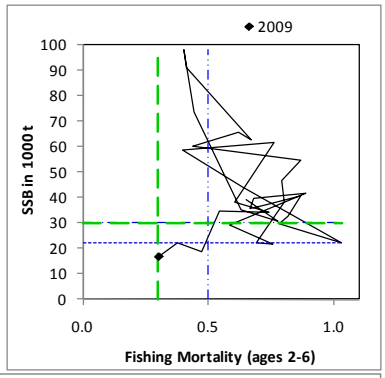
ECOREGION Celtic Sea and West of Scotland
STOCK Haddock in Division VIa (West of Scotland)

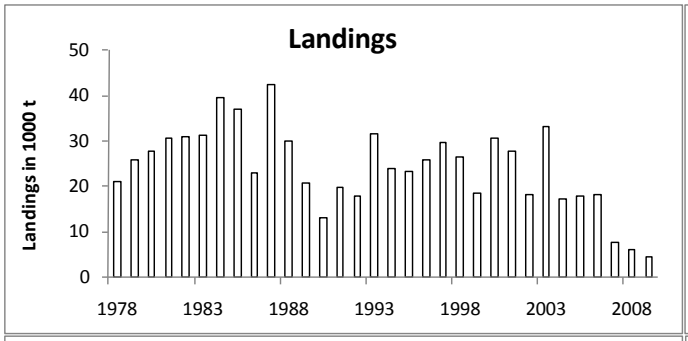
Advice summary for 2011

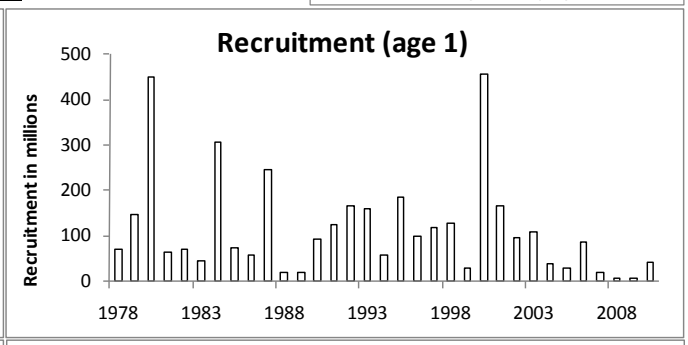
Management Objective (s)	Landings in 2011
Transition to an **MSY approach** with caution at low stock size	Less than 2 800 t
Cautiously avoid impaired recruitment (**Precautionary Approach**)	Zero catch and management plan
Cautiously avoid impaired recruitment and achieve other objective(s) of a **management plan** (e.g., catch stability)	940 t

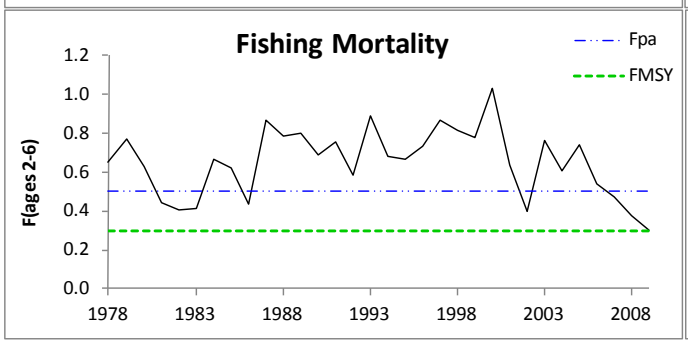
Stock status

Fishing mortality	2007	2008	2009
F_{MSY}	above	above	above
F_{PA}	below	below	below
Spawning Stock Biomass (SSB)	2008	2009	2010
MSY $B_{trigger}$	below	below	below
B_{PA}/B_{lim}	between	below	below









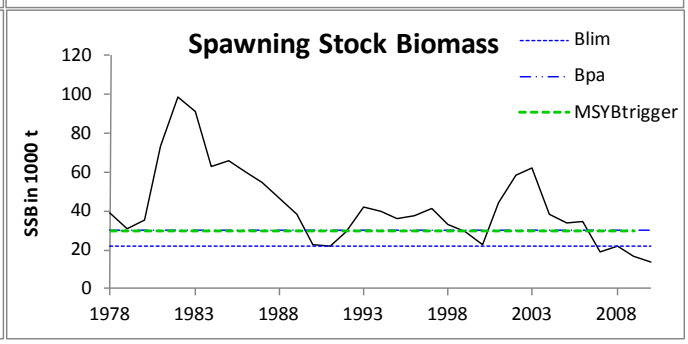


Figure 5.4.23.1 Haddock in Division VIa (West of Scotland). Summary of stock assessment (weights in '000 tonnes). Top right: SSB and F over the years.

The very strong 1999 year class caused SSB to increase from a level near the historic low in 2000 to a peak in 2003, although SSB has declined since that time. F has been above F_{pa} in most years since 1987 and has been below F_{pa} since 2007. The 2006 to 2009 year classes are estimated to be below the long term average.

Management plans

A management plan is under development (Annex 5.4.23). This plan results in a TAC of 940 t in 2011. ICES has evaluated the option and considers this to be in accordance with the precautionary approach.

Biology

Haddock are widely distributed across the continental shelf from the North Sea to the Celtic Sea. There is some connectivity with the haddock stock in the North Sea, which is assessed as a different stock. The stock recruit relationship for haddock is characterised by sporadic high recruitments. There may be periods of low recruitment at any stock size.

The fisheries

Haddock in Division VIa is caught mainly by Scottish and Irish bottom trawlers, which target mixed demersal fish assemblages. Catches are widely distributed, and are concentrated in several areas e.g. Butt of Lewis and on the shelf west of the Outer Hebrides.

Catch by fleet	Total catch (2009) 2.8 kt where ~62% landings, ~37% discards, ~1% unaccounted removals.

Quality considerations

In 2010 fishery landings and catch at age data from 2006 onwards were reintroduced into the assessment, based on perception of improved accuracy of landing statistics.

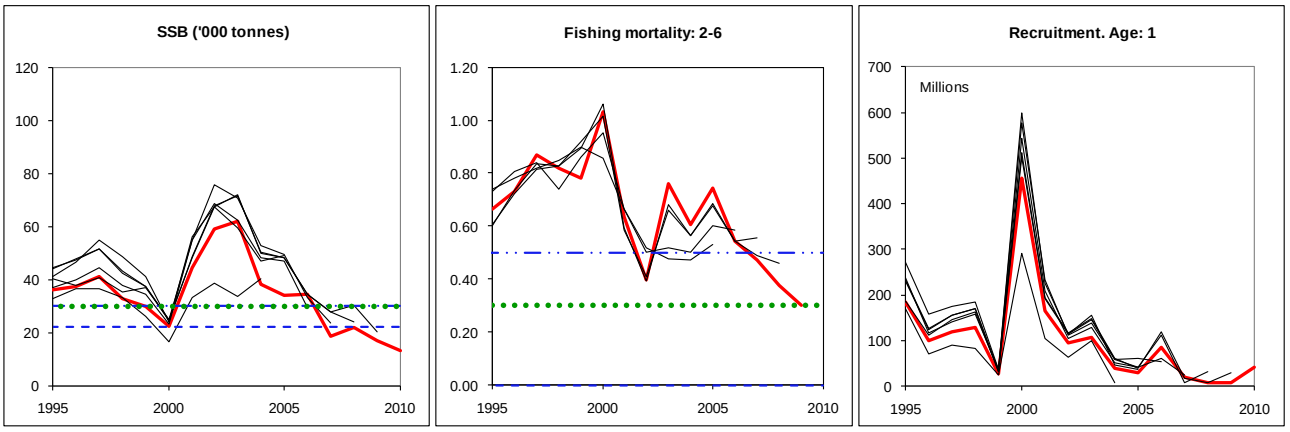


Figure 5.4.23.2 Haddock in Division VIa (West of Scotland). Historical assessment results (final year recruitment estimates included).

Scientific basis

Assessment type	analytical age-based assessment (TSA)
Input data	2 survey indices (ScoGFS Q1; ScoGFS Q4)
Discards and bycatch	Included in the assessment
Indicators	None
Other information	Catch data were re-included for years since 2006
Working group report	WGCSE

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

Reference points

	Type	*Value*	*Technical basis*
MSY Approach	MSY $B_{trigger}$	30 000 t	Bpa
	F_{MSY}	0.3	Provisional proxy by analogy with North Sea haddock. Fishing mortalities in the range 0.19 – 0.41are consistent with Fmsy
Precautionary Approach	B_{lim}	22 000 t	B_{lim} = B_{loss}, the lowest observed spawning stock estimated when reference point was established in 1998
	B_{pa}	30 000 t	B_{pa} = B_{lim} *1.4. This is considered to be the minimum SSB required to obtain a high probability of maintaining SSB above Blim, taking into account the uncertainty of assessments
	F_{lim}	Not defined	
	F_{pa}	0.5	The F below which there is a high probability of avoiding SSB < B_{pa}

(unchanged since: 2010)

Yield and spawning biomass per Recruit F-reference points (2010):

	Fish Mort Ages 2-6	**Yield/R**	**SSB/R**
Average last 3 years	0.50	0.19	0.43
$\mathbf{F}_{max}$ [*]	-	-	-
$\mathbf{F}_{0.1}$	0.19	0.17	0.96
$\mathbf{F}_{med}$	0.52	0.19	0.41

[*] not well defined

Outlook for 2011

The short-term forecast is presented in terms of total removals. These are then divided into landings (53%), discards (37%) and unallocated remoals (10%) using the most recent assessment to calculate the average proportions of these catch components over the last three years.

Basis: $F_{2010} = F_{sq}$ = F(07–09) = 0.38; SSB (2011) = 13.6 ; R (2011) = TSA model estimate = 76.2 million; R(2012) = GM 78-09 = 75.9 million; removals (2010)= 5.35

Rationale	**Total Removals (2011)**	**Human Consumption (2011)**	**Discards (2011)**	**Unallocated removals (2011)**	**Basis**	**F (2011)**	**SSB (2012)**	**%SSB change** [1)]	**%TAC change** [2)]	**%TAC change** [3)]
MSY approach	2.4	1.3	0.9	0.24	F_{MSY}*SSB(2011)/Btrigger	0.14	24.1	77 %	-10 %	-52 %
ICES MSY transition	5.4	2.8	2.0	0.54	Transition	0.33	20.7	52 %	100 %	6 %
EC MSY transition	5.8	3.1	2.2	0.58	F_{sq} *0.95	0.36	20.2	49 %	117 %	15 %
Policy paper	4.9	2.6	1.8	0.49	F_{MSY}	0.3	21.2	56 %	84 %	-3 %
Management plan	1.8	0.94	0.66	0.18	F_{sq} *0.26	0.1	24.7	82 %	-34 %	-65 %
Zero catch	0	0	0	0	F=0	0	26.7	96 %	-100 %	-100 %
Status quo	2.9	1.5	1.1	0.29	F_{sq} *0.42	0.16	23.5	73 %	7 %	-43 %
	3.8	2.0	1.4	0.38	F_{sq} *0.59	0.22	22.5	65 %	42 %	-25 %
	4.2	2.2	1.6	0.42	SSB>Blim (F_{sq} *0.67)	0.25	22.0	62 %	58 %	-16 %
	4.3	2.3	1.6	0.43	F_{sq} *0.68	0.26	21.9	61 %	60 %	-15 %
	5.0	2.7	1.9	0.50	F_{sq} *0.81	0.31	21.1	55 %	89 %	0 %
	5.8	3.1	2.2	0.58	F_{sq} *0.95	0.36	20.2	49 %	117 %	15 %
	6.1	3.2	2.2	0.61	F_{sq}	0.38	19.9	46 %	127 %	20 %
	6.3	3.3	2.3	0.63	F_{sq} *1.05	0.40	19.7	44 %	136 %	25 %

Weights in '000 tonnes

[1)] SSB 2012 relative to SSB 2011.

[2)] Total removals 2011 relative to TAC 2010.

[3)] Human consumption landings 2011 relative to TAC 2010. Note: this is the percentage TAC change as it was used in the management plan evaluation.

MSY approach

Following the ICES MSY framework implies fishing mortality to be reduced to 55% below F_{MSY} because current SSB is 55% below MSY $B_{trigger}$, to 0.14. This implies removals from the stock of 2400 tonnes in 2011. At current rates of landings, discards and unallocated removals this implies landings of 1 300 tonnes in 2011. This is expected to lead to an SSB of around 24 100 t in 2012.

Following the transition scheme towards the ICES MSY framework implies fishing mortality to be reduced to ((0.8*0.38)+(0.2 *(0.3*0.45))) = 0.33. This results in removals from the stock of 5 400 tonnes and Human consumption landings of 2 800 tonnes in 2011. This is expected to lead to an SSB of 20 700 t in 2012.

The (EC) transition scheme without extra reduction on account of low SSB implies a target F of 0.36. This results in removals from the stock of 5800 tonnes and Human consumption landings of 3100 tonnes in 2011. This is expected to lead to an SSB of 20 200 t in 2012.

PA approach

Fishing mortality is estimated to be below F_{pa}. However, SSB is estimated to be below B_{lim}. Reducing fishing mortality to zero is not expected to bring SSB above B_{pa} in the short term. ICES recommends a management plan to be developed and implemented.

The fishing mortality that would be expected to bring SSB above B_{lim} in 2012 would be 0.25. This would imply removals of 4200 tonnes and Human Consumption landings of 2200 tonnes.

Policy paper

In light of the EU policy paper on fisheries management (17 May 2010, COM(2010) 241) this stock is classified under category 3. The stock is outside safe biological limits because SSB is estimated to be below B_{pa}. This implies removals from the stock following a 22% reduction in F_{2010} to 0.3 (=F_{MSY}), with a maximum TAC change of 30%. This results in removals from the stock of 4900 tonnes and Human consumption landings of 2600 tonnes in 2011. This is expected to lead to an SSB of 21 200 t in 2012.

However, in light of the precautionary advice for this stock, the stock can also be classified under category 10 because the advice on this basis would be zero catch. This implies a TAC reduction of 25%.

Management plan

A management plan is under development by the EC (See annex). This works on the following boundaries:

The result for a TAC and SSB in the following year is calculated for F = 0.3.

Rule no	SSB result for F = 0.3:	F for TAC year	Maximum TAC variation
2	SSB > 30 000 t	0.3	15%
3	22 000 t < SSB < 30 000 t	(0.3-0.2)*((Bpa-SSB)/Bpa-Blim))	No maximum
4	SSB < 22 000 t	0.1	No maximum

Following these rules, the TAC would be set on the basis of F = 0.3. However, this leads to an SSB in 2012 lower than 22 000 t (B_{lim}). Therefore the TAC should be set on the basis of paragraph 4, with a target F of 0.1. There is no maximum in inter-annual TAC variation. This results in removals from the stock of 1800 tonnes and Human consumption landings of 940 tonnes in 2011. This is expected to lead to an SSB of 24 700 t in 2012. ICES evaluated this plan and found it to be in accordance with the precautionary approach.

Additional considerations

Management considerations

ICES recommends a management plan which would offer maximum protection to the haddock, recognizing that it is caught in a mixed fishery. Special attention needs to be given to the sporadic nature of the haddock recruitment and how to manage periods of low recruitment interspersed with large, occasional pulses. In recent years around 50% of the total catch in weight has been discarded, so restricting landings alone may not achieve the necessary increase in SSB.

A large proportion (~66%) of the estimated total numbers of haddock caught in 2009 were discarded. Most of these were below age 2. Haddock are discarded mainly up to age 4, but there are also smaller numbers discarded at ages up to 7. For example, 18% of the estimated total numbers caught aged 7 in 2009 were discarded. Haddock reach full maturity at age 3. Therefore, it is clear that immature fish are subject to high fishing mortality and this increases the susceptibility of the stock to overexploitation.

Several technical conservation measures have been introduced in the demersal fishery in Division VIa in recent years. These have affected selectivity for haddock because of the switching between mesh categories. In addition, a number of decommissioning rounds and the reallocation of effort from Division VIa to other ICES areas have reduced the effort. However, the relationship between effort and the mortality of haddock remains unclear. The management of haddock will be strongly linked to that of cod, for which a management plan is currently in force.

Management plan evaluations

ICES has evaluated a management plan option for Haddock in zones VIa and EC waters of Vb (ICES advice 2010, Section 5.3.3.1). ICES responded:

"ICES advises that a harvest rule with a target fishing mortality of 0.3 and a TAC constraint of ±15% is consistent with the precautionary approach (high probability of SSB being above B_{lim} by 2015 and beyond). In addition, simulations suggest that this harvest rule has the best chance, among those tested, of producing a combination of low risk to biomass and high cumulative yield, thus it conforms with the goal of achieving long-term maximum sustainable yield from the stock." Note that further evaluations are ongoing.

Impacts of fisheries on the ecosystem

Haddock are taken in mixed demersal fisheries and there is no impact specific to the catching of haddock. In general, the impact of the fisheries concerns the effects of bottom trawling on benthos, poor selectivity of gear acting on mixed fish assemblages, and the practice of discarding in response to, for example, available quota or market prices.

Regulations and their effects

The fishery is managed by a combination of TAC and technical measures, and in addition, the cod recovery plan measures (including effort restrictions and closed areas are also expected to affect haddock. A detailed description of the effects of cod recovery measures and regulations and can be found in the Division VIa cod section.

U.K. "Buyers and Sellers" regulation and Irish "Sales Note" regulation – Unreported landings are expected to have reduced under these regulations. Discard rates have, however remained stubbornly high.

Changes in fishing technology and fishing patterns

Haddock in Division VIa are caught mainly by Scottish trawlers. There has been a general decline in the haddock fishery in Division VIa: both Irish and Scottish sources suggest that there is an increasing focus in the corresponding Division VIb (Rockall) fishery and the neighbouring *Nephrops* fishery in Division IVa. There has been a shift from twin trawls to single trawls, and an increase in the use of pair trawls and seines. This was very much driven by fuel costs during 2008 and may have had implications for catch rates and possibly discards. Implications of fuel costs may have reduced slightly as of the start of 2009.

Data and methods

The analytical age-based assessment is based on landings-at-age data, discard-at-age data, and indices from research vessel surveys. Due to uncertainties in landings for several years, commercial catch numbers from 1995–2005 were not used in the assessment. In 2010 fishery landings and catch at age data from 2006 onwards were reintroduced into the assessment, based on perception of improved accuracy of landing statistics.

Uncertainties in assessment and forecast

The use of recent landing and catch at age data has reduced the size of confidence intervals in F because the catch data that the assessment model fits to are more precise than survey data.

Unaccounted removals have been estimated in the assessment. Changes in natural mortality are not thought to be the principal source of the estimated unallocated removals from the stock.

The 2009 year class, although below average, is stronger than has been seen for the last five years. This results in a forecast increase in SSB if fishing mortality is kept at precautionary levels. However, the forecast does not make provision for specific discarding behaviour in the future.

Comparison with previous assessment and advice

Last year's assessment indicated that SSB would continue to decline as the 1999 year class moves out of the population and recent recruitment continues to be poor; the current assessment is consistent with this.

The basis for the advice is the same as last year but extended by MSY considerations and a management plan option.

Sources

ICES. 2010. Report of the Working Group on Celtic Seas Ecosystems, 12–20 May 2010, Copenhagen, Denmark. ICES CM 2010/ACOM:12.

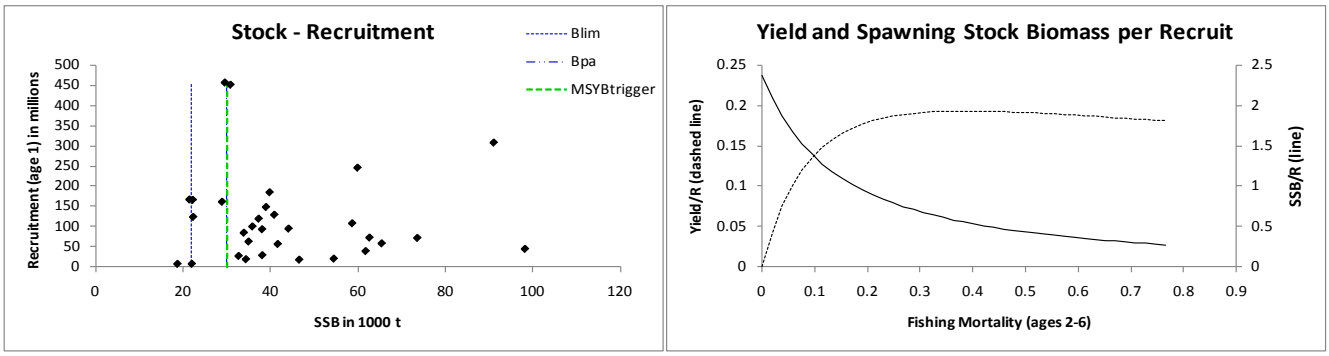


Figure 5.4.23.3 Haddock in Division VIa (West of Scotland). Yield per recruit analysis and stock–recruitment plot.

Table 5.4.23.1 Haddock in Division VIa (West of Scotland). ICES advice, management and landings and catches.

Year	ICES Advice/ Single-Stock Exploitation Boundaries from 2004 onwards[4]	Predicted catch corresp. to advice	Agreed TAC[1]	Official Landings	ICES Landings	Discard Slip.	ICES Catch
1987	Reduce F towards F_{max}	20.0	32.0	27	27.0	16.2	43.2
1988	No increase in F; TAC	25.0	35.0	21	21.1	10.2	31.3
1989	80% of F(87); TAC	15.0	35.0	24	16.7	3.2	19.9
1990	80% of F(88); TAC	14.0	24.0	13	10.1	5.4	15.5
1991	70% of effort (89)	-	15.2	10	10.6	9.2	19.8
1992	70% of effort (89)	-	12.5	7	11.4[2]	9.4[2]	20.8[2]
1993	70% of effort (89)	-	17.6	13	19.1[2]	16.9[2]	36.0[2]
1994	30% reduction in effort	-	16.0	9	14.2[2]	11.2[2]	25.4[2]
1995	Significant reduction in effort	-	21.0	13	12.4	8.8	21.2
1996	Significant reduction in effort	-	22.9	13	13.4	11.8	25.3
1997	Significant reduction in effort	-	20.0	13	12.9	6.6	19.5
1998	No increase in F	20.8[3]	25.7	14	14.4	5.7	20.1
1999	F reduced to F_{pa}	14.3[3]	19.0	11	10.4	5.1	15.6
2000	Maintain F below F_{pa}	<14.9[3]	19.0	7	6.9	8.2	15.2
2001	Reduce F below F_{pa}	<11.2[3]	13.9	7	6.7	7.2	14.0
2002	Reduce F below F_{pa}	<14.1[3]	14.1	7	7.1	8.6	15.2
2003	No cod catches	-	8.7	4.9	5.3	4.2	9.6
2004	F_{pa}	12.2	6.5	3.0	3.2	n/a[5]	n/a[5]
2005	¾* F_{pa}	7.6	7.6	3.2	3.1	n/a	n/a
2006	0.7* F_{pa}	8.0	7.81	5.7	5.7	n/a	n/a
2007	0.87* F_{pa}	7.2	7.2	3.7	3.7	n/a	n/a
2008	$SSB>B_{pa}$	4.2	6.12	2.8	2.8	n/a	n/a
2009	No fishing and recovery plan	0	3.52	2.8	2.8	n/a	n/a
2010	No fishing and recovery plan	0	2.67				
2011	See scenarios	-					

All weights in '000 tonnes.

[1] TAC is set for Divisions VIa and VIb (plus Subdivision Vb_1, and Subareas XII and XIV), combined with restrictions on the quantity that can be taken in Division VIa from 1990.

[2] Adjusted for misreporting.

[3] For Division VIa only.

[4] Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits.

[5] From 2004 the assessment chosen has generated estimates of total removals – not divided into landings and discards.

Table 5.4.23.2 Haddock in Division VIa. Landings (tonnes) by country since 1988.

Country	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
Belgium	8	9	-	9	1	7	1	-	1	3	2	2	1
Denmark	+	+	+	+	-	1	-	1	1	-	-	-	-
Faroe Is.	-	13	-	1	-	-	-	-	-	-	-	-	-
France	3001	13352	8632	7612	761	1132	753	671	445	270	394	788	282
Germany	4	4	15	1	2	9	19	14	2	1	1	2	1
Ireland	2731	2171	773	710	700	911	746	1406	1399	1447	1352	1054	677
Norway	54	74	46	12	72	40	7	13	16	21	28	18	70
Spain	-	-	-	-	-	-	-	1	-	-	2	4	-
UK (E&W)3	114	235	164	137	132	155	254	322	448	493	458	315	199
UK (N. Ire)	35								...	...	…	...	…
UK (Scot.)	15151	19940	10 964	8434	5263	10423	7421	10367	10790	10352	12 125	8630	5933
UK (total)													
Netherlands	-	-	-	-	-	-	-	-	-	-	-	-	-
Total reported	21098	23781	12825	10065	6932	12678	9201	12794	13102	12587	14360	10813	7163
WG estimates	21136	16688	10135	10557	11350	19060	14243	12368	13453	12874	14401	10430	6952

Country	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**[1]
Belgium	2	-	-	+	-	-	-	-	-
Denmark	-	-	+	-				-	-
Faroe Is.	-	-	-	4	-	1	2	-	1
France	160	151	183	173	273	291	211	85	124
Germany	1	+	-	-	1	7	-	1	-
Ireland	744	672	497	194	152	526	759	879	297
Norway	32	30	23	4	21	17	16	28	18
Spain	4	4	5	-	47	44	5	-	-
UK (E&W)3	201	237	107	93	42	19	193	-	2
UK (N. Ire)	…	…	…	…	…	…	…	-	8
UK (Scot.)	5886	5988	4582	2909	2025	4928	2587	-	2351
UK (total)							-	1769	2380
Netherlands	-	-	-	1	-	-	-	-	-
Total reported	7030	7082	5397	3378	2561	5833	3773	2762	2695
WG estimates	6731	7097	5334	3199	3148	5723	3702	2801	2800

[1]Preliminary.

[2]Includes Divisions Vb(EC) and VIb.

[3]1989–2005 N. Ireland included with England and Wales.

n/a = Not available.

WG estimates refers to the sum-of-products of landings and weights-at-age provided to the WG, rather than the estimated removals produced in the final assessment.

Table 5.4.23.3 Haddock in VIa (West of Scotland) Summary of stock assessment.

Year	Recruitment Age 1 thousands	SSB tonnes	Catch tonnes[1]	Mean F Ages 2-6
1978	70152	39101	21164	0.649
1979	148478	30974	25890	0.775
1980	451131	35115	27828	0.628
1981	63077	73728	30749	0.441
1982	71998	98368	31005	0.403
1983	44841	91221	31423	0.410
1984	307976	62780	39554	0.669
1985	72879	65580	37188	0.622
1986	58508	60041	22951	0.437
1987	245833	54615	42635	0.868
1988	20765	46703	30137	0.789
1989	18186	38211	20734	0.801
1990	93427	22435	13274	0.690
1991	124036	21574	19983	0.757
1992	167262	29046	18012	0.585
1993	161499	41789	31760	0.888
1994	56927	39929	23827	0.678
1995	184980	35986	23481	0.666
1996	100407	37416	25742	0.733
1997	119655	40998	29612	0.868
1998	129373	32835	26674	0.817
1999	27416	29680	18598	0.781
2000	456691	22344	30681	1.030
2001	166094	44261	27749	0.636
2002	95068	58826	18365	0.398
2003	108188	61898	33355	0.760
2004	39439	38256	17267	0.605
2005	29217	34023	17847	0.742
2006	84889	20580	11885	0.593
2007	19210	18834	7544	0.471
2008	7769	22114	5998	0.375
2009	7902	16818	4487	0.303
2010	41994[2]	13377		
Average	117290	42690	23981	0.652

[1]TSA estimates of total catch.
[2] Survey estimate

Annex 5.4.23

Option for a harvest rule

ICES is requested to evaluate the consequences of applying the following harvest rule for the management of haddock in zones VIa and EC waters of Vb:

1. *For 2010 and subsequent years the TAC will be set consistent with a fishing mortality rate of no more than 0.3 for appropriate age-groups, when the SSB in the end of the year in which the TAC is applied is estimated to be above 30,000 tonnes (B_{pa}).*
2. *Where the rule in paragraph 1 would lead to a TAC which deviates by more than 15 % from the TAC of the preceding year, the TAC will be set that is no more than 15 % greater or 15 % less than the TAC of the preceding year.*
3. *Where the SSB referred to in paragraph 1 is estimated to be below B_{pa} but above 22,000 tonnes (B_{lim}) the TAC shall not exceed a level which will result in a fishing mortality rate equal to $0.3-0.2*(B_{pa}-SSB)/(B_{pa}-B_{lim})$. This consideration overrides paragraph 2.*
4. *Where the SSB referred to in paragraph 2 is estimated to be below B_{lim} the TAC shall be set at a level corresponding to a total fishing mortality rate of no more than 0.1. This consideration overrides paragraph 2.*
5. *In the event that STECF advises that changes are required to the precautionary reference points B_{pa} (30,000t) or B_{lim}, (22,000t) paragraphs 1-4 shall be reviewed*