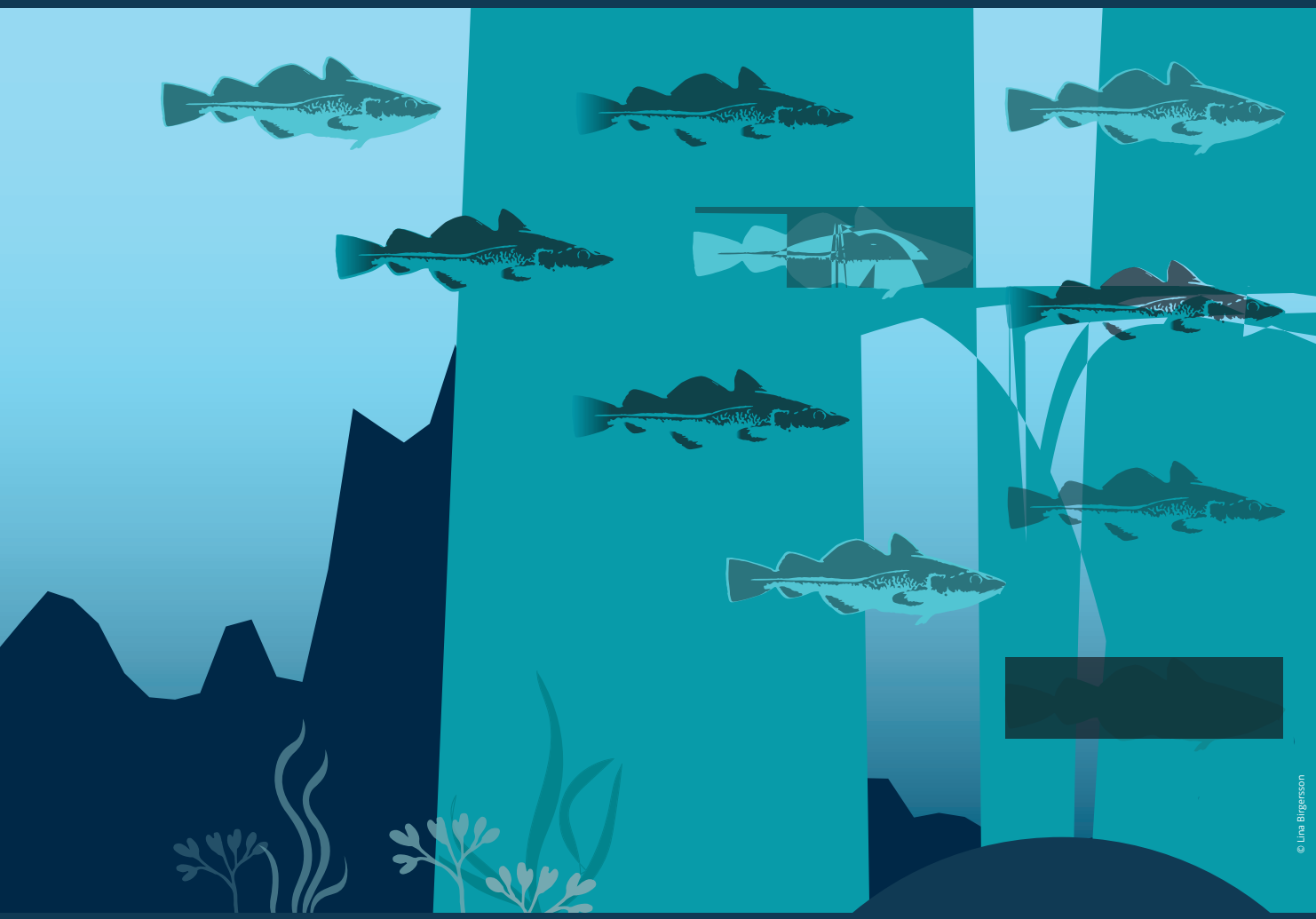
The Decline of Cod in the Baltic Sea

A review of biology, fisheries and management, including recommendations for cod recovery



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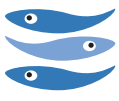

The Decline of Cod in the Baltic Sea

A review of biology, fisheries and management, including recommendations for cod recovery

Lina Birgersson
Sara Söderström
Mohammed Belhaj

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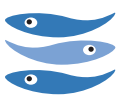

Recommended actions

Implement an ecosystem-based approach to fsheries management

Make fsheries sustainable

Improve environmental protection

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Disposition of report

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Chapter 1
Literature review of Baltic cod

1.1. Introduction

1.1.1. Aim

1.2. Method

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1.3. Background

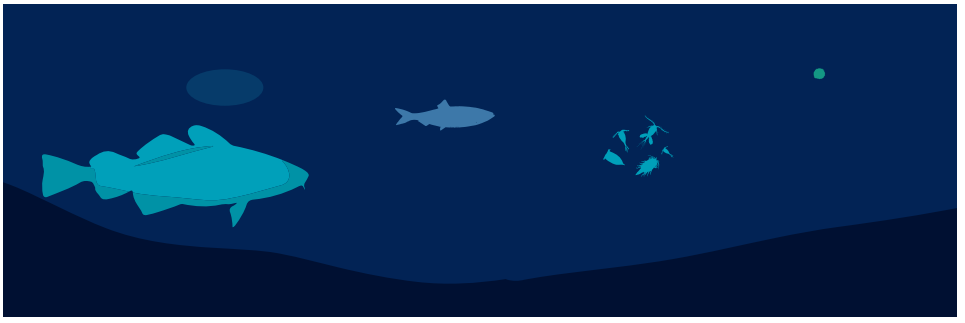
1 Grey literature is a term used for scientific material that is not formally published, such as reports or governmental papers. https://kib.ki.se/en/search-evaluate/grey-literature

Figure 1. ICES Subdivisions in the Baltic Sea ecoregion

1.3.1. The Baltic Sea is a unique and challenging environment to live in

1.3.3. Importance of cod in the ecosystem

Figure 2. Simplified overview of the food web in the Baltic Sea ecosystem. Large cod eat sprat and herring, which in turn feed on zooplankton, and zooplankton eat phytoplankton. A decrease in the number of large cod has led to an increase in the numbers of sprat, a decrease in zooplankton and an increase in phytoplankton



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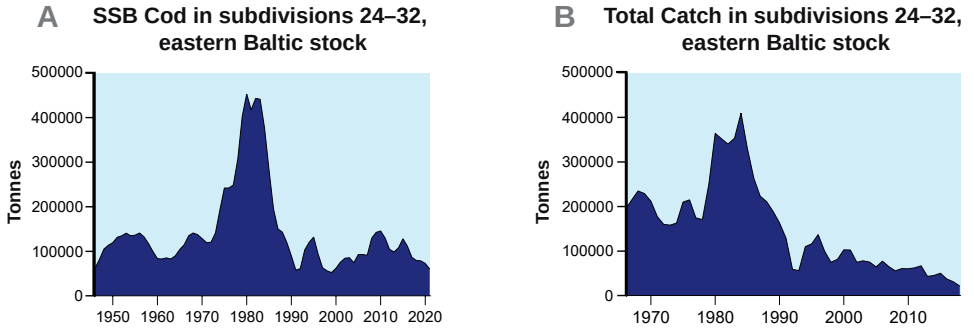

Figure 4. Overview of the A) spawning stock biomass of WBC cod in SD 22-24 based on ICES data for the period 1985-2021 and B) annual Total Catch of WBC in SD 22-24 based on ICES data for the period 1992-2020 (ICES, 2021d)

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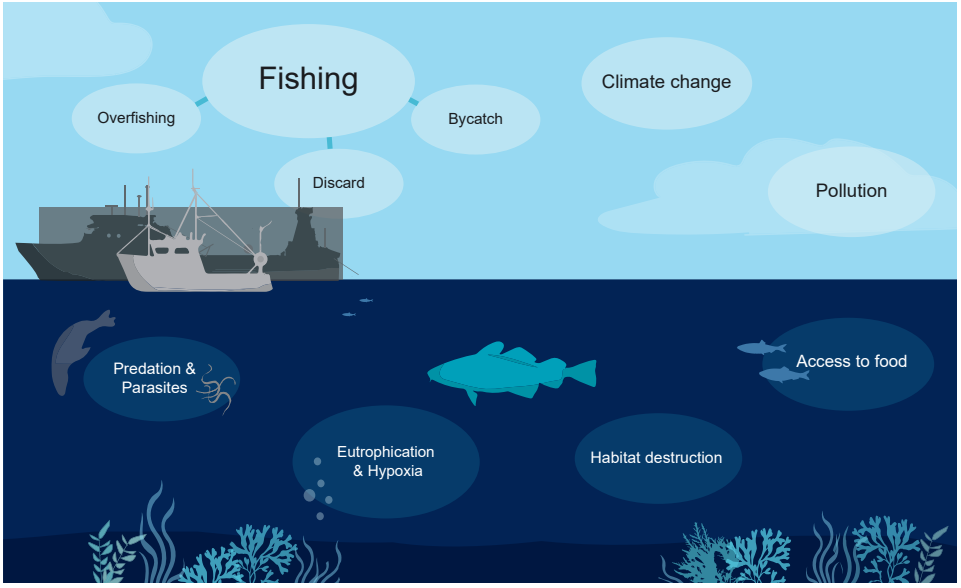
1.4.2. Age determination and growth estimation in Baltic cod

1.4.3. Stock mixing and stock assessment uncertainties

1.4.4. Cod in Öresund, a positive exception

1.5. Possible causes of the poor state of Baltic cod

Figure 6. Overview of the multiple different factors that can affect the status of Baltic cod according to current scientific literature used in the literature study and described further in Section 1.5.1-1.5.2. Several of these factors are linked together; the lack of oxygen can, for example, reduce access to food for young cod, and fishing of cod prey, including sprat, can reduce food availability for older cod. The fishing category includes both targeted fishing (prior to summer 2019 for EBC), bycatch of cod in other fisheries, discard and fishing of prey species that are important for cod



1.5.1. Fisheries-related factors

1.5.1.1. Overfishing

1.5.1.2. Discards

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1.5.1.3. Bycatch

1.5.1.4. Bottom trawling

1.5.1.5. Management and management problems

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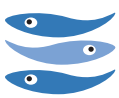
1.5.2.2. Lack of food and fishing for prey species

1.5.2.3. Climate change

1.5.2.4. Seal predation



1.5.2.5. Seal parasites

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1.5.2.7. Thiamine deficiency

1.5.2.8. Chemical pollution

1.5.2.9. Chemical Warfare Agents

1.5.2.10. Other factors

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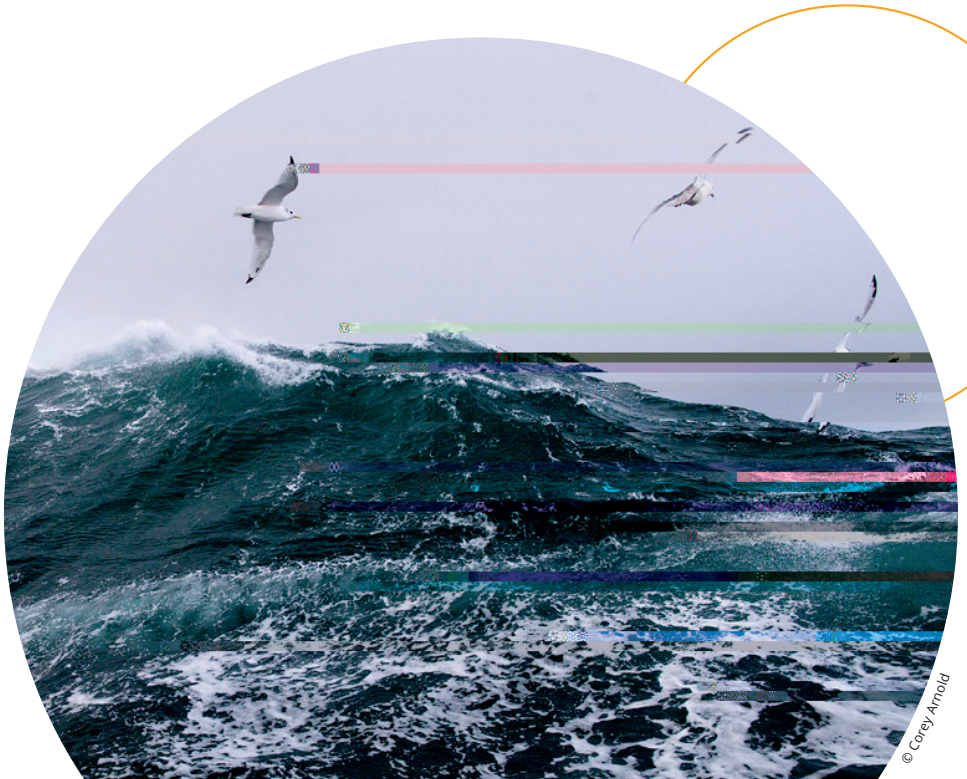

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Chapter 2
Socio-economic impact assessment

2.1. Background, rationale and objectives

2.1.1. Methods and delimitations

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2.1.2. The Baltic Sea Region

2.2. Socio-economic impact assessment

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2 In general, there are at least three methods to accomplish this task. The most widely used is cost-benefit analysis (CBA). The other methods are multicriteria analysis (MCA) and cost-effectiveness analysis (CEA). For more details on each of these see MCA: European Commission, EC (2021). 'Better regulation' toolbox. TOOL #63. MULTI-CRITERIA ANALYSIS. PAGE 516-520. https://ec.europa.eu/info/sites/default/files/file_import/better-regulation-toolbox-63_en_0.pdf. CEA: https://europa.eu/capacity4dev/evaluation_guidelines/wiki/cost-effectiveness-analysis-0

2.2.1. Externalities

Table 1. Is the industry sector (in general) affected (Yes) or not affected (No) by current marine environment problems? Per country (Hasselström., 2008).

	DK	EE	FI	DE	LV	LT	PL	SE	RU
Beach tourism	Yes	No	Yes	Yes	No	No	Yes	Yes	No
Recreational fishing	Yes	Yes	Yes	Yes	n.a	No	No	Yes	n.a

2.2.2. WTP case studies in the Baltic Sea area

Table 2. Studies of the economic value of ecosystem services provided by the Baltic Sea and Skagerrak with focus on fisheries, adapted from Swedish EPA (Söderqvist & Hasselström, 2008).

Country	Reference
Denmark, Finland, Iceland, Norway, Sweden	Toivonen et al (2000)
Denmark	Roth & Jensen (2003)
Estonia	Vetemaa et al (2003)
Finland	NOA (2007), Olkio (2005), Parkkila (2005), Valkeajärvi & Salo (2000)
Germany	Bundesforschungsanstalt für Fischerei (2007)
Sweden	Fiskeriverket (2008) Olsson (2004), Paulrud (2004), Soutukorva et al (2005)

2.2.3. Baltic Sea fisheries

2.2.3.1. Commercial fisheries

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-
-
- Latvia
-
- Poland
-
- Sweden

Table 3. History of ICES estimates of landings of cod caught in the eastern Baltic management area (SDs 25–32) by country. Weights are in tonnes (ICES 2019c).

Year	DK	EE	FI	DE	LV	LT	PL	SE	USSR Russia*	Total
1988	60 436	—	2 904	14 078	—	—	33 351	48 964	28 137	194 787
1998	7 818	1 188	1 026	1 270	7 765	4 176	25 155	14 431	4 599	67 428
2008	7 374	841	670	2 341	3 990	2 835	8 721	8 901	3 888	42 235
2018	2 684	1	53	241	1 253	694	5 695	1 912	3 376	15 907

* Until 1990 USSR, then Russia

2.2.3.2. Recreational fisheries

Table 4. Distribution of recreational fishers in the Baltic Sea region. Table adapted from Sporrong, 2017.

	DK	EE	FI	DE	LV	LT	PL	SE	RU
Recreational fishermen	500 000	149 000	1.495 mill.	3.4 mill.	120 000	200 000	1.5 - 2 mill.	1.4 mill.	>100 000
Anglers	191 940*		1.4 mill.	163 000	100 000-120 000	200 000	37 000 (2014)	++	-

* Angling licences: 191 940 in 2016, of which 14 022 annual angling licences. Recreational licence (including angling): 31 502 in 2016

3 Analysis of the development in fishing in Sweden in 2008 shows that from the commercial fishing side, recreational fishing is generally not seen as a competitor for the fish resource. The report is based on a number of interviews with fishermen from different coastal stretches, and most of the fishermen interviewed do not consider themselves to have any problems with recreational fishermen. In some fishing and areas, however, there are contradictions. One example is lobster fishing on the west coast, another is salmon fishing in the Baltic Sea (Waldo et al., 2009).

2.3. 2. lua

Table 5. Baltic Sea vessels using passive or active gear in 2019 (European Commission, 2020b).

Countries	Vessels using passive gear	Vessels using active gear
Denmark	862	441
Finland	3 170	42
Estonia	1 784	33
Germany	1 028	53
Latvia	236	51
Lithuania	103	35
Poland	636	189
Sweden	640	213
Russia*	9	44
Total	**8 468**	**1101**

* Data for Russia is adapted from ICES (2019e)

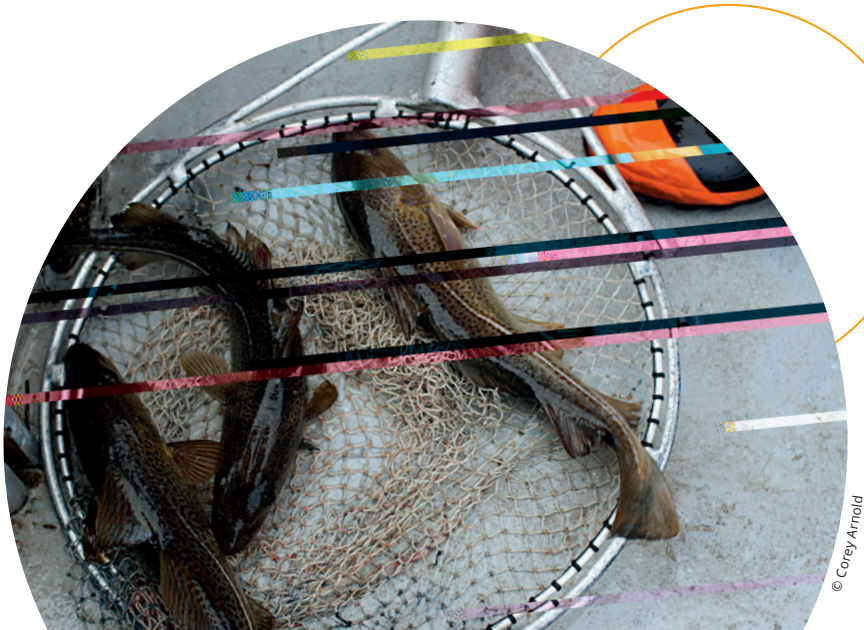

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Table 6. Number of vessels used in the analysis (based on Table 5).

Countries	Vessels with passive gear to be compensated (65% of total)	Vessels with active gear to be compensated (75% of total)
Denmark	560	331
Finland	2 061	21
Germany	1 160	25
Estonia	668	40
Latvia	153	38
Lithuania	67	26
Poland	413	142
Sweden	416	160
Russia	6	32
Total	**5 504**	**825**

Table 7. Net present value of Scenario 1 (PPP, € million).

PV of benefits	+ 55,030
PV of compensation	- 2,875
PV of costs of selective gear	- 32
PV of management cost	- 925
Net present value	+ 51,198

2.3.1.1. In case of eutrophication measures

2.3.1.2. Sensitivity analysis

2.3.2. Scenario 2: Regulatory difficulties and cooperation

2.3.2.1. Cooperation to apply the laws and regulations

4 Information on stock depletion is available but goes unheeded and is counteracted by fishermen who want to fish more and who are routinely supported by the 'political establishment' who appear to be most concerned about (short-term) employment, Sterner & Svedäng (2005).

2.3.2.2. Cooperation, management and efficient use of Baltic Sea resources

Table 8. Country level aggregated net present values (€ millions) for non-cooperative (NC) and the grand coalition (GC) games under three climate scenarios (Tunca et al., 2019).

	Base scenario		Scenario 1		Scenario 2	
Country	**NC**	**GC**	**NC**	**GC**	**NC**	**GC**
Denmark	2 444	2 684	2 358	2 985	1 955	1 955
Poland	747	735	903	889	646	663
Sweden	1 399	1 730	1 652	1 878	1 246	1 378
Total	**4 590**	**5 139**	**4 913**	**5 753**	**3 847**	**3 998**

Chapter 3
Policy and management

3.1. The EU Common Fisheries Policy (CFP) and related fisheries laws

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3.1.1. Total Allowable Catch (TAC) – limits on the number of fish that may be caught

5 CFP Basic Regulation Art. 15 https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32013R1380&from=EN

Table 9. Number of stocks by ecoregion for which fishing mortality (F) exceeded FMS
Source: STECF, 2021, p 33.

Eco Region	2003	2004	2005	2006	2007	2008	2009	2010	1
ALL	45	47	49	49	49	47	43	38	
Baltic Sea	**7**	**7**	**7**	**7**	**7**	**6**	**7**	**6**	
BoBiscay & Iberia	7	7	7	7	7	7	6	5	
Celtic Seas	12	12	13	13	15	15	13	11	
Greater North Sea	13	16	17	18	17	15	14	13	
Widely	6	5	5	4	3	4	3	3	

Eco Region	2012	2013	2014	2015	2016	2017	2018	2019
ALL	36	35	36	33	33	33	27	28
Baltic Sea	**4**	**4**	**4**	**5**	**5**	**6**	**5**	**5**
BoBiscay & Iberia	5	6	6	5	5	4	3	1
Celtic Seas	13	9	10	9	10	9	8	7
Greater North Sea	11	13	13	11	10	11	8	13
Widely	3	3	3	3	3	3	3	2

Table 10. Number of stocks outside safe biological limits by ecoregion. Source: STECF, 2021, p 37.

	2003	2004	2005	2006	2007	2008	2009	2010	2011
ALL	31	32	32	27	26	23	21	20	19
Baltic Sea	**5**	**6**	**6**	**3**	**3**	**4**	**5**	**4**	**4**
BoBiscay & Iberia	5	4	5	5	5	3	3	2	1
Celtic Seas	10	10	10	8	8	8	6	7	6
Greater North Sea	7	7	7	7	7	5	5	5	6
Widely	4	5	4	4	3	3	2	2	2

Eco Region	2012	2013	2014	2015	2016	2017	2018	2019
ALL	16	17	20	19	14	15	13	17
Baltic Sea	**3**	**3**	**3**	**4**	**3**	**3**	**2**	**4**
BoBiscay & Iberia	2	3	3	3	0	0	0	0
Celtic Seas	5	5	7	6	6	6	6	6
Greater North Sea	5	5	6	5	4	5	4	6
Widely	1	1	1	1	1	1	1	1

3.1.2. Regionalisation and the Baltic Sea multiannual plan

3.1.3. Regulation of fishing capacity

6 The plan shall implement the ecosystem-based approach to fisheries management in order to ensure that negative impacts of fishing activities on the marine ecosystem are minimised. It shall be coherent with Union environmental legislation, in particular with the objective of achieving good environmental status by 2020 as set out in Article 1(1) of Directive 2008/56/EC.

3.1.4. Landing Obligation and measures to prevent bycatch, discards and IUU

7 The Technical Measures Regulation came into force in 2019. EU countries with a fisheries interest in a given sea basin can agree on regional technical measures, adapted to the specific regional circumstances. Such measures can then be adopted as EU secondary legislation, if confirmed by scientists to be consistent with the objectives of the common fisheries policy. The Technical Measures Regulation aims to de-centralise the management of technical features to the regional level. It is therefore important to measure progress regularly. The regulation states that the Commission should carry out such assessments every 3 years. https://ec.europa.eu/oceans-and-fisheries/fisheries/rules/technical-measures_en

3.1.5. Technical measures and Article 17 – where, when and how fishing can be done

3.1.5.1. Measures to aid recovery of cod

Table 11. Examples of measures with potential to contribute to cod recovery in Swedish waters (beyond regulation of cod fishing), as suggested in HaV 2020, p 54-55. SU – Skagerrak - open sea spawning stock, SK – Skagerrak coastal spawning stock, K – Kattegatt cod, WB – Western Baltic cod, EB – Eastern Baltic cod.

	Significance for the recovery of the cod							
Measure	**SU**	**SK**	**K**	**WB**	**EB**	**Timeframe for effect**	**Ecological risk**	**Scale**
Trials with local reduction of seals and cormorants	No	Unclear	Unclear	Unclear	Unclear	Short	Yes	Local
More selective and low-impact fisheries	High	High	High	High	High	Short	No	Large
Prevent and reduce ghost fishing	Unclear	Unclear	Unclear	Unclear	Unclear	Short	No	Local/Large
Protect and restore cod habitats	High	High	High	High	High	Short-Long	No	Local/Large
Trials to improve food web conditions	No	No	No	No	High/ Unclear	Short-Medium	Yes	Large
Trials with feeding of cod	No	No	No	No	Unclear	Short	Yes	Local
Trials with releases of cod	No	Unclear	Unclear	No	No	Medium	Yes	Local
Trials with artificial reefs	No	Unclear	Unclear	Unclear	Unclear	Medium	Yes	Local
Accelerate the reduction of carbon dioxide emissions	High	High	High	High	High	Long	No	Large
Accelerate action to prevent eutrophication	High	High	High	High	High	Long	No	Large
Trials to locally mitigate the effects of eutrophication	No	Unclear	No	No	Unclear	Medium	Yes	Local
Investigate the effects of environmental toxins on cod	Unclear	Unclear	Unclear	Unclear	Unclear	Medium	No	Large
Investigate the effects of pharmaceutical residues on cod	Unclear	Unclear	Unclear	Unclear	Unclear	Medium	No	Large

3.1.5.2. Article 17 of the CFP: support low impact fisheries

Table 12. Summary of answers in a survey targeting fisheries experts in EU MS, asking about fishing restrictions on the basis of Article 17. Source: WWF, 2018, p 24.

	PT	LT	DK	LV	IE	CY	EE	ES	FI	FR	GR
Perceived as transparent?	no		yes	yes	yes	yes	yes	yes	yes	yes	yes
Favouring low- impact fishers?	no		yes	yes	yes	no	no	no	no	no	no
Changes to come in the system?	yes	yes	yes					yes			
Group of MS	About to change		Implementation under way		Starting implementation			No implementation yet			

	IT	MT	RO	HR	SE	BE	DE	NL	PL	SI	BG
Perceived as transparent?	yes	yes	yes		no	no	no	no	no		
Favouring low- impact fishers?	no	no	no	no	no	no	no	no	no		
Changes to come in the system?											
Group of MS	No implementation yet									No info	

Depending on the answers to the question, the MS belong to one of the five groups, “about to change”, “implementation underway”, “starting implementing”, “no implementation yet”, and “no information”.

3.2. Cod landings and fishing management

Figure 7. ICES SSB assessment and fishing pressure for WBC. It is clearly shown that the predicted SSB has been much larger than actual stock development. Source: ICES, 2021d

Table 13. History of the advice, catch and manangement. From ICES 2021a.

Cod in subdivisions 25–32, eastern Baltic stock. ICES advice and official landings. All weights are in tonnes.

Year	ICES Advice	Catches corresp. to advice	Landings corresp. to advice	Agreed TAC	ICES landings (SDs 25–32)	ICES EBC stock catches (SDs 24 and 25–32)
2007	No fishing		0	44 300	50 843**	64 656
2008	No fishing		0	42 300***	42 235**	55 578
2009	Limit (total) landings to 48 600 tonnes		48 600	49 380***	48 439**	60 513
2010	Follow management plan		56 800	56 100***	50 277	60 400
2011	See scenarios		-	64 500***	50 368	62 245
2012	Follow management plan		74 200	74 200***	51 225	67 024
2013	Follow management plan		65 900	68 700***	31 355	42 977
2014	Follow management plan		70 301	73 400***	28 909	45 289
2015	20% reduction in catches	29 085		55 800***	38 079	50 008
2016	Precautionary approach^	29 220		46 900***	29 313	37 438
2017	Precautionary approach^	26 994		36 957***	25 496	30 965
2018	Precautionary approach^	26 071		34 288***	15 907	21 605
2019	Precautionary approach^	16 685		29 912***	8 383	11 938
2020	Precautionary approach^	0		7 500***	2 319	2 899
2021	Precautionary approach^	0		3 595***		
2022	Precautionary approach^	0				

** Reported landings in 1992–1995 and 2000–2009 are likely to be minimum estimates due to incomplete reporting.
*** TAC is for SDs 25–32 and is calculated as EU + Russian autonomous quotas.
^ ICES stock-based advice (for the eastern Baltic cod stock).

Table 14. History of the advice, catch and manangement. From ICES 2021d.

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 corresp. to the advice	Commercial catch corresp. to advice*	Agreed TAC**	ICES estimated total commercial landings subdivisions 22–24 (eastern and western Baltic cod stocks)
2007	Keep SSB at Bpa		< 20 500	26 700	23 736
2008	Rebuild SSB to Bpa		< 13 500	19 200	20 082
2009	Rebuild SSB to Bpa		< 13 700	16300	15 549
2010	Management plan		< 17 700	17 700	14 120
2011	See scenarios		-	18 800	16 332
2012	Management plan		21 300	21 300	17 072
2013	Management plan		20 800	20 000	12 968
2014	Management plan		17 037	17 000	13 538
2015	MSY approach		8 793	15 900	13 418
2016	MSY approach (F = 0.23)	7 797		12 720	10 629
2017	MSY approach (F = 0.15)	3 475	917	5 597	5 865^
2018	MAP F ranges: Flower to FMSY adjusted by SSB2018/MSY Btrigger (F = 0.11–0.188)	3 130–5 295	1 376–3 541	5 597	5 850^
2019	MAP range: FMSY Flower to Fupper (F = 0.15–0.45)	9 094–23 992	5 867–22 238	9 515	7 701^
2020	MAP range: FMSY Flower to Fupper (F = 0.18–0.43)	5 205–11 006	3 065–8 866	3 806	3 329^
2021	Management plan	5 950 (range 4 275–9 039)	4 635 (range 2 960–7 724)	4 000	
2022	MSY approach	698			

* 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.

Table 15. ICES advice, catches and TAC 1988-2018 (ICES, 2019c).

Year	ICES advice	Catches corresp. to advice	Landings corresp. to advice	Agreed TAC	ICES landings subdiv. 25-32	ICES Baltic stock catches subdiv. 24 & 25-32
1988	TAC	n.a.	150 000		194 000	210 527
1998	40% reduction in fishing mortality from 1996 level	n.a.	60 000	140 000	67 428	74 940
2008	No fishing	n.a.	0	42 300	42 235	55 578
2018	Precautionary approach	26 071		34 288	15 907	21 065

Table 16. Cod in subdivisions 24–32, eastern Baltic stock. History of ICES estimates of landings, discards, and catch by area. Weights are in tonnes (ICES, 2019c).

	Eastern BC stock in SD 25-32			Eastern BC stock in SD 24			Eastern BC stock in SD 24 & 25-32
Year	**Discards**	**Total landings**	**Catch**	**Discards**	**Total landings**	**Catch**	**Total catch**
1988	7 253	194 787	202 040		8 487	8 487	210 527
1998	2 299	67 428	69 727	631	4 582	5 213	74 940
2008	3746	42 234	45 980	787	8 811	9 598	55 578
2018	3 103	15 907	19 010	300	2 295	2 595	21 605

Table 17. Discards, recreational and total catch of western Baltic stock 1988-2018 (ICES, 2020f).

	Management area SDs 22-24		
Year	**Discards**	**Recreational catch**	**Total catch**
1988		2 082	31 241
1998	6 206	3 410	43 833
2008	1123	3 039	24 274
2018	469	1 600	7 907

Figure 8. Historical landings of the EBC. Source: ICES, 2021a

Catches

3.3. EU environmental laws and directives

3.3.1. Habitat Directive and Natura 2000

3.3.2. Marine Strategy Framework Directive

3.3.3. Regional Sea Conventions (RSCs) – HELCOM and the BSAP

3.3.5. EU restoration law

3.4. Ecosystem-based management – a cornerstone of official EU fisheries and environmental policies

Key principles of EBM:

(i)	***Consider Ecosystem Connections***
(ii)	***Appropriate Spatial & Temporal Scales***
(iii)	***Adaptive Management***
(iv)	*Use of Scientific Knowledge*
(v)	*Stakeholder Involvement*
(vi)	*Integrated Management*
(vii)	*Sustainability, Account for Dynamic Nature of Ecosystems*
(viii)	*Ecological Integrity & Biodiversity*
(ix)	*Recognize Coupled Social-Ecological systems*
(x)	*Decisions reflect Societal Choice*
(xi)	*Distinct Boundaries*
(xii)	*Interdisciplinarity*
(xiii)	*Appropriate Monitoring*
(xiiv)	*Acknowledge Uncertainty*

Source: Long et al., 2015

Key objectives of EBFM:

(i) *"avoid degradation of ecosystems, as measured by indicators of environmental quality and system status;*

(ii) *minimize the risk of irreversible change to natural assemblages of species and ecosystem processes;*

(iii) *obtain and maintain long-term socioeconomic benefits without compromising the ecosystem;*

(iv) *generate knowledge of ecosystem processes sufficient to understand the likely consequences of human actions. Where knowledge is insufficient, robust and precautionary fishery management measures that favor the ecosystem should be adopted."*

Source: Pikitch et al., 2004, page 346

3.4.1. EBM within CFP

3.4.2. Tracing EBM through WFD, MSFD, MSPD and HELCOM BSAP

3.4.3. Adding precaution to the agenda

8 Annex I to the Report of the united nations conference on environment and development. A/CONF.151/26 (Vol. I)

ICES classification categories used for advice on fishing possibilities:

"Category 1 – Stocks with quantitative assessments. Includes stocks with full analytical assessments, and forecasts that are either age-/length-structured or production models."

"Category 2 – Stocks with analytical assessments and forecasts that are only treated qualitatively. Includes stocks with quantitative assessments and forecasts which, for a variety of reasons, are considered indicative of trends in fishing mortality, recruitment, and biomass."

"Category 3 – Stocks for which survey-based assessments or exploratory assessments indicate trends. Includes stocks for which survey, trends-based assessments, or other indices are available that provide reliable indications of trends in stock metrics, such as total mortality, recruitment, and biomass."

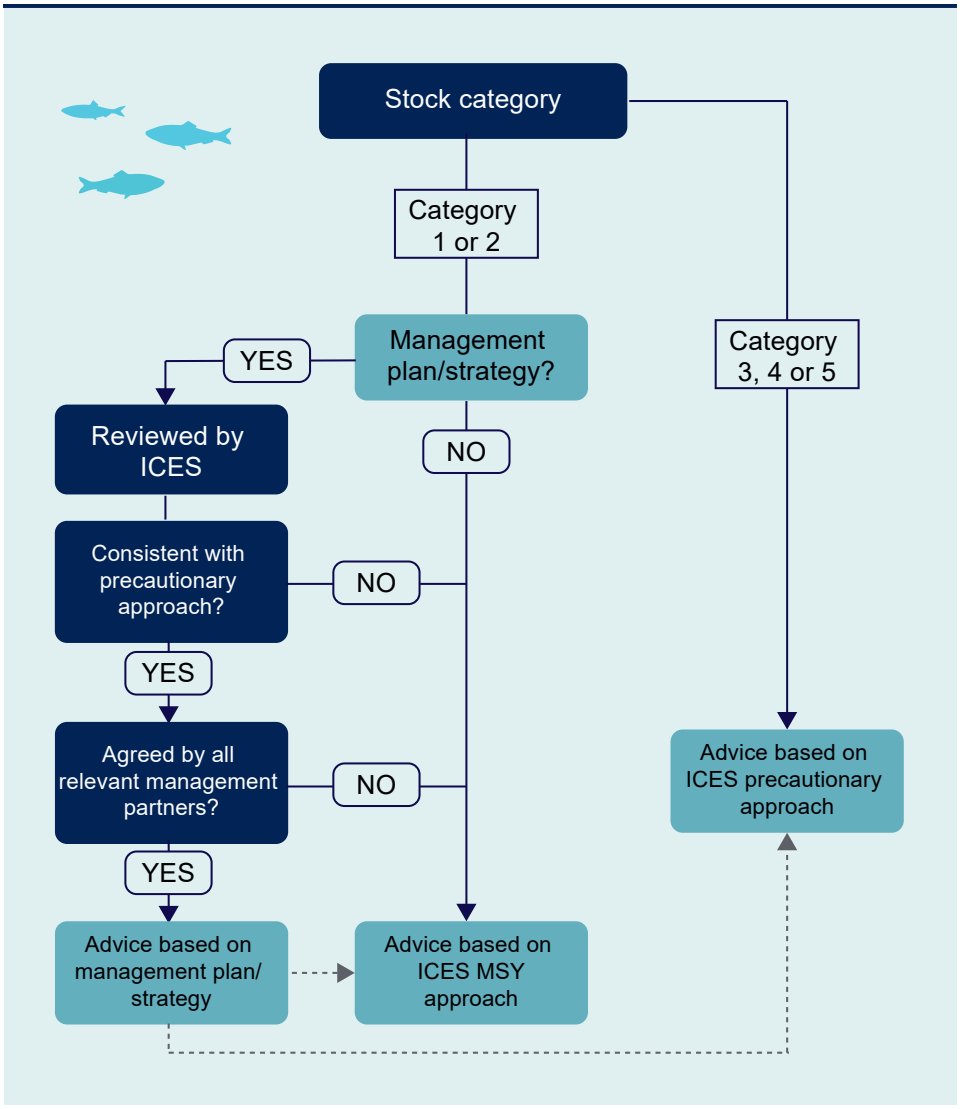
"Category 4 – Nephrops stocks where information on possible abundance can be inferred and stocks for which a reliable time-series of catch can be used to approximate MSY. This is where there are reasonable scientific grounds to use life-history information and density information from neighbouring areas to provide advice."

"Category 5 – Stocks for which only landings or a short series of catches are available."

"Category 6 – Negligible landings stocks and stocks caught in minor amounts as bycatch. Includes stocks where landings are negligible in comparison to discards, as well as stocks that are primarily caught as bycatch species in other targeted fisheries."

Source: ICES (2019d)

Figure 9. ICES flow diagram showing the basis of ICES advice. Adapted from: ICES (2019d). General context of ICES advice



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Chapter 4
Conclusions and recommendations

4.1. Recommendations

Management must align with the principles of ecosystem-based management

In order to implement EBM, research emphasises the following measures :

- Strengthened multi-species management, see also point 4 below.
- Actively taking other aspects of the ecosystem and its functions into consideration. This is also highlighted in the CFP.
- Apply the precautionary approach, i.e. where there is high uncertainty, fisheries management should be more precautionary.
- Apply a reversed burden of proof, i.e. a suggested action should only take place if proven not to harm the ecosystem.
- Avoid a too large outtake of biomass that threatens the productivity, resilience and integrity of the ecosystem.
- Flexibility in the management plans to adapt to the local context, i.e. what is necessary in one place is not necessarily as relevant in another.

(Pikitch et al., 2004, Trochta et al., 2018)

Management measures must be in line with EU environmental legislation and regional commitments

The need to urgently address hypoxia, eutrophication and climate change

Recommended actions:

- All managers work actively to implement the 2021 HELCOM Baltic Sea Action Plan.
- All MS must continue and strengthen their national and regional efforts to reduce eutrophication and hypoxia.
- Step up the work to combat climate change, at all possible levels.
- Reduce the area of seabed subjected to bottom trawling in order to minimise the leakage of nutrients stirred up from sediments and maximise the binding of CO in the sediments.

Proper multispecies management

Recommended actions:

- Apply a precautionary approach when setting the fishing opportunities for sprat, particularly in SD 25-26, considering the importance of sprat as prey for cod, the changes in spatial distribution of sprat and unusually high abundance of cod.
- The assignment to ICES should change and broaden to produce proper multi-species stock assessments, instead of the single species assessments carried out today.
- When setting fishing opportunities, apply a precautionary buffer to the MSY advice, i.e. leave room for multi-species interactions, including predator-prey interactions and other ecosystem processes (same as Recommendation 2 above).

Do not set TACs higher than scientific advice – apply the precautionary approach

Recommended actions:

- The Commission must change the assignment to ICES to add more precaution in the stock assessment, addressing ecosystem functions and predator-prey interactions.
- Managers and politicians must acknowledge the difference between the ICES precautionary approach and the Precautionary Approach/Principle as is widely used within environmental management.
- It's the responsibility of all MS to adhere to the objectives of the CFP and in environmental legislation and ensure that negotiations do not result in TACs above the scientific advice.

Effective fisheries control measures including Remote Electronic Monitoring (REM), restrictions on bottom trawling and restoration of natural demersal habitats

Recommended actions:

- Restrict all bottom trawling in the Baltic Sea, since the practice adds to eutrophication, releases carbon dioxide and destroys cod habitats.
- Actively work to restore seabed habitats and natural caves/reefs.
- Promote small-scale, low impact fishing, as stipulated in Article 17 of the CFP.
- Install REM in ALL vessels larger than 12 metres in the whole of the Baltic Sea.

Reserve fishing opportunities for fisheries with the lowest bycatch of cod

Recommended actions:

- Encourage stakeholder engagement, as is required by EBM, through cooperation with fishermen and make use of local knowledge.
- For fisheries where cod is a bycatch species, use the most selective gear and make them mandatory in the whole of the Baltic Sea as a matter of urgency.
- Continue to work with fleet reduction, i.e. counteract overcapacity by ensuring that MS report properly to the Commission and promptly follow the required action plan, if a need for fleet reduction is identified (in accordance with Article 22).

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4.2. Concluding remarks

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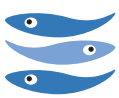
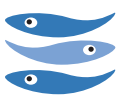
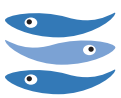
References







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Appendix

Full tables Eastern Baltic cod (EBC) TAC and ICES advice

Appendix Table 1. History of the advice, catch and manangement. From ICES 2021a.

Cod in subdivisions 25–32, eastern Baltic stock. ICES advice and official landings. All weights are in tonnes.

Year	ICES Advice	Catches corresp. to advice	Landings corresp. to advice	Agreed TAC	ICES landings (SDs 25–32)	ICES EBC stock catches (SDs 24 and 25–32)
1987	Reduce towards Fmax		245 000		207 000	223 295
1988	TAC		150 000		194 000	210 527
1989	TAC		179 000	220 000*	179 000	188 361
1990	TAC		129 000	210 000*	153 000	163 276
1991	TAC		122 000	171 000*	123 000	129 020
1992	Lowest possible level		-	100 000*	55 000**	59 110
1993	No fishing		0	40 000*	45 000**	56 154
1994	TAC		25 000	60 000*	100 856**	109 984
1995	30% reduction in fishing effort from 1994 level		-	120 000*	107 718**	115 843
1996	30% reduction in fishing effort from 1994 level		-	165 000*	124 189	136 788
1997	20% reduction in fishing mortality from 1995 level		130 000	180 000*	88 600	99 251
1998	40% reduction in fishing mortality from 1996 level		60 000	136 950*	67 428	74 940
1999	Proposed Fpa (= 0.6)		88 000	126 000*	72 995	81 653
2000	40% reduction in F from 1996–1998 level		60 000	105 000*	89 289**	102 833
2001	Fishing mortality of 0.30		39 000	105 000*	91 328**	102 402
2002	No fishing		0	76 000*	67 740**	74 824
2003	70% reduction in F		See option table	75 000	69 476**	78 093
2004	90% reduction in F		< 13000	45 400	68 578**	75 276
2005	No fishing		0	42 800	55 032**	64 495
2006	Develop management plan		< 14900	49 200	65 532**	77 086

Year	ICES Advice	Catches corresp. to advice	Landings corresp. to advice	TAC Agreed	ICES landings (SDs 25–32)	ICES EBC stock catches (SDs 24 and 25–32)
2007	No fishing		0	44 300	50 843**	64 656
2008	No fishing		0	42 300***	42 235**	55 578
2009	Limit (total) landings to 48 600 tonnes		48 600	49 380***	48 439**	60 513
2010	Follow management plan		56 800	56 100***	50 277	60 400
2011	See scenarios		-	64 500***	50 368	62 245
2012	Follow management plan		74 200	74 200***	51 225	67 024
2013	Follow management plan		65 900	68 700***	31 355	42 977
2014	Follow management plan		70 301	73 400***	28 909	45 289
2015	20% reduction in catches	29 085		55 800***	38 079	50 008
2016	Precautionary approach^	29 220		46 900***	29 313	37 438
2017	Precautionary approach^	26 994		36 957***	25 496	30 965
2018	Precautionary approach^	26 071		34 288***	15 907	21 605
2019	Precautionary approach^	16 685		29 912***	8 383	11 938
2020	Precautionary approach^	0		7 500***	2 319	2 899
2021	Precautionary approach^	0		3 595***		
2022	Precautionary approach^	0				

* For the total Baltic Sea until and including 2003.
** Reported landings in 1992–1995 and 2000–2009 are likely to be minimum estimates due to incomplete reporting.
*** TAC is for SDs 25–32 and is calculated as EU + Russian autonomous quotas.
^ ICES stock-based advice (for the eastern Baltic cod stock).

Full tables Western Baltic cod (WBC) TAC and ICES advice

Appendix Table 2. History of the advice, catch and manangement. From ICES 2021d.

Cod in subdivisions 25–32, eastern Baltic stock. ICES advice and official landings. All weights are in tonnes.

Year	ICES advice	Total catch from the stock corresp. to the advice	Commercial catch corresp. to advice*	Agreed TAC**	ICES estimated total commercial landings subdivisions 22–24 (eastern and western Baltic cod stocks)
1987	TAC		9 000		28 566
1988	TAC		16 000		29 159
1989	TAC		14 000	220 000	18 516
1990	TAC		8 000	210 000	17 780
1991	TAC		11 000	171 000	16 693
1992	Substantial reduction in F		-	100 000	17 996
1993	F at lowest possible level		-	40 000	21 228
1994	TAC		22 000	60 000	30 695
1995	30% reduction in fishing effort from 1994 level		-	120 000	33 895
1996	30% reduction in fishing effort from 1994 level		-	165 000	50 845
1997	Fishing effort should not be allowed to increase above the level of recent years		-	180 000	43 624
1998	20% reduction in F from 1996		35 000	136 950	34 216
1999	At or below Fsq with 50% probability		38 000	126 000	42 155
2000	Reduce F by 20%		44 600	105 000	38 347
2001	Reduce F by 20%		48 600	105 000	34 244
2002	Reduce F to below 1.0		36 300	76 000	24 158
2003	Reduce F to below 1.0		***22600 or 28800	75 000	24 624
2004	Reduce F to below 1.0		< 29600	29 600	20 854
2005	Reduce F to below 0.92		< 23400	24 700	22 045
2006	Management plan		< 28400	28 400	22 751

Year	ICES advice	from the stock corresp. to the advice	Commercial catch corresp. to advice*	Agreed TAC**	commercial landings subdivisions 22–24 (eastern and western Baltic cod stocks)
2007	Keep SSB at Bpa		< 20 500	26 700	23 736
2008	Rebuild SSB to Bpa		< 13 500	19 200	20 082
2009	Rebuild SSB to Bpa		< 13 700	16300	15 549
2010	Management plan		< 17 700	17 700	14 120
2011	See scenarios		-	18 800	16 332
2012	Management plan		21 300	21 300	17 072
2013	Management plan		20 800	20 000	12 968
2014	Management plan		17 037	17 000	13 538
2015	MSY approach		8 793	15 900	13 418
2016	MSY approach (F = 0.23)	7 797		12 720	10 629
2017	MSY approach (F = 0.15)	3 475	917	5 597	5 865^
2018	MAP F ranges: Flower to FMSY adjusted by SSB2018/MSY Btrigger (F = 0.11–0.188)	3 130–5 295	1 376–3 541	5 597	5 850^
2019	MAP range: FMSY Flower to Fupper (F = 0.15–0.45)	9 094–23 992	5 867–22 238	9 515	7 701^
2020	MAP range: FMSY Flower to Fupper (F = 0.18–0.43)	5 205–11 006	3 065–8 866	3 806	3 329^
2021	Management plan	5 950 (range 4 275–9 039)	4 635 (range 2 960–7 724)	4 000	
2022	MSY approach	698			

* 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.