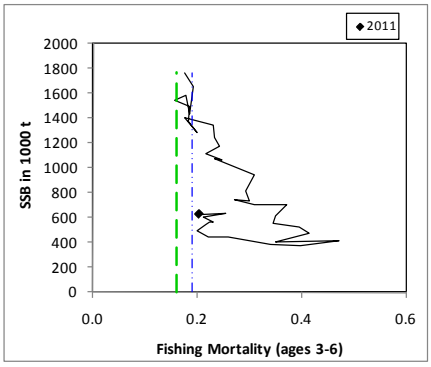
ECOREGION Baltic Sea
STOCK Herring in Subdivisions 25–29 and 32 (excluding Gulf of Riga herring)

Advice for 2013

ICES advises on the basis of the transition to the MSY approach that catches in 2013 should be no more than 117 000 tonnes.

Stock status

F (Fishing Mortality)	2009	2010	2011	
MSY (F_{MSY})	✗	✗	✗	Above target
Precautionary approach (F_{pa},F_{lim})	✗	✗	✗	Harvested unsustainably
SSB (Spawning-Stock Biomass)	**2010**	**2011**	**2012**	
MSY ($B_{trigger}$)	?	?	?	Undefined
Precautionary approach (B_{pa},B_{lim})	?	?	?	Undefined
Qualitative evaluation	→	→	→	Stable but low biomass



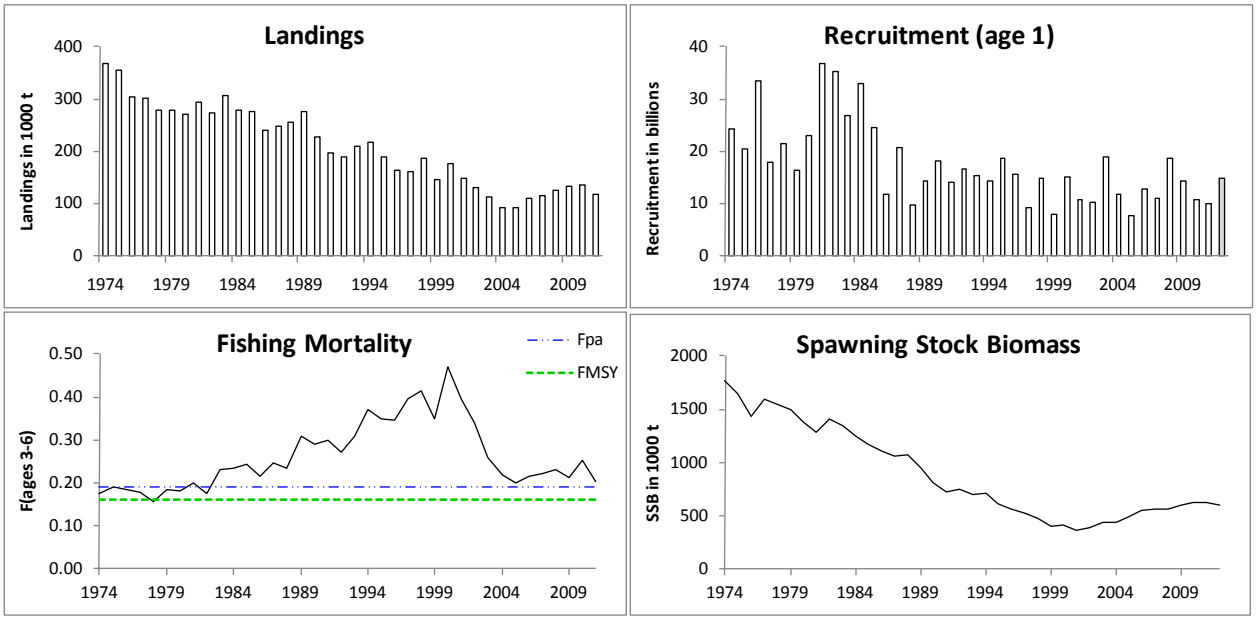


Figure 8.4.4.1 Herring in Subdivisions 25–29 and 32 (excluding Gulf of Riga herring). Summary of stock assessment (SSB and recruitment in 2012 predicted). Top right: SSB and F for the time-series used in the assessment.

SSB in 2011 (628 000 t) was 70% of the long-term (1974–2011) average. Fishing mortality has been above F_{pa} and F_{MSY} since the beginning of the 1980s. The last stronger year classes were the 2002 and 2007 year classes. Both year classes are, however, just above the long-term average.

Management plans

No specific management objectives are known to ICES.

Biology

Herring biomass is dependent on the cod stock through predator–prey interactions, and on sprat through competition. Regional differences in growth rate result in a high proportion of small individuals in the north (Subdivisions 28.2, 29,

and 32) and large individuals in the south (Subdivisions 25 and 26). The strong increase in sprat stock size since the early 1990s in the northern areas (Subdivisions 27–29 and 32) exacerbated the inter-specific competition and the decrease in herring weight-at-age especially in these northern areas. Herring mean weights have stabilized since the late 1990s, but remain low.

Environmental influence on the stock

The decline in SSB of Central Baltic herring was partly caused by a reduction in mean weights-at-age. Growth rate tends to change due to salinity variations, changes in zooplankton (prey) community, and competition with the Baltic sprat, i.e. density-dependent effect.

Recently, a strong increase of cod has occurred in the southern Baltic (mainly in Subdivision 25 and, to a lesser degree in Subdivision 26), whereas in the northern areas (Subdivisions 27–32) no significant increase has been noticed. The increase of cod in Subdivision 25 might have a significant effect on herring in this area, but very limited effect on the whole central Baltic herring population.

The fisheries

The pelagic fisheries take a mixture of herring and sprat and this causes uncertainties in the catch of each species. The extent to which species misreporting has occurred is not well known. Since 2006 the restrictions on unsorted landings, including EU member states obligation to ensure adequate sampling, may have improved the accuracy of estimating proportions of sprat and herring in the catches.

Catch distribution	Total landings (2011) are 117 kt. Discards are considered to be low.

Effects of the fisheries on the ecosystem

As both herring and sprat are the major prey of cod, the mixed pelagic fishery can indirectly affect the cod stock.

Quality considerations

There are uncertainties related to mixed landings of herring and sprat. It would be beneficial to have a higher sampling coverage of the species composition of the small-mesh industrial fisheries targeting sprat in Subdivisions 27–29 and 32 to decrease the potential uncertainty. The overall biological sampling (length and age data) seems to be sufficient. However, for Germany it is difficult to monitor the national fishing activities since a larger part of the herring/sprat catches are landed in foreign ports.

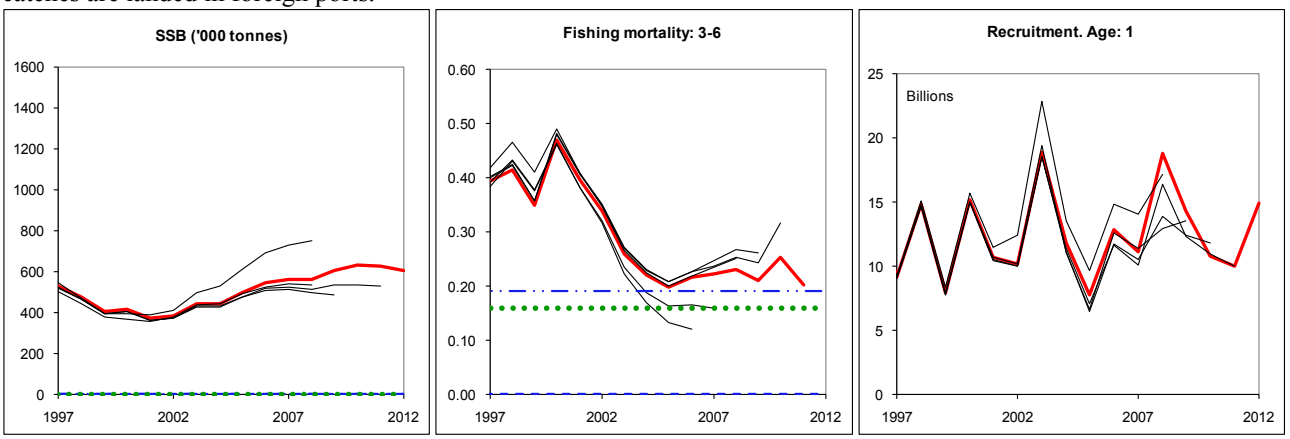


Figure 8.4.4.2 Herring in Subdivisions 25 to 29 and 32, excluding the Gulf of Riga. Historical performance of the assessments. F_{pa} and F_{MSY} are indicated as horizontal lines in the middle panel.

Scientific basis

Assessment type	Age-based analytical assessment (XSA).
Input data	One Acoustic survey index (BIAS) and catch-at-age data.
Discards and bycatch	Discards are not included, but are considered to be low. The bycatch of sprat and juvenile cod is unknown.
Indicators	None.
Other information	The latest benchmark was performed in 2004. A new benchmark is planned for 2013.
Working group report	WGBFAS

ECOREGION Baltic Sea
STOCK Herring in Subdivisions 25–29 and 32 (excluding Gulf of Riga herring)

Reference points

	Type	*Value*	*Technical basis*
MSY Approach	MSY $B_{trigger}$	not defined	
	F_{MSY}	0.16	Based on stochastic simulations and long-term deterministic simulations (ICES, 2011).
Precautionary Approach	B_{lim}	not defined	
	B_{pa}	not defined	
	F_{lim}	not defined	
	F_{pa}	0.19*	F_{med} (assessment 2000).

(F_{MSY} changed in 2011)

* Simulations (see Section 8.3.3.1 in ICES, 2009) indicate that the F_{pa} needs revision.

Outlook for 2013

Basis: F_{2012} = TAC constraint = 0.156; SSB (2012) = 604; Recruitment (age 1 in 2012) = 14.9 billion; Catches (2012) = 93.

Rationale	Catches (2013)	Basis	F (2013)	SSB (2013)	SSB (2014)	%SSB change[1)]	%TAC change[2)]
MSY framework	99	F_{MSY}	0.16	641	666	+4%	+7%
MSY transition	117	F_{pa}	0.19	635	645	+2%	+25%
Precautionary approach	117	F_{pa}	0.19	635	645	+2%	+25%
Zero catch	0	F = 0	0.00	675	794	+18%	-100%
Status quo	79	−15%TAC (F_{sq} *0.56)	0.13	648	692	+7%	-15%
	93	0%TAC (F_{sq} *0.67)	0.15	643	674	+5%	0%
	107	+15%TAC (F_{sq} *0.78)	0.17	638	657	+3%	+15%
	122	F_{sq} *0.9	0.20	632	638	+1%	+31%
	135	F_{sq} *1	0.22	628	623	-1%	+44%
	146	F_{sq} *1.1	0.24	623	609	-2%	+57%
	158	F_{sq} *1.2	0.27	619	595	-4%	+70%
	170	F_{sq} *1.3	0.29	614	581	-5%	+82%
	181	F_{sq} *1.4	0.31	610	568	-7%	+94%

Weights in thousand tonnes.
[1)] SSB 2014 relative to SSB 2013.
[2)] Catches 2013 relative to TAC 2012 (EU 78 417 t + EU/Russia 14 900 t).

MSY approach

As no MSY $B_{trigger}$ has been identified for this stock, the ICES MSY framework has been applied with F_{MSY} without considering SSB in relation to MSY $B_{trigger}$.

Following the ICES MSY framework implies fishing at F = 0.16, corresponding to catches of less than 99 000 tonnes in 2013. This is expected to lead to an SSB of 666 000 tonnes in 2014.

Following the ICES transition to the MSY framework implies a fishing mortality of 0.22 (F_{2010}*0.4+F_{MSY}*0.6), which is higher than F_{pa} = 0.19. Therefore, F_{pa} is used as the basis for advice, resulting in catches of less than 117 000 tonnes in 2013. This is expected to lead to an SSB of 645 000 tonnes in 2014.

Precautionary approach

The fishing mortality in 2013 should be no more than F_{pa}, corresponding to catches of less than 117 000 tonnes in 2013. This is expected to lead to an SSB of 645 000 tonnes in 2014.

Additional considerations

Management considerations

Most pelagic fisheries in the Baltic take a mixture of herring and sprat and this contributes to uncertainties in the actual catch. All passive gears and purse seiners, which are directed for human consumption, can be regarded as an almost clean herring fishery. Only the pelagic trawl fishery takes a mixture of herring and sprat. The landings figures taken in small-mesh (minimum mesh size >16 mm) industrial trawl fisheries, which are directed to catch sprat, can be considered as the most uncertain ones.

The reported landings have been well below the TAC in the period 1992–2002; since then the reported landings have increased and the TAC was fully taken in 2010 and in 2011. This may have resulted in an incentive for misreporting of herring as sprat. However, the extent to which species misreporting has occurred is not well known. From 2005 onwards, EU vessels operating in the sprat and herring fishery have not been allowed to land unsorted catches, unless there is a proper sampling scheme to monitor species composition. This is thought to have led to a reduction in the amount of species misreporting.

The mean weights-at-age for this stock have decreased during 1980–1998 (Figure 8.4.4.4) after which the weights fluctuated without clear trend. The decrease in weight-at-age has been relatively more pronounced in the northern areas (Subdivisions 27–29) where the sprat stock has been concentrated since the beginning of the 1990s. This could result from inter-specific density-dependent effects.

The herring stock is affected by cod predation. However, the present species distribution pattern implies that an increase in F on cod will not necessarily result in Baltic-wide positive effects on herring stock size. Conversely, a decrease in F on cod will not necessarily result in a negative impact on the herring stock size if it is not accompanied by a cod expansion into northern areas.

An increase in herring F in the northern areas (Subdivisions 27–29 and 32) will not have a negative effect on cod, given that this will not affect the cod stock that is now mainly distributed in southern areas (Subdivisions 25–26). On the other hand, a reduction of herring F in Subdivision 25 will likely improve the growth and condition of cod, as well as reducing cod cannibalism in this area.

An increase in sprat F in the northern areas (Subdivisions 27–32), where the sprat stock is currently mainly concentrated, would be potentially beneficial for herring weights-at-age by releasing density dependence.

Preliminary investigations indicate that western Baltic spring-spawning herring (WBSSH, Division IIIa and Subdivisions 22–24) and central Baltic herring (CBH) are mixing in Subdivisions 24–26. The degree of mixing will be explored during the next benchmark assessment of WBSSH and CBH in 2013.

A mixture of central Baltic herring (Subdivisions 25–27, 28.2, 29, and 32) and the Gulf of Riga (Subdivision 28.1) herring is caught in Subdivisions 28.1 and 28.2. All catches of the central Baltic herring stock, taken both in as well as outside the central Baltic Sea, are considered in the assessment and the advice. The TAC is set for herring caught in Subdivisions 25–27, 28.2, 29, and 32, which includes a small percentage of Gulf of Riga herring caught in Subdivision 28.2 but does not include central Baltic herring taken in the Gulf of Riga. The fraction of herring caught outside the stock area should be taken into account when setting the TAC. In the past five years, the average annual catch of:

- Central Baltic herring taken in Subdivision 28.1 (Gulf of Riga) was 4600 t (4.0% of total catches of central Baltic herring);
- Gulf of Riga herring taken in Subdivision 28.2 was 160 t (less than 0.2% of the catches of herring in the central Baltic).

In 2004 the management areas for herring in the Baltic were revised to coincide with the stock definition used in the assessment.

To optimize the growth potential and yield of cod, sprat, and herring, a spatially explicit management plan needs to be developed.

Scientific basis

Data and methods

The assessment is based on catch data and on an international acoustic survey. Natural mortality (M) is derived from a multispecies model that was last updated in 2006, and takes cod predation into account. To account for the increase of the cod stock in recent years, M for 2006–2011 was taken from a regression of M fitted against eastern cod SSB. Recruitment estimates for forecasts are based on the acoustic survey. Catches of central Baltic spring-spawning herring taken in the Gulf of Riga are included in the assessment.

Uncertainties in assessment and forecast

The quality of the assessment is acceptable and can be used for the calculation of forecasts. However, there are uncertainties with the catch data due to problems estimating the catch composition in the mixed landings of herring and sprat.

Herring in the central Baltic is composed of a number of local populations differing in biological parameters and population dynamics. Among other factors recruitment success for the separate populations influences the future mean weight-at-age of the stock. Separate trial assessments for different populations conducted earlier, however, showed only a limited impact of this complex stock structure on the perception of the overall stock dynamics.

Comparison with previous assessment and advice

In comparison to the 2011 advice the updated assessment this year shows a decline of 20% in the estimated fishing mortality and 18% increase for the SSB in 2010.

The basis for the advice is the same as last year.

Sources

ICES. 2009. Report of the ICES Advisory Committee, 2009. ICES Advice, 2009. Book 8. 132 pp.
ICES. 2011. Report of the Baltic Fisheries Assessment Working Group. ICES Headquarters, Copenhagen, 12–19 April 2011. ICES CM 2011/ACOM:10.
ICES. 2012. Report of the Baltic Fisheries Assessment Working Group. ICES Headquarters, Copenhagen, 12–19 April 2012. ICES CM 2012/ACOM:10.

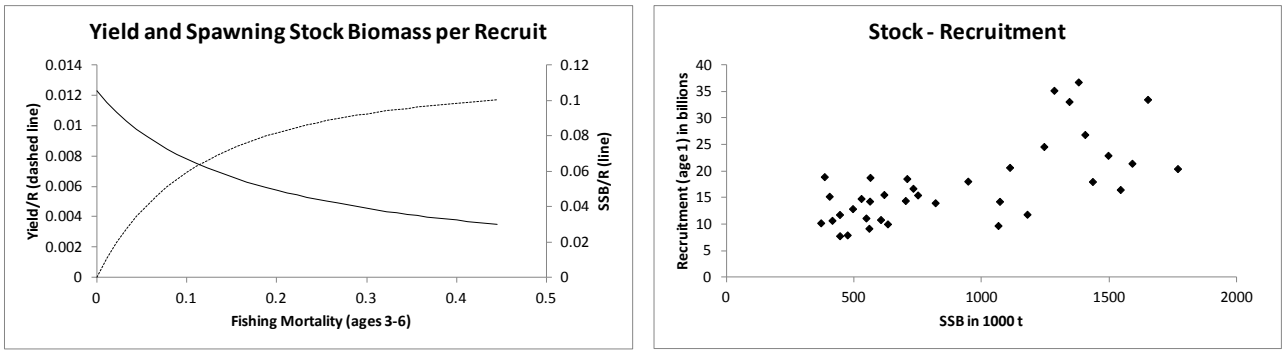


Figure 8.4.4.3 Herring in Subdivisions 25 to 29 and 32, excluding the Gulf of Riga. Yield-per-recruit analysis (left panel) and stock–recruitment plot (right panel).

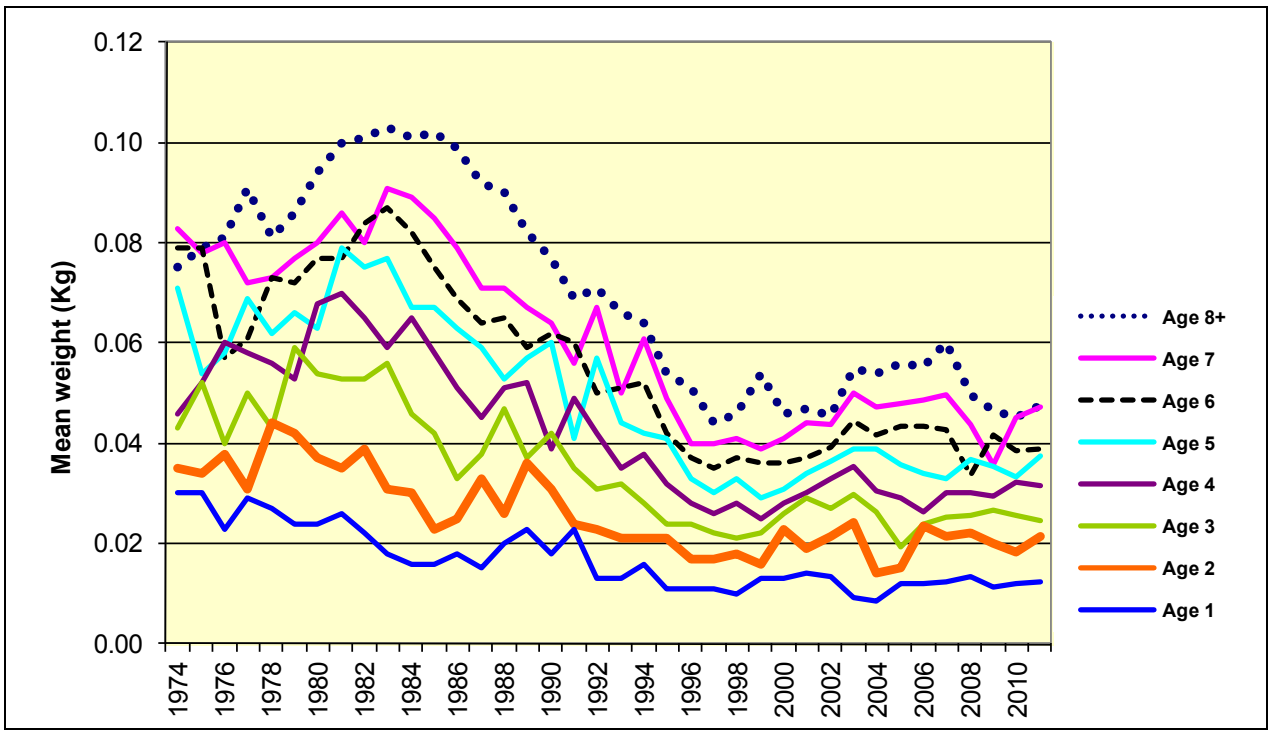


Figure 8.4.4.4 Herring in Subdivisions 25 to 29 and 32, excluding the Gulf of Riga. Trends in the mean weights-at-age (kg) in the catch.

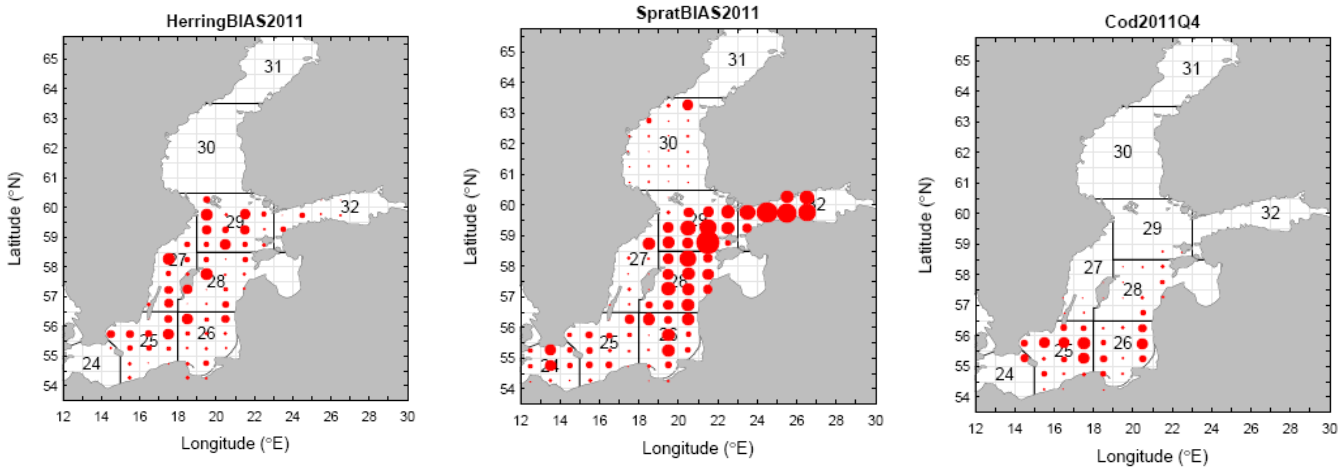


Figure 8.4.4.5 Herring in Subdivisions 25 to 29 and 32, excluding the Gulf of Riga. Distribution of central Baltic herring (Subdivisions 25–29 and 32, excl. GoR, left panel), Baltic Sea sprat (Subdivisions 22–32, central panel), and eastern Baltic cod (Subdivisions 25–32, right panel) from acoustic surveys (BIAS, herring and sprat) and bottom trawl surveys (BITS, cod) in the 4th quarter.

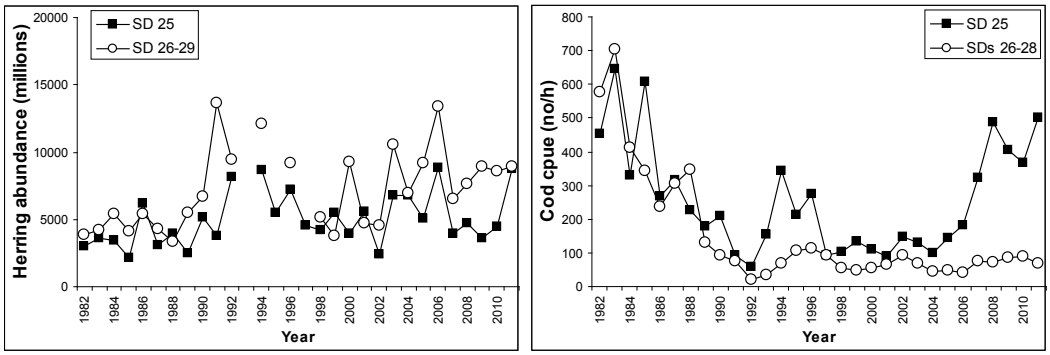


Figure 8.4.4.6 Herring in Subdivisions 25 to 29 and 32, excluding the Gulf of Riga. Trends of average herring abundance (left panel) and cod cpue in the southwest (Subdivision 25) and northeast (Subdivisions 26–29, right panel), respectively from acoustic and BITS surveys.

Table 8.4.4.1 Herring in Subdivisions 25–29 and 32 (excluding Gulf of Riga herring). ICES advice, management, and official landings.

Year	ICES Advice	Predicted landings corresp. to advice	Agreed TAC[1]	Official landings		
				22–24	25–29+32	Total
1988[4]		204	399	99	286	385
1989[4]		176	399	95	290	385
1990[4]		112	399	78	244	322
1991[4]	TAC for entire area	293	402	70	213	283
1992[4]	F near present level	343	402	85	210	295
1993[4]	Increase in yield at higher F	371	560	81	231	312
1994[4]	Increase in yield at higher F	317–463	560	66	242	308
1995[4]	TAC	394	560	74	221	295
1996[4]	TAC	394	560	58	195	253
1997[4]	No advice	-	560	67	208	276
1998[4]	No advice	-	560	51	212	263
1999[4]	Proposed $F_{pa =}$ (0.17)	117	476	50	178	228
2000[4]	Proposed $F_{pa =}$ (0.17)	95	405	54	208	262
2001[4]	Proposed $F_{pa =}$ (0.17)	60	300	64	188	252
2002[4]	$F < F_{pa}$	<73	Not agreed	53	168	221
2003	$F < F_{pa}$	<72	143	41	154	195
2004	$F < F_{pa}$	<80	171	**	93*	
2005	$F < F_{pa}$ (single-stock exploitation boundaries)	<130	130[2]	**	92*	
2006	$F < F_{pa}$ (single-stock exploitation boundaries)	<120	128[2]	**	110*	
2007	$F < F_{pa}$ (single-stock exploitation boundaries)	<164	133[3]	**	116*	
2008	$F < F_{pa}$ (single-stock exploitation boundaries)	<194	153[3]	**	126*	
2009	$F < F_{pa}$ (single-stock exploitation boundaries)	<147	144[3]	**	132*	
2010	$F < F_{pa}$ (single-stock exploitation boundaries)	<103	126[3]	**	137*	
2011	MSY Framework (F = 0.19)	< 95	107[3]	**	117*	
2012	MSY transition ($F = F_{pa} = 0.19$)	< 92	78[3]			
2013	MSY transition ($F = F_{pa} = 0.19$)	< 117				

Weights in thousand tonnes.
[1] TAC for Subdivisions 22–29S and 32.
[2] TAC for Subdivisions 25–28(2), 29, and 32.
[3] EU quota for Subdivisions 25–28(2), 29, and 32.
[4] 1987–2002 incl. Gulf of Riga herring.
* Excl. GoR (Subdivision 28.1).
** Separate management since 2004.

Table 8.4.4.2 Herring in Subdivisions 25 to 29 and 32, excluding the Gulf of Riga. Official landings ('000 tonnes).

Year	Denmark	Estonia	Finland	Germany	Latvia	Lithuania	Poland	Russia**	Sweden	Total
1977	11.9		33.7	0.0			57.2	112.8	48.7	264.3
1978	13.9		38.3	0.1			61.3	113.9	55.4	282.9
1979	19.4		40.4	0.0			70.4	101.0	71.3	302.5
1980	10.6		44.0	0.0			58.3	103.0	72.5	288.4
1981	14.1		42.5	1.0			51.2	93.4	72.9	275.1
1982	15.3		47.5	1.3			63.0	86.4	83.8	297.3
1983	10.5		59.1	1.0			67.1	69.1	78.6	285.4
1984	6.5		54.1	0.0			65.8	89.8	56.9	273.1
1985	7.6		54.2	0.0			72.8	95.2	42.5	272.3
1986	3.9		49.4	0.0			67.8	98.8	29.7	249.6
1987	4.2		50.4	0.0			55.5	100.9	25.4	236.4
1988	10.8		58.1	0.0			57.2	106.0	33.4	265.5
1989	7.3		50.0	0.0			51.8	105.0	55.4	269.5
1990	4.6		26.9	0.0			52.3	101.3	44.2	229.3
1991	6.8	27.0	18.1	0.0	20.7	6.5	47.1	31.9	36.5	194.6
1992	8.1	22.3	30.0	0.0	12.5	4.6	39.2	29.5	43.0	189.2
1993	8.9	25.4	32.3	0.0	9.6	3.0	41.1	21.6	66.4	208.3
1994	11.3	26.3	38.2	3.7	9.8	4.9	46.1	16.7	61.6	218.6
1995	11.4	30.7	31.4	0.0	9.3	3.6	38.7	17.0	47.2	189.3
1996	12.1	35.9	31.5	0.0	11.6	4.2	30.7	14.6	25.9	166.7
1997	9.4	42.6	23.7	0.0	10.1	3.3	26.2	12.5	44.1	172.0
1998	13.9	34.0	24.8	0.0	10.0	2.4	19.3	10.5	71.0	185.9
1999	6.2	35.4	17.9	0.0	8.3	1.3	18.1	12.7	48.9	148.7
2000	15.8	30.1	23.3	0.0	6.7	1.1	23.1	14.8	60.2	175.1
2001	15.8	27.4	26.1	0.0	5.2	1.6	28.4	15.8	29.8	150.2
2002	4.6	21.0	25.7	0.3	3.9	1.5	28.5	14.2	29.4	129.1
2003	5.3	13.3	14.7	3.9	3.1	2.1	26.3	13.4	31.8	113.8
2004	0.2	10.9	14.5	4.3	2.7	1.8	22.8	6.5	29.3	93.0
2005	3.1	10.8	6.4	3.7	2.0	0.7	18.5	7.0	39.4	91.6
2006	0.1	13.4	9.6	3.2	3.0	1.2	16.8	7.6	55.3	110.4
2007	1.4	14.0	13.9	1.7	3.2	3.5	19.8	8.8	49.9	116.0
2008	1.2	21.6	19.1	3.4	3.5	1.7	13.3	8.6	53.7	126.2
2009	1.5	19.9	23.3	1.3	4.1	3.6	18.4	***11.8	50.2	134.1
2010	5.4	17.9	21.6	2.2	3.9	1.5	25.0	9	50.0	136.7
2011*	1.8	14.9	19.2	2.7	3.4	2.0	28.0	8.5	36.2	116.8

* Preliminary.
** In 1977–1990 sum of catches for Estonia, Latvia, Lithuania, and Russia.
*** Updated in 2011.

Table 8.4.4.3 Herring in Subdivisions 25 to 29 and 32, excluding the Gulf of Riga. Summary of stock assessment (weights in tonnes).

Year	Recruitment Age 1 thousands	SSB* tonnes	Landings tonnes	Mean F Ages 3–6
1974	24353882	1768238	368652	0.1759
1975	20427920	1650878	354851	0.1921
1976	33471388	1434874	305420	0.1850
1977	17994640	1589773	301952	0.1782
1978	21432602	1543964	278966	0.1558
1979	16484494	1495911	278182	0.1843
1980	22927592	1379454	270282	0.1828
1981	36753320	1283970	293615	0.2001
1982	35176940	1405001	273134	0.1744
1983	26851980	1343336	307601	0.2299
1984	33070424	1244498	277926	0.2334
1985	24589392	1178582	275760	0.2422
1986	11821557	1110258	240516	0.2162
1987	20658080	1064920	248653	0.2462
1988	9702218	1070763	255734	0.2334
1989	14257203	946425	275501	0.3090
1990	18060628	818604	228572	0.2917
1991	13990298	731585	197676	0.3005
1992	16712554	749827	189781	0.2717
1993	15457907	701646	209094	0.3078
1994	14413552	707488	218260	0.3702
1995	18547548	617581	188181	0.3496
1996	15542234	558868	162578	0.3456
1997	9178268	528239	160002	0.3944
1998	14794665	473966	185780	0.4148
1999	7932189	403493	145922	0.3490
2000	15214451	414310	175646	0.4704
2001	10677889	370079	148404	0.3960
2002	10207247	384139	129222	0.3396
2003	18909054	443723	113584	0.2599
2004	11779709	444118	93006	0.2202
2005	7776287	494830	91592	0.1990
2006	12882180	547358	110372	0.2158
2007	11120635	563194	116030	0.2223
2008	18772570	561729	126155	0.2303
2009	14294974	604571	134127	0.2111
2010	10823758	631782	136706	0.2539
2011	10006729	627856	116785	0.2028
2012	**14908000	***604117		
Average	17486589	884460	210111	0.2620

* At spawning time.

** Output from RCT3 analysis.

***Predicted.