ECOREGION Widely distributed and migratory stocks
STOCK Blue whiting in Subareas I–IX, XII, and XIV

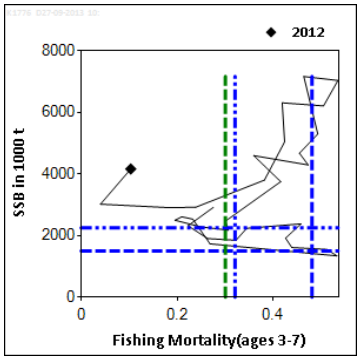
Advice for 2014

ICES advises on the basis of the management plan agreed by Norway, the EU, the Faroe Islands, and Iceland that landings in 2014 should be no more than 948 950 tonnes. All catches are assumed to be landed.

Stock status

F (Fishing Mortality)	2010	2011	**2012**	
MSY (F_{MSY})	✓	✓	✓	Appropriate
Precautionary approach (F_{pa},F_{lim})	✓	✓	✓	Harvested sustainably
Management plan (F_{MP})	✗	✓	✓	Below target

SSB (Spawning-Stock Biomass)	2011	2012	**2013**	
MSY ($B_{trigger}$)	✓	✓	✓	Above trigger
Precautionary approach (B_{pa},B_{lim})	✓	✓	✓	Full reproductive capacity
Management plan (SSB_{MP})	✓	✓	✓	Above trigger



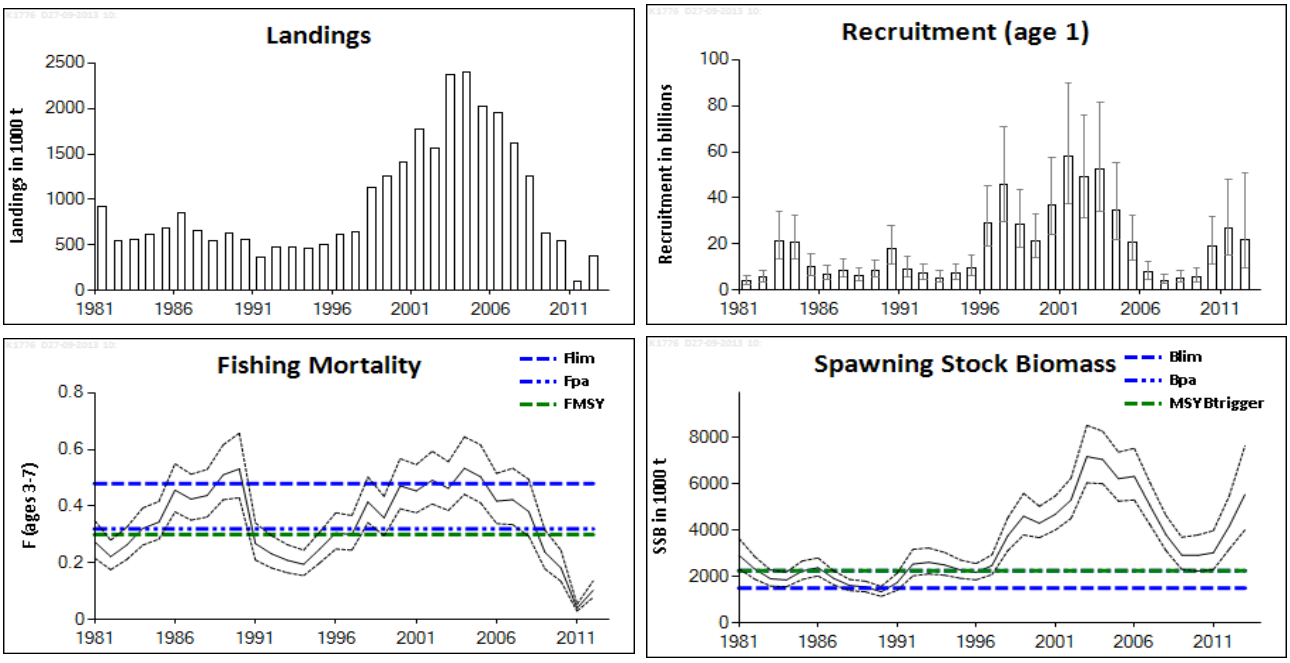


Figure 9.4.5.1 Blue whiting in Subareas I–IX, XII, and XIV. Summary of stock assessment.

SSB has almost doubled from 2010 (2.9 million tonnes) to 2013 (5.5 million tonnes) and is well above B_{pa} (2.25 million tonnes). This increase is due to the lowest Fs in the time-series in 2011 and 2012, in combination with increased recruitment since 2010.

Management plans

A management plan (Section 9.4.5.1 Annex) was agreed by Norway, the EU, the Faroe Islands, and Iceland in 2008. The plan uses i) a target fishing mortality (F = 0.18) if SSB is above SSB_{MP} (= B_{pa}), ii) a linear reduction to F = 0.05 if SSB is between B_{pa} and B_{lim}, and iii) F = 0.05 if SSB is below B_{lim}. ICES evaluated the plan in 2008 and concluded that it is in accordance with the precautionary approach (PA; ICES, 2008). ICES evaluated a NEAFC request concerning an alternative management plan in May 2013 (ICES, 2013a) and further in October 2013 (ICES, 2013b).

Biology

Blue whiting is widely distributed in the eastern part of the North Atlantic from Norway to the south of Portugal, with the highest concentrations along the edge of the continental shelf between 300 and 600 m. Most spawning takes place along the shelf edge and on banks west of the British Isles. Juveniles are also widely distributed, including in the Bay of Biscay and Iberian waters, with the main nursery area believed to be in the Norwegian Sea.

Environmental influence on the stock

The position and strength of the North Atlantic subpolar gyre (SPG) appears to influence the spawning distribution of blue whiting (Hátún *et al.*, 2009). The strong gyre constrains spawning distribution. This gyre may influence recruitment success through food availability and/or predation levels (Payne *et al.*, 2012). However, these mechanisms are not fully understood and are being explored further.

The fishery

The main fisheries on blue whiting in 2012 were conducted west of Scotland, around the Porcupine Bank, and south of the Faroe Islands. Most blue whiting catches occurred in the first half of the year. Catches have become increasingly used for human consumption rather than industrial purposes.

Catch distribution	Total landings (2012) = 384 kt (mainly pelagic trawl). Discards are considered negligible.

Effects of the fisheries on the ecosystem

Blue whiting feed on zooplankton and small fish in the same areas as herring and mackerel, but at greater depth.

Quality considerations

The principal survey for the adult part of this stock conducted in 2013 had high quality coverage of the survey area in space and time and is considered to have provided good quality data. Incoming recruitment is poorly estimated due to a lack of juvenile indices suitable for inclusion in the assessment model. The new modelling framework used is likely to result in more stable assessments than in previous years.

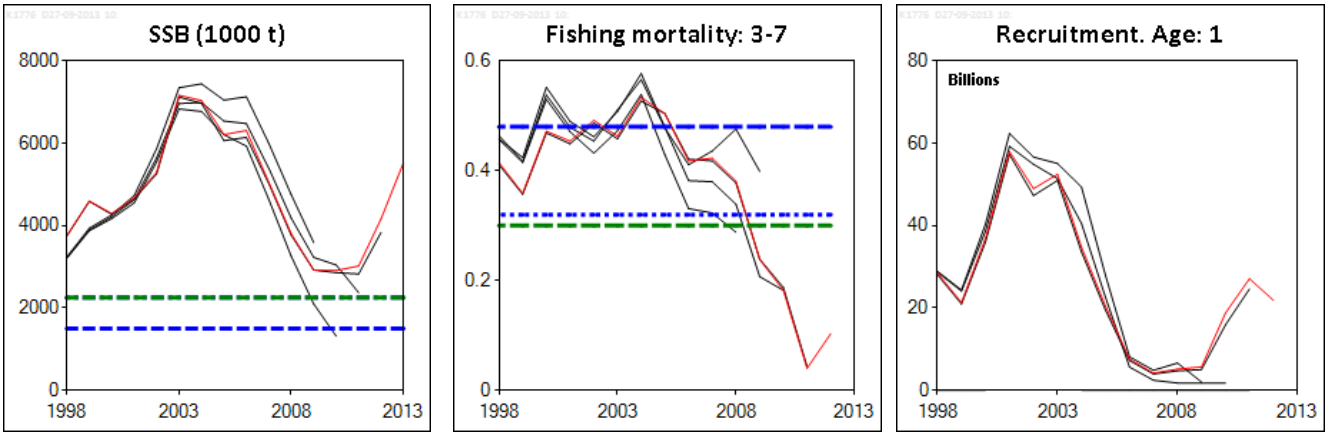


Figure 9.4.5.2 Blue whiting in Subareas I–IX, XII, and XIV. Historical assessment results. Horizontal lines represent reference points.

Scientific basis

Assessment type	Age-based analytical (SAM).
Input data	Commercial catches from international landings, ages and length frequencies from catch sampling. One survey index (International blue whiting spawning stock survey (IBWSS) 2004–2013, excluding 2010). No commercial indices. Annual maturity data from fixed values, estimated in 1994 by combining maturity ogives from the southern and northern areas. Natural mortalities fixed at 0.2, derived in the 1980s from age compositions before the industrial fishery started.
Discards and bycatch	Discards are not included and assumed negligible.
Indicators	Not used.
Other information	The stock was benchmarked in February 2012 (ICES, 2012b).
Working group report	WGWIDE (ICES, 2013c).

ECOREGION Widely distributed and migratory stocks
STOCK Blue whiting in Subareas I–IX, XII, and XIV

Reference points

	Type	*Value*	*Technical basis*
Management plan	SSB_{MP}	2.25 million t	B_{pa}
	F_{MP}	0.18	Management strategy evaluation conducted in 2008 (Anon., 2008; ICES, 2008).
MSY approach	MSY $B_{trigger}$	2.25 million t	B_{pa} (ICES, 2013a).
	$F_{0.1}$	0.22	Yield per recruit (ICES, 2013a, 2013c).
	F_{MSY}	0.30	Simulations in 2013 (ICES, 2013a).
Precautionary approach	B_{lim}	1.50 million t	Approximately B_{loss} (confirmed by ICES, 2013a).
	B_{pa}	2.25 million t	$B_{lim} \exp(1.645 \times \sigma)$, with $\sigma = 0.25$.
	F_{lim}	0.48	Equilibrium stochastic simulations (ICES, 2013a).
	F_{pa}	0.32	Based on F_{lim} and assessment uncertainties (ICES, 2013a).

(unchanged since: 2013)

F_{MSY} = 0.30 gives a high yield and a low risk of SSB< B_{lim}.

Outlook for 2014

Basis: F(2013) = 0.14 (catch constraint = 643 = TAC). SSB(2014) = 6715. R(2013), R(2014), and R(2015) = GM(1981–2010) = 13 463 million at age 1.

Rationale	**Catch (2014)**	**Basis**	**F 2014**	**SSB (2015)**	**% SSB change [1)]**	**% TAC change [2)]**
Management plan	948.950	F = 0.18 for SSB(2014) >2250	0.18	6958	4	48
NEAFC request	1140	Management plan, F = 0.22	0.22	6767	1	77
NEAFC request	1279	Management plan, F = 0.25	0.25	6635	−1	99
NEAFC request	1502	Management plan, F = 0.30	0.30	6422	−4	134
MSY framework	1502	F_{MSY} = 0.30	0.30	6422	−4	134
F_{pa} 0.32	1588	F_{pa}	0.32	6333	−6	144
F_{lim} 0.48	2232	F_{lim}	0.48	5723	−15	247
Zero catch	0		0.00	7877	17	−100
1.00 × F(2012)	562	1.00 × F(2012)	0.10	7336	9	−13
0.50 × F(2013)	401	0.50 × F(2013)	0.07	7484	11	−38
Status quo F	777	1.00 × F(2013)	0.15	7131	6	21
1.50 × F(2013)	1129	1.50 × F(2013)	0.22	6779	1	75
2.00 × F(2013)	1460	2.00 × F(2013)	0.29	6465	−4	127

Weights in thousand tonnes.
[1)] SSB 2015 relative to SSB 2014.
[2)] Catch 2014 relative to TAC 2013 (643).

Management plan

The management plan agreed by Norway, EU, the Faroe Islands, and Iceland in November 2008 (see Section 9.4.5.1 Annex) implies a TAC of 949 000 tonnes in 2014, compared to 643 000 tonnes in 2013. This is expected to lead to an increase in SSB in 2015 to 6.96 million tonnes, which is above SSB_{MP}. The stock projection for 2013–2015, with uncertainties included for this option, is shown in Figure 9.4.5.6.

MSY approach

Following the ICES MSY framework implies a TAC of 1 502 000 t in 2014 based on a fishing mortality at F_{MSY} = 0.30. This is expected to lead to a decrease in SSB in 2015 to 6.42 million tonnes, which is above MSY $B_{trigger}$ (2.25 million tonnes).

Precautionary approach

Following the ICES precautionary approach implies a TAC of 1 588 000 tonnes in 2014 based on a fishing mortality at F_{pa} = 0.32. This is expected to lead to a decrease in SSB in 2015 to 6.33 million tonnes, which is above B_{PA} (2.25 million tonnes).

Additional considerations

Management considerations

The assessment shows a moderate uncertainty of the absolute estimate of F and SSB, and a higher uncertainty on the recruiting year classes. Due to good planning and favorable weather conditions the implementation of the survey in 2013 resulted in high quality data, even though the Norwegian vessel did not participate in 2013. It is essential that this survey be maintained and it is important to maintain good geographical survey coverage within the agreed time window to avoid increases in assessment uncertainty.

Recruitment (age 1) is estimated significantly higher in 2011–2013 than in the years 2007–2009 with the historically low recruitments. The forecast and catch options for 2014 use recruitment (age 1) in 2012 from the assessment and an assumed average recruitment in 2013–2015. A TAC derived from the target F at 0.18 (or from higher F at 0.22) from the management plan is expected to lead to an SSB well above B_{pa} in 2015.

There are uncertainties about the stock structure even though ICES (2012b) evaluated available evidence on sub-stock structure and came to the conclusion that there is no scientific evidence in support of multiple stocks with distinct spawning locations or timings. The emerging picture is one of a single stock whose large-scale spatial spread varies as a function of hydrographical conditions and total abundance; this is commonly described as an abundance–occupancy relationship. Further, there seem to be a number of core nursery and feeding areas with marginal areas being occupied at times of high stock abundance. As a result, ICES considers blue whiting in ICES Subareas I–IX, XII, and XIV as a single stock for assessment purposes.

Data and methods

The assessment is based on catch-at-age data from commercial catches in 1981–2012 and one international blue whiting spawning stock survey (IBWSS) 2004–2013. The IBWSS survey is the only survey that covers almost the entire distributional area of the spawning stock.

Recruitment in the forecast is based on a qualitative analysis of trawl surveys covering parts of the distribution area for juveniles. The five available indices indicate that the 2012 year class is near average. The new information regarding the 2011 year class suggests that this is at or above average. ICES therefore decided to use the geometric mean of the whole period (1981–2010) for the 2012 and 2013 year classes, and the estimate from the assessment for the 2011 year class (above the geometric mean).

Limited information was available on discarding and discards were therefore not included in the assessment. However, discarding is considered to be minor.

Comparison with previous assessment

In the 2013 assessment, SSB in 2012 was estimated at 9% higher than in the previous assessment. Estimated fishing mortality in 2011 was 7% lower than in the previous assessment. The basis for advice was the same as last year.

Sources

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ICES. 2013a. NEAFC request to ICES to evaluate the harvest control rule element of the long-term management plan for blue whiting. Special request, Advice May 2013. *In* Report of the ICES Advisory Committee, 2013. ICES Advice 2013, Book 9, Section 9.3.3.1.

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Payne, M. R., Egan, A., Fässler, S. M. M., Hátún, H., Holst, J. C., Jacobsen, J. A., Slotte, A., *et al*. 2012. The rise and fall of the NE Atlantic blue whiting (*Micromesistus poutassou*). Marine Biology Research, 8: 475–487.

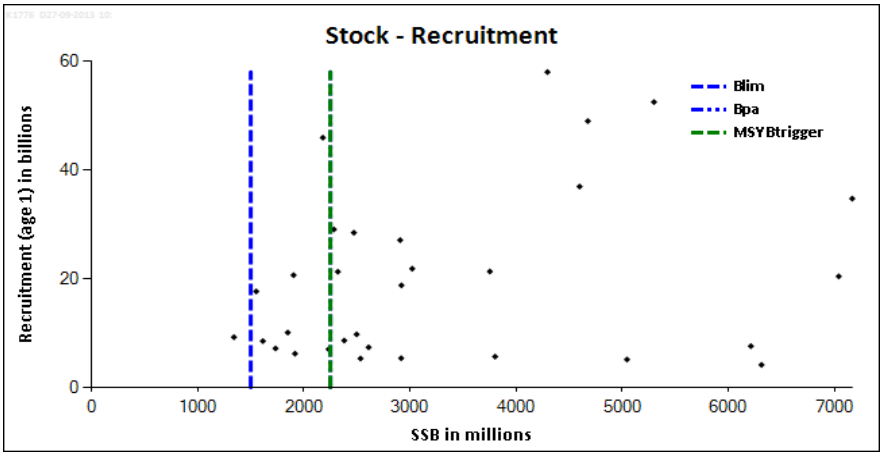

Figure 9.4.5.3 Blue whiting in Subareas I–IX, XII, and XIV. Stock–recruitment relationship.

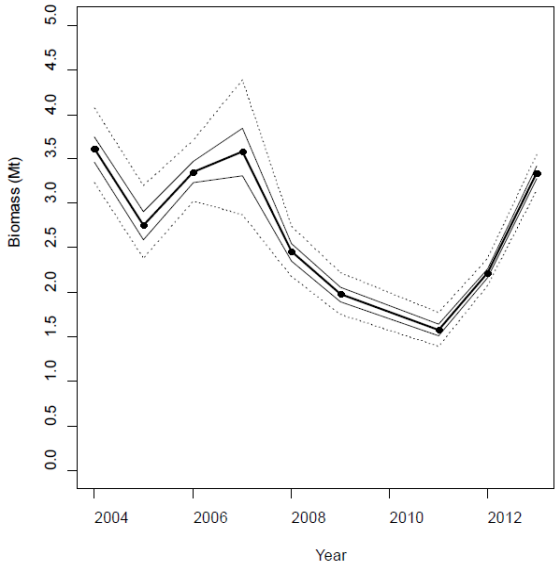

Figure 9.4.5.4 Blue whiting in Subareas I–IX, XII, and XIV. Total stock biomass and 50% and 95% confidence limits from the IBWSS survey, 2004–2013. The SSB index from the 2010 survey was excluded from the assessment.

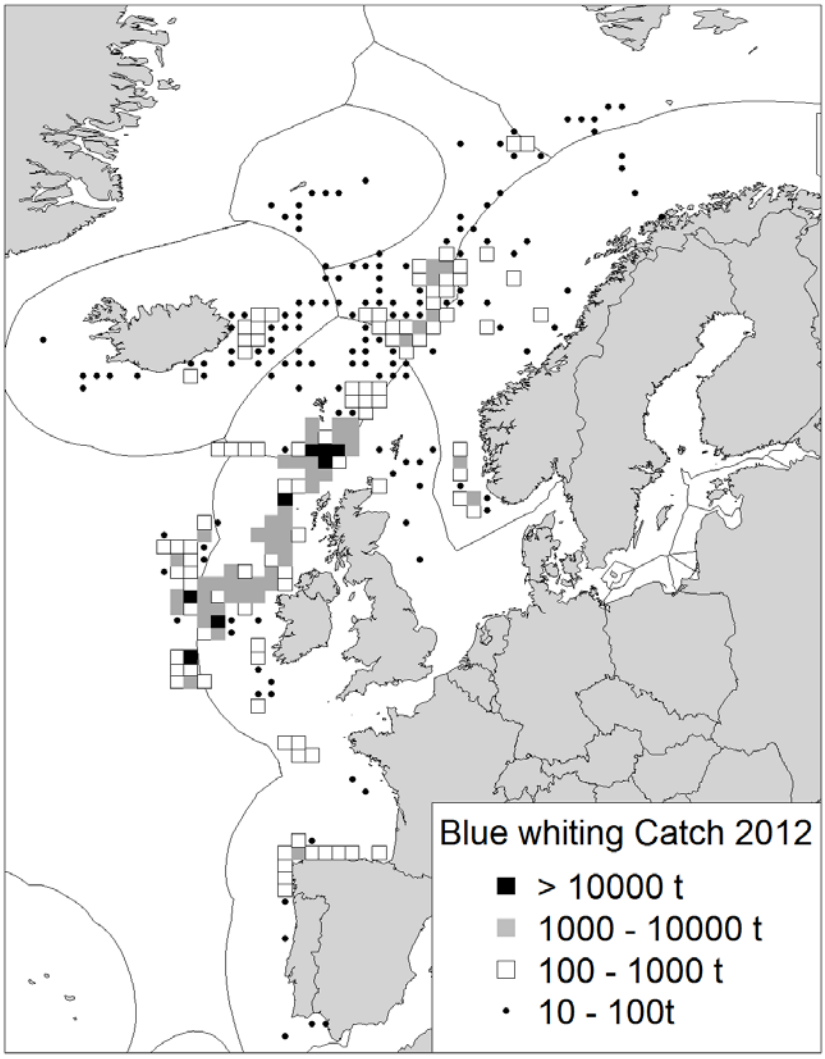

Figure 9.4.5.5 Blue whiting in Subareas I–IX, XII, and XIV. Total blue whiting catches (t) in 2012 by ICES rectangle. Catches below 10 t are not shown on the map.

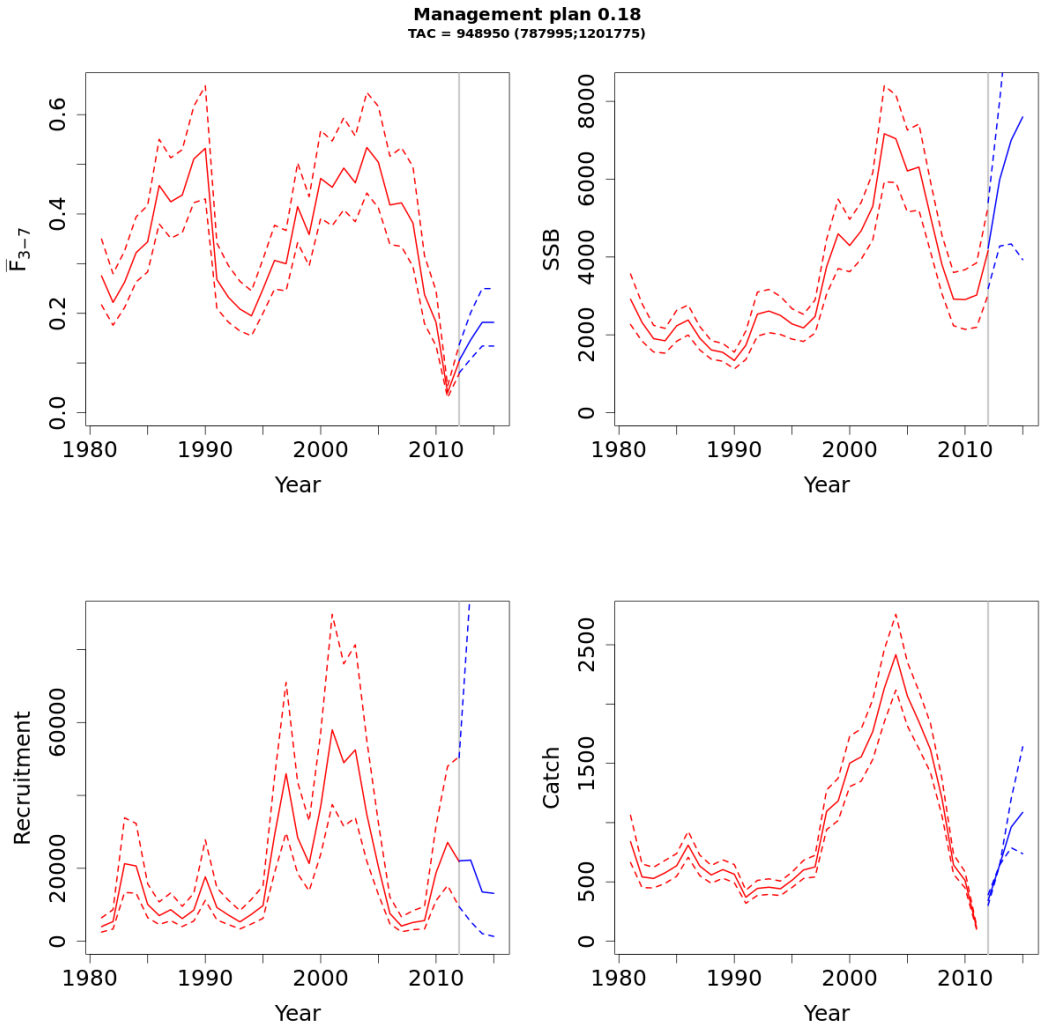

Figure 9.4.5.6 Blue whiting in Subareas I–IX, XII, and XIV. Stock projection 2013–2015 following the management plan. Mean value and 95% confidence intervals are shown.

Table 9.4.5.1 Blue whiting in Subareas I–IX, XII, and XIV. ICES advice, management, and landings.

Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	ICES catch
1987	TAC for northern areas; no advice for southern areas	950	-	665
1988	TAC for northern areas; no advice for southern areas	832	-	558
1989	TAC for northern areas; no advice for southern areas	630	-	627
1990	TAC for northern areas; no advice for southern areas	600	-	562
1991	TAC for northern areas; no advice for southern areas	670	-	370
1992	No advice	-	-	475
1993	Catch at *status quo* F (northern areas); no assessment for southern areas	490	-	481
1994	Precautionary TAC (northern areas); no assessment for southern areas	485	650[1]	459
1995	Precautionary TAC for combined stock	518	650[1]	579
1996	Precautionary TAC for combined stock	500	650[1]	646
1997	Precautionary TAC for combined stock	540		672
1998	Precautionary TAC for combined stock	650		1125
1999	Catches above 650 000 t may not be sustainable in the long run	650		1256
2000	F should not exceed the proposed F_{pa}	800		1412
2001	F should not exceed the proposed F_{pa}	628		1780
2002	Rebuilding plan	0		1556
2003	F should be less than the proposed F_{pa}	600		2321
2004	Achieve 50% probability that F will be less than F_{pa}	925		2378
2005	Achieve 50% probability that F will be less than F_{pa}	1075		2027
2006	F old management plan	1500	2100[2]	1966
2007	F should be less than the proposed F_{pa}	980	1847[3]	1612
2008	F should be less than F_{pa}	835	1250[4]	1246
2009	Maintain stock above B_{pa}	384	606[5]	636
2010	Follow the agreed management plan	540	548	540
2011	See scenarios	40–223	40	105
2012	Follow the agreed management plan	391	391	384
2013	Follow the agreed management plan	643	643	
2014	Follow the agreed management plan	948.950		

Weights in thousand tonnes.
[1]NEAFC proposal for NEAFC regions 1 and 2.
[2] Agreed TAC from four Coastal States of 2 million tonnes, and an additional allocation to Russia in the international zone of 100 000 t.
[3]Agreed TAC from four Coastal States of 1.7 million tonnes, and an additional allocation to Russia and Greenland of 147 000 t.
[4]Agreed TAC from four Coastal States of 1.1 million tonnes, and an additional allocation to Russia and Greenland.
[5]Agreed TAC from four Coastal States of 0.59 million tonnes, and an additional allocation to Russia (0.016 million tonnes).

Table 9.4.5.2 Blue whiting in Subareas I–IX, XII, and XIV. Landings (tonnes) by country for the period 2004–2012, as estimated by the Working Group.

Country	2004	2005	2006	2007	2008	2009	2010	2011	2012
Denmark	89 500	41 450	56 979	48 659	18 134	248	140	165	340
Estonia	*								
Faroes	322 322	266 799	321 013	317 859	225 003	58 354	49979	16405	43290
France		8 046	18 009	16 638	11 723	8 831	7839	4337	9799
Germany	15 293	22 823	36 437	34 404	25 259	5 044	9108	278	6239
Iceland	379 643	265 516	309 508	236 538	159 307	120 202	87942	5887	63056
Ireland	75 393	73 488	54 910	31 132	22 852	8 776	8324	1195	7557
Japan									
Latvia									
Lithuania			4 635	9 812	5 338				
Netherlands	95 311	147 783	102 711	79 875	78 684	35 686	33762	4595	26526
Norway	957 684	738 490	642 451	539 587	418 289	225 995	194317	20539	118832
Poland									
Portugal	3 937	5 190	5 323	3 897	4 220	2 043	1482	603	1955
Spain	15 612	17 643	15 173	13 557	14 342	20 637	12891	2416	6726
Sweden **	19 083	2 960	101	464					
UK (England)***									1590
UK (Scotland)	57 028	104 539	72 106	43 540	38 150	173	5496	1331	6305
Russia	346 762	332 226	329 100	236 369	225 163	149 650	112553	45841	88303
Uanllocated									3499
TOTAL	2 377 568	2 026 953	1 968 456	1 612 330	1 246 465	635 639	523 832	103 592	384 016

* Reported to the EU but not to the ICES WGNPBW. (Landings of 19 467 tonnes).
** Imprecise estimates for Sweden: reported catch of 34 265 t in 1993 is replaced by the mean of 1992 and 1994, i.e. 2867 t, which is used in the assessment.
*** From 2012 only UK split into England and Scotland.

Table 9.4.5.3 Blue whiting in Subareas I–IX, XII, and XIV. Landings (tonnes) by main areas.

Area	Norwegian Sea fishery (SAs 1+2; Divs. Va, XIVa–b)	Fishery in the spawning area (SA XII; Divs. Vb, VIa–b, VIIa–c)	Directed- and mixed fisheries in the North Sea (SA IV; Div. IIIa)	**Total northern areas**	Total southern areas (SAs VIII+IX; Divs. VIId–k)	**Grand total**
1988	55 829	426 037	45 143	**527 009**	30 838	**557 847**
1989	42 615	475 179	75 958	**593 752**	33 695	**627 447**
1990	2 106	463 495	63 192	**528 793**	32 817	**561 610**
1991	78 703	218 946	39 872	**337 521**	32 003	**369 524**
1992	62 312	318 081	65 974	**446 367**	28 722	**475 089**
1993	43 240	347 101	58 082	**448 423**	32 256	**480 679**
1994	22 674	378 704	28 563	**429 941**	29 473	**459 414**
1995	23 733	423 504	104 004	**551 241**	27 664	**578 905**
1996	23 447	478 077	119 359	**620 883**	25 099	**645 982**
1997	62 570	514 654	65 091	**642 315**	30 122	**672 437**
1998	177 494	827 194	94 881	**1 099 569**	29 400	**1 128 969**
1999	179 639	943 578	106 609	**1 229 826**	26 402	**1 256 228**
2000	284 666	989 131	114 477	**1 388 274**	24 654	**1 412 928**
2001	591 583	1 045 100	118 523	**1 755 206**	24 964	**1 780 170**
2002	541 467	846 602	145 652	**1 533 721**	23 071	**1 556 792**
2003	931 508	1 211 621	158 180	**2 301 309**	20 097	**2 321 406**
2004	921 349	1 232 534	138 593	**2 292 476**	85 093	**2 377 569**
2005	405 577	1 465 735	128 033	**1 999 345**	27 608	**2 026 953**
2006	404 362	1 428 208	105 239	**1 937 809**	28 331	**1 966 140**
2007	172 709	1 360 882	61 105	**1 594 695**	17 634	**1 612 330**
2008	68 352	1 111 292	36 061	**1 215 704**	30 761	**1 246 465**
2009	46 629	533 996	22 387	**603 012**	32 627	**635 639**
2011	20 599	72 279	7 524	**100 401**	3 191	**103 592**
2012	24 391	324 545	5678.346	**354 614**	29 402	**384 016**

Table 9.4.5.4 Blue whiting in Subareas I–IX, XII, and XIV (Combined Stock). Summary of stock assessment.

Year	Recruitment Age 1 thousands	SSB tonnes	Landings Tonnes	Mean F Ages 3–7
1981	4004783	2916807	922980	0.275
1982	5378930	2319820	550643	0.222
1983	21274080	1903110	553344	0.263
1984	20645336	1848712	615569	0.322
1985	10099536	2233320	678214	0.344
1986	7018078	2380926	847145	0.457
1987	8632114	1916479	654718	0.425
1988	6205832	1613635	552264	0.438
1989	8520623	1550364	630316	0.511
1990	17663307	1341099	558128	0.532
1991	9248760	1732368	364008	0.268
1992	7167016	2533215	474592	0.232
1993	5309456	2610363	475198	0.209
1994	7377903	2497998	457696	0.195
1995	9761923	2282998	505175	0.249
1996	29063685	2178180	621104	0.306
1997	45947041	2470670	639680	0.3
1998	28459711	3752752	1131954	0.415
1999	21316671	4597393	1261033	0.359
2000	36947184	4295163	1412449	0.472
2001	58002693	4676217	1771805	0.454
2002	48983791	5298848	1556955	0.492
2003	52483007	7167016	2365319	0.463
2004	34726026	7039164	2400795	0.534
2005	20419482	6212041	2018344	0.504
2006	7594995	6312233	1956239	0.418
2007	4155736	5045463	1612269	0.423
2008	5142243	3801856	1251851	0.381
2009	5666034	2919725	634978	0.238
2010	18774310	2908069	539539	0.182
2011	27098800	3020703	103771	0.04
2012	21834460	4164055	375692	0.103
2013		5531668*		

*SSB in 2013 is based on survivors, age 1 numbers as in 2012 and mean weight-at-age as in 2012.

9.4.5.1 Annex

The management plan below was agreed by Norway, the EU, the Faroe Islands, and Iceland, and endorsed by NEAFC in November 2008.

1. *The Parties agree to implement a long term management plan for the fisheries on the Blue Whiting stock, which is consistent with the precautionary approach, aiming at ensuring harvest within safe biological limits and designed to provide for fisheries consistent with maximum sustainable yield, in accordance with advice from ICES.*
2. *For the purpose of this long term management plan, in the following text, "TAC" means the sum of the coastal State TAC and the NEAFC allowable catches.*
3. *As a priority, the long term plan shall ensure with high probability that the size of the stock is maintained above 1.5 million tonnes (B_{lim}).*
4. *The Parties shall aim to exploit the stock with a fishing mortality of 0.18 on relevant age groups as defined by ICES.*
5. *While fishing mortality exceeds that specified in paragraph 4 and 6, the Parties agree to establish the TAC consistent with reductions in fishing mortality of 35% each year until the fishing mortality established in paragraph 4 and 6 has been reached. This paragraph shall apply only during 2009 and 2010.*

For the purposes of this calculation, the fishing percentage mortality reduction should be calculated with respect to the year before the year in which the TAC is to be established. For this year, it shall be assumed that the relevant TAC constrains catches.

6. *When the fishing mortality in paragraph 4 has been reached, the Parties agree to establish the TAC in each year in accordance with the following rules:*

    - *In the case that the spawning biomass is forecast to reach or exceed 2.25 million tonnes (SSB trigger level) on 1 January of the year for which the TAC is to be set, the TAC shall be fixed at the level consistent with the specified fishing mortality.*
    - *In the case that the spawning biomass is forecast to be less than 2.25 million tonnes on 1 January of the year for which the TAC is to be set (B), the TAC shall be fixed that is consistent with a fishing mortality given by:*

    $$F = 0.05 + [(B - 1.5)*(0.18 - 0.05) / (2.25 - 1.5)]$$

    In the case that spawning biomass is forecast to be less than 1.5 million tonnes on 1 January of the year for which the TAC is to be set, the TAC will be fixed that is consistent with a fishing mortality given by F = 0.05.

7. *When the fishing mortality rate on the stock is consistent with that established in paragraph 4 and the spawning stock size on 1 January of the year for which the TAC is to be set is forecast to exceed 2.25 million tonnes, the Parties agree to discuss the appropriateness of adopting constraints on TAC changes within the plan.*
8. *The Parties, on the basis of ICES advice, shall review this long term management plan at intervals not exceeding five years and when the condition specified in paragraph 4 is reached.*