

Example only! Based mainly on 2009 advice / draft MSY approach, do not quote

8.4.2

Advice June 2009

**ECOREGION** Widely distributed and migratory stocks  
**STOCK** Hake in Division IIIa, Subareas IV, VI, and VII, and Divisions VIIIa,b,d) (Northern stock)

Advice for 2010

ICES advises on the basis of the transition scheme towards the ICES MSY framework<sup>1</sup> that landings for 2010 should be no less than 48 000 t. Additionally, management measures for hake should aim to reduce catches of species the mixed fisheries catching this stock<sup>2</sup>. These measures could include selective gears, gear restrictions, area closures, etc.

Stock status

SSB (Spawning Stock Biomass)				
MSY B <sub>trigger</sub>	○	○	+	Healthy stock size
Precautionary approach	○	○	+	Full reproductive capacity
	2007	2008	2009	
F (Fishing Mortality)				
MSY	−	−	−	Overfished
Precautionary approach	+	○	+	Harvested sustainably
	2006	2007	2008	

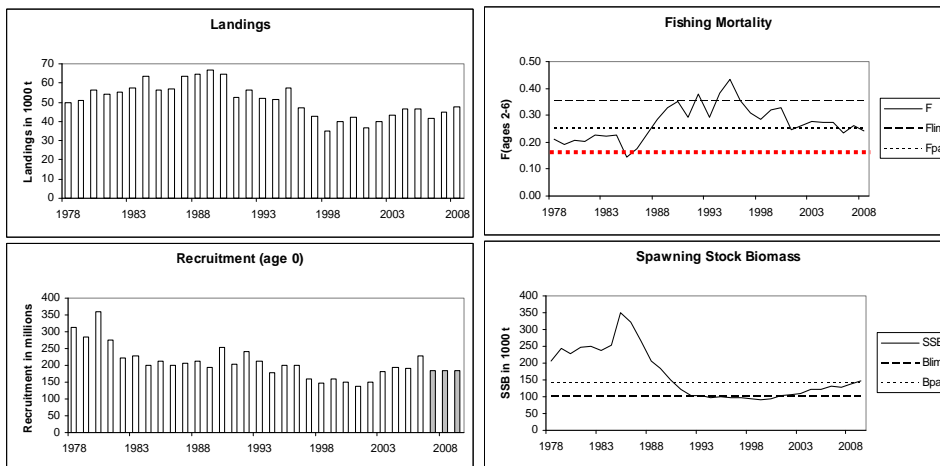
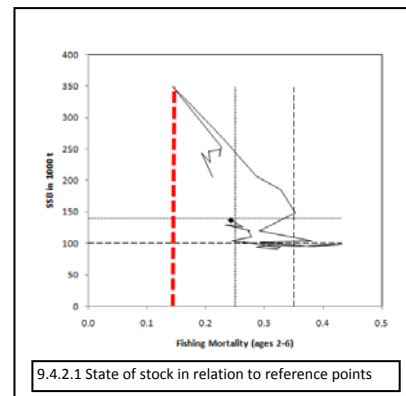


Figure 9.4.2.2 Summary of stock assessment (weights in '000 tonnes). Recruitment 2007- 2009 replaced by geometric mean (1990-06).

SSB is estimated to have increased to just above B<sub>pa</sub> in 2009. ICES considers that the stock has been around this level (the recovery plan target) for the last 2 years. F has been around F<sub>pa</sub> since 2001, but has not been near F<sub>MSY</sub> since 1986.

Management objectives

A recovery plan has been agreed by the EU in 2004 (EC Reg. No. 811/2004) which results in a TAC of 54 500 t in 2010. The aim of the plan is to increase the SSB to above 140 000 t with a fishing mortality (F<sub>mgt</sub>) than 0.25, constrained by a year-to-year change in TAC of 15% when SSB is above 100 000 t. The recovery plan has not been evaluated by ICES.

<sup>1</sup> Reference to ICES MSY framework and transition  
<sup>2</sup> See advice for anglerfish in the same area: x.x.y

### Biology

Hake is a bottom dwelling fish that is part of the top range of the food chain in the ecosystem. There is no biological basis for the current ICES stock definition of northern and southern hake. [*relevance?*]

### Environmental influence on the stock

There is no scientific understanding of the influence of the environment on this stock.

### The fisheries

Hake is caught in mixed fisheries together with megrim and anglerfish. Discards of juvenile hake can be substantial in some areas and fleets.

**Catch by fleet** Total catch (year) # kt where # kt landings (% gear-type(s), % other gear-types), # kt discards, # kt industrial by-catch, # kt unaccounted removals

### Effects of the fisheries on the ecosystem

Catch of juvenile hake reduce the stock abundance in the long run and reduce the long-term yield. Reducing mortality of small fish can be achieved by measures that reduce unwanted bycatch through shifting the selection pattern towards larger fish. This would reduce discards of other species as well and will increase the mean weight in the catch.

### Quality considerations

Age reading for this stock may overestimate the age categories. Additionally, recruitment is assessed with only one survey. Both uncertainties influence the assessment predictions. Discards data are not taken into account due to deficiencies in the area coverage.

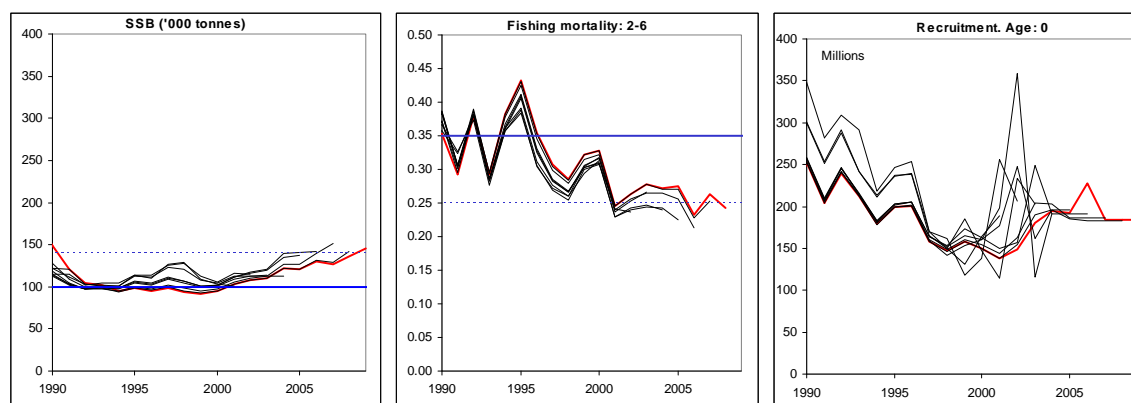


Figure 9.4.1.3 Comparison between current and previous assessments (predicted intermediate years are included<sup>3</sup>).

The assessment is consistent with last year.

### Scientific basis

<b>Assessment type</b>	<b>age-based assessment (XSA)</b>
<b>Input data</b>	4 survey indices ( <a href="#">list of abbreviations...</a> ) 4 commercial cpue indices (.....)
<b>Discards and by-catch</b>	Not included in the assessment
<b>Other information</b>	<a href="#">The last benchmark of the assessment method dates from 200?</a>

### Sources

ICES, 2006. Report of the Working Group on the Assessment of Southern Shelf Stocks of Hake, Monk and Megrim, 9 - 18 May 2006, Bilbao, Spain, ICES CM 2006/ACFM:29.

ICES, 2009. Report of the Working Group on the Assessment of Southern Shelf Stocks of Hake, Monk, and Megrim, 5-11 May 2009, ICES CM 2009/ACOM:08.

<sup>3</sup> R intermediate year will be excluded in future

## 8.4.2

## Supporting Information June 2009

**ECOREGION** Widely distributed and migratory stocks  
**STOCK** Hake in Division IIIa, Subareas IV, VI, and VII, and Divisions VIIIa,b,d (Northern stock)

## Reference points

	Type	Value	Technical basis
MSY approach <sup>4</sup>	MSY $B_{trigger}$	140 000 t	$B_{pa}$ as defined in 1998
	$F_{MSY}$	0.18	$F_{max}$ in 2009
Precautionary approach	$B_{lim}$	100 000 t	$B_{lim} = B_{loss}$ the lowest observed biomass in the 2003 assessment
	$B_{pa}$	140 000 t	$B_{pa} \sim B_{lim} * 1.4$
	$F_{lim}$	0.35	$F_{lim} = F_{loss}$
	$F_{pa}$	0.25	$F_{pa} \sim F_{lim} * 0.72$

(unchanged since: 2009)

Yield and spawning biomass per Recruit  $F$ -reference points (2009):

	Fish Mort Ages 2-6	Yield/R	SSB/R
Average last 3 years	0.25	0.31	0.91
$F_{max}$	0.18	0.32	1.21
$F_{0.1}$	0.10	0.29	1.88
$F_{med}$	0.34	0.29	0.64

## Catch options

Basis:  $F(2009) = \text{mean } F(06-08) = 0.25$ ;  $R(07-10) = \text{GM } 1990-2006 = 184$  millions;  $SSB(2010) = 161.6$ ; landings (2009) = 50.1

Rationale	Landings (2010)	Basis	F (2010)	SSB (2011)	%SSB change <sup>1</sup>	%TAC change <sup>2</sup>
MSY framework	42	$F_{MSY}$	0.18	186	15%	-19%
MSY transition	48	Avg $F_{this}/F_{that}$ <sup>5</sup>	0.21	178	10%	-2%
Precautionary approach	55	$F_{pa}$	0.25	172	6%	6%
EU recovery plan	55	F(recovery plan)	0.25	172	6%	6%
Status quo	0	$F=0$	0.00	233	44%	-100%
	6	$F_{sq} * 0.1$	0.03	226	40%	-88%
	16	$F_{sq} * 0.25$	0.06	216	33%	-70%
	30	$F_{sq} * 0.5$	0.13	200	23%	-42%
	43	$F_{sq} * 0.75$	0.19	185	14%	-16%
	51	$F_{sq} * 0.9$	0.23	177	9%	-2%
	55	$F_{sq}$	0.25	171	6%	7%
60	$F_{sq} * 1.1$	0.28	166	3%	16%	

All weights in '000 tonnes.

<sup>1)</sup> SSB 2011 relative to SSB 2010.

<sup>2)</sup> Predicted landings 2010 relative to TAC 2009 (51.5 thousand tonnes).

**MSY approach**

Following the ICES MSY framework implies fishing mortality to be reduced to 0.18 (equal to  $F_{MSY}$ ), resulting in landings of 42 000 t in 2010. This is expected to lead to an SSB of 186 000 t in 2011

<sup>4</sup> MSY reference points are made up, not to be quoted as the final ones, since the decision rule is not final yet.

<sup>5</sup> The MSY transition scheme is not yet settled, this figure is a guesstimate for the sake of this example.

Following the transition scheme towards the ICES MSY framework implies fishing mortality to be reduced to 0.21 ( $\text{Avg } F_{\text{this}}/F_{\text{that}}$ ), resulting in landings of 48 000 t in 2010. This is expected to lead to an SSB of 178 000 t in 2011

#### ***PA approach***

The fishing mortality in 2010 should be no more than  $F_{\text{pa}}$  corresponding to landings of less than 54 500 t in 2010. This is expected to keep SSB above  $B_{\text{pa}}$  in 2011.

#### ***Management plan(s) / policy paper***

Following the agreed EU recovery plan implies a TAC of 54 500 t in 2010 which is expected to lead to a TAC increase of 6%.

#### **Additional considerations**

Discards of juvenile hake can be substantial in some areas and fleets. The spawning biomass and the long-term yield can be substantially improved by reducing mortality of small fish. This could be achieved by measures that reduce unwanted bycatch through shifting the selection pattern towards larger fish.

The northern hake SSB is for 2009 estimated to be above the recovery plan target (140 000 t). Article 3 of the recovery plan prescribes that a management plan should be implemented when the target is reached in two consecutive years. ICES considers that SSB has been approximately 140 000 t in the last two years.

Stable fishing mortalities since 2001 at about  $F_{\text{pa}}$  (0.25) and the 2006 year class that is above average have contributed to the recent increase in SSB.

#### **Data**

The fishing industry and scientists have, at national level, discussed information that can be used in the assessments. However, national industries have not provided any additional quantitative information for use in the assessment.

#### **Comparison with previous assessment and catch options**

The estimate for SSB in 2008 has been revised up/downward by X% and F in 2007 has been revised up/downward by Y% compared to last year's assessment. Last year's advice was based on the precautionary principle ( $F_{\text{pa}}$ ). This year's advice is based on the ICES MSY framework ( $F_{\text{MSY}}$ )

#### **Uncertainties in assessment and catch options**

Age from otolith readings may be overestimated. Further studies, extensive tag-recapture studies, complementary ageing and growth methodologies, and even alternative non-age-based assessment methods are required to draw any firm conclusions on these matters. Analyses indicate that stock trends are robust to uncertainties in growth (ICES, 2006). However, if growth of hake is underestimated, reference points would need to be revisited.

Discards are not included in the assessments. The available data are patchy and noisy and discard rates of several fleets are still simply not known. Even, when data are available, it has not yet been possible to incorporate them in a consistent way.

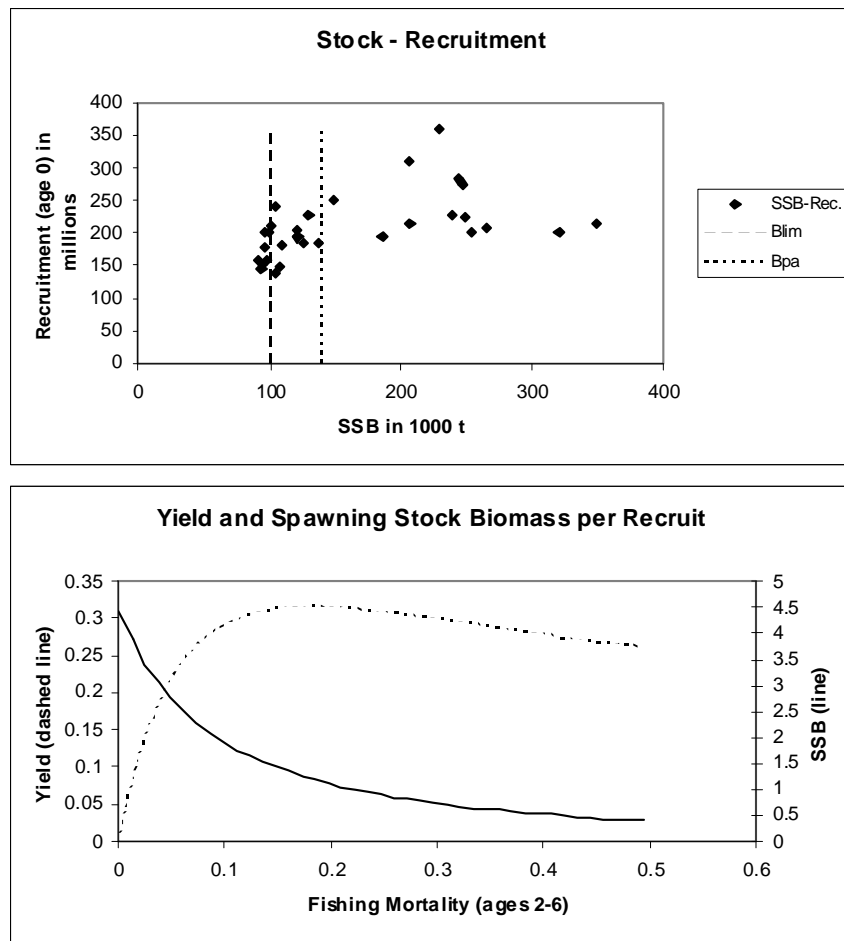
The historical performance of the assessments shows consistent overestimation of SSB and underestimation of fishing mortality for the last few years in the assessment. SSB for 2008 has been revised downwards by 3% and F for 2007 upwards by 4%.

There are large uncertainties associated with the most recent recruitment estimates; these are only estimated by a single survey. In the absence of reliable 2007 and 2008 recruitment estimates, geometric mean recruitment has been used.

There is no biological basis for the current stock definition of northern and southern hake.

**Assessment and management area**

Maps of ICES' stock assessment (advice) area and map of management area, to be produced.



**Figure 9.4.1.2.** Hake in Division IIIa, Subareas IV, VI, and VII, and Divisions VIIIa,b,d) (Northern stock). Stock-recruitment plot, yield per recruit analysis

**Table 9.4.1.1** Hake in Division IIIa, Subareas IV, VI, and VII, and Divisions VIIIa,b,d) (Northern stock). Single stock exploitation boundaries (advice), management, catch, and landings.

Year	ICES Advice / Single-stock exploitation boundaries (from 2004 onwards)	Predicted catch corresp to advice	Agreed TAC <sup>1</sup>	ICES landings	Disc. slip.	ICES Catch***
1987	Precautionary TAC; juvenile protection	-	63.5	63.4	2.0	65.3
1988	Precautionary TAC; juvenile protection	54	66.2	64.8	2.0	66.8
1989	Precautionary TAC; juvenile protection	54	59.7	66.5	2.3	68.8
1990	Precautionary TAC; juvenile protection	59	65.1	59.9	1.5	61.4
1991	Precautionary TAC; juvenile protection	59	67.0	57.6	1.7	59.3
1992	If required, precautionary TAC	61.5	69.0	56.6	1.7	58.3
1993	Enforce juvenile protection legislation	-	71.5	52.1	1.5	53.6
1994	F significantly reduced	<46	60.0	51.3	1.9	53.1
1995	30% reduction in F	31	55.1	57.6	1.2	58.9
1996	30% reduction in F	39	51.1	47.2	1.5	48.8
1997	20% reduction in F	54	60.1	42.6	1.8	44.4
1998	20% reduction in F	452	59.1	35.0	0.8	35.8
1999	Reduce F below F <sub>pa</sub>	<362	55.1	39.8	0.8	40.6
2000	50% reduction in F	<202	42.1	42.0	0.6	42.6
2001	Lowest possible catch, recovery plan	-	22.6	36.7	0.5	37.2
2002	Lowest possible catch / recovery plan	-	27.0	40.0	0.3	40.3
2003	Lowest possible catch / recovery plan	-	30.0	43.1	- **	-
2004	70% reduction in F or recovery plan*	<13.8	39.1	46.4		-
2005	F=0.19	33	42.6	46.6		
2006	F=0.25	44	43.9	41.5		
2007	Recovery plan limits	50.5	52.7	44.4		
2008	Recovery plan limits	54	54	47.8		
2009	F =0.25 = F <sub>pa</sub>	51.5	51.5			
2010	F =0.18 = F <sub>MSY</sub>	< 48				

Weights in '000 t.

<sup>1</sup> Sum of area TACs corresponding to northern stock plus Division IIa (EC zone only).<sup>2</sup> Landings.

\*Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries.

\*\*In 2003 onwards, no estimations of discards were available.

\*\*\*ICES catch not used in the assessment. Assessment based on landings only.

**Tables 9.4.1.2** Hake in Division IIIa, Subareas IV, VI, and VII, and Divisions VIIIa,b,d) (Northern stock).  
Estimated landings, discards, and catches ('000 tonnes) by ICES area.

Year	Landings (1)				Total	Discards (2)	Catches (3)
	IVa+VI	VII	VIIIa,b	Unallocated		VIIIa,b	Total
1961	-	-	-	95.6	95.6	-	95.6
1962	-	-	-	86.3	86.3	-	86.3
1963	-	-	-	86.2	86.2	-	86.2
1964	-	-	-	76.8	76.8	-	76.8
1965	-	-	-	64.7	64.7	-	64.7
1966	-	-	-	60.9	60.9	-	60.9
1967	-	-	-	62.1	62.1	-	62.1
1968	-	-	-	62.0	62.0	-	62.0
1969	-	-	-	54.9	54.9	-	54.9
1970	-	-	-	64.9	64.9	-	64.9
1971	8.5	19.4	23.4	0	51.3	-	51.3
1972	9.4	14.9	41.2	0	65.5	-	65.5
1973	9.5	31.2	37.6	0	78.3	-	78.3
1974	9.7	28.9	34.5	0	73.1	-	73.1
1975	11.0	29.2	32.5	0	72.7	-	72.7
1976	12.9	26.7	28.5	0	68.1	-	68.1
1977	8.5	21.0	24.7	0	54.2	-	54.2
1978	8.0	20.3	24.5	-2.2	50.6	2.4	52.9
1979	8.7	17.6	27.2	-2.4	51.1	2.7	53.8
1980	9.7	22.0	28.4	-2.8	57.3	3.2	60.5
1981	8.8	25.6	22.3	-2.8	53.9	2.3	56.3
1982	5.9	25.2	26.2	-2.3	55.0	3.1	58.1
1983	6.2	26.3	27.1	-2.1	57.5	2.6	60.1
1984	9.5	33.0	22.9	-2.1	63.3	1.9	65.1
1985	9.2	27.5	21.0	-1.6	56.1	3.8	59.9
1986	7.3	27.4	23.9	-1.5	57.1	3.0	60.1
1987	7.8	32.9	24.7	-2.0	63.4	2.0	65.3
1988	8.8	30.9	26.6	-1.5	64.8	2.0	66.8
1989	7.4	26.9	32.0	0.2	66.5	2.3	68.8
1990	6.7	23.0	34.4	-4.2	59.9	1.5	61.4
1991	8.3	21.5	31.6	-3.9	57.6	1.7	59.3
1992	8.6	22.5	23.5	2.1	56.6	1.7	58.3
1993	8.5	20.5	19.8	3.3	52.1	1.5	53.6
1994	5.4	21.1	24.7	0	51.3	1.9	53.1
1995	5.3	24.1	28.1	0	57.6	1.2	58.9
1996	4.4	24.7	18.0	0	47.2	1.5	48.8
1997	3.3	18.9	20.3	0	42.6	1.8	44.4
1998	3.2	18.7	13.1	0	35.0	0.8	35.8
1999	4.3	24.0	11.6	0	39.8	0.8	40.6
2000	4.0	26.0	12.0	0	42.0	0.6	42.6
2001	4.4	23.1	9.2	0	36.7	0.5	37.2
2002	2.9	21.2	15.9	0	40.1	0.3	40.4
2003*	3.3	25.4	14.4	0	43.2	-	43.2
2004*	4.4	27.5	14.5	0	46.4	-	46.4
2005*	5.5	26.6	14.5	0	46.6	-	46.6
2006*	6.1	24.7	10.6	0	41.5	-	41.5
<b>2007*</b>	<b>7.0</b>	<b>27.5</b>	<b>10.6</b>	<b>0</b>	<b>45.1</b>	-	<b>45.1</b>
2008*	10.7	22.8	14.3	0	47.8	-	47.8

(1) Spanish data for 1961-1972 not revised, data for Sub-area VIII for 1973-1978 include data for Divisions VIIIa,b only. Data for 1979-1981 are revised based on French surveillance data. Includes Divisions IIIa, IVb,c from 1976.

There are some unallocated landings ( moreover for the period 1961-1970).

(2) Discards have been estimated from 1978 and only for Divisions VIIIa,b.

(3) From 1978 total catches used for the Working Group.

(\*) Year for which no discards estimates is available

**Table 9.4.1.3** Hake in Division IIIa, Subareas IV, VI, and VII, and Divisions VIIIa,b,d) (Northern stock).  
Summary of stock assessment.

Year	Recruitment Age 0 millions	SSB tonnes	Landings tonnes	Mean F Ages 2-6
1978	311	206100	49500	0.212
1979	283	243900	50600	0.193
1980	359	228800	56500	0.208
1981	276	246900	53900	0.205
1982	223	248700	55000	0.225
1983	228	238200	57500	0.223
1984	200	253800	63300	0.226
1985	214	349600	56100	0.143
1986	199	320900	57100	0.174
1987	207	265900	63400	0.230
1988	213	206600	64800	0.286
1989	195	185500	66500	0.327
1990	252	148700	64300	0.353
1991	204	120400	52400	0.292
1992	240	104100	56600	0.380
1993	212	102100	52100	0.293
1994	179	95500	51300	0.382
1995	199	98900	57600	0.432
1996	201	95600	47200	0.355
1997	158	98300	42600	0.307
1998	147	94000	35000	0.286
1999	158	91800	39800	0.322
2000	150	94600	42000	0.328
2001	138	103600	36700	0.245
2002	149	107700	40100	0.263
2003	181	110000	43200	0.278
2004	195	121600	46400	0.272
2005	192	120500	46500	0.275
2006	228	129800	41500	0.233
2007	184*	126700	45100	0.263
2008	184*	136600	47800	0.243
2009	184*	145900		
Average	208	163791	51045	0.273

\*2007, 2008 and 2009 recruitment estimates replaced by geometric mean (1990-06)