basis of the advice.

Advice basis	Precautionary approach
Management plan	An EU multiannual plan (MAP) is in place for stocks in the Baltic Sea that includes cod (EU, 2016). F_{MSY} ranges are not presently available for this stock.

Quality of the assessment

The advice is based on a combined biomass index from two surveys, used as proxy for SSB. The uncertainty associated with the index values is not available.

The stock was benchmarked in 2015 (WKBALTCOD; ICES, 2015b), but it was not possible to conduct an analytical assessment of the stock.

Three main areas of quality concerns are important for the analytical assessment, which is the reason for not applying an age-based assessment:

- inability to determine age in eastern Baltic cod;
- potential changes in growth that have not been quantified;
- potential changes in natural mortality that have not been quantified.

Mixing of the eastern and western Baltic cod stocks is substantial in Subdivision 24. The stock mixing within Subdivision 24 is variable spatially, and possibly also between seasons and age groups. This introduces uncertainty in the allocation of catches to stock. Catch separation is applied from 1994, and year-specific data for stock separation is available for 11 of the 23 years in the time-series. The allocation of catches to stock for the remaining years was performed by extrapolation. The longest gap in the data is from 2001 to 2007. From 2013 on a stock-splitting key is available for every year.

Issues relevant for the advice

The decrease in biomass of cod during 2011–2014 in length classes above 40 cm has been stronger than reflected in the overall index of cod ≥ 30 cm (Figure 3). The 2017 biomass, based on the two latest surveys, shows a decline in all length groups. The relative harvest rate for larger cod (especially cod > 45 cm) is higher than the average relative harvest rate of the stock (Figure 3).

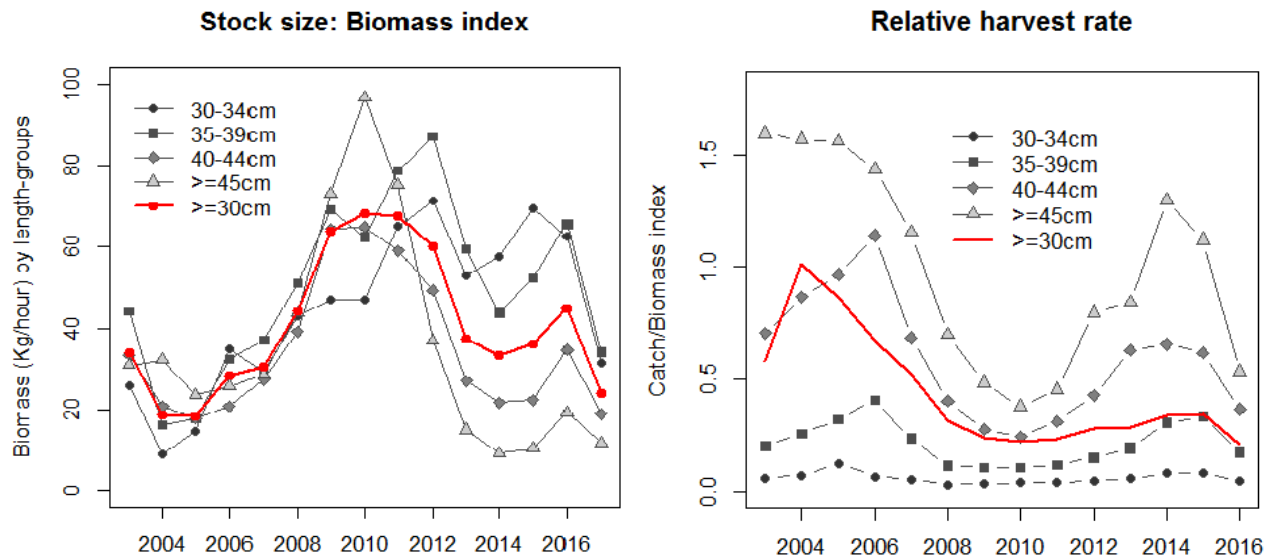


Figure 3 Cod in subdivisions 24–32, eastern Baltic stock. Left panel: Stock size indicator by length groups and overall index ≥ 30 cm (note: the index of biomass ≥ 30 cm is the same as the one shown in Figure 1, but rescaled in order to facilitate visual comparison). Right panel: Mean relative harvest rate (total catch divided by stock size indicator for ≥ 30 cm cod; red line) compared with relative harvest rates for individual length groups.

Landings of fish below the minimum conservation reference size (MCRS, 35 cm) are very low and discarding still takes place despite the fact that the landing obligation has been in place since 2015. The discard rate in 2016, with the present MCRS, was estimated at approximately 10% based on observer data; however, there have been problems gaining observer access in some countries and the 10% figure is considered to be an underestimate. The available information from the fisheries and observers suggests that modification of the selectivity properties of the gear takes place, leading to a higher proportion of smaller fish being caught.

The TACs and catches in 2015–2016 and the TAC for 2017 have been considerably higher than the advised catch. The full TAC has not been taken since 2007.

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

To derive a management area-based total commercial cod catch for the eastern Baltic areas (SDs 25–32) consistent with the ICES advice for the stocks, catches of EB cod in the western management area have to be taken into account. At present, WB cod is the smaller and more vulnerable stock. In the three most recent years (2014–2016), the ratio EB cod / WB cod catch in SD 24 has been 2.30 (advice on western Baltic cod, Table 6, ICES, 2017b). Assuming the same stock distribution and fishing pattern as in recent years, this implies that the intended catch of the WB cod stock in SD 24 will determine the amount of EB cod expected to be caught in that subdivision.

Assuming the same relative geographical distribution of the western Baltic cod stock commercial catch in 2018 as observed in recent years, the distribution of a commercial catch of western Baltic cod of 3541 t in 2018 will be 2443 t in SDs 22–23 and 1098 t in SD 24 (advice on western Baltic cod, ICES, 2017b). The additional amount of eastern Baltic cod fished in SD 24 is estimated at 2525 t, assuming the same ratio (2.30) between the eastern and the western Baltic cod in the commercial catches as observed on average during 2014–2016. This amount has to be deducted from the advised catch of eastern Baltic cod to get

the estimated corresponding catch of cod in SDs 25–32. The resulting catch of cod in SDs 25–32 is 23 546 t. Table 5 of the advice on western Baltic cod (ICES, 2017b) illustrates the calculation for the upper and lower limit of the MAP F range for the western stock.

The EU Commission has requested ICES to only 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. There could be other allocation schemes also consistent with the advice per stock. There is no optimal biological solution for these allocation issues.

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 $B_{\text{trigger proxy}}$	0.5*	Relative value (B/B_{MSY}) from the SPiCT assessment model. B_{MSY} is estimated directly from the SPiCT model and changes when the assessment is updated.	(ICES, 2017a)
	$F_{\text{MSY proxy}}$	1*	Relative value (F/F_{MSY}) from the SPiCT assessment model. F_{MSY} is estimated directly from the SPiCT model and changes when the assessment is updated.	(ICES, 2017a)
Precautionary approach	B_{lim}			
	B_{pa}			
	F_{lim}			
	F_{pa}			
Management plan	SSB_{mgt}			
	F_{mgt}			

* No reference points are defined for this stock in terms of absolute values. The SPiCT-estimated values of the ratios F/F_{MSY} and B/B_{MSY} are used to estimate stock status relative to the proxy MSY reference points.

Basis of the assessment

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

ICES stock data category	3 (ICES, 2016).
Assessment type	Survey trends (ICES, 2017a).
Input data	International catches and length-based survey indices (BITS–Q1 since 2003; BITS–Q4 since 2002).
Discards and bycatch	Discards estimates are available and included in the catch data, with data series from all the main fleets but not from all countries. The discard estimates are considered underestimates of the true discards for the stock.
Indicators	Harvest rate.
Other information	This stock was benchmarked in 2015 (WKBALTCOD; ICES, 2015b).
Working group	Baltic Fisheries Assessment Working Group (WGBFAS)

Information from stakeholders

There is no available information.

History of the advice, catch, and management

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

Year	ICES advice	Predicted 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	
1988	TAC	150000		194000	
1989	TAC	179000	220000	179000	
1990	TAC	129000	210000	153000	
1991	TAC	122000	171000	123000	
1992	Lowest possible level	-	100000	55000**	
1993	No fishing	0	40000	45000**	
1994	TAC	25000	60000	100856**	104762
1995	30% reduction in fishing effort from 1994 level	-	120000	107718**	114172
1996	30% reduction in fishing effort from 1994 level	-	165000	124189	136929
1997	20% reduction in fishing mortality from 1995 level	130000	180000	88600	99306
1998	40% reduction in fishing mortality from 1996 level	60000	140000	67428	74945
1999	Proposed F_{pa} (= 0.6)	88000	126000	72995	81759
2000	40% reduction in F from 1996– 1998 level	60000	105000	89289**	103155
2001	Fishing mortality of 0.30	39000	105000	91328**	101863
2002	No fishing	0	76000	67740**	74316
2003	70% reduction in F	See option table	75000	69476**	78924
2004	90% reduction in F	< 13000	45400	68578**	74888
2005	No fishing	0	42800	55032**	63701
2006	Develop management plan	< 14900	49200	65532**	76596
2007	No fishing	0	44300	50843**	63722
2008	No fishing	0	42300***	42235**	55682
2009	Limit (total) landings to 48 600 t	≤ 48600	49380***	48439**	60696
2010	Follow management plan	56800	56100***	50277	60856
2011	See scenarios	-	64500***	50368	62227
2012	Follow management plan	74200	74200***	51225	67002
2013	Follow management plan	65900	68700***	31355	42932
2014	Follow management plan	70301 [†]	73400***	28909	45243
2015	20% reduction in catches	29085 [^]	55800***	37342	49629
2016	Precautionary approach ^{^^}	≤ 29220 [^]	46900***	29313	37656
2017	Precautionary approach ^{^^}	≤ 26994 [^]	36957***		
2018	Precautionary approach ^{^^}	≤ 26071 [^]			

* For the total Baltic Sea until and including 2003, and for SDs 25–32 since then.

** 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.

[^] Total catches.

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

[†] Version 3: Value corrected.

History of the catch and landings

Table 7 Cod in subdivisions 24–32, eastern Baltic stock. Catch distribution by fleet in 2016 as estimated by ICES.

Catch (2016)	Landings		Discards
37 656 tonnes	Active gears 84%	Passive gears 16%	3 913 tonnes
	33 743 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.

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	Catch	Landings	Discards	Catch	Total catch
1965			147352	147352				
1966		8735	177318	186053				
1967		11733	195446	207179				
1968		9700	216353	226053				
1969		10654	212160	222814				
1970		7625	198451	206076				
1971		5426	164840	170266				
1972		8490	143833	152323				
1973		7491	143164	150655				
1974		7933	147815	155748				
1975		9576	194649	204225				
1976		4341	203303	207644				
1977		2978	164792	167770				
1978		9875	154009	163884				
1979		14576	227699	242275				
1980		8544	347619	356163				
1981		6185	331642	337827				
1982		11548	316052	327600				
1983		10998	332148	343146				
1984		8521	391952	400473				
1985		8199	315083	323282				
1986		3848	252558	256406				
1987		9340	207081	216421				
1988		7253	194787	202040				
1989		3462	179178	182640				
1990		4187	153546	157733				
1991		2741	122517	125258				
1992		1904	54882	56786				
1993	18978	1558	50711	52269				
1994	44000	1956	100856	102812	1784	166	1950	104762
1995	18993	1872	107718	109590	4041	541	4582	114172
1996	10815	1443	124189	125632	10210	1087	11297	136929
1997**		3462	88600	92062	6615	629	7244	99306
1998		2299	67428	69727	4588	630	5218	74945
1999		1838	72995	74833	6338	588	6926	81759
2000	23118	6019	89289	95308	6694	1153	7847	103155
2001	23677	2891	91328	94219	7261	383	7644	101863
2002	17562	1462	67740	69202	4566	548	5114	74316
2003	22147	2024	69477	71501	6569	854	7423	78924
2004	19563	1201	68578	69779	4925	184	5109	74888
2005	14991	1670	55032	56702	5191	1808	6999	63701
2006	17836	4644	65531	70175	6279	142	6421	76596
2007	12418	4146	50843	54989	7876	856	8733	63722
2008	2673	3746	42234	45980	8934	768	9702	55682
2009	3189	3328	48438	51766	8456	474	8930	60696
2010		3543	50276	53819	6479	559	7037	60856
2011		3850	50368	54218	7487	521	8009	62227
2012		6795	51225	58020	8419	564	8982	67002
2013		5020	31355	36375	5226	1331	6557	42932
2014		9627	28909	38536	5439	1268	6707	45243
2015		6328	37342	43670	5047	912	5959	49629
2016		3620	29313	32933	4430	293	4723	37656

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

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

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 (SD 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
1965	35313		23	10680	15713			41498		21705	22420				147352
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
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	9652	189	388		1477	2586	1974	12937	3512	4628					37343
2016*	6756	2	57		918	2717	1698	9583	3392	4189					29313

* Provisional data.

[‡] Version 4: Table 9 does not include landings in SD 24.

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

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

Summary of the assessment

Table 10 Cod in subdivisions 24–32, eastern Baltic stock. Assessment summary. The small fish index is a combined abundance index of cod < 30 cm, from the Baltic International Trawl Survey (BITS) in quarters 1 and 4 in subdivisions 25–28. The stock size indicator is a combined biomass index of cod ≥ 30 cm, from the Baltic International Trawl Survey (BITS) in quarters 1 and 4 in subdivisions 25–28. The quarter 1 and quarter 4 indices are combined using geometric mean and shifting the quarter 4 index forward to the next year. The relative harvest rate is the stock catch divided by the stock size indicator.

Year	Small fish index (number per hour, < 30 cm)	Stock size indicator (kg per hour, ≥ 30 cm)	Landings eastern Baltic cod stock in SDs 25–32 (tonnes)	Discards eastern Baltic cod stock in SDs 25–32 (tonnes)	Relative harvest rate (on biomass ≥ 30 cm)	Eastern Baltic cod stock catch in SD 24 (tonnes)
2003	90	136	69477	2024	0.582	7423
2004	144	74	68578	1201	1.011	5109
2005	326	74	55032	1670	0.862	6999
2006	127	114	65531	4644	0.673	6421
2007	220	122	50843	4146	0.521	8733
2008	295	177	42234	3746	0.314	9702
2009	208	256	48438	3328	0.237	8930
2010	265	273	50276	3543	0.222	7037
2011	202	270	50368	3850	0.230	8009
2012	182	241	51225	6795	0.278	8982
2013	537	150	31355	5020	0.286	6557
2014	444	133	28909	9627	0.340	6707
2015	269	144	37342	6328	0.344	5959
2016	256	179	29313	3620	0.211	4723
2017	156	96				

Sources and references

EU. 2016. 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 191/1. <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32016R1139&rid=1>.

ICES. 2012. ICES Implementation of Advice for Data-limited Stocks in 2012 in its 2012 Advice. ICES CM 2012/ACOM 68. 42 pp.

ICES. 2015a. Cod in Subdivisions 25–32 (Eastern Baltic Sea) and Subdivision 24. In Report of the ICES Advisory Committee, 2015. ICES Advice 2015, Book 8, Section 8.3.3. <http://www.ices.dk/sites/pub/Publication%20Reports/Advice/2015/2015/cod-2532.pdf>.

ICES. 2015b. Report of the Benchmark Workshop on Baltic Cod Stocks (WKBALTCOD), 2–6 March 2015, Rostock, Germany. ICES CM 2015/ACOM:35. 172 pp.

ICES. 2016. Advice basis. In Report of the ICES Advisory Committee, 2016. ICES Advice 2016, Book 1, Section 1.2.

ICES. 2017a. Report of the Baltic Fisheries Assessment Working Group (WGBFAS), 19–26 April 2017, ICES Headquarters, Copenhagen, Denmark. ICES CM 2017/ACOM:11.

ICES. 2017b. Cod (*Gadus morhua*) in subdivisions 22–24, western Baltic stock (western Baltic Sea). In Report of the ICES Advisory Committee, 2017. ICES Advice 2017, cod.27.22-24.