

ECOREGION Celtic Sea and West of Scotland
STOCK Cod in Division VIa (West of Scotland)

Advice for 2014

ICES advises on the basis of the MSY approach that there should be no directed fisheries and that bycatch and discards should be minimized in 2014.

Stock status

F (Fishing Mortality)			
	2010	2011	2012
MSY (F_{MSY})	✗	✗	✗ Above target
Precautionary approach (F_{pa}, F_{lim})	✗	✗	✗ Harvest unsustainable

SSB (Spawning-Stock Biomass)			
	2011	2012	2013
MSY ($B_{trigger}$)	✗	✗	✗ Below trigger
Precautionary approach (B_{pa}, B_{lim})	✗	✗	✗ Reduced reproductive capacity

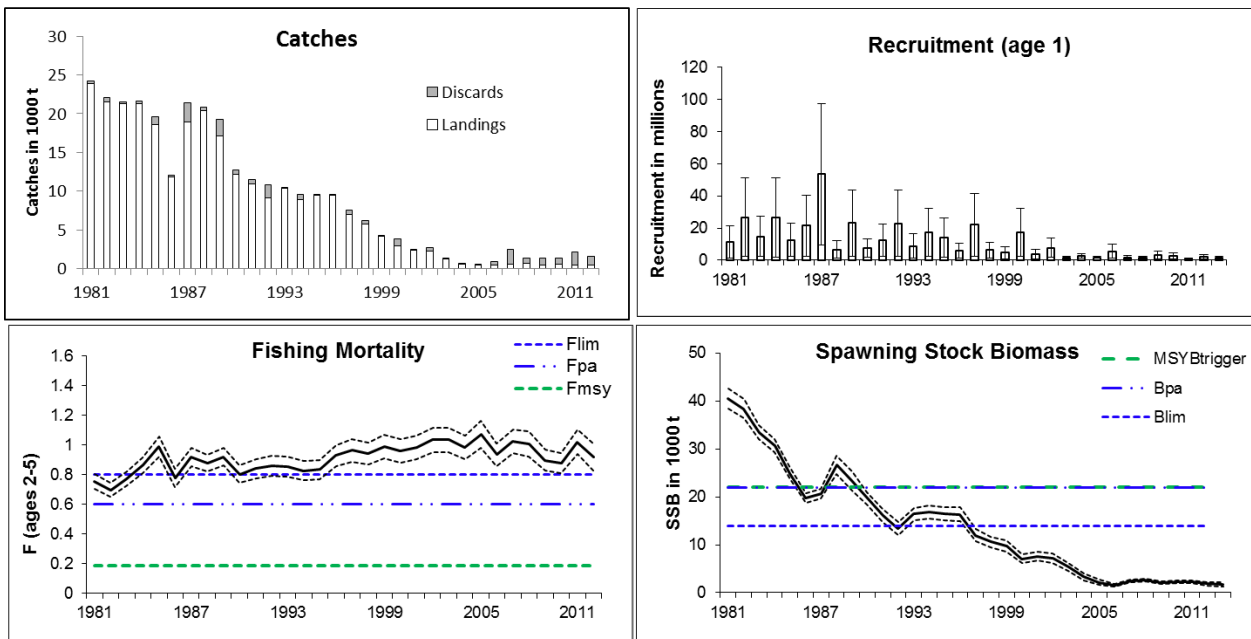
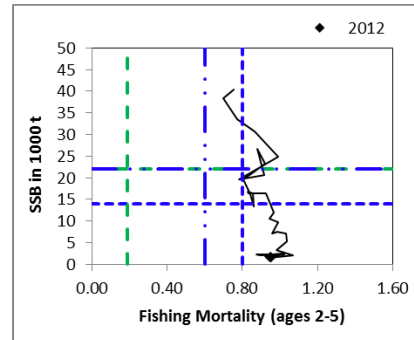


Figure 5.4.3.1 Cod in Division VIa (West of Scotland). ICES observed catches and summary of stock assessment (weights in thousand tonnes), dotted black lines are standard error for assessment estimates. Top right: SSB/F for the time-series used in the assessment.

Fishing mortality is high. The spawning-stock biomass has been below B_{lim} since 1997 and has remained very low, well below B_{lim} since 2006. Recruitment has been estimated to be low over the last decade and is considered impaired.

Management plans

Cod in Division VIa is subject to the EU cod long-term management plan ([EC 1342/2008](#)). ICES has not evaluated whether the management plan is in accordance with the precautionary approach. However, management measures taken so far have not constrained catches and no increase in stock biomass has occurred.

Biology

Cod are known to form aggregations, so it is still possible to find areas of high cod density at low stock abundance. This can lead to high catches in localized areas, generating high fishing mortality even with low fishing effort. Occasional

large catches cause greater uncertainty in survey abundance indices. Relatively stable aggregations on timescales of several weeks are consistent with management measures based on temporary spatial closures.

Environmental influence on the stock

With rising sea temperature a negative impact on recruitment has been shown for cod in the warmer waters of this species' range, including west of Scotland. Grey seal abundance is significant to the west of Scotland and they are known to feed on cod, among other species. The latest estimates of grey seal abundance over time show the population in the area to have remained stable since the mid-1990s. The contribution of seal predation to total cod mortality is likely to be significant, but data are limited.

The fisheries

The >100 mm otter trawl gear vessels targeting finfish (TR1) take roughly 90–95% of the cod catch and the 70–99 mm *Nephrops* fleet (TR2) takes 5–10% of the catch. Part of the landings comes from vessels using TR1 gear, fishing west of the line defined in the cod long-term management plan. Discards reported to ICES (all fleets combined) are 2.6 times greater than landings.

Catch distribution Total catch (2012) = 1632 t, where 29% are reported landings adjusted for misreporting and 71% are discards.

Effects of the fisheries on the ecosystem

Cod is taken in mixed demersal fisheries and there are no impacts specific to the catching of cod.

Quality considerations

Due to changes to the Scotland survey design and gear after 2010, later surveys must be considered a new abundance series (UKSGFS-WIBTS-Q1 and Q4). No fisheries-independent abundance series were available for 2012. Predicted catch is divided into landings and discards. Discard information is imprecise compared to landings data because of lower sampling coverage. Because catch is now dominated by discards it is very important to maintain the highest possible sampling (observer) coverage of vessels in Division VIa. Scottish landings (from 2006) are adjusted by estimates of misreporting. The misreporting estimates will have uncertainty associated with them. Implementing surveys that provide estimates of consumption by seals would give greater confidence in natural mortality estimates.

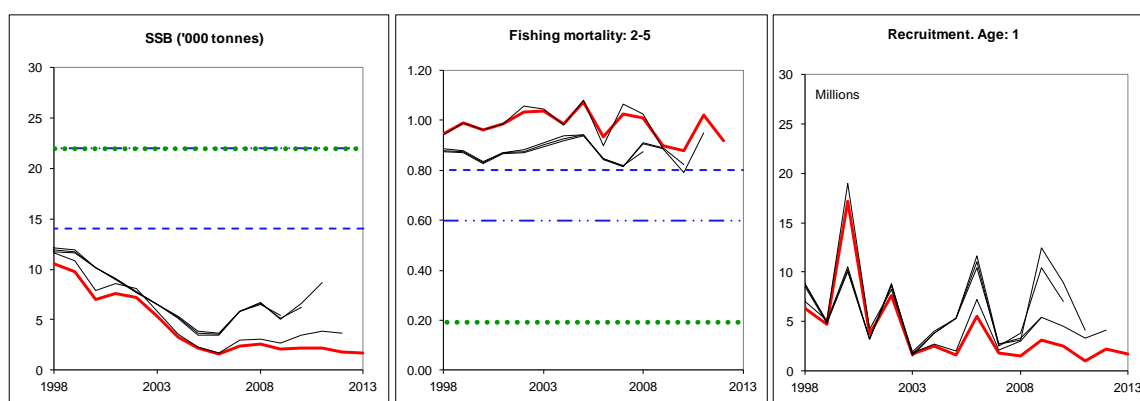


Figure 5.4.3.2 Cod in Division VIa (West of Scotland). Historical assessment results (final-year recruitment estimates included). This stock was benchmarked in 2012.

Scientific basis

Assessment type	Analytical age-based assessment (TSA).
Stock data category	Category 1.
Input data	Commercial catches (international landings, ages and length frequencies from catch sampling); one survey index (ScoGFS-WIBTS-Q1); maturity data from surveys; natural mortalities from M at mean weight model (Lorenzen), using mean weight data from market sampling and discard observations.
Discards and bycatch	Included in the assessment 1981–1990 and 2006 onwards, age structure only from 1991 to 2005, from (Scottish trawlers, Irish trawlers).
Indicators	Surveys: ScoGFS-WIBTS-Q4, IGFS-WIBTS-Q4, UKSGFS-WIBTS-Q1, and UKSGFS-WIBTS-Q4.
Other information	The stock was benchmarked in 2012 (WKROUND 2012; ICES, 2012).
Working group report	WGCSE (ICES, 2013).

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Reference points

	<i>Type</i>	<i>Value</i>	<i>Technical basis</i>
MSY Approach	MSY B_{trigger}	22 000 t.	B_{pa} .
	F_{MSY}	0.19	Provisional proxy by analogy with North Sea cod F_{max} . Fishing mortalities in the range of 0.17–0.33 are consistent with F_{MSY} .
Precautionary Approach	B_{lim}	14 000 t.	$B_{\text{lim}} = B_{\text{loss}}$, the lowest observed spawning stock estimated in previous assessments.
	B_{pa}	22 000 t.	Considered to be the minimum SSB required to ensure a high probability of maintaining SSB above B_{lim} , taking into account the uncertainty of assessments. This also corresponds with the lowest range of SSB during the earlier, more productive historical period.
	F_{lim}	0.8	Fishing mortalities above this have historically led to stock decline.
	F_{pa}	0.6	This F is considered to have a high probability of avoiding F_{lim} .

(unchanged since: 2010)

Outlook for 2014

Basis: $F(2013) = F_{\text{sq}}(2010-2012) = 0.92$; $SSB(2014) = 1.68$; Recruitment (2013) = 1.74 millions; Landings (2013) = 0.42; Discards (2013) = 0.77.

Rationale	Catch Total (2014)	Landings (2014)	Discards (2014)	Basis	F Total (2014)	F Land (2014)	F Disc (2014)	SSB (2015)	%SSB change ¹⁾
MSY transition	0.33	0.11	0.22	$(F_{2010} \times 0.2) + ((F_{\text{MSY}} \times (SSB_{2014}/MSY B_{\text{trigger}})) \times 0.8)$	0.19	0.06	0.13	3.01	+79%
MSY approach	0.010	0.003	0.007	$F_{\text{MSY}} \times SSB_{2014}/MSY B_{\text{trigger}}$	0.01	0.003	0.007	3.44	+105%
Precautionary approach	0	0	0	B_{pa}	0	0	0	3.46	+106%
Management plan	0.98	0.31	0.67	$F = F_{2013} \times 0.75$	0.69	0.22	0.47	2.12	+26%
Zero catch	0	0	0	$F = 0$	0	0	0	3.46	+106%
Other options	0.32	0.10	0.22	$F_{2013} \times 0.2$	0.18	0.06	0.12	3.02	+80%
	0.59	0.19	0.40	$F_{2013} \times 0.4$	0.37	0.12	0.25	2.65	+58%
	0.83	0.26	0.57	$F_{2013} \times 0.6$	0.55	0.17	0.38	2.33	+39%
	1.03	0.32	0.71	$F_{2013} \times 0.8$	0.74	0.23	0.51	2.06	+23%
	1.20	0.37	0.83	$F_{2013} \times 1.0$	0.92	0.28	0.64	1.82	+8.3%
	1.35	0.41	0.94	$F_{2013} \times 1.2$	1.10	0.33	0.77	1.62	-3.6%

Units: thousand tonnes.

¹⁾ SSB 2015 relative to SSB 2014.

Note: no information for % TAC change can be shown as a zero TAC was set in 2013.

MSY approach

Following the ICES MSY approach implies fishing mortality to be reduced to 0.01 (lower than the F_{MSY} proxy because SSB in 2014 is 92% below MSY B_{trigger}), resulting in total catches of no more than 10 tonnes in 2014. If discard rates do not change from the average of the last three years, this implies landings in 2014 of no more than 3 tonnes. This is expected to lead to an SSB of 3440 tonnes in 2015.

Following the transition scheme towards the ICES MSY approach implies fishing mortality to be reduced to 0.19, based on $(F_{2010} \times 0.2) + ((F_{\text{MSY}} \times (SSB_{2014}/MSY B_{\text{trigger}})) \times 0.8)$, resulting in catches of no more than 330 tonnes in 2014. This

is expected to lead to an SSB of 3010 tonnes in 2015. If discard rates do not change from the average of the last three years, this implies landings in 2014 of no more than 110 tonnes.

However, considering the low SSB and low recruitment over the last decade, it is not possible to identify any non-zero catch that would be compatible with the MSY approach. Bycatches, including discards of cod in all fisheries in Division VIa, should be reduced to the lowest possible level and further technical measures to reduce catches should be implemented.

Precautionary approach

Given the low SSB and low recruitments in recent years, it is not possible to identify any non-zero catch which would be compatible with the precautionary approach. No targeted fishing should take place on cod in Division VIa. Bycatches, including discards of cod in all fisheries in Division VIa, should be reduced to the lowest possible level.

Management plan

The fisheries on this stock are managed under the cod long-term management plan (EC 1342/2008). Until the 2012 assessment benchmark ICES did not consider it possible to assess unaccounted mortality accurately. As a consequence ICES has not yet evaluated whether the management plan is in accordance with the precautionary approach. However, management measures taken so far have not constrained catches and no increase in stock biomass has occurred.

There was no effort reduction in 2013 compared to 2012. Following the agreed management plan implies $F_{2014} = 0.75 \times F_{2013}$. This results in a TAC for 2014 of 310 tonnes. If discard rates do not change from the average of the last three years, this corresponds to catches in 2014 of 980 tonnes.

Additional considerations

Management considerations

Management measures taken thus far have not recovered the stock and not constrained catches.

The stock is suffering impaired recruitment. The 2008 year class is estimated to be more abundant and is estimated to have been discarded in large quantities at age 3 in 2011. Estimated mortality is increasingly due to discards (Figure 5.4.3.4). SSB is very low. It is necessary to reduce all sources of fishing mortality to recover the stock above B_{pa} as quickly as possible.

The zero TAC for this area and 1.5% bycatch by live weight limit implemented in 2012 applies to the retained part of the catches and therefore does not constrain discards.

The cod long-term management plan (EC 1342/2008) includes a west of Scotland management line that follows the 200 m depth contour. Fleets fishing at depths less than 200 m (i.e. within the cod recovery zone) are subject to the effort restrictions of the management plan and new gear technical measures specified in EC 53/2010. Vessels fishing to the west of the management line are still subject to effort restrictions, but may apply for additional effort up to the point where fleet-aggregated effort equals that from the previous year (if fleet effort allowances were cut). Some landings from this stock are taken west of the line defined in EC 1342/2008. Some vessels using >100 mm otter trawl (TR1) gear had larger cod landings from west of the line than from within the cod recovery zone in 2010. In 2012, 60% of Scottish cod landings are estimated to come from west of the line.

Grey seal abundance is significant west of Scotland and they are known to feed on cod, among other species. The latest estimates of grey seal abundance over time consider the population in the area to have remained stable since the mid-1990s (Thomas, 2011), but depending on the feeding behaviour seal predation mortality may still have increased in recent years. The contribution of seal predation to total cod mortality is likely to be significant and this may impair the ability of the cod stock to recover. Data on seal predation are insufficient for reliable estimation of predation mortality.

Management plan evaluations

In 2009 the EU adopted a long-term plan for cod stocks and the fisheries exploiting those stocks (Council Regulation (EC) 1342/2008, see Annex 5.4.3.2). The objective of this regulation is to ensure the sustainable exploitation of the cod stocks on the basis of maximum sustainable yield, while maintaining a target fishing mortality of 0.4 on specified age groups.

In 2009 ICES evaluated this revised long-term plan for cod (Council Regulation (EC) 1342/2008) in relation to the precautionary approach. This evaluation concluded that assuming TAC and effort constraints would lead to rapid

declines in fishing mortality, the stock would recover by 2015. Given the recent changes in discarding in response to moderate year classes, ICES could not conclude the plan was precautionary.

ICES has previously commented on the appropriateness of $F = 0.4$ as a target for this stock. Based on the yield-per-recruit analysis, which estimates $F_{\max} = 0.17$ and the positive relationship of SSB and recruitment, the long-term target fishing mortality of 0.4 is not expected to achieve the management objective of maximum sustainable yield.

Regulations and their effects

The fishery is managed by a combination of bycatch restriction, area closures, technical measures, and effort restrictions. TAC restrictions on landings and effort and spatial management of fisheries catching cod in Division VIa have not controlled mortality levels. Catch (landings + discards) is 3.6 times the reported landings. Details of the area closures, technical measures, effort restrictions, and other measures are given in Annex 5.4.3.1.

Changes in fishing technology and fishing patterns

The implementation of the cod long-term plan effort controls (Annex IIa of Reg. (EC) 43/2009) and other technical measures including gear restriction in Division VIa (Annex III of Reg. (EC) 43/2009) was expected to lead to large changes in fishing patterns starting in 2009. Analysis is not yet available to evaluate this.

Uncertainties in assessment and forecast

In an attempt to remove bias from underreporting, the assessment relies on survey data from 1995 to 2005. Catch data is re-introduced from 2006 but is dominated by discards in this period (Figure 5.4.3.4). Mortality estimates heavily based on survey and or discard data are considered to be poorly estimated. Scottish landings (from 2006) are adjusted by estimates of misreporting and the misreporting estimates will have uncertainty associated with them. However, historical trends in spawning biomass and recruitment appear to be robust measures of stock dynamics (see Figure 5.4.3.1).

Some changes have been made to the survey design in the past, but surveys are considered to be a reasonable indicator of stock trends from the mid-1990s. The survey gear changed in 2011 to bring it in line with other surveys in the area so that these can be combined in future to provide a more robust and precise survey index. Implementing surveys that provide estimates of consumption by seals would give greater confidence in natural mortality estimates.

The contribution of seal predation to total cod mortality is likely to be significant and this may impair the ability of the cod stock to recover, but data is limited. New mean weights-at-age that are dependent on natural mortalities-at-age have been adopted to better take account of higher natural mortality at younger ages, but it is not certain these values fully accommodate the possible large source of natural mortality from seals.

Comparison with previous assessment and advice

The 2012 assessment adjusted Scottish landings and discards for estimates of misreporting, for 2006 onwards. In this year's assessment these data were revised and only landings were adjusted for misreporting.

The basis for the advice is the same as last year, the MSY approach.

Sources

- ICES. 2012. Report of the Benchmark Workshop on Western Waters Roundfish (WKROUND), 22–29 February 2012, Aberdeen, UK. ICES CM 2012/ACOM:49. 283 pp.
- ICES. 2013. Report of the Working Group on Celtic Seas Ecosystems (WGCSE), 8–17 May 2013, Copenhagen, Denmark. ICES CM 2013/ACOM:12.
- STECF. 2007. EU Scientific, Technical and Economic Committee for Fisheries. Evaluation of closed area schemes. SGMOS-07-03.
- STECF. 2012. EU Scientific, Technical and Economic Committee for Fisheries. Evaluation of Fishing Effort Regimes in European Waters. STECF-12-16.
- Thomas, L. 2011. Estimating the size of the UK grey seal population between 1984 and 2010. SCOS Briefing Paper 11/02.

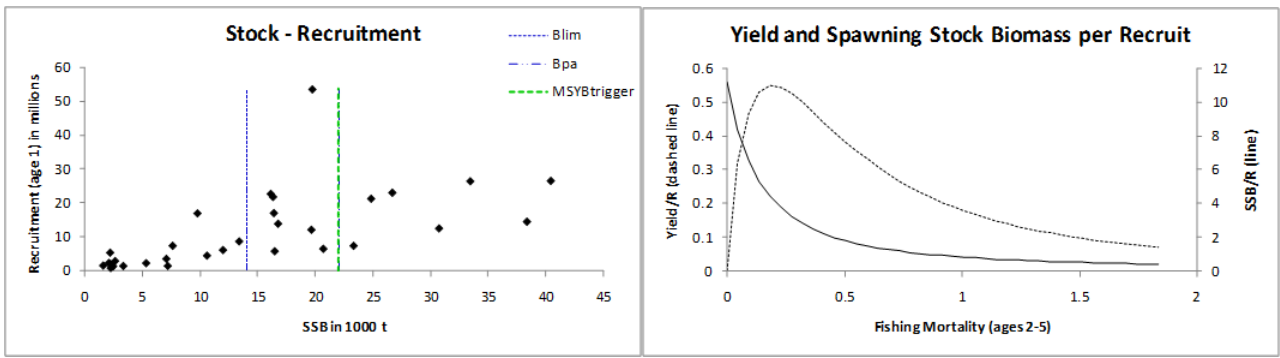


Figure 5.4.3.3 Cod in Division VIa. Stock–recruitment relationship (left panel) and yield-per-recruit analysis (right panel).

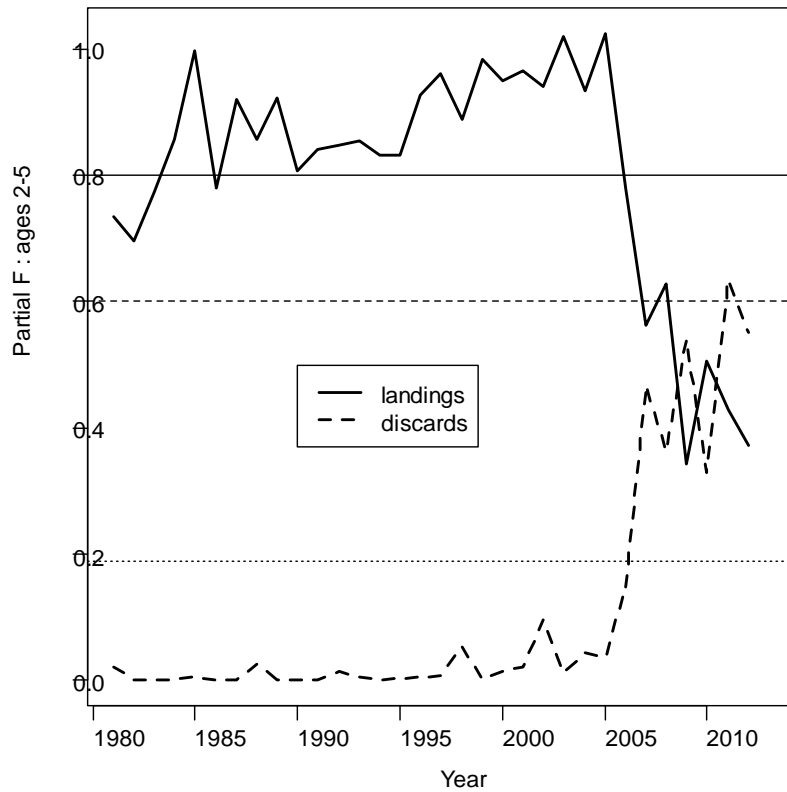


Figure 5.4.3.4 Cod in Division VIa. Partial mean F attributed to landings and discards. Horizontal lines represent F_{lim} (solid), F_{pa} (dashed), and F_{MSY} (dotted) reference points defined for the stock.

Table 5.4.3.1

Cod in Division VIa (West of Scotland). ICES advice, management, landings, discards, and catches.

Year	ICES advice Single-stock exploitation boundaries since 2004	Predicted catch corresp. to advice	Agreed TAC ¹	Agreed TAC ²	Official landings	ICES landings	ICES discards	ICES catch
1987	Reduce F towards F_{max}	18.0	22.0		19.2	19.0	2.39	21.39
1988	No increase in F; TAC	16.0	18.4		19.2	20.4	0.37	20.77
1989	80% of F(87); TAC	16.0	18.4		15.4	17.2	2.08	19.28
1990	80% of F(88); TAC	15.0	16.0		11.8	12.2	0.57	12.77
1991	70% of effort (89)	-	16.0		10.6	10.9 ³	0.62	11.52
1992	70% of effort (89)	-	13.5		9.0	9.7 ⁴	1.78	11.48
1993	70% of effort (89)	-	14.0		10.5	11.8 ⁴	0.14	11.94
1994	30% reduction in effort	-	13.0		9.1	10.8 ⁴	0.66	11.46
1995	Significant reduction in effort	-	13.0		9.7	9.6 ⁴	0.14	9.74
1996	Significant reduction in effort	-	13.0		9.6	9.4	0.06	9.46
1997	Significant reduction in effort	-	14.0		7.0	7.0	0.50	7.5
1998	20% reduction in F	9.5 ⁶	11.0		5.7	5.7	0.54	6.24
1999	F reduced to below F_{pa}	< 9.7 ⁶	11.8		4.3	4.2	0.07	4.27
2000	Recovery plan, 60% reduction in F	< 4.2	7.48		2.8 ⁵	3.0	0.82	3.82
2001	Lowest possible F, recovery plan	-	3.7		2.4	2.3	0.09	2.39
2002	Recovery plan or lowest possible F	-	4.6		2.2	2.2	0.48	2.68
2003	Closure	-	1.81		1.3	1.2	0.03	1.23
2004	Zero catch ⁷	0	0.85		0.6	0.5	0.07	0.57
2005	Zero catch ⁷	0	0.72		0.4	0.5	0.04	0.54
2006	Zero catch ⁷	0	0.613		0.5	0.49 ⁹	0.47	0.96
2007	Zero catch ⁷	0	0.49		0.5	0.60 ⁹	1.88	2.48
2008	Zero catch ⁷	0	0.402		0.4	0.68 ⁹	0.70	1.38
2009	Zero catch ⁷	0	0.302	0.240	0.23	0.41 ⁹	0.95	1.36
2010	Zero catch ⁷	0		0.240	0.25	0.56 ⁹	0.79	1.35
2011	Zero catch ⁷	0		0.182	0.22	0.45 ⁹	1.67	2.12
2012	Zero catch ⁷	0		0 ⁸	0.22	0.47 ⁹	1.17	1.64
2013	No directed fisheries, minimize by-catch and discards	0		0 ⁸				
2014	No directed fisheries, minimize by-catch and discards	0						

Weights in thousand tonnes.

¹ TAC is for the whole of Subdivision Vb₁ and Subareas VI, XII, and XIV.² TAC is for Subdivision Vb₁ and Division VIa.³ Not including misreporting.⁴ Including ICES estimates of misreporting.⁵ Incomplete data.⁶ For Division VIa only.⁷ Single-stock boundaries and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits.⁸ Bycatch of cod in the area covered by this TAC may be landed provided that it does not comprise more than 1.5% of the live weight of the total catch retained on board per fishing trip.⁹ Includes an adjustment for misreporting.

Table 5.4.3.2 Cod in Division VIa. Official landings (tonnes).

Country	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Belgium	48	88	33	44	28	-	6	-	22	1	2	+	11	1	+	+	2	+
Denmark	-	-	4	1	3	2	2	3	2	+	4	2	-	-	+	-	-	-
Faroe Islands	-	-	-	11	26	-	-	-	-	-	-	-	-	-	-	-	-	-
France	7 411	5 096	5 044	7 669	3 640	2 220	2 503	1 957	3 047	2 488	2 533	2 253	956	714*	842*	236	391	208
Germany	66	53	12	25	281	586	60	5	94	100	18	63	5	6	8	6	4	+
Ireland	2 564	1 704	2 442	2 551	1 642	1 200	761	761	645	825	1 054	1 286	708	478	223	357	319	210
Netherlands	-	-	-	-	-	-	-	-	-	-	-	-	2	1	-	-	-	-
Norway	204	174	77	186	207	150	40	171	72	51	61	137	36	36	79	114*	40*	88
Spain	28	-	-	-	85	-	-	-	-	-	16	+	6	42	45	14	3	11
UK (E. W. N.I.)	260	160	444	230	278	230	511	577	524	419	450	457	779	474	381	280	138	195
UK (Scotland)	8 032	4 251	11 143	8 465	9 236	7 389	6 751	5 543	6 069	5 247	5 522	5 382	4 489	3 919	2 711	2 057	1 544	1 519
UK	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total landings	18 613	11 526	19 199	19 182	15 426	11 777	10 634	9 017	10 475	9 131	9 660	9 580	6 992	5 671	4 289	2 767	2 439	2 231

Country	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012*
Belgium	-	-	-	-	-	-	-	0	0	0
Denmark	-	-	-	-	-	-	-	-	-	-
Faroe Islands	-	2	0	0.8	12	1		0.2	0	-
France	172	91	107	100.7	92	82	74	60.3	46	4.21
Germany	+			2	2	1	0	0	0	0.04
Ireland	120	34	27.9	18	70	58.2	24.4	48.7	41.3	17.8
Netherlands	-	-	-	-	-	-	0		0	0
Norway	45	10	17	30	30	65	18	20.7	8.3	56.2
Spain	3	-	-	-	-	-	-	-	-	-
UK (E. W. N.I.)	79	46	25	-	21	6	14	-	-	-
UK (Scotland)	879	413	243	-	260	232	-	-	-	-
UK	-	-	-	332.1	-	-	104	118.6	110	137.2
Total landings	1 298	596	419.9	483.6	487	445.2	234.4	248.5	205.6	215.5

* Preliminary.

Table 5.4.3.3 Cod in Division VIa (West of Scotland). Summary of stock assessment (weights in thousand tonnes).

Year	Catch	Catch estimate	Catch s.e.	Landings	Landings estimate	Landings s.e.	Discards	Discards estimate	Discard s.e.	meanF estimate	meanF s.e.	SSB estimate	SSB s.e.	TSB estimate	TSB s.e.	Recruit estimate	Recruit s.e.
1982	22.082	21.846	1.333	21.511	21.272	1.351	0.571	0.574	0.241	0.698	0.045	38.353	2.016	58.275	2.643	26.670	2.236
1983	21.503	20.536	1.054	21.305	20.310	1.050	0.197	0.226	0.117	0.775	0.049	33.439	1.417	48.940	2.102	14.680	2.122
1984	21.601	20.631	1.049	21.272	20.023	1.076	0.329	0.607	0.248	0.865	0.054	30.726	1.355	52.759	2.074	26.574	1.860
1985	19.570	18.025	0.880	18.607	17.559	0.885	0.963	0.466	0.144	0.991	0.067	24.827	1.118	35.863	1.637	12.684	2.194
1986	12.083	12.363	0.815	11.820	11.763	0.787	0.263	0.599	0.191	0.780	0.061	19.728	1.010	34.107	1.676	21.430	2.253
1987	21.358	18.205	1.219	18.971	17.009	1.139	2.388	1.196	0.533	0.919	0.061	20.676	1.020	43.414	3.239	53.594	9.642
1988	20.781	19.428	1.732	20.413	19.190	1.723	0.368	0.237	0.111	0.880	0.056	26.670	1.870	43.155	3.500	6.685	1.283
1989	19.246	17.040	1.499	17.169	15.957	1.452	2.076	1.082	0.376	0.921	0.058	23.310	1.960	37.134	2.626	23.191	2.592
1990	12.746	12.532	0.895	12.175	12.386	0.886	0.571	0.146	0.059	0.805	0.058	19.647	1.354	27.440	1.838	7.566	1.856
1991	11.549	10.774	1.095	10.927	10.446	1.062	0.622	0.328	0.141	0.841	0.065	16.117	1.408	24.016	2.198	12.291	2.153
1992	10.865	9.632	1.009	9.086	8.958	0.976	1.779	0.674	0.211	0.863	0.068	13.375	1.282	23.773	2.009	22.837	2.156
1993	10.453	11.231	1.054	10.314	10.848	1.043	0.139	0.383	0.136	0.854	0.068	16.388	1.305	28.304	2.118	8.875	1.031
1994	9.588	10.930	1.048	8.928	10.397	1.011	0.661	0.533	0.178	0.827	0.066	16.750	1.356	26.691	2.121	17.203	2.364
1995	9.580	10.995	1.076	9.439	10.658	1.053	0.141	0.337	0.112	0.835	0.065	16.459	1.365	27.252	2.262	14.060	1.894
1996	9.489	11.288	1.164	9.427	11.089	1.146	0.063	0.199	0.071	0.928	0.072	16.315	1.478	24.130	2.266	5.978	1.291
1997	7.533	9.588	1.092	7.034	8.848	1.023	0.499	0.740	0.272	0.966	0.076	11.970	1.289	24.211	2.325	21.951	2.646
1998	6.252	8.817	1.010	5.714	8.592	0.991	0.538	0.225	0.092	0.945	0.074	10.579	1.111	17.251	1.806	6.333	1.473
1999	4.270	7.034	0.962	4.201	6.851	0.940	0.069	0.182	0.068	0.990	0.079	9.750	1.206	14.121	1.772	4.687	1.018
2000	3.798	6.215	0.792	2.977	5.551	0.738	0.821	0.664	0.230	0.960	0.077	7.051	0.932	14.835	1.681	17.121	2.268
2001	2.439	5.958	0.801	2.347	5.784	0.786	0.092	0.174	0.068	0.987	0.079	7.600	0.921	12.611	1.546	3.747	0.945
2002	2.722	5.765	0.832	2.243	5.501	0.799	0.480	0.264	0.114	1.035	0.083	7.174	0.968	11.558	1.565	7.584	1.657
2003	1.275	3.989	0.694	1.241	3.902	0.673	0.034	0.087	0.049	1.036	0.083	5.298	0.829	7.732	1.415	1.658	1.016
2004	0.612	2.352	0.571	0.540	2.256	0.543	0.072	0.096	0.052	0.984	0.080	3.315	0.739	4.647	1.150	2.465	1.170
2005	0.552	1.683	0.419	0.511	1.606	0.402	0.041	0.077	0.049	1.072	0.093	2.172	0.485	3.437	0.856	1.628	1.089
2006	0.954	1.359	0.252	0.488	0.416	0.069	0.465	0.943	0.215	0.935	0.075	1.570	0.280	3.579	0.558	5.554	1.171
2007	2.474	1.901	0.296	0.595	0.513	0.070	1.880	1.388	0.277	1.026	0.081	2.430	0.325	4.043	0.556	1.758	0.545
2008	1.377	1.754	0.238	0.682	0.580	0.079	0.695	1.175	0.232	1.009	0.086	2.603	0.327	3.610	0.455	1.540	0.564
2009	1.353	1.451	0.181	0.408	0.446	0.050	0.945	1.005	0.176	0.898	0.071	2.061	0.225	3.436	0.409	3.103	0.768
2010	1.344	1.559	0.223	0.559	0.556	0.052	0.785	1.003	0.207	0.877	0.068	2.222	0.271	3.880	0.508	2.524	0.598
2011	2.124	1.620	0.217	0.454	0.436	0.043	1.670	1.184	0.212	1.022	0.080	2.217	0.260	3.207	0.427	1.036	0.678
2012	1.632	1.243	0.232	0.466	0.457	0.051	1.166	0.787	0.220	0.920	0.092	1.835	0.332	2.576	0.533	2.198	0.851
2013	-	1.221	0.311	-	0.448	0.116	-	0.773	0.258	0.950	0.098	1.689	0.413	2.690	0.680	1.739	0.871

Annex 5.4.3.1 Regulations and cod avoidance schemes relevant to Division VIa cod

Area closures

- Clyde Sea area closure – STECF (2007) noted that the Clyde closure includes the main spawning area of a reproductively isolated aggregation of cod and concluded that the closure is likely to have a positive effect in reducing targeting of high densities of mature cod.
- Windsock closed area – STECF (2007) concluded that the extent of the Windsock closure is unlikely to be large enough to greatly reduce fishing mortality on cod, and its boundaries should be reconsidered. However, its removal would not help improve cod recovery.
- Since 2009, the Irish authorities introduced a seasonal closure in Division VIa. The closure covers ICES statistical rectangle 39E3 and is in force from October 31 to March 31. Historically, over 40% of Irish cod landings from ICES Division VIa are from the closed area. For contrast, standardized cpue rates observed from a dedicated survey conducted inside the closed area in 2006 were on average 26.8 kg hr⁻¹ while cpue rates estimated from observer trips outside the closure gathered in the same period were 0.015 kg hr⁻¹. STECF (2012) concluded that, in accordance with the provisions of article 13 (1342/2008), the partial cod mortality associated with the Irish fleet had declined considerably (>50%) since the introduction of the cod closure and other measures, although it is not possible to disentangle the effects of the Cape closure from other measures.

Mesh sizes and catch composition rules

- Catch composition rules related to days-at-sea allowances (Reg. (EC) 850/1998 Annex I and Reg. (EC) 2056/2001) – These rules legislate for landings compositions, but do not restrict discards.
- Emergency measures introduced in EC regulation 43/2009 (Annex III) (and rolled forward into 2010 and 2011) prohibited all fishing activity to the east of the West of Scotland Management (French) line in Division VIa, with the exception of a number of derogated fisheries. These measures have been incorporated into a new EC regulation 227/2013. For demersal otter trawlers targeting whitefish this required an increase in mesh size to 120 mm and the inclusion of a 120 mm square-meshed panel (SMP). Vessels targeting *Nephrops* also require the 120 mm SMP or a sorting grid. More stringent catch composition rules have also been introduced. For *Nephrops*-directed fisheries, no more than 10% of the retained catch can consist of cod, haddock, and whiting, where the limit is no more than 30% for whitefish targeted vessels. For 2012 a zero TAC for cod and a 1.5% bycatch by live weight limit was introduced and this was carried through to 2013, but in 2012 the catch composition limit on haddock was removed (Reg. (EU) 161/2012).

Effort limitations

- Between 2003 and 2011 STECF (2012) reported that the fishing effort (in kW-days) of trawlers using >100 mm mesh declined by 59%. These vessels primarily targeted roundfish, including cod. Over the same period effort for trawlers using 70–99 mm mesh declined by 16%. These vessels primarily target *Nephrops* and in 2011 22% of the effort in this category was exempt from effort controls because of less than 1.5% of cod in the catch, (article 11).
- Annex IIa of Reg. (EC) 39/2013 does not require effort reduction compared to 2012 except for French trawlers using >100 mm mesh (20% reduction).

Supply chain traceability

Unreported landings are expected to have reduced under the UK “Buyers and Sellers” and Irish “Sales Note” regulations. Observer data, however, show an increase in discards starting in 2006. The amount of discards relative to landings has increased and the age pattern of discarding has changed. Currently discards of fish aged 3 and above are being recorded.

Cod avoidance measures

In 2008, Scotland introduced a voluntary programme known as “Conservation Credits”, which involved seasonal closures, real-time closures (RTCs), and various selective gear options. This was designed to reduce mortality and discarding of cod. The number of RTCs west of Scotland were four in 2008, twenty in 2009, nineteen in 2010, four in 2011, and nine in 2012, representing 27%, 14%, 12%, 2%, and 5% of the total RTCs in each year. RTCs are determined by lpue, based on fine-scale VMS data and daily logbook records, and also by on-board inspections. The low number of RTCs west of Scotland result from few instances of high lpue in the area. Estimates of continuing high discard rates in Division VIa indicate the scheme has not been effective west of Scotland.

Annex 5.4.3.2 EU management plan

The European Commission has adopted Council Regulation (EC) No. 1342/2008 which establishes measures for the recovery and long-term management of cod stocks. The stated objective of the plan is to ensure the sustainable exploitation of the cod stocks on the basis of maximum sustainable yield while maintaining a fishing mortality of 0.4. Articles 7–9, describing aspects of the plan relevant for west of Scotland cod, are reproduced below:

Article 7

Procedure for setting TACs for cod stocks in the Kattegat the west of Scotland and the Irish Sea

1. Each year, the Council shall decide on the TAC for the following year for each of the cod stocks in the Kattegat, the west of Scotland and the Irish Sea. The TAC shall be calculated by deducting the following quantities from the total removals of cod that are forecast by STECF as corresponding to the fishing mortality rates referred to in paragraphs 2 and 3: (a) a quantity of fish equivalent to the expected discards of cod from the stock concerned; (b) as appropriate a quantity corresponding to other sources of cod mortality caused by fishing to be fixed on the basis of a proposal from the Commission.

2. The TAC shall, based on the advice of STECF, satisfy all of the following conditions: (a) if the size of the stock on 1 January of the year of application of the TAC is predicted by STECF to be below the minimum spawning biomass level established in Article 6, the fishing mortality rate shall be reduced by 25 % in the year of application of the TAC as compared with the fishing mortality rate in the previous year; (b) if the size of the stock on 1 January of the year of application of the TAC is predicted by STECF to be below the precautionary spawning biomass level set out in Article 6 and above or equal to the minimum spawning biomass level established in Article 6, the fishing mortality rate shall be reduced by 15 % in the year of application of the TAC as compared with the fishing mortality rate in the previous year; and (c) if the size of the stock on 1 January of the year of application of the TAC is predicted by STECF to be above or equal to the precautionary spawning biomass level set out in Article 6, the fishing mortality rate shall be reduced by 10 % in the year of application of the TAC as compared with the fishing mortality rate in the previous year.

If the application of paragraph 2(b) and (c) would, based on the advice of STECF, result in a fishing mortality rate lower than the fishing mortality rate specified in Article 5(2), the Council shall set the TAC at a level resulting in a fishing mortality rate as specified in that Article.

4. When giving its advice in accordance with paragraphs 2 and 3, STECF shall assume that in the year prior to the year of application of the TAC the stock is fished with an adjustment in fishing mortality equal to the reduction in maximum allowable fishing effort that applies in that year.

5. Notwithstanding paragraph 2(a), (b) and (c) and paragraph 3, the Council shall not set the TAC at a level that is more than 20 % below or above the TAC established in the previous year.

Article 9

Procedure for setting TACs in poor data conditions

Where, due to lack of sufficiently accurate and representative information, STECF is not able to give advice allowing the Council to set the TACs in accordance with Articles 7 or 8, the Council shall decide as follows: (a) where STECF advises that the catches of cod should be reduced to the lowest possible level, the TACs shall be set according to a 25 % reduction compared to the TAC in the previous year; (b) in all other cases the TACs shall be set according to a 15 % reduction compared to the TAC in the previous year, unless STECF advises that this is not appropriate.

Article 10

Adaptation of measures

1. When the target fishing mortality rate in Article 5(2) has been reached or in the event that STECF advises that this target, or the minimum and precautionary spawning biomass levels in Article 6 or the levels of fishing mortality rates given in Article 7(2) are no longer appropriate in order to maintain a low risk of stock depletion and a maximum sustainable yield, the Council shall decide on new values for these levels.

2. In the event that STECF advises that any of the cod stocks is failing to recover properly, the Council shall take a decision which: (a) sets the TAC for the relevant stock at a level lower than that provided for in Articles 7, 8 and 9; (b) sets the maximum allowable fishing effort at a level lower than that provided for in Article 12; (c) establishes associated conditions as appropriate.