

Herring (*Clupea harengus*) in Subarea 4 and divisions 3.a and 7.d, autumn spawners (North Sea, Skagerrak and Kattegat, eastern English Channel)

ICES stock advice

ICES advises that when the European Union (EU)–Norway management strategy is applied, catches in 2018 should be no more than 517 891 tonnes, including 491 355 tonnes for the A-fleet.

ICES advises that, under precautionary considerations, activities that have an impact on the spawning habitat of herring should not occur, unless the effects of these activities have been assessed and shown not to be detrimental.

Stock development over time

Spawning-stock biomass (SSB) fluctuated between 1.1 and 2.3 million tonnes from 1997 to 2016, in all years above B_{pa} . Fishing mortality (F) has been below F_{MSY} since 1996. Since 2003, recruitment (R) has been low despite the large size of the stock. However, the 2014 recruitment was strong and has contributed to the increase in the spawning stock.

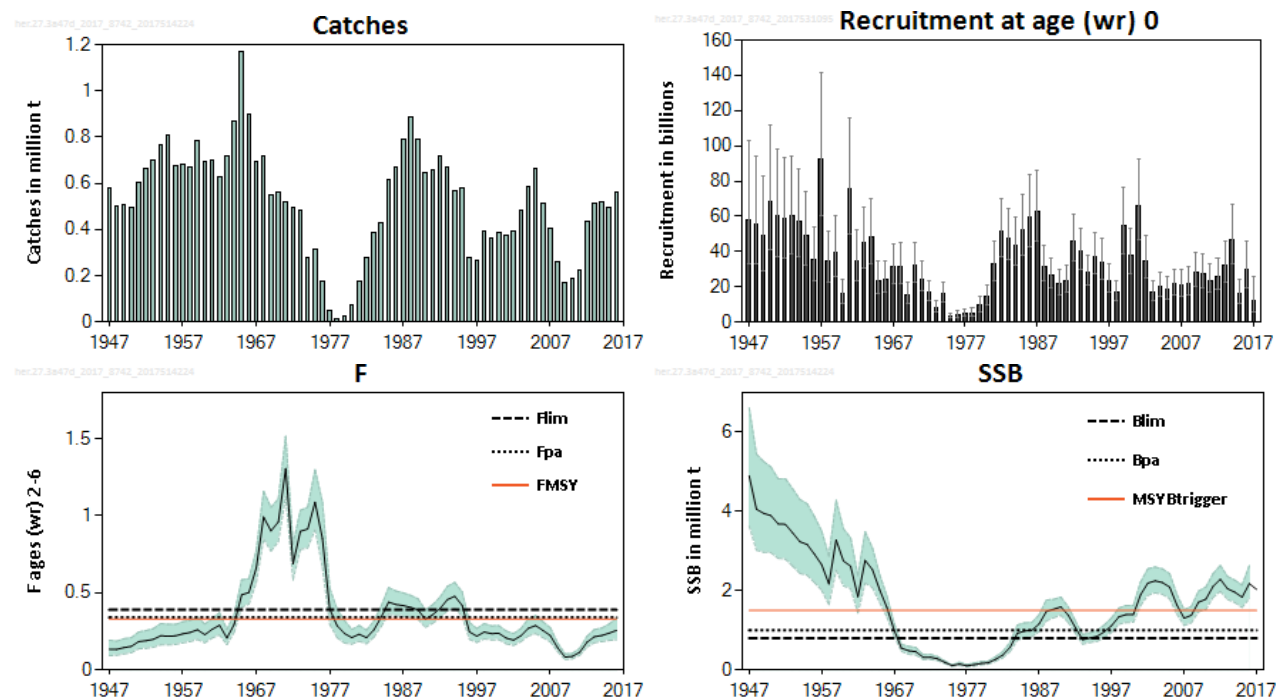


Figure 1 Herring in Subarea 4 and divisions 3.a and 7.d, autumn spawners. Summary of the stock assessment.

Stock and exploitation status

Table 1 Herring in Subarea 4 and divisions 3.a and 7.d, autumn spawners. State of the stock and fishery relative to reference points.

		Fishing pressure				Stock size				
		2014	2015	2016		2014	2015	2016		
Maximum sustainable yield	F_{MSY}	✓	✓	✓	Below	$MSY B_{trigger}$	✓	✓	✓	Above trigger
Precautionary approach	F_{pa} , F_{lim}	✓	✓	✓	Harvested sustainably	B_{pa} , B_{lim}	✓	✓	✓	Full reproductive capacity
Management plan	F_{MGT}	✓	✓	✓	Below	SSB_{MGT}	✓	✓	✓	Above

Catch options

Table 2 Herring in Subarea 4 and divisions 3.a and 7.d, autumn spawners. The basis for the catch options.

Variable	Value	Source	Notes
$F_{ages(wr)2-6}$ (2017)	0.26	ICES (2017)	Catch constraint.
SSB (2017)	2033511	ICES (2017)	Calculated based on catch constraint (in tonnes).
$R_{age(wr)0}$ (2017)	12127668	ICES (2017)	Estimated by assessment model (in thousands).
$R_{age(wr)0}$ (2018)	25868225	ICES (2017)	Weighted mean over 2006–2016 (in thousands).
Total catch (2017)	527502	ICES (2017)	Agreed catch options, including a 46% transfer (23 340 t) of C-fleet TAC to the A-fleet in the North Sea (in tonnes).

Table 3 Herring in Subarea 4 and divisions 3.a and 7.d, autumn spawners. The intermediate year (2017) assumptions. Weights are in tonnes.

F values by fleet and total						Catches by fleet				SSB 2017
$F_{ages(wr)2-6}$ A-fleet	$F_{ages(wr)0-1}$ B-fleet	$F_{ages(wr)0-1}$ C-fleet	$F_{ages(wr)0-1}$ D-fleet	$F_{ages(wr)2-6}$	$F_{ages(wr)0-1}$	Catches A-fleet	Catches B-fleet	Catches C-fleet	Catches D-fleet	
0.25	0.051	0.0031	0.0190	0.26	0.073	502424	11375	9042	4661	2033511

Table 4 Herring in Subarea 4 and divisions 3.a and 7.d, autumn spawners. Annual catch options. All weights are in tonnes.

Basis	F values by fleet and total						Catches by fleet				Total stock catch	Biomass*			
	A- F _{ages} (wr) fleet 2-6	B- F _{ages} (wr) fleet 0-1	C- F _{ages} (wr) fleet 0-1	D- F _{ages} (wr) fleet 0-1	F _{ages} (wr) 2-6	F _{ages} (wr) 0-1	A-fleet	B-fleet	C-fleet	D-fleet		SSB 2018	SSB 2019 **	%SSB change ***	A- %TAC fleet change ^
Management strategy	0.25	0.028	0.0057	0.0158	0.26	0.050	491355	7643	14233	4661	517891	1892282	1508743	-6.9	2.0
Other options															
F = F _{MSY}	0.32	0.028	0.0064	0.0159	0.33	0.051	600588	7643	15981	4661	628873	1816243	1377083	-11	25
F = 0	0	0	0	0	0	0	0	0	0	0	0	2223416	2226726	9.3	-100
No change in A-fleet TAC	0.25	0.028	0.0067	0.0158	0.26	0.051	481608	7643	16744	4661	510656	1897217	1517011	-6.7	0
A-fleet TAC reduction of 15%	0.20	0.028	0.0056	0.0158	0.21	0.050	409367	7643	14233	4661	435903	1947575	1611023	-4.2	-15
A-fleet TAC increase of 15%	0.29	0.028	0.0077	0.0159	0.30	0.052	553849	7643	19256	4661	585409	1846244	1426685	-9.2	15
F = F ₂₀₁₇	0.25	0.028	0.0055	0.0158	0.26	0.050	486951	7643	13843	4661	513098	1895532	1514684	-6.8	1.11
F _{pa}	0.33	0.028	0.0066	0.0159	0.34	0.051	615491	7643	16261	4661	644057	1805732	1359681	-11	28
F _{lim}	0.38	0.029	0.0072	0.0159	0.39	0.052	687563	7643	17617	4661	717484	1754532	1277579	-14	43
SSB ₂₀₁₈ = B _{pa}	1.5	0.029	0.0171	0.0162	1.5	0.064	1661488	7643	35936	4661	1709729	1000000	463381	-51	245
SSB ₂₀₁₈ = B _{lim}	2.0	0.030	0.020	0.0163	2.1	0.068	1896592	7643	40359	4661	1949254	800000	335933	-61	294
SSB ₂₀₁₈ = MSY B _{trigger}	0.66	0.029	0.0103	0.0160	0.68	0.056	1033643	7643	24127	4661	1070073	1500000	928399	-26	115

* For autumn-spawning stocks, the SSB is determined at spawning time and is influenced by fisheries between 1 January and spawning.

** Assuming same catch option in 2019 as in 2018.

*** SSB (2018) relative to SSB (2017).

^ A-fleet catches (2018) relative to TAC 2017 for the A-fleet (481 608 tonnes).

Table 5 Herring in Subarea 4 and divisions 3.a and 7.d, autumn spawners. Catch options for herring in Subarea 4 and divisions 3.a and 7.d (North Sea autumn spawners; NSAS) and herring in subdivisions 20–24 (western Baltic spring spawners; WBSS). The table shows the advised catch and resulting catch options by fleet following the agreed EU–Norway management rule, with the North Sea herring long-term management strategy (LTMS) and the ICES MSY approach for WBSS, and with 0% and 50% TAC transfer flexibility. All weights are in tonnes.

Area	Fishing mortality			TACs and catch by fleet									
	NSAS		WBSS	A-Fleet	B-Fleet	C-Fleet	D-Fleet	F-Fleet	Total catch				
	F _{ages (wr)2–6}	F _{ages (wr)0–1}	F _{ages (wr)3–6}										
	All	All	All	Subarea 4 and Division 7.d	Subarea 4 and Division 7.d	Division 3.a	Division 3.a	Subdiv. 22–24	NSAS	WBSS			
Area TAC (LTMS, F _{MSY})	0.26	0.050	0.46	493824	7643	43129	6659	17309	517891	50672			
Stock	NSAS		WBSS	NSAS	WBSS	NSAS	NSAS	WBSS	NSAS	WBSS	WBSS	NSAS	WBSS
	F _{ages (wr)2–6}	F _{ages (wr)0–1}	F _{ages (wr)3–6}										
Predicted catch 0% transfer	0.26	0.050	0.46	491355	2469	7643	14233	28896	4661	1998	17309	517891	50672
Predicted catch 50% transfer	0.27	0.047	0.31	512919	2577	7643	7116	14448	4661	1998	17309	532339	36332

Catch options by stock and area for NSAS and WBSS are based on fleet-wise predictions for five fleets (A, B, C, D, and F). The catch options for the five fleets are interlinked and therefore calculated simultaneously to ensure that options are consistent among stocks and areas. For technical details see ICES (2016a).

When addressing NSAS options, the catch of NSAS by the A-, B-, C-, and D-fleets in Subarea 4 and divisions 3.a and 7.d have to be considered all at once. For the A-, C-, and D-fleets it is expected that a yearly varying portion of the catch consists of NSAS. The A-fleet catches almost exclusively NSAS herring in Subarea 4 and Division 7.d. The C- and D-fleets in Division 3.a catch a mixture of WBSS and NSAS. The B- and F-fleets are assumed to catch only NSAS and WBSS, respectively. The combined fishing mortality on NSAS ages (wr) 2–6 and ages (wr) 0–1 are determined by the EU–Norway long-term management strategy. Though all fleets cause mortality on a wider age range, the main contribution to $F_{\text{ages (wr) 2-6}}$ on NSAS herring comes from the A-fleet, whereas the other three fleets contribute mainly to $F_{\text{ages (wr) 0-1}}$.

An optimization routine is used to calculate catch options in which total exploitation of NSAS ages (wr) 2–6 and ages (wr) 0–1 match their target as set in the EU–Norway long-term management strategy while at the same time achieving the catch targets set for the C-fleet (EU–Norway, 2014) and D-fleet (EU–Norway, 2016). This provides fishing mortality rates for each individual fleet. These rates are then used to calculate TAC options by fleet, comprising all the herring stocks caught by each fleet. Given the mixture of NSAS and WBSS in many of these areas, these TAC options can be split by stock again.

WBSS catch advice is based on the ICES MSY approach. The F-fleet TAC is set as 50% of this catch. The C-fleet TAC is set as a combination of 41% of the WBSS advised catch and 5.7% of the A-fleet TAC, with a 15% constraint on interannual change in TAC as set in the EU–Norway TAC-setting method for Division 3.a. The D-fleet TAC is set to a constant catch (EU–Norway, 2014).

The TAC-setting procedure for the C-fleet in Division 3.a with $F = 0.28$ has been evaluated to be precautionary for WBSS herring, provided an optional quota transfer of greater than 10% (ICES, 2015a) is implemented. The same rule assuming $F_{\text{MSY}} = 0.32$ for WBSS has not been evaluated by ICES. However, the evaluations carried out do not indicate that this influences precautionary considerations for NSAS.

Basis of the advice

Table 6 Herring in Subarea 4 and divisions 3.a and 7.d, autumn spawners. The basis of the advice.

Advice basis	EU–Norway management strategy.
Management plan	Herring fisheries in this area are managed by a joint EU–Norway Management Strategy (EU–Norway, 2016).

Quality of the assessment

Input data from sampling and monitoring programmes are considered to be of good quality. Both the spawning-stock biomass and the fishing mortality are estimated consistently between years by the stock assessment.

Inclusion of time-varying natural mortality in the assessment model aims to take into account changes in the ecosystem that affect the herring stock size. In 2016, new natural mortality estimates were derived from the North Sea multispecies assessment model (ICES, 2016b). This led in 2016 to a change in perception of the stock and mortality. The reference points were adapted accordingly.

The increase in SSB in 2016, compared to estimates provided last year, is the result of higher estimates of the strong 2014 year class. This also explains the increase in advised catch compared to the advice from last year.

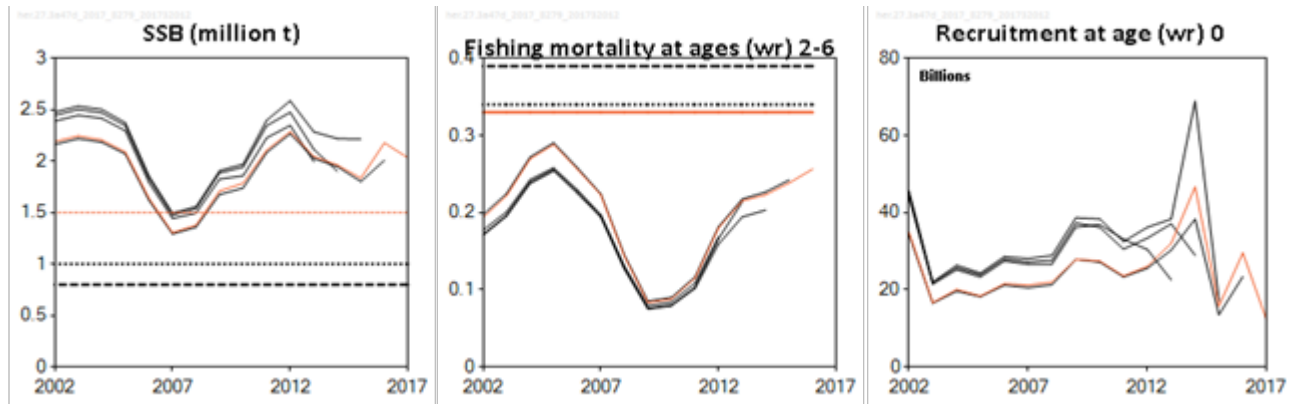


Figure 2 Herring in Subarea 4 and divisions 3.a and 7.d, autumn spawners. Historical assessment results.

Issues relevant for the advice

EU and Norway set the 2017 TAC based on F_{MSY} (updated in 2016), rather than on the agreed management strategy (EU–Norway, 2016). Following the new perception of the stock since 2016, there is a difference between the F_{MSY} and the target of the agreed management strategy. The EU–Norway management strategy, which is still considered precautionary, is the advice basis agreed with clients for this stock.

A management decision allows the transfer of a flexible percentage (up to 50%) of the herring TAC from Division 3.a to the North Sea. Evaluations have shown that the agreed TAC-setting procedure for Division 3.a (C-fleet) requires that a transfer of at least 10% takes place in order to be precautionary for WBSS herring. The transfer reduces the pressure on the WBSS because of the low proportion of this stock in the North Sea, although, with transfer rates at the lower end of the range, fishing mortality on WBSS may be above F_{MSY} . Conversely, the transfer increases the pressure on NSAS above the F intended by the EU–Norway management strategy.

Under the EU landing obligation, which entered into force in 2015, up to 9% interspecies quota transfers are allowed for stocks that are considered to be within safe biological limits (see Article 15 of EU, 2013). Quota transfers were not considered in this catch advice. To achieve F_{MSY} exploitation, any transfer under this regulation should be accounted for in setting the TAC. In 2016, no interspecies quota transfer was used in the North Sea (ICES, 2017).

NSAS herring has several spawning components, including the Downs herring that spawns in divisions 4.c and 7.d. These components are fished on individual spawning grounds and in a mixed-component fishery in the central and northern North Sea. Only the Downs component is caught in the southern North Sea. Sub-TACs have been set for divisions 4.c and 7.d and for the remainder of the area to help protect these components; such measures should be continued to give protection to the different components. To ensure a total production of the stock, all populations within the stock must be protected under the long-term management strategy.

Activities that have a negative impact on the spawning habitat of herring should not occur, unless the effects of these activities have been assessed and shown not to be detrimental (ICES, 2003, 2015b).

Reference points

Table 7 Herring in Subarea 4 and divisions 3.a and 7.d, autumn spawners. Reference points, values, and their technical basis.

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY $B_{trigger}$	1 500 000 t	Biomass trigger value that results in < 5% probability of being below B_{lim} when the ICES MSY advice rule is applied.	ICES (2016c)
	F_{MSY}	0.33	Stochastic simulations with Beverton and Ricker stock–recruitment curve from short time-series (2002–2015).	ICES (2016c)
Precautionary approach	B_{lim}	800 000 t	Breakpoint in the segmented regression of the stock–recruitment time-series (1985–2015).	ICES (2016c)
	B_{pa}	1 000 000 t	$B_{pa} = B_{lim} \times \exp(1.645 \times \sigma)$ with $\sigma \approx 0.10$, based on the average CV from the terminal assessment year.	ICES (2012)
	F_{lim}	0.39	FP50% from stochastic simulations with Beverton and Ricker stock–recruitment curve (2002–2015).	ICES (2016c)
	F_{pa}	0.34	$F_{pa} = F_{lim} \times \exp(-1.645 \times \sigma)$ with $\sigma \approx 0.08$, based on the average CV from the terminal assessment year.	ICES (2016c)
Management plan	SSB_{mgt}	800 000 t and 1 500 000 t	Informed by simulations and chosen by managers.	EU–Norway (2016)
	F_{MGT}	$F_{ages(wr)0-1} = 0.05$ $F_{ages(wr)2-6} = 0.26$	SSB is greater than the SSB_{MGT} upper trigger of 1.5 million t (based on simulations).	EU–Norway (2016)
		$F_{ages(wr)0-1} = 0.05$ $F_{ages(wr)2-6} = 0.26 - (0.16 \times (1\,500\,000 - SSB) / 700\,000)$	SSB is between the SSB_{MGT} triggers of 0.8 and 1.5 million t (based on simulations).	EU–Norway (2016)
		$F_{ages(wr)0-1} = 0.04$ $F_{ages(wr)2-6} = 0.10$	SSB is less than the SSB_{MGT} lower trigger of 0.8 million t (based on simulations).	

Basis of the assessment

Table 8 Herring in Subarea 4 and divisions 3.a and 7.d, autumn spawners. Basis of the assessment and advice.

ICES stock data category	1 (ICES, 2016d).
Assessment type	Age-based analytical assessment, SAM (ICES, 2017) that uses catches in the model and in the forecast.
Input data	Commercial catches and four survey indices (IBTS Q1 1-ringer, IBTS0, SCAI, HERAS); annual maturity data from HERAS survey natural mortalities from SMS North Sea multispecies model.
Discards and bycatch	Considered to be negligible.
Indicators	None.
Other information	The last benchmark for this stock occurred in 2012. Reference points (B_{lim} , F_{lim} , F_{pa} , F_{MSY} , and $MSY B_{trigger}$) were updated (ICES, 2016c).
Working group	Herring Assessment Working Group for the Area South of 62°N (HAWG)

Information from stakeholders

During 2017, the Pelagic Advisory Council is planning to gather relevant information on herring spawning habitats and on the marine anthropogenic activity in those areas (e.g. marine aggregates (e.g. gravel and sand), bottom trawling, and construction for the marine renewable industry).

History of the advice, catch, and management

Table 9 Herring in Subarea 4 and divisions 3.a and 7.d, autumn spawners. ICES advice and official landings. All weights are in tonnes.

Year	ICES advice	Predicted catch corresponding to advice	Agreed TAC*	Bycatch ceiling B-fleet	ICES landings in 4, 7.d #	ICES catch in 4, 7.d ##	ICES catch of autumn spawners in 3.a, 4, 7.d
1987	TAC	610000	600000		625000	625000	792000
1988	TAC	515000	530000		710000	710000	888000
1989	TAC	514000	514000		669000	717000	787000
1990	TAC	403000	415000		523000	578000	646000
1991	TAC	423000	420000		537000	588000	657000
1992	TAC	406000	430000		518000	572000	716000
1993	No increase in yield at $F > 0.3$	340000	430000		495000	540000	671000
1994	No increase in yield at $F > 0.3$	346000	440000		463000	498000	571000
1995	Long-term gains expected at lower F	429000	440000		510000	516000	579000
1996	50% reduction of agreed TAC**	156000	156000***	44000	207000	233000	275000
1997	$F = 0.2$	159000	159000	24000	175000	238000	264000
1998	$F(\text{adult}) = 0.2, F(\text{juv}) < 0.1$	254000	254000	22000	268000	338000	392000
1999	$F(\text{adult}) = 0.2, F(\text{juv}) < 0.1$	265000	265000	30000	290000	333000	363000
2000	$F(\text{adult}) = 0.2, F(\text{juv}) < 0.1$	265000	265000	36000	284000	346000	388000
2001	$F(\text{adult}) = 0.2, F(\text{juv}) < 0.1$	See scenarios	265000	36000	296000	323000	363000
2002	$F(\text{adult}) = 0.2, F(\text{juv}) < 0.1$	See scenarios	265000	36000	304000	353000	372000
2003	$F(\text{adult}) = 0.25, F(\text{juv}) = 0.12$	See scenarios	400000	52000	414000	450000	480000
2004	$F(\text{adult}) = 0.25, F(\text{juv}) = 0.1$	See scenarios	460000	38000	484000	550000	567000
2005	$F(\text{adult}) = 0.25, F(\text{juv}) = 0.1$	See scenarios	535000	50000	568000	639000	664000
2006	$F(\text{adult}) = 0.25, F(\text{juv}) = 0.12$	See scenarios	455000	43000	490000	511000	515000
2007	Bring SSB above B_{pa} by 2008	See scenarios	341000	32000	361000	388000	407000
2008	$F(\text{adult}) = 0.17, F(\text{juv}) = 0.08$ (MP)	See scenarios	201000	19000	228000	245000	258000
2009	Adopt one of the new proposed HCRs	See scenarios	171000	16000	167000	166000	168000
2010	$F(\text{adult}) = 0.15, F(\text{juv}) = 0.05$ (MP)	See scenarios	164000	14000	175000	175000	188000
2011	See scenarios	See scenarios	200000	16000	218000	218000	226000
2012	2008 Management plan	See scenarios	405000	18000	425000	425000	435000
2013	2008 Management plan	See scenarios	478000	14000	498000	498000	511000
2014	2008 Management plan	See scenarios	470000	13000	504000	508000	517000
2015	2008 Management plan	See scenarios	445000	16000	480000	482000	494000
2016	2014 Management strategy	555086	518000	13000	559700	559900	563600
2017	2014 Management strategy	458926	481608	11375			
2018	2014 Management strategy	517891					

* Catch in directed fishery in Subarea 4 and Division 7.d (A-fleet).

** Revision of advice given in 1995.

*** Revised in June 1996, down from 263 000 tonnes.

Landings are provided by ICES and do not in all cases correspond to official statistics.

ICES catch includes unallocated and misreported landings, discards, and slipping.

History of the catch and landings

Table 10 Herring in Subarea 4 and divisions 3.a and 7.d, autumn spawners. Catch distribution by fleet and area in 2016 as estimated by ICES.

Area where NSAS are caught	Fleet	Fishery	NSAS 2016 catches (tonnes)
North Sea fisheries (Subarea 4)	A	Directed herring fisheries	543560
	B	Bycatches of herring	14526
Division 3.a	C	Directed herring fisheries	4087
	D	Bycatches of herring	1419

Table 11 Herring in Subarea 4 and divisions 3.a and 7.d, autumn spawners. Catch distribution in 2016 as estimated by ICES.

Catch (2016)	Landings		Discards
563 611 tonnes	Directed fishery 97%	Bycatch 3%	Negligible
	563 611 tonnes		

Table 12 Herring in Subarea 4 and divisions 3.a and 7.d, autumn spawners. History of commercial catch and landings of all stocks of herring caught in the North Sea; official or ICES estimated values are presented by area for each country participating in the fishery. All weights are in tonnes. These figures do not in all cases correspond to the official statistics and cannot be used for legal purposes.

Country	2005	2006	2007	2008	2009	2010
Belgium	6	3	1	-	-	-
Denmark *	128380	102322	84697	62864	46238	45869
Faroe Islands	738	1785	2891	2014	1803	3014
France	38829	49475	24909	30347	18114	17745
Germany	46555	40414	14893	8095	5368	7670
Netherlands	81531	76315	66393	23122	24552	23872
Norway	156802	135361	100050	59321	50445	46816
Poland	458	-	-	-	-	90
Sweden	13464	10529	15448	13840	5299	4395
USSR/Russia	99	-	-	-	-	-
UK (England)	25311	22198	15993	11717	652	10770
UK (Scotland)	73227	48428	35115	16021	14006	14373
UK (N. Ireland)	2912	3531	638	331	-	-
Unallocated landings	57788	18764	26641	17151	-726	-
Total landings	626101	509125	387669	244823	165751	174614
Discards	12824	1492	93	224	91	13
Total catch	638925	510617	387762	245047	165842	174627
Parts of the catches that have been allocated to spring-spawning stocks						
WBSS	7039	10954	1070	124	3941	774
Thames estuary **	74	65	2	7	48	85
Norw. spring spawners ***	417	626	685	2721	44560	56900
Country	2011	2012	2013	2014	2015	2016
Belgium	4	3	14	27	18	26
Denmark *	58726	105707	117367	124423	113481	133962
Faroe Islands	-	-	-	118	981	833
France	16693	23819	30122	29679	30269	35177
Germany	9427	24515	46922	36767	44377	44231
Netherlands	34708	72344	80462	74647	70076	98859
Norway	60705	119253	143718	142002	134349	150183
Lithuania	-	-	-	9830	-	-
Sweden	8086	14092	15615	15583	13184	16625
Ireland	-	-	221	68	183	127
UK (England)	11468	25346	19079	19287	18897	20485
UK (Scotland)	18564	34414	39243	45119	48332	59240
UK (N. Ireland)	17	4794	5738	6612	5948	-
Unallocated landings	-	321	-	3292	1516	8
Total landings	218398	424608	498501	507454	481611	559756
Discards/BMS	-	-	-	31	-	170
Total catch	218398	424608	498501	507485	481611	559926
Parts of the catches that have been allocated to spring-spawning stocks						
WBSS	308	2095	452	2953	2205	1839
Thames estuary **	2	63	20	10	10	1
Norw. spring spawners ***	12178	9619	3150	2307	2191	216

* Including any bycatches in the industrial fishery.

** Landings from the Thames estuary area are included in the North Sea catch figure for UK (England).

*** These catches (including some local fjord-type spring spawners) are taken by Norway under a separate quota south of 62°N and are not included in the Norwegian North Sea catch figure for this area.

Table 13 Herring in Subarea 4 and divisions 3.a and 7.d, autumn spawners. History of commercial catch and landings of all stocks of herring caught in Division 4.a West. Catch in tonnes by country, 2005–2016. These figures do not in all cases correspond to the official statistics and cannot be used for legal purposes.

Country	2005	2006	2007	2008	2009	2010
Denmark *	80990	60462	45948	28426	16550	25092
Faroe Islands		580	1118	2	288	1110
France	13474	18453	8570	13068	7067	6412
Germany	22278	18605	4985	498	-	505
Netherlands	36619	39209	42622	11634	11017	13593
Norway	66232	38363	40279	40304	25926	38897
Poland	458	-	-	-	-	90
Sweden	8261	4957	7658	7025	1435	2310
Russia	99	-	-	-	-	-
UK (England)	15523	12031	11833	8355	578	7384
UK (Scotland)	71941	47368	35115	14727	10249	13567
UK (N. Ireland)	2912	3531	638	331	-	-
Unallocated landings **	39324	10981	22215	14952	-977	0
Total landings	358111	253048	220981	139322	72133	108960
Discards	10861	1492	93	194	91	13
Total catch	368972	254540	221074	139516	72224	108973
Country	2011	2012	2013	2014	2015	2016
Denmark *	26523	42867	80874	74719	68017	81080
Faroe Islands	-	-	-	118	981	811
France	7885	11131	9750	12620	13401	15073
Germany	2642	13060	19323	23245	32253	27926
Netherlands	15202	46654	18418	37380	44309	66740
Norway	45200	72581	49517	89974	47010	57056
Lithuania	-	-	-	8129	-	-
Sweden	5121	6065	12280	7760	10388	9933
Ireland	-	-	221	68	183	127
UK (England)	4555	18289	10874	10085	12249	13010
UK (Scotland)	17909	33352	37889	41844	46931	58557
UK (N. Ireland)	17	4794	5738	6021	4878	-
Unallocated landings **	0	-3416	0	3292	1939	-
Total landings	125054	245377	244884	315255	282539	330313
Discards/BMS	-	-	-	31	-	100
Total catch	125054	245377	244884	315286	282539	330413

* Including any bycatches in the industrial fishery.

** May include misreported catch from Division 6.a N and discards. Negative unallocated catches due to misreporting into other areas.

Table 14 Herring in Subarea 4 and divisions 3.a and 7.d, autumn spawners. History of commercial catch and landings of all stocks of herring caught in Division 4.a East. Catch in tonnes by country, 2005–2016. These figures do not in all cases correspond to the official statistics and cannot be used for legal purposes.

Country	2005	2006	2007	2008	2009	2010
Denmark *	5761	8614	2646	1587	499	-
Faroe Islands	738	975	577	400	700	719
France	-	-	-	-	-	-
Germany	-	34	-	-	-	-
Netherlands	-	-	263	-	-	-
Norway	89925	90065	54424	17474	6981	7362
UK (Scotland)	-	83	-	-	-	-
Sweden	3510	2857	640	-	1735	1505
Unallocated landings **	0	0	-96	0	0	0
Total landings	99934	102628	58454	19461	9915	9586
Discards	-	-	-	-	-	-
Total catch	99934	102628	58454	19461	9915	9586
Norw. spring spawners ***	417	626	685	2721	44560	56900
Country	2011	2012	2013	2014	2015	2016
Denmark *	1590	1822	1162	-	16739	16305
Faroe Islands	-	-	-	-	-	-
France	-	-	-	30	-	-
Germany	-	-	15	-	-	-
Netherlands	-	-	-	-	-	-
Norway	12922	32714	76894	44060	67254	78125
UK (Scotland)	167	-	-	124	1369	-
Sweden	150	815	865	940	570	3985
Unallocated landings	0	0	0	0	-423	-
Total landings	14829	35351	78936	45154	85509	98415
Discards	-	-	-	-	-	-
Total catch	14829	35351	78936	45154	85509	98415
Norw. spring spawners ***	12178	9619	3150	2307	2191	216

* Including any bycatches in the industrial fishery.

** Negative unallocated catches due to misreporting into other areas.

*** These catches (including some fjord-type spring spawners) are taken by Norway under a separate quota south of 62°N and are not included in the Norwegian North Sea catch figure for this area.

Table 15 Herring in Subarea 4 and divisions 3.a and 7.d, autumn spawners. History of commercial catch and landings of all stocks of herring caught in Division 4.b. Catch in tonnes by country, 2005–2015. These figures do not in all cases correspond to the official statistics and cannot be used for legal purposes.

Country	2005	2006	2007	2008	2009	2010
Denmark*	41423	32277	35990	32230	29164	19671
Faroe Islands	-	200	1196	1612	815	1185
France	10205	17385	8421	9687	4316	2349
Germany	14381	14222	2205	2415	1061	1994
Netherlands	10038	13363	8550	904	3164	-
Norway	645	6933	5347	1543	17538	830
Sweden	1694	2715	7150	6815	2129	-
UK (England)	3869	4924	577	833	2	557
UK (Scotland)	1286	977	-	1293	3757	580
Unallocated landings**	10233	2364	-203	-904	-166	1577
Total landings	93774	95360	69233	56428	61780	805
Discards	1963	-	-	30	-	0
Total catch	95737	95360	69233	56458	61780	29548
Country	2011	2012	2013	2014	2015	2016
Denmark*	30498	60503	34707	49118	28551	36149
Faroe Islands	-	-	-	-	-	22
France	1687	3898	8728	7839	6342	6225
Germany	1778	4187	17701	4424	107	3419
Lithuania	-	-	-	1701	-	-
Netherlands	7314	9202	43339	22628	10606	17233
UK (N. Ireland)	-	-	-	591	1070	-
Norway	2537	13958	17307	7968	20077	15002
Sweden	2815	7212	2470	6883	2226	2705
UK (England)	4748	3045	4391	4498	3484	3820
UK (Scotland)	488	1062	1312	3151	32	683
Unallocated landings**	0	411	42	0	0	-
Total landings	51865	103478	129955	108801	72495	85258
Discards	-	-	-	-	-	-
Total catch	51865	103478	129997	108801	72495	85258

* Including any bycatches in the industrial fishery.

** Negative unallocated catches due to misreporting into other areas.

Table 16 Herring in Subarea 4 and divisions 3.a and 7.d, autumn spawners. History of commercial catch and landings of all stocks of herring caught in Divisions 4.c and 7.d. Catch in tonnes by country, 2005–2016. These figures do not in all cases correspond to the official statistics and cannot be used for legal purposes.

Country	2005	2006	2007	2008	2009	2010
Belgium	6	3	1	-	-	-
Denmark*	206	969	113	621	25	1106
Faroe Islands	-	30	-	-	-	8984
France	15150	13637	7918	7592	6731	5171
Germany	9896	7553	7703	5182	4307	9449
Netherlands	34874	23743	14958	10584	10371	-
UK (England)	5919	5243	3583	2529	72	1809
UK (Scotland)	-	-	-	1	-	1
Unallocated landings	8231	5419	4725	3103	417	0
Total landings	74282	56597	39001	29612	21923	26520
Discards	-	-	-	-	-	-
Total catch	74282	56597	39001	29612	21923	26520
**Coastal spring spawners included above	74	65	2	7	48	85
Country	2011	2012	2013	2014	2015	2016
Belgium	4	3	14	27	18	26
Denmark*	115	515	624	586	174	428
France	7121	8790	11644	9190	10526	13879
Germany	5007	7268	9883	9098	12017	12886
Netherlands	12192	16488	18705	14639	15161	14886
Norway	46	-	-	-	8	-
Sweden						2
UK (England)	2165	4012	3814	4704	3164	3655
UK (Scotland)	-	-	42	-	-	-
***Unallocated landings	0	3326	-42	0	0	8
Total landings	26650	40402	44684	38244	41068	45770
Discards/BMS	-	-	-	-	-	70
Total catch	26650	40402	44684	38244	41068	45840
**Coastal spring spawners included above	2	63	20	10	10	1

* Including any bycatches in the industrial fishery.

** Landings from the Thames estuary area are included in the North Sea catch figure for UK (England).

*** Negative unallocated catches due to misreporting into other areas

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Table 17 Herring in Subarea 4 and divisions 3.a and 7.d, autumn spawners. The “Wonderful Table”, which shows herring TACs and catches by different fleets, areas and stocks. Weights are in thousand tonnes.

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Subarea 4 and Division 7.d: TAC												
Agreed Divisions 4.a–b	404.7	303.5	174.6	147.4	149.0	173.5	360.4	427.7	418.3	396.3	461.2	428.7
Agreed Divisions 4.c, 7.d	50.0	37.5	26.7	23.6	15.3	26.5	44.6	50.3	51.7	49.0	57.0	53.0
Bycatch ceiling in the small-mesh fishery *	42.5	31.9	18.8	16.0	13.6	16.5	17.9	14.4	13.1	15.7	13.4	11.4
CATCH (Subarea 4 and Division 7.d)												
National catch divisions 4.a–b **	439.2	326.8	201.2	145.0	148.1	191.7	387.2	453.8	465.9	439	514.0	
Unallocated catch divisions 4.a–b	13.3	21.9	14.0	-1.1	0.0	0.0	-3.0	0.0	3.3	1.5	0.0	
Discard/slipping divisions 4.a–b ***	1.5	0.1	0.2	0.1	0.0	-	-	-	0.0	-	0.1	
Total catch divisions 4.a–b #	454.0	348.8	215.4	143.9	148.1	191.7	384.2	453.9	469.2	440.5	514.1	
National catch divisions 4.c, 7.d **	51.2	34.3	26.5	21.5	26.5	26.7	37.1	44.7	38.2	41.1	45.8	
Unallocated catch divisions 4.c, 7.d	5.4	4.7	3.1	0.4	0.0	0.0	3.3	0.0	0.0	0.0	0.0	
Discard/slipping divisions 4.c, 7.d ***	-	-	-	-	-	-	-	-	-	-	0.1	
Total catch divisions 4.c, 7.d	56.6	39.0	29.6	21.9	26.5	26.7	40.4	44.7	38.2	41.1	45.8	
Total catch Subarea 4 and Division 7.d as used by ICES #	510.6	387.8	245.0	165.8	174.6	218.4	424.6	498.5	507.5	481.6	559.9	
CATCH BY FLEET/STOCK (Subarea 4 and Division 7.d) ##												
North Sea autumn spawners directed fisheries (A-fleet)	487.1	379.6	236.3	152.1	164.8	209.2	411.8	489.9	490.5	471.5	543.6	
North Sea autumn spawners industrial (B-fleet)	11.9	7.1	8.6	9.8	9.1	8.9	10.6	8.1	14.0	7.9	14.5	
North Sea autumn spawners in Subarea 4 and Division 7.d total	499.0	386.7	244.9	161.9	173.9	218.1	422.5	498.1	504.5	479.4	558.1	
Baltic-20–24-type spring spawners in Subarea 4	11.0	1.1	0.1	3.9	0.8	0.3	2.1	0.5	3.0	2.2	1.8	
Coastal-type spring spawners	0.1	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.0	
Norw. spring spawners caught under a separate quota in Subarea 4 ####	0.6	0.7	2.7	44.6	56.9	12.2	9.6	3.2	2.3	2.2		
Division 3.a: TAC												
Agreed herring TAC	81.6	69.4	51.7	37.7	33.9	30.0	45.0	55.0	46.8	43.6	51.1	50.7
Bycatch ceiling in the small-mesh fishery	20.5	15.4	11.5	8.4	7.5	6.7	6.7	6.7	6.7	6.7	6.7	6.7
CATCH (Division 3.a)												
National catch	88.9	47.3	38.2	38.8	37.3	20.0	27.7	31.2	28.9	27.8	29.9	
Catch as used by ICES	51.2	47.4	38.2	38.8	37.3	20.0	27.7	31.2	28.9	27.8	29.9	
CATCH BY FLEET/STOCK (Division 3.a) ##												
Autumn spawners human consumption (C-fleet)	11.6	16.4	9.2	5.1	12.0	6.6	7.8	11.8	9.5	10.2	4.1	
Autumn spawners mixed clupeoid (D-fleet)	3.4	3.4	3.7	1.5	1.8	1.8	4.4	1.6	3.3	4.4	1.4	
Autumn spawners in Division 3.a total	15.0	19.8	12.9	6.5	13.8	8.4	12.2	13.4	12.8	14.7	5.5	
Spring spawners human consumption (C-fleet)	30.2	25.3	23.0	29.4	23.0	10.8	14.5	16.6	15.4	11.3	23.3	
Spring spawners mixed clupeoid (D-fleet)	5.9	2.3	2.2	2.9	0.5	0.8	1.0	1.3	0.6	1.8	1.1	
Spring spawners in Division 3.a total	36.1	27.6	25.2	32.3	23.5	11.6	15.5	17.9	16.1	13.1	24.4	
North Sea autumn spawners: Total as used by ICES	514.6	406.5	257.9	168.4	187.6	226.5	434.6	511.4	517.3	494.1	563.6	

* Divisions 4.a–b and EC zone of Division 2.a. ** ICES estimates. *** Incomplete, only some countries providing discard information. # Includes spring spawners not included in assessment. ## Based on sum-of-products (number × mean weight-at-age). #### These catches (including local fjord-type spring spawners) are taken by Norway under a separate quota south of 62°N and are not included in the Norwegian North Sea catch figure.

Summary of the assessment

Table 18 Herring in Subarea 4 and divisions 3.a and 7.d, autumn spawners. Assessment summary. Weights are in tonnes. High and low refer to the 95% confidence intervals.

Year	Recruitment	High	Low	SSB*	High	Low	ICES	Modelled	F	High	Low
	Age 0 (wr)										
	thousands			tonnes			tonnes	tonnes			
1947	58176962	103291371	32767103	4901246	6614289	3631866	581760	847461	0.134	0.193	0.093
1948	55617030	94125768	32862988	4057185	5448136	3021355	502100	687626	0.133	0.186	0.095
1949	49130963	82651605	29205138	3953058	5259840	2970940	508500	714973	0.145	0.20	0.104
1950	68066791	111823109	41432295	3894205	5122158	2960633	491700	656711	0.153	0.21	0.111
1951	60309488	97717498	37221935	3685807	4824538	2815849	600400	772201	0.184	0.25	0.137
1952	58351755	93246175	36515464	3674766	4826992	2797582	664400	831511	0.189	0.26	0.140
1953	60309488	93764230	38791279	3460764	4571085	2620141	698500	842391	0.198	0.27	0.147
1954	56797337	86775111	37175838	3236490	4302428	2434641	762900	918962	0.22	0.30	0.163
1955	48690768	73787242	32130092	3166065	4192342	2391019	806400	864581	0.22	0.30	0.162
1956	35783591	54111647	23663397	2922646	3870323	2207015	675200	850858	0.22	0.30	0.165
1957	92525977	141112274	60668404	2655119	3504696	2011489	682900	784655	0.23	0.31	0.176
1958	34243249	51320601	22848527	2171655	2871483	1642386	670500	791749	0.24	0.32	0.184
1959	39745214	60611063	26062603	3282120	4280498	2516602	784500	1143953	0.26	0.34	0.198
1960	15886814	24423668	10333864	2749693	3565859	2120334	696200	835679	0.23	0.30	0.176
1961	75678147	115709674	49496138	2615589	3330617	2054066	696700	766048	0.26	0.33	0.20
1962	34622004	51934029	23080882	1846865	2373695	1436962	627800	681465	0.29	0.37	0.23
1963	44992214	65531769	30890350	2766241	3488511	2193512	716000	653436	0.21	0.26	0.163
1964	48013847	69749388	33051609	2530684	3078946	2080049	871200	930986	0.30	0.36	0.25
1965	23487995	34245468	16109749	2022814	2403030	1702757	1168800	1240469	0.49	0.58	0.41
1966	23842971	34283954	16581729	1576945	1864679	1333610	895500	971892	0.50	0.59	0.43
1967	31108760	44465742	21764057	1002493	1174773	855477	695500	831511	0.66	0.78	0.57
1968	31705477	45477052	22104275	549080	643583	468454	717800	824061	0.99	1.2	0.85
1969	15294441	22309331	10485295	484077	593540	394802	546700	551833	0.90	1.1	0.77
1970	32056162	45265604	22701510	460008	565889	373939	563100	535523	0.96	1.11	0.83
1971	24593679	34419713	17572751	319017	387402	262704	520100	543617	1.3	1.5	1.13
1972	16936811	23597506	12156182	321901	391809	264467	497500	468832	0.69	0.81	0.58
1973	8376997	11822663	5935556	280688	336542	234104	484000	446413	0.90	1.04	0.78
1974	15966447	22566548	11296695	188716	224400	158707	275100	272938	0.92	1.06	0.79
1975	3328392	4979006	2224982	108554	131101	89884	312800	271034	1.1	1.30	0.91
1976	4164055	6421234	2700316	148449	195516	112713	174800	152207	0.85	1.09	0.67
1977	4694959	7436232	2964222	103363	139952	76339	46000	59456	0.40	0.53	0.30
1978	4955457	8047442	3051474	130483	173322	98233	11000	50970	0.29	0.39	0.21
1979	9369778	14587647	6018294	163081	208891	127317	25100	64537	0.24	0.32	0.174
1980	14374984	20586992	10037413	181861	225800	146473	70764	80580	0.21	0.26	0.167
1981	32736460	45771839	23413431	269413	334845	216767	174879	160492	0.23	0.29	0.187
1982	51187197	70091045	37381796	377377	465422	305988	275079	271305	0.21	0.26	0.169
1983	47726626	64655543	35230248	570918	702105	464242	387202	403931	0.26	0.32	0.21
1984	43793677	59731256	32108585	922645	1134699	750220	428631	453160	0.34	0.41	0.28
1985	52064818	72298909	37493585	981660	1186788	811986	613780	613540	0.44	0.53	0.36
1986	59888796	83393690	43008864	1000490	1198076	835489	671488	765282	0.42	0.51	0.35
1987	62645349	85745486	45768471	1160081	1390754	967667	792058	787800	0.42	0.50	0.35
1988	31737198	43607321	23098180	1477704	1766511	1236114	887686	1034057	0.41	0.48	0.34
1989	26509136	36349013	19332968	1531870	1779331	1318825	787899	797311	0.39	0.46	0.33
1990	21574012	30015390	15506645	1591202	1838311	1377309	645229	692456	0.33	0.39	0.28
1991	23394231	32111860	17043237	1386094	1596512	1203408	658008	672663	0.36	0.42	0.30

Year	Recruitment Age 0 (wr)	High	Low	SSB*	High	Low	ICES estimated catch	Modelled catch	F Ages 2-6 (wr)	High	Low
	thousands			tonnes			tonnes	tonnes			
1992	46085089	61461652	34555456	1069819	1238459	924142	716799	701517	0.40	0.47	0.34
1993	40144660	53496158	30125411	760704	889707	650407	671397	684196	0.46	0.54	0.38
1994	28317768	38221151	20980425	805324	938193	691272	568234	600189	0.48	0.57	0.40
1995	37393221	51015517	27408386	845768	995123	718829	579371	551281	0.42	0.51	0.35
1996	34209023	47593236	24588731	965113	1137376	818940	275098	293314	0.25	0.31	0.198
1997	23558565	33302266	16665712	1115708	1313628	947608	264313	280688	0.22	0.27	0.178
1998	16835495	23679920	11969377	1341099	1561107	1152097	391628	386930	0.25	0.30	0.20
1999	54624879	76784304	38860513	1395830	1628292	1196556	363163	363306	0.24	0.29	0.195
2000	38034340	53353642	27113632	1398625	1627324	1202067	388157	377755	0.24	0.29	0.197
2001	65989091	92589657	47030741	1899308	2219309	1625447	374065	383847	0.21	0.25	0.169
2002	34935009	49115597	24848621	2191288	2551290	1882084	394709	406362	0.19	0.24	0.159
2003	16634676	23311860	11870029	2246761	2595998	1944506	482281	496332	0.22	0.27	0.183
2004	20095370	28005907	14419240	2206681	2550422	1909268	587698	588305	0.27	0.33	0.22
2005	18384160	25603510	13200430	2090680	2430840	1798120	663813	643708	0.29	0.35	0.24
2006	21552449	30058354	15453542	1641301	1908986	1411153	514597	511959	0.26	0.31	0.21
2007	21189154	30041070	14945548	1305374	1521098	1120244	406482	371016	0.22	0.27	0.182
2008	21987837	31392915	15400449	1379180	1600550	1188428	257870	253977	0.14	0.17	0.118
2009	27840434	39103667	19821410	1709993	1989559	1469711	168443	181135	0.083	0.104	0.067
2010	27453384	38658406	19496104	1785127	2090900	1524070	187611	193300	0.088	0.108	0.072
2011	23582135	33057757	16822590	2107473	2427705	1829481	226478	233982	0.115	0.140	0.095
2012	26062290	36558826	18579452	2287568	2638604	1983234	434710	417901	0.180	0.22	0.148
2013	32056162	45926920	22374624	2047234	2356871	1778275	511416	484077	0.22	0.26	0.177
2014	46688106	66560562	32748811	1963030	2264997	1701322	517356	507372	0.22	0.27	0.184
2015	15775994	23864277	10429061	1835817	2139427	1575292	494099	480701	0.24	0.30	0.191
2016	29532444	45590887	19130254	2178180	2629322	1804445	563610	541447	0.26	0.34	0.195
2017	12127668	25966121	5664317	2033511**							
Average	34303463	50426533	23461849	1682925	2083216	1356306	519536	564682	0.36	0.44	0.30

* At spawning time (September).

** Predicted.

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