9.3.6 Blue whiting (*Micromesistius poutassou*) in subareas 1–9, 12, and 14 (Northeast Atlantic)

ICES stock advice

ICES advises that when the MSY approach is applied, catches in 2017 should be no more than 1 342 330 tonnes.

Stock development over time

Fishing mortality (F) has increased from a historical low in 2011 to above F_{MSY} since 2014. Spawning-stock biomass (SSB) increased since 2010 and is above MSY $B_{trigger}$. Recent recruitments are estimated above average, but with a high uncertainty.

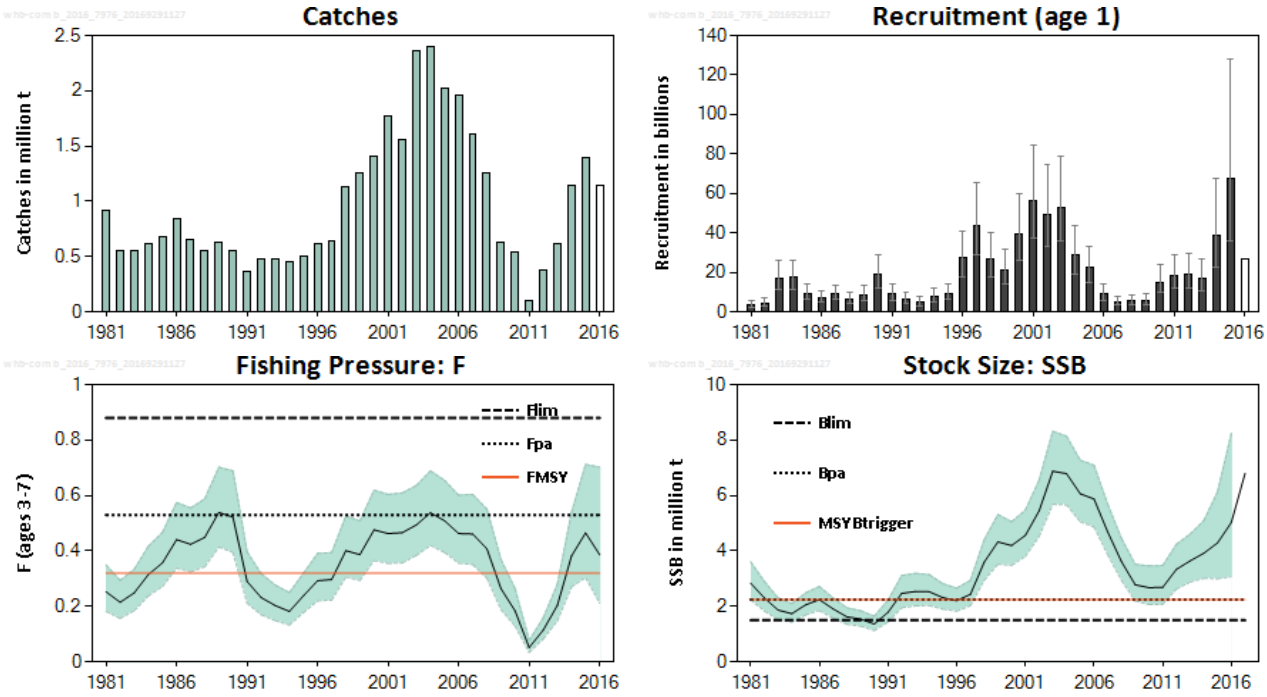

Figure 9.3.6.1 Blue whiting in subareas 1–9, 12, and 14. Summary of stock assessment. Confidence intervals (95%) are included in the recruitment, fishing mortality, and spawning stock biomass plots. Recruitment for 2016 (not shaded) is the 75th percentile of recruitment 1981–2015. Catches for 2016 (not shaded) are preliminary.

Stock and exploitation status

Table 9.3.6.1 Blue whiting in subareas 1–9, 12, and 14. State of the stock and fishery relative to reference points.

		Fishing pressure					Stock size			
		2014	2015	2016			2015	2016	2017	
Maximum sustainable yield	F_{MSY}	✗	✗	✗	Above	MSY $B_{trigger}$	✓	✓	✓	Above trigger
Precautionary approach	F_{pa}, F_{lim}	✓	✓	✓	Harvested sustainably	B_{pa}, B_{lim}	✓	✓	✓	Full reproductive capacity
Management plan	F_{MGT}	-	-	-	Not applicable	SSB_{MGT}	-	-	-	Not applicable

Catch options

Table 9.3.6.2 Blue whiting in subareas 1–9, 12, and 14. The basis for the catch options.

Variable	Value	Source	Notes
F ages 3–7 (2016)	0.386	ICES (2016a)	From assessment model, including preliminary 2016 catches.
SSB (2017)	6.804 mill. t	ICES (2016a)	From assessment, but revised recruitments in 2016 and 2017.
$R_{age\ 1}$ (2016)	26.973 billions	ICES (2016a)	75% percentiles of recruitment 1981–2015.
$R_{age\ 1}$ (2017)	14.633 billions	ICES (2016a)	GM (1981–2015)
$R_{age\ 1}$ (2018)	14.633 billions	ICES (2016a)	GM (1981–2015)
Total catch (2016)	1.147 mill. t	ICES (2016a)	Estimated by ICES, based on declared quotas and expected uptake raised with the age distribution from the preliminary 2016 catch data.

*

Table 9.3.6.3 Blue whiting in subareas 1–9, 12, and 14. The catch options. Weights in tonnes.

Rationale	Catch (2017)	Basis	F 2017	SSB (2018)	% SSB change *	% Catch change **
MSY approach	1342330	F_{MSY} = 0.32	0.32	6700746	−2	17
Other options	0	F = 0	0	7984004	17	−100
	793663	F = 0.18	0.18	7225455	6	−31
	875482	F = 0.20	0.20	7147053	5	−24
	956118	F = 0.22	0.22	7069836	4	−17
	1074904	F = 0.25	0.25	6956183	2	−6
	1152681 (~1147 kt)	Catch 2017 = Catch 2016	0.27	6881829	1	0
	1582620	F (2016)	0.39	6471736	−5	38
	2070268	F_{pa}	0.53	6008626	-12	80
	3077862	F_{lim}	0.88	5059556	−26	168
	6159997	$SSB_{2018} = B_{pa}$	2.88	2257026	−67	437
	7039918	$SSB_{2018} = B_{lim}$	4.16	1507999	−78	514

* SSB 2018 relative to SSB 2017.

** Catch 2017 relative to estimated catch in 2016 (1147 kt).

Basis of the advice

Table 9.3.6.4 Blue whiting in subareas 1–9, 12, and 14. The basis of the advice.

Advice basis	MSY approach.
Management plan	There is no management plan for blue whiting in this area.

Quality of the assessment

The assessment now uses preliminary catch-at-age data in the assessment year to supplement information from the acoustic survey conducted in the spring. In most recent years more than 90% of the annual catches of the age 3+ fish are consistently taken in the first half year, which makes it reasonable to estimate the total annual catch-at-age from preliminary first semester data. This is expected to provide more realistic fishing mortalities in the assessment year.

Additionally, a new version of the SAM model (Berg and Nielsen, 2016) is now used for the blue whiting assessment. This model accounts for age-correlated observations in the IBWSS survey. However, the blue whiting assessment results are still highly sensitive to the value of the most recent survey index.

The historical assessment results show a consistent picture of SSB and F for the assessment in 2015 (using catch data 1981–2014) and in the most recent assessment (using catch data 1981–2016). The recruitment estimates for 2014 and 2015 are much higher than assumed in last year's assessment.

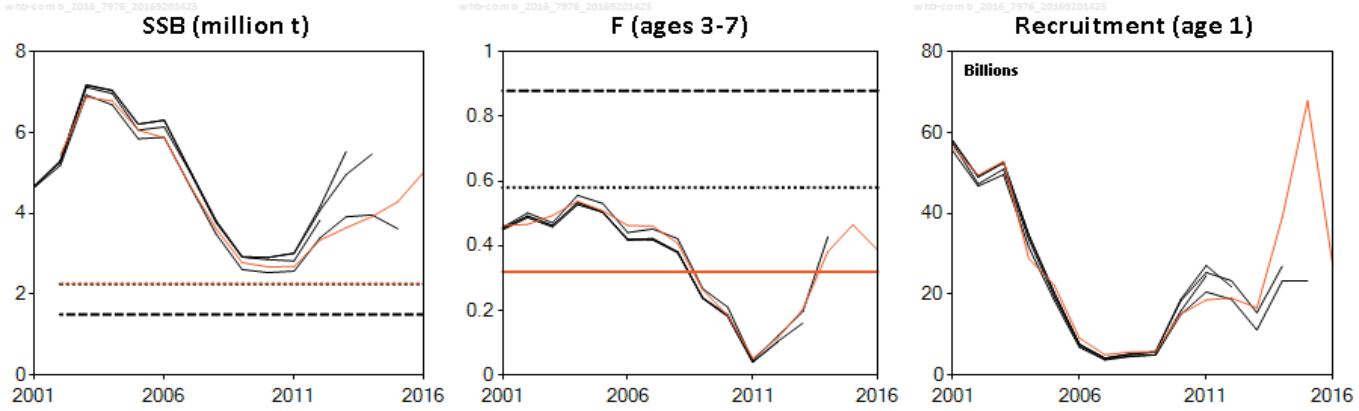

Figure 9.3.6.2 Blue whiting in subareas 1–9, 12, and 14. Historical assessment results (final-year recruitment estimates included). The 2016 assessment includes preliminary 2016 catches.

Issues relevant for the advice

The catch advice for 2017 is a considerable increase compared to the advice given for 2016. This is mainly a result of the large 2013 and 2014 year classes, which the 2016 assessment estimates to be much more abundant than assumed in 2015. The assessment results are highly sensitive to the value of the most recent survey index and in 2016 this index showed a significant increase compared to last year. Another aspect that also contributes to the increase in the catch advice this year is the upwards revision of the F_{MSY} value (from 0.30 to 0.32).

Reference points

Table 9.3.6.5 Blue whiting in subareas 1–9, 12, and 14. Reference points, values, and their technical basis.

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY $B_{trigger}$	2.25 million t	B_{pa}	ICES (2013a, 2013b, 2016b)
	F_{MSY}	0.32	Stochastic simulations with segmented regression stock–recruitment relationship	ICES (2016b)
Precautionary approach	B_{lim}	1.50 million t	Approximately B_{loss}	ICES (2013a, 2013b, 2016b)
	B_{pa}	2.25 million t	$B_{lim} \exp(1.645 \times \sigma)$, with $\sigma = 0.246$	ICES (2013a, 2013b, 2016b)
	F_{lim}	0.88	Equilibrium scenarios with stochastic recruitment: F value corresponding to 50% probability of (SSB< B_{lim})	ICES (2016b)
	F_{pa}	0.53	Based on F_{lim} and assessment uncertainties. $F_{lim} \exp(-1.645 \times \sigma)$, with $\sigma = 0.299$	ICES (2016b)

Basis of the assessment

Table 9.3.6.6 Blue whiting in subareas 1–9, 12, and 14. The basis of the assessment.

ICES stock data category	1 (ICES, 2016c).
Assessment type	Age-based analytical assessment (SAM; Berg and Nielsen, 2016) that uses catches for the model and the forecast.
Input data	Commercial catches, preliminary within-year catches, ages and length frequencies from catch sampling. One survey index (International blue whiting spawning stock survey (IBWSS) ages 1–8, 2004–2016, excluding 2010). Qualitative estimate of recruitment from surveys: Norwegian bottom trawl survey in the Barents Sea, International Ecosystem Survey in the Nordic Seas in May (IESNS), the Faroese bottom trawl surveys in spring, and the Icelandic bottom trawl survey in spring. Fixed maturity 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 targeted fishery started.
Discards and bycatch	Discard data have been included since 2014.
Indicators	None
Other information	The stock was benchmarked in 2012 (WKPELA; ICES, 2012). An inter-benchmark protocol was conducted in the spring of 2016 (ICES, 2016d).
Working group	Working Group on Widely Distributed Stocks (WGWIDE)

Information from stakeholders

The EU industry reported that the fishery for blue whiting in 2016 was very good. High catch rates were maintained all through the season and the vessels had no difficulty catching their allocations. There was a higher proportion of smaller blue whiting in the catch at the start of the 2016 season than in the previous year. The main fishery off the west coast of Ireland took place further offshore in 2016 than in 2015. The industry considers recruitment to have been good over last two years.

History of advice, catch, and management

Table 9.3.6.7 Blue whiting in subareas 1–9, 12, and 14. History of ICES advice, the agreed TAC, and ICES estimates of catch. Weights in thousand tonnes.

Year	ICES advice	Predicted catch corresp. to advice	TAC	ICES catch
1987	TAC for northern areas; no advice for southern areas	950	-	655
1988	TAC for northern areas; no advice for southern areas	832	-	552
1989	TAC for northern areas; no advice for southern areas	630	-	630
1990	TAC for northern areas; no advice for southern areas	600	-	558
1991	TAC for northern areas; no advice for southern areas	670	-	364
1992	No advice	-	-	475
1993	Catch at *status quo* F (northern areas); no assessment for southern areas	490	-	475
1994	Precautionary TAC (northern areas); no assessment for southern areas	485	650*	458
1995	Precautionary TAC for combined stock	518	650*	505
1996	Precautionary TAC for combined stock	500	650*	621
1997	Precautionary TAC for combined stock	540	-	640
1998	Precautionary TAC for combined stock	650	-	1132
1999	Catches above 650 000 t may not be sustainable in the long run	650	-	1261
2000	F should not exceed the proposed F_{pa}	800	-	1412
2001	F should not exceed the proposed F_{pa}	628	-	1772
2002	Rebuilding plan	0	-	1557
2003	F should be less than the proposed F_{pa}	600	-	2365
2004	Achieve 50% probability that F will be less than F_{pa}	925	-	2401
2005	Achieve 50% probability that F will be less than F_{pa}	1075	-	2018
2006	F old management plan	1500	2100**	1956
2007	F should be less than the proposed F_{pa}	980	1847***	1612
2008	F should be less than F_{pa}	835	1250^	1252
2009	Maintain stock above B_{pa}	384	606^^	635
2010	Follow the agreed management plan	540	548	540
2011	See scenarios	40–223	40	104
2012	Follow the agreed management plan	391	391	376
2013	Follow the agreed management plan	643	643	614
2014	Follow the agreed management plan	948.950	1200	1148
2015	Follow the agreed management plan	839.886	1260^^^	1391
2016	MSY approach	≤ 776.391	1147^^^	1147[§]
2017	MSY approach	≤ 1342.330		

* NEAFC proposal for NEAFC regions 1 and 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.
*** Agreed TAC from four Coastal States of 1.7 million tonnes, and an additional allocation to Russia and Greenland of 147 000 t.
^ Agreed TAC from four Coastal States of 1.1 million tonnes, and an additional allocation to Russia and Greenland.
^^ Agreed TAC from four Coastal States of 0.59 million tonnes, and an additional allocation to Russia of 16 000 t.
^^^ No agreed TAC by the Coastal States, sum of unilateral quotas.
[§] Preliminary

History of catch and landings

Table 9.3.6.8 Blue whiting in subareas 1–9, 12, and 14. Catch distribution by fleet in 2015 from official catches.

Total catch	Landings		Discards
1396 kt	98% pelagic trawl	2% bottom trawl	6 kt
	1390 kt		

Table 9.3.6.9 Blue whiting in subareas 1–9, 12, and 14. History of catches, official values are presented by country. Discard data included since 2014.

Country	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Denmark	89500	41450	54663	48659	18134	248	140	165	340	2167	35256	45178
Estonia												
Faroes	322322	266799	321013	317859	225003	58354	49979	16405	43290	85768	224700	282502
France		8046	18009	16638	11723	8831	7839	4337	9799	8978	10410	9659
Germany	15293	22823	36437	34404	25259	5044	9108	278	6239	11418	24487	24107
Iceland	379643	265516	309508	236538	159307	120202	87942	5887	63056	104918	182879	214870
Ireland	75393	73488	54910	31132	22852	8776	8324	1195	7557	13205	21466	24785
Japan												
Latvia												
Lithuania			4635	9812	5338						4717	
Netherlands	95311	147783	102711	79875	78684	35686	33762	4595	26526	51635	38524	56397
Norway	957684	738490	642451	539587	418289	225995	194317	20539	118832	196246	399520	489439
Poland												
Portugal	3937	5190	5323	3897	4220	2043	1482	603	1955	2056	2150	2547
Spain	15612	17643	15173	13557	14342	20637	12891	2416	6726	15274	32065	29206
Sweden	19083	2960	101	464	4	3	50	1	4	199	2	32
UK (England + Wales)	2593	7356	10035	12926	14147	6176	2475	27	2866	4100	11	131
UK (Northern Ireland)										1232	2205	1119
UK (Scotland)	57028	104539	72106	43540	38150	173	5496	1331	6305	8166	24630	30508
USSR / Russia	346762	332226	329100	236369	225163	149650	112553	45841	88303	120674	152256	185763
Greenland										2133		
Unallocated									3499			
TOTAL	2380161	2034309	1976175	1625257	1260615	641818	526358	103620	385297	628169	1155278	1396243

Table 9.3.6.10 Blue whiting in subareas 1–9, 12, and 14. Official catches (tonnes) by main fishing areas.

Area	Norwegian sea fishery (SAs 1+2; Divs. 5.a, 14.a–b)	Fishery in the spawning area (SA 12; Divs. 5.b, 6.a–b, 7.a–c)	Fisheries in the North Sea (SA 4; Div. 3.a)	Total northern areas	Total southern areas (SAs 8+9; Divs. 7.d–k)	Grand total
1988	55829	426037	45143	527009	30838	557847
1989	42615	475179	75958	593752	33695	627447
1990	2106	463495	63192	528793	32817	561610
1991	78703	218946	39872	337521	32003	369524
1992	62312	318018	65974	446367	28722	475026
1993	43240	347101	58082	448423	32256	480679
1994	22674	378704	28563	429941	29473	459414
1995	23733	423504	104004	551241	27664	578905
1996	23447	478077	119359	620883	25099	645982
1997	62570	514654	65091	642315	30122	672437
1998	177494	827194	94881	1099569	29400	1128969
1999	179639	943578	106609	1229826	26402	1256228
2000	284666	989131	114477	1388274	24654	1412928
2001	591583	1045100	118523	1755206	24964	1780170
2002	541467	846602	145652	1533721	23071	1556792
2003	931508	1211621	158180	2301309	20097	2321406
2004	921349	1232534	138593	2292476	85093	2377569*
2005	405577	1465735	128033	1999345	27608	2026953*
2006	404362	1428208	105239	1937809	28331	1966140*
2007	172709	1360882	61105	1594695	17634	1612330*
2008	68352	1111292	36061	1215704	30761	1246465*
2009	46629	533996	22387	603012	32627	635639*
2010	36214	441521	17545	495280	28552	523832*
2011	20599	72279	7524	100401	3191	103592*
2012	24391	324545	5678	354614	29402	384016**
2013	31759	481356	8749	521864	103973	625837**
2014	45580	885483	28596	959659	195620	1155279
2015	150828	895684	44661	1091173	305071	1396244

* Data from UK (England+Wales) not included.

** Data from Sweden and Greenland not included.

Summary of the assessment

Table 9.3.6.11 Blue whiting in subareas 1–9, 12, and 14. Assessment summary; weights in tonnes and recruitment in thousands.

Year	Recruitment (age 1) thousands	High	Low	Stock size: SSB tonnes	High	Low	Total catch tonnes	Fishing pressure: F Ages 3–7 Year −1	High	Low
1981	3838871	5912627	2492450	2840555	3610440	2234839	923000	0.253	0.35	0.182
1982	4617053	7169714	2973225	2308694	2904159	1835323	551000	0.215	0.294	0.157
1983	17256711	26289732	11327392	1869115	2304659	1515883	553000	0.249	0.334	0.185
1984	17410430	26249995	11547548	1737993	2102535	1436657	616000	0.315	0.417	0.238
1985	9423303	14145866	6277356	2055796	2491743	1696121	678000	0.357	0.467	0.272
1986	7276066	10887006	4862782	2244999	2719421	1853343	847000	0.441	0.575	0.338
1987	9095659	13644895	6063148	1910529	2310147	1580039	655000	0.424	0.555	0.325
1988	6501860	9765235	4329050	1627634	1951532	1357494	552000	0.449	0.588	0.343
1989	8707052	13135512	5771587	1544325	1847092	1291186	630000	0.539	0.702	0.414
1990	18862487	28925473	12300349	1366379	1647302	1133363	558000	0.522	0.689	0.395
1991	9093984	14054006	5884483	1789828	2227762	1437984	364000	0.29	0.397	0.212
1992	6717404	10256585	4399467	2469241	3117337	1955885	475000	0.232	0.318	0.17
1993	5011587	7738172	3245728	2539181	3191846	2019971	475000	0.203	0.277	0.149
1994	7895935	12091103	5156336	2530060	3147869	2033505	458000	0.182	0.25	0.133
1995	9293593	14090441	6129750	2316577	2818994	1903703	505000	0.239	0.32	0.178
1996	27144300	41037828	17954483	2206320	2659468	1830385	621000	0.293	0.391	0.22
1997	43484969	65687990	28786732	2440195	2939722	2025550	640000	0.297	0.394	0.223
1998	26810589	40201459	17880139	3595118	4396065	2940101	1132000	0.401	0.526	0.306
1999	20823338	31405076	13807048	4327262	5314630	3523330	1261000	0.387	0.508	0.294
2000	39447425	59581340	26117227	4196062	5055551	3482693	1412000	0.476	0.619	0.366
2001	56348281	84551517	37552594	4562747	5473235	3803720	1772000	0.463	0.604	0.355
2002	49510327	74283029	32999092	5443674	6547631	4525849	1557000	0.466	0.609	0.357
2003	52916331	78515898	35663326	6875311	8316034	5684188	2365000	0.494	0.636	0.384
2004	28824194	43395755	19145517	6791147	8140614	5665381	2401000	0.538	0.689	0.42
2005	22266769	33258797	14907605	6062446	7273412	5053097	2018000	0.509	0.655	0.395
2006	9127776	13790163	6041720	5875110	7089970	4868415	1956000	0.463	0.601	0.356
2007	5038340	7680658	3305039	4686640	5681204	3866187	1612000	0.461	0.604	0.351
2008	5699714	8772355	3703308	3617723	4451969	2939804	1252000	0.408	0.551	0.302
2009	5785322	9260002	3614464	2781230	3518267	2198594	635000	0.264	0.369	0.189
2010	15064115	23629765	9603462	2677882	3461833	2071461	540000	0.184	0.264	0.129
2011	18622510	29067666	11930710	2686041	3473362	2077185	104000	0.052	0.078	0.034
2012	19054700	29693976	12227449	3339257	4242827	2628115	376000	0.115	0.159	0.083
2013	16642001	26832432	10321696	3643950	4609664	2880551	614000	0.204	0.28	0.148
2014	38952418	67576940	22452791	3920996	5099750	3014699	1148000	0.382	0.539	0.271
2015	67872796	128213581	35930019	4292740	6140542	3000975	1391000	0.465	0.712	0.304
2016	26973000			5031888	8244304	3071199	1147000	0.386	0.702	0.212
2017				6804000						
Average	20483645	31736931	13048716	3432666	4181191	2678799	966500	0.351	0.473	0.261

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