3 Herring in Division 3.a and subdivisions 22–24, spring spawners [Update Assessment]

3.1 The Fishery

3.1.1 Advice and management applicable to 2020 and 2021

ICES advised in 2019 on the basis of the MSY approach. This corresponds to zero catch in 2020 (ICES 2019).

The EU and Norway agreement on a herring TAC for 2019 was 29 326 t in Division 3.a for the human consumption fleet and a bycatch ceiling of 6659 t to be taken in the small mesh fishery. For 2020, the EU and Norway agreement on herring TACs in Division 3.a was 24 528 t for the human consumption fleet and a bycatch ceiling of 6659 t to be taken in the small mesh fishery.

Prior to 2006, no separate TAC for subdivisions 22–24 was set. In 2019, a TAC of 9001 t was set on the Western Baltic stock component. The TAC for 2020 was set at 3150 t.

3.1.2 Landings in 2019

Herring caught in Division 3.a are a mixture of North Sea Autumn Spawners (NSAS) and Western Baltic Spring Spawners (WBSS). This section gives the landings of both NSAS and WBSS but the stock assessment applies only to spring spawners.

Landings from 1989 to 2019 are given in Table 3.1.1 and Figure 3.1.1. In 2019, the total landings in Division 3.a and subdivisions 22–24 have decreased to 24 750 t. Landings in 2019 decreased by 27% in the Skagerrak, by 56% in the Kattegat and by 49% in subdivisions 22–24. As in previous years the 2019 landing data are calculated by fleet according to the fleet definitions used when setting TACs.

3.1.2.1 Fleets

One of the unresolved issues from the benchmark in 2018 was the definition of the fleets, which differs between years and countries (ICES WKPELA, 2018).

The definition of the fleets in the EU TAC and quota regulation, since 1998 (e.g. EU 2017/127 and 2016/1903)

Fleet C: Catches of herring in Kattegat and Skagerrak taken in fisheries using nets with mesh sizes equal to or larger than 32 mm.

Fleet D: Exclusively for catches of herring in Kattegat and Skagerrak taken as bycatch in fisheries using nets with mesh sizes smaller than 32 mm.

Fleet F: Not defined directly in the regulation, but landings from subdivisions 22–24. Most of the catches are taken in a directed fishery for herring and some as bycatch in a directed sprat fishery

The definition used by HAWG, since 2010

Fleet C: Directed fishery for herring in Kattegat and Skagerrak in which trawlers (with 32 mm minimum mesh size) and purse-seiners participate. Since 2010 this fleet also includes the Swedish fishery with mesh sizes less than 32 mm, since an earlier change in the Swedish industrial fishery

implies that there is no difference in age structure of the landings between vessels using different mesh sizes since both are basically targeting herring for human consumption.

Fleet D: Bycatch of herring in Kattegat and Skagerrak in the industrial fleet and only including Danish landings. Covering all fisheries with mesh sizes less than 32 mm e.g. the sprat fishery, but also including other fisheries where herring is landed as bycatch e.g. Norway pout and blue whiting fisheries.

Fleet F: Landings from subdivisions 22–24. Most of the catches are taken in a directed fishery for herring and some as bycatch in a directed sprat fishery.

In Table 3.1.2 the landings are given for 2003 to 2019 in thousands of tonnes by fleet (as defined by HAWG) and quarter.

The text table below gives the TACs and Quotas (t) for the fishery by the C- and D-fleets in Division 3.a and for the F-fleet in subdivisions 22–24.

	TAC	**DK**	**GER**	**FI**	**PL**	**SWE**	**EC**	**NOR**
2019								
Div. 3.a fleet-C	29 326	12 325	197	0		12 893	25 415	3911
Div. 3.a fleet-D	6659	5692	51			916	6659	
SD 22–24	9001	1262	4966	1	1171	1601	9001	
fleet-F								
% of 3.a fleet-C can be taken in 4							-50%	
EU waters								
% of 3.a fleet-C can be taken in 4 Norwegian waters								-50%
	TAC	DK	GER	FI	PL	SWE	EC	NOR
2020								
Div. 3.a fleet-C	24 528	10 309	165	0		10 783	21 257	3271
Div. 3.a fleet-D	6659	5692	51			916	6659	
SD 22–24	3150	442	1738	0	410	560	3150	
fleet-F								
% of 3.a fleet-C can be taken in 4							-50%	
EU waters								
% of 3.a fleet-C can be taken in 4 Norwegian waters								-50%

3.1.3 Regulations and their effects

Before 2009, HAWG has calculated a substantial part of the catch reported as taken in Division 3.a in fleet C actually has been taken in Area 4. These catches have been allocated to the North Sea stock and accounted for under the A-fleet. Misreported catches have been moved to the appropriate stock for the assessment. However, from 2009 and on onwards, information from both the industry and VMS estimates suggest that this pattern of misreporting of catches into Division 3.a does no longer occurs. Thus no catches were moved out of Division 3.a to the North Sea for catches taken in 2019.

Regulations allowing quota transfers from Division 3.a to the North Sea were introduced as an incentive to decrease misreporting of the fishery, and the percentage has gradually been reduced until 2010. Since 2011 the EU-Norway agreement allowed 50% of the Division 3.a quotas for human consumption (Fleet C) to be taken in the North Sea. The optional transfer of quotas from one management area to another introduces uncertainty for catch predictions and thus influence the quality of the stock projections. To decrease the uncertainty industry agreed in the 2013 benchmark to inform HAWG prior to the meeting of the assumed transfer in the intermediate year. In the last few years this information has proved to be highly valuable and consistent with the realized distribution of the catches. For the fishery in 2019, the fishing industry informed HAWG that about 50% of the predicted catches in the C-fleet will be taken in Division 3.a and 50% will be transferred to the Division 4.

The quota for the C fleet and the bycatch TAC for the D fleet (see above) are set for the NSAS and the WBSS stocks together. The implication for the catch of NSAS must also be taken into account when setting quotas for the fleets that exploit these stocks.

3.1.4 Changes in fishing technology and fishing patterns

The amount of WBSS herring caught in the D-fleet was reduced from a typical catch of 1107 t in 2016 to 43 t in 2019. The decrease is linked to the low catches of sprat in 27.3.a. The low sprat catches is a result of merging the sprat stocks in the Skagerrak-Kattegak and in the North Sea into one stock unit (ICES, 2018), which had the consequence that most of the 3a fishery moved into the North Sea.

3.1.5 Winter rings vs. ages

To avoid confusion and facilitate comparability among herring stocks with different "spawning style" (i.e. NSAS) the age of WBSS, as well as other HAWG herring stocks, is specified in terms of winter rings (wr) throughout the entire assessment and advice. In the case of WBSS perfect correspondence exists between wr and age with no actual risk of confusion, so that a wr 1 is also an age 1 WBSS herring.

3.2 Biological composition of the landings

Tables 3.2.1 and 3.2.2 show the total catch in numbers and mean weight-at-age in the catch for herring by quarter and fleet landed from Skagerrak and Kattegat, respectively. The total catch in

numbers and mean weights-at-age for herring landed from subdivisions 22–24 are shown in Table 3.2.3.

The 24 750 t of landed herring were submitted stratified by area, fleet and quarter, resulting in 56 strata with landings. 27 of these strata were sampled – accounting for 87% of the landings.

Some strata with large amount of landings were un-sampled and 14 of the sampled strata, accounting for 13% of the landings, had less than three samples (Table 3.2.4). Un-sampled strata accounted in total for 3089 t and samples from either other nations or adjacent areas and quarters were used to estimate catch in numbers and mean weight-at-age (Table 3.2.5).

Based on the proportions of spring- and autumn-spawners in the landings, catches were split between NSAS and WBSS (Table 3.2.6 and the stock annex for more details).

The total numbers and mean weight-at-age of the WBSS and NSAS landed from Kattegat, Skagerrak, and Division 3.a respectively were then estimated by quarter and fleet (tables 3.2.7–3.2.12).

The total catch, expressed as SOP, of the WBSS taken in the North Sea + Division 3.a in 2019 was estimated to be 15 589 t, which represents a decrease of 29% compared to 2018 (Table 3.2.13).

Total catches of WBSS from the North Sea, Division 3.a, and subdivisions 22–24 respectively, by quarter, were estimated for 2019 (Table 3.2.14). Additionally, the total catches of WBSS in numbers and tonnes, divided between the North Sea and Division 3.a and subdivisions 22–24 respectively for 1993–2019, are presented in tables 3.2.15 and 3.2.16.

The total catch of NSAS in Division 3.a amounted to 6087 t in 2019, which represents the third lowest value in the 27 year time-series (Table 3.2.17).

The catches of WBSS from Subarea 4.aE and the catches of NSAS from Division 3.a in 2019 were reallocated to the appropriate stocks as shown in the text table below:

Stock	Catch reallocation	Tonnes
WBSS	4.aE (A-fleet)	6757
NSAS	3.a (C+D-fleet)	6087

3.2.1 Quality of Catch Data and Biological Sampling Data

No quantitative estimates of discards were available to the Working Group. However, the amount of discards for 2019 is assumed to be insignificant, as in previous years.

Table 3.2.4 shows the number of fish aged by country, area, fishery and quarter. The overall sampling in 2018 meets the recommended level of one sample per 1000 t landed per quarter and the coverage of areas, times of the year and gear (mesh size). Fortunately occasional lack of national sampling of catches by quarter and area has been covered by similar fisheries in other countries.

Splitting of catches into WBSS (Spring spawners) and NSAS (Autumn spawners) in Division 3.a were based on Danish and Swedish analyses of otolith micro-structure (OM) of hatch type. Different components of NSAS herring spawn at different times of the year, the three northern components spawn in autumn and are assigned to OM hatch month 9, whereas the Downs components spawning during winter in the Eastern Channel assigned to OM hatch month 12. Herring are predominantly spawning during spring in the western Baltic, the Kattegat and the Skagerrak and are assigned to the OM hatch month 4, however smaller stock components also spawn during winter, which would lead to an assignment to OM hatch month 12. This leads to potential overlapping distributions in Division 3.a of herring from both stocks with the same OM hatch month 12 signal. These winter-hatched individuals have traditionally been assigned differently in Danish and Swedish samples, where OM hatch month 12 has been assigned to WBSS in Sweden and to NSAS in Denmark. The samples from the IBTS have been split according to the Danish perception of stock affiliation.

A subsample of herring from different years 2002-2019 were individually assigned to both one of nine genetic stocks as well as to OM hatch month by Danish readers. OM type 12 and OM type 9 were pooled into OM type 9. Assignment error of OM type into genetic stock shows no specific trend and indicates around 5% incorrect assignment of OM type 4 into NSAS, and 12% incorrect assignment of OM type 9 or 12 into WBSS. There has been no correction for any bias indicated by these results.

	genetic stock	incorrectly assigned	WBSS	NSAS
All years	OM type 4	12%	478	65
	OM type 9 or 12	5%	23	448

For Danish data, OM based classification was extended using discriminant analysis (DA) based on otolith shape (OS) as well as fish and sample parameters. These data were calibrated with stock hatch type (4 or 9) and applied on production samples using non biased k = 1 nearest neighbour DA, with classification parameters: herring OS and otolith metrics as well as quarter, age, length and ICES Subdivision (see Stock Annex). The total sample size for hatch type was 2563 with 23% of the samples in Subdivision 20 (Skagerrak) and 77% in Subdivision 21 (Kattegat). Danish and Swedish sampling intensity was about equal and together covered all quarters and both subdi- vision. Proportion WBSS in sampled age classes were weighted by the national catches in the respective quarters and subdivisions. Not all age classes were covered by the sampling and thus proportions were estimated by relevant adjacent age classes or subdivisions. No samples from Kattegat 3rd quarter were available for split of ages 2-8+ wr, in this case the Swedish IBTS samples were used as a basis for the split, since it was expected to best reflect the proportions in the local distribution.

Random samples of 50 individual herring from Norwegian commercial catches in the 4a east are analysed for size at age distribution and stock affiliation based on vertebral series (vs) counts. Catches from the so called “transfer area” are split into proportions of NSAS and WBSS by quarter and age group based on the mean vs count in the two stocks using the formula:

Proportion(WBSS) = 1-MAX(MIN(1,(VSsample - VSWBSS)/(VSNSAS - VSWBSS),0)

Where the assumption is that VSWBSS = 55.8 and VSNSAS = 56.5.

A total of 18 308 tonnes of herring was caught in the transfer area in 2019, with catches in quarter 2 constituting 64%, and with 5 samples (245 fish) taken in four ICES stat. rect. from this quarter being available for calculating stock proportions. No samples from the commercial fishery in other quarters in the transfer area were available.

For quarter 3, the same split as in quarter 2 was applied based on the assumption that the fishery is restricted to June and early July would catch similar proportions of the two stocks in this period.

Due to lack of sampling data in 2019 the split for quarters 1 and 4 had to be based on data from the time-series of samples from the commercial fishery with respectively 48 (from 2016 Q1) and 246 herring (from 2012 Q4 and 2014 Q4) available for the analysis.

Based on vs mean counts 6757 tonnes of WBSS herring were caught in the transfer area in 2019, with 90% from quarter 2 and 3 (fishery in June and July).

There are clear indications from weight at age of mixing with Central Baltic herring in catches from SD 24 throughout the year from most of the countries. However, the catches are dominated by the German directed fishery in the spawning areas where mixing is likely to be minimum.

Catch data were not corrected for this mixing neither for potential catches of Western Baltic Spring-spawning herring in SD 25–26.

3.3 Fishery-independent Information

3.3.1 German Autumn Acoustic Survey (GERAS) in subdivisions 21-24

As a part of Baltic International Acoustic Survey (BIAS); the German autumn acoustic survey (GERAS) was carried out with RV "SOLEA" on 1–21 October 2019 in the Western Baltic, covering subdivisions 21, 22, 23 and 24. A survey report is given in the report of the 'ICES Working Group of International Pelagic Surveys' (ICES WGIPS, 2020). In the western Baltic, the distribution areas of two stocks, the Western Baltic Spring-spawning herring (WBSSH) and the Central Baltic herring (CBH) overlap. Survey results indicated in the recent years that in SD 24, which is part of the WBSSH management area, a considerable fraction of CBH is present and correspondingly erroneously allocated to WBSSH stock indices (ICES 2013/ACOM:46). Accordingly, a stock separation function (SF) based on growth parameters in 2005 to 2010 has been developed to quantify the proportion of CBH and WBSSH in the area (Gröhsler et al., 2013; Gröhsler et al., 2016). The estimates of the growth parameters from baseline samples of WBSSH and CBH in 2011-2018 support the applicability of the SF (Oeberst et al., 2013; WD Oeberst et al., 2014, 2015, 2016, 2017; WD Gröhsler and Schaber, 2018, 2019). The age-length distribution of herring in SDs 21, 22 and SD 23 in 2019 indicated some contribution of fish of CBH origin in 2019. This also included the SD 23 area of ICES rectangle 39G2, since biological samples of that rectangle were also used to raise the corresponding mean NASC values in the SD 24 area of the rectangle. Accordingly, the SF was applied all areas (SDs 21-24) in 2019. The applicability of the SF, which is normally checked by analysing the growth parameters based on baseline samples of WBSSH in SDs 21 and 23, could not be tested in 2019 due to some degree of mixing of CBH/WBSSH in these areas.

Individual mean weight, total numbers and biomass-by-age as estimated from the GERAS are presented in Table 3.3.1. The Western Baltic spring-spawning herring stock index in 2019 was

estimated to be 2.3 x 109 fish or about 51.6 x 103 tonnes in subdivisions 21–24. The biomass index in 2019 represents the lowest in the time-series.

The time-series has been revised in 2008 (ICES 2008/ACOM:02) to include the southern part of SD 21. The years 1991–1993 were excluded from the assessment due to different recording method and 2001 was also excluded from the assessment since SD 23 was not covered during that year (ICES 2008/ACOM:02).

Age (wr) classes (1–4) are included in the assessment.

3.3.2 Herring Summer Acoustic Survey (HERAS) in Division 3.a

The Herring acoustic survey (HERAS) was conducted from 25 June to 9 July 2019 and covered the Skagerrak and the Kattegat. The 2019 estimate of Western Baltic spring-spawning herring was 138 tonnes and 1,568 million herring. Compared to the value in 2018, the 2019 estimates represent an increase of 48% in numbers and of 6% in biomass. The stock biomass is dominated by 1–4 winter ring (80%). The present numbers of older herring (3+ group) in the stock decreased to 40% of the average of the whole time-series (2019: 575 million; mean 1991–2018: 1437 million). The results from the HERAS index are summarized in Table 3.3.2.

The 1999 survey was excluded from the assessment due to different survey area coverage.

Ages (wr) 3–6 are used in the assessment.

3.3.3 Larvae Surveys (N20)

Herring larvae surveys (Greifswalder Bodden and adjacent waters; SD 24) were conducted in the western Baltic at weekly intervals during the 2019 spawning season (March–June). The larval index was defined as the total number of larvae that reach the length of 20 mm (N20; Table 3.3.3; Oeberst et al., 2009). With an estimated product of 1317 million larvae, the 2019 N20 recruitment index is in similar dimensions as the previous year and more than double as high as the record low of 2016. However, the value is only in the range of about 1/5 of the time-series mean thus not countering the decreasing trend of larval production observed in the system during the past two decades.

The larval index is used as recruitment index (age (wr) 0) in the assessment.

3.3.4 IBTS/BITS Q1 and Q3-Q4

Since the recent benchmark (ICES, WKPELA 2018), the IBTS and the BITS data are combined according to the standardization methodology proposed by Berg et al., (2014), (hauls showed in Figure 3.3.1). In addition to the standardization model, two extra modelling steps are included, which consist of splitting the survey length and age data by stock using subsamples of stock-identified individuals. First, the length distributions are split by haul into WBSS / non-WBSS. Next the individual age samples are split into WBSS / non-WBSS. This gives a stock-specific ALK, which is used to convert the split length distributions from the first step into numbers-at-age by haul. Stock proportions for these splitting are based on otolith microstructure from the IBTS samples by assuming that only OM4 (Spring-spawning) contribution to the WBSS fraction, while OM9 and OM12 (Autumn and Winter spawning) are considered non-WBSS. The following equation describes the model considered for both the presence/absence and positive parts of the Delta-Lognormal model:

g(μi) =Year(i) + Gear(i) + f1(loni; lati) + f2(Depthi) + f3(timei) + log(HaulDuri)

where Gear(i) and Year(i) maps the ith haul to categorical gear/year effects for each age group.

Age (wr) classes (1–3) and (2-3) are included in the assessment from the surveys in Q1 and Q3-4.

3.4 Mean weights-at-age and maturity-at-age

Mean weights at age in the catch in the 1st quarter were used as estimates of mean weight-at-age in the stock (Table 3.2.14).

The maturity ogive of WBSS applied in HAWG has been assumed constant between years and has been the same since 1991 (ICES 1992/Assess:13), although large year-to-year variations in the percentage mature have been observed (Gröhsler and Müller, 2004). Maturity ogive has been investigated in the recent benchmark assessment of WBSS (ICES 2013/ACOM:46). WKPELA in 2013 decided to carry on with the application of the constant maturity ogive vector for WBSS.

The same maturity ogive was used as in the last year assessment (ICES CM 2018/ACOM:07):

W-rings	0	1	2	3	4	5	6	7	8+
Maturity	0.00	0.00	0.20	0.75	0.90	1.00	1.00	1.00	1.00

3.5 Recruitment

Indices of recruitment of 0-ringer WBSS for 2019 were available from the N20 larval surveys (see Section 3.3.3).

The strong correlation of the N20 with the 1-wr group of the GERAS (R2 = 0.74, Figure 3.5.1), which also shows a good internal consistency with the GERAS 2-wr group, indicates that the N20 is a good proxy for the strength of the new incoming year class. Since 2010, the N20 recruitment index lies below the long-term average (1992–2019: 5 667 million). The 2019 N20 recruitment index represents the fifth record low in the 28-year time-series (Table 3.3.3).

3.6 Assessment of Western Baltic spring spawners in Division 3.a and subdivisions 22–24

3.6.1 Input data

All input data can be found in tables 3.6.1–3.6.8.

Only the input landings data differs between the single and multifleet model – the rest of the input files are the same for both models.

3.6.1.1 Landings data

Catch in numbers-at-age from 1991 to 2019 were available for Subdivision 27.4.a (East, fleet A), Division 27.3.a (fleet C and D, respectively) and subdivisions 27.3.c–27.3.d.24 (fleet F) (Table 3.6.1.a–f). Years before 1991 are excluded due to lack of reliable data for splitting spawning type

and also due to a large change in fishing pattern caused by changes in the German fishing fleets (ICES 2008/ACOM:02).

Mean weights-at-age in the catch vary annually and are available for the same period as the catch in numbers (Table 3.6.2.a–f; Figure 3.6.1.1). Proportions at age thus reflect the combined variation in weight at age and numbers-at-age (Figures 3.6.1.2 and 3.6.1.3).

3.6.1.2 Biological data

Estimates of the mean weight of individuals in the stock (Table 3.6.3 (Q1) and Figure 3.6.1.4) are available for all years considered.

Natural mortality was assumed constant over time and equal to 0.3, 0.5, and 0.2 for 0-ringers, 1-ringers, and 2+ -ringers respectively (Table 3.6.4). The estimates of natural mortality were derived as a mean for the years 1977–1995 from the Baltic MSVPA (ICES 1997/J:2) as no new values were available as confirmed in the recent benchmark.

The percentage of individuals that are mature is assumed constant over time (Table 3.6.5): ages (wr) 0–1 are assumed to be all immature, ages (wr) 2–4 are 20%, 75% and 90% mature respectively, and all older ages are 100% mature.

The proportions of fishing mortality and natural mortality before spawning are 0.1 and 0.25 respectively and are assumed to be constant over time (Table 3.6.6–7). The difference between these two values is due to differences in the seasonal patterns of fishing and natural mortality.

3.6.1.3 Surveys

Surveys indices used in the both model runs can be found in Tables 3.6.8a–e.

According to the last benchmark of WBSS (ICES WKPELA, 2018), the following age (w-rings) classes (in grey) are used from each survey to tune the assessment of this stock:

Survey	0	1	2	3	4	5	6	7	8+
HERAS									
GERAS									
N20									
IBTS/BITS Q1									
IBTS/BITS Q3-4									

3.6.2 Assessment method

Since the 2018 benchmark (ICES WKPELA, 2018), the WBSS assessment is based on the state-space multifleet assessment model SAM. The assessment model presents one fishing mortality matrix for each of the four fleets fishing WBSS herring (A, C, D, and F). The model is designed to handle fleet disaggregated catches, which are available only from year 2000 while the model is run over the time period 1991–2019. The current implementation is an R-package based on Template Model Builder (TMB) and can be found at https://github.com/fishfollower/SAM (branch "multi").

The benchmark found highly consistent estimates of SSB, F and Recruitment as well as combined age selections between the multi- and the single-fleet SAM using comparable model settings.

The disaggregation of the fishing catches in the multifleet SAM can bring problems of convergence due to the increase of zeros in the fleet observed catches, which are ignored by the model since zeros cannot be fitted with a lognormal distribution. It is therefore important to compare the outputs of both the single and the multifleet models every year and check that the results are consistent between the models. For this year update assessment, the corresponding single fleet version is available with a configuration as close as possible to the multifleet model. The single fleet model output is represented as an overlay in the SSB, F, recruitment and total catch plots in the multifleet output. Both the multifleet (WBSS_HAWG_2020) and the single fleet (WBSS_HAWG_2020_sf) outputs are available at www.stockassessment.org.

Details of the software version employed are given in Table 3.6.9.

3.6.3 Assessment configuration

The model configuration was set as specified in Table 3.6.10.

This year, problems of convergence occurred when adding the 2019 data. This was due to difficulties estimating the variance parameter of the F process for the C-fleet (logSdLogFsta). To solve the problem without changing the configuration of the model, which would require a benchmark, the model was first run with coupling the variance parameters for all fleets so only one logSdLogFsta parameter was estimated. The converged run was used to provide initial values to the run with the original configuration. This allowed the logSdLogFsta parameter for the C-fleet to be well estimated in the second run and removed the problem of convergence.

3.6.4 Final run

The results of the assessment are given in Tables 3.6.11–3.6.14. The estimated SSB for 2019 is 56 621 [40 271, 79 611 (95% CI)] t. The mean fishing mortality (ages 3–6) is estimated as

0.382 [0.249, 0.584 (95% CI)] yr-1.

After a marked decline from almost 300 000 t in the early 1990s to a low of about 120 000 t in the late 1990s, the SSB of this stock was above 100 000 t in the early 2000s (Figure 3.6.4.1). After a small peak in 2006 coinciding with the maturing of the last major year-class, the SSB has declined up to 2011 with a SSB of 67.7 kt. SSB has only slightly increased in the following period up to 83 kt in 2014 and then has declined to 56.6 kt in 2019, which is the lowest SSB of the time-series.

Fishing mortality on this stock was high in the mid-1990s, reaching a maximum of over 0.6 yr-1. In 1999–2009, F3–6 stabilized between 0.50 and 0.57. In 2010 and 2011, F3–6 decreased significantly to a value of approx. 0.37 yr-1, where it stabilized for few years until it increased again above 0.4 yr-1 from 2015 to 2018. F3–6 then decreased below 0.4 in 2019 (Table 3.6.11, Figure 3.6.4.2).

Recruitment was the highest (~4 billion) at the beginning of the time-series (1991-1999) and has been decreasing overall since 2000. The 2019 estimate of 778 899 thousands is the lowest on record (Tables 3.6.11, Figure 3.6.4.3). The stock-recruitment plot for the WBSS stock (Figure 3.6.4.4) shows three distinct periods of recruitment with an early period of high recruitments varying between 3 and 5 billion coinciding with a declining SSB from 300 kt to 120 kt in the years 1991–1999 and no signs of density-dependence. This is followed by a distinct decline in recruitment to

values below 3 billion at a relatively constant spawning-stock biomass between 120 and 160 kt over the period from 2000–2006. In the most recent period, from 2007 to 2019 recruitment has varied from about 1.5 billion to less than 1 billion at SSB between 57 kt and 104 kt, with a worrying trend of declining recruitment in the latest years since 2017.

The total catch is well fitted (Figure 3.6.4.5) but also the catch per fleet (Figure 3.6.4.6) except for the fleet A where some observations are outside the confidence interval of the estimated catch.

The estimated partial fishing mortalities show remarkable differences between the four fleets reflecting the targeted ages of the individual fisheries, increasing with age for the A-fleet and the F-fleet, whereas distinct peaks are found for the C-fleet and the D-fleet at ages 2 and 1 wr respectively (Figure 3.6.4.7). The fishing mortality increases in the recent years for the A-fleet. The C-fleet shows an increasing trend in F for the last three decades, while there is a decreasing trend in F for the D- and F-fleet. The selectivity pattern for the D-fleet has a tendency of shifting its highest selectivity from age 1 to age 2 (wr) in later years. Total fishing mortality on the WBSS stock increased with herring age (Figure 3.6.4.8). It decreased overall over time but showed an increase in 2015-2018 and a decrease again in 2019.

The model was constrained to have the same selectivity for the two oldest ages (wr) 7+ in all fleets. The fishing mortality was assumed to be independent across ages for the A-fleet (see

$corFlag in Table 3.6.10). The estimated correlation parameter in the F random walk for the C-fleet was estimated to a very high value, which caused convergence problems in initial runs during the benchmark, it was therefore assigned a fixed high value in the subsequent assessment runs resulting in parallel selection patterns.

The estimated survey catchability is rather different among the surveys. The HERAS and the GerAs surveys are relatively constant over the applied ages (wr) 3–6 and 1–4 respectively. Whereas both IBTS Q1 and Q3.4 surveys show, sharp declines with increasing ages 1–3 and 2–3, respectively (Figure 3.6.4.9). Interpretation of the different catchability patterns is complex, and likely, a number of reasons including ontogenetic differences in the spatial distribution and behaviour of the different age classes at the time of the surveys may affect their relative availability to the different samplings.

The surveys present some strong correlations notably between the older ages (Figure 3.6.4.10). The same is observed for fleets C and F. The tracking of each cohort can be observed in Figure 3.6.4.11.

The F-fleet (ages 1-8+) has a lower observation variance than the GerAs and the HERAS, the IBTS Q3.4 surveys variance is lower than the C-fleet (ages 2-8+), the IBTS Q1 and the N20. Both the D-fleet and the A-fleet have very high observation variances, as well as the age 0 for all fishing fleets (Figure 3.6.4.12).

Residuals for catch in different fleets generally show poorer fit to the youngest year-classes 0–1 wr (Figure 3.6.4.13). The A-fleet shows large positive residuals in 2019 showing that the model underestimates the catches-at-age in 2019. The inverse is observed for the C-fleet with large negative residuals in 2019 for ages 4-8+, showing an overestimation of the catches for these ages. The F-fleet presents large negative residuals for ages 0-1 over the entire time-series. Further, the fit by fleet to some degree follows the amount of catches in the fleets with increasingly better fit from A-fleet, D-fleet, C-fleet to the F-fleet (Figures 3.6.4.13–3.6.4.17). The fit to the combined fleets at the beginning of the time-series follows the observations to some degree except for the two youngest age classes 0–1 wr, which exhibit a rather poor fit. (Figure 3.6.4.18).

Inspection of model diagnostics shows the occurrence of high residuals in some years (i.e. 2009 and 2018-2019 in the GerAs and 2013–2014 in HERAS; Figure 3.6.4.13). Overall, the agreement between the data and the fitted model appears acceptable throughout the data sources, which are most influential in the model. The individual survey diagnostics show some differences in how the model fit the different survey data, and the level of fitting is widely in agreement with the estimated observation variance for each data component (Figures 3.6.4.19–24). In general, a similar fit is found for all included ages (wr) 3–6 of the HERAS index (Figure 3.6.4.19). In recent years, GerAs shows a clear drop in observed indices for ages (wr) 1–4 that are poorly fitted and show therefore large negative residuals (Figures 3.6.13 and 3.6.4.20). The N20 picks up the negative trend in the observations of the recruitment index (Figure 3.6.4.21) however still with negative residuals by the end of the time-series (Figure 3.6.4.13). Poorer fit is observed for the IBTS+BITS-Q1 for all ages (wr) 1–3, over the entire time-series (Figure 3.6.4.22) and likewise to the IBTS+BITS-Q3.4 for the two ages (wr) 2–3 (Figure 3.6.4.23) with large positive residuals for age (wr) 2 in recent years (Figure 3.6.4.13).

Retrospective patterns have increased compared to last year assessment (Figure 3.6.4.24). While in the 2019 assessment, the SSB had a Mohn's rho of 13% and the retrospective estimates were within the confidence interval of the 2019 SSB estimate; the Mohn's rho in this year assessment has increased to 25% and the retrospective estimates for the 2- to 4-year peels are outside the confidence interval of the 2020 SSB estimates. Moreover, retrospective in the number-at-age shows that the oldest age groups (age 7-8+) contribute most to the deterioration of the retrospective pattern in SSB. Average fishing mortality retrospective estimates are also outside the confidence bounds for F for the 2 to 4-year peels (Mohn's rho = -18% compared to -7% in the 2019 assessment, Figure 3.6.4.25). The retrospective for recruitment is acceptable having a Mohn's rho = 2% (Figure 3.6.4.26). Retrospective is very small for total catch (Figure 3.6.4.27).

This year, different exploratory runs were conducted to investigate why the retrospective patterns have increased. Two runs were made without the HERAS survey and without the GerAs survey. Both of them showed large retrospective patterns similar to the original fit suggesting that none of the two surveys is the main only responsible for the retrospective pattern in the model. The retrospective patterns seem to be due to the catch-at-age data which is poorly fitted in the recent years (see large residuals for A-, C- and F-fleet Figure 3.6.4.13). In addition, the 2019 catch data were marked by an increase in the A-fleet catches and a decrease in the C- and F-fleets catches. This was notably clear in the small proportion of old fish in the C-fleet, the large proportion of old fish in the A-fleet and a decrease in the catches of all ages, except age 2, for the F-fleet.

These contrasting signals in the catch data are the likely reason for the large retrospective patterns in the 2020 assessment.

Similarly with what happened in the 2019 assessment, the decrease in stock perception between the 2019 assessment estimates and the 2020 ones seems to follow the GerAs survey that pushes the stock down due to very low indices for ages 1–4 in 2019. Indeed, leaving out the GerAs survey from the dataset induces an increase in the perception of the stock with increasing SSB in recent year (Figures 3.6.4.32–35). This pattern is also observed in the single-fleet model (Figures 3.6.4.28–31).

3.7 State of the stock

The stock was benchmarked in 2018 with a substantial increase in the chosen value of B_{lim} and a slight downwards revision of the SSB levels. The stock has decreased consistently from mid

2000s to a historical low in 2019 (Tables 3.6.11, Figure 3.6.4.1). With the new B_{lim} (120 kt) the stock has been in a state of impaired recruitment since 2007.

The 2018 benchmark calculated a new F_{MSY} of 0.31. Fishing mortality ($F_{3–6}$) was reduced between 2007 and 2011 from above 0.50 to 0.37 (Tables 3.6.11, Figure 3.6.4.2). $F_{3–6}$ has then remained stable slightly above F_{MSY} until 2014 (~0.38), but showed an increase in 2015-2018 with an estimated $F_{3–6}$ between 0.42 and 0.50. $F_{3–6}$ then decreased in 2019 but was still well above F_{MSY} (0.382).

Recruitment has be declining in the last five years with a historical low value in 2019 of 778 899 thousands (Tables 3.6.11, Figure 3.6.4.3).

The lower level of fishing mortality since 2011 has allowed a slight increase in SSB (from 68 kt in 2011 to 83 kt in 2014) despite the general low recruitment level, but since the strong 2013 year-class, recruitment has declined to historic low values that will not support a rebuilding of the stock with present levels of fishing mortalities.

3.8 Comparison with previous years perceptions of the stock

The table below summarizes the differences between the current and the previous year assessment. The addition of the 2019 data resulted in a change in the perception of the stock compared to last year assessment. The recent estimates of recruitment have decreased in the current assessment (-5.78%) and F appears to be larger than previously estimated (+16.63% to +12.05%) and SSB smaller (-16.67% to -21.64%).

In this year assessment, recruitment for the 2013 year class (most recent large year class) was estimated to be 1 581 113 thousands compared to 1 743 986 thousands in the 2019 assessment. This decrease in recruitment induced a decrease in the SSB estimates in the following years compared to the 2019 assessment. This change in the perception of the stock resulted in an increase in the fishing mortality estimates since 2013 to satisfy the observed catches. This change in stock perception with decrease in SSB and recruitment and increase in $F_{3–6}$ was already observed in the 2019 assessment compared to the 2018 assessment and seemed to worsen every year.

Parameter	Assessment in 2019	Assessment in 2020	Difference (2020-2019)/2020
SSB (t) 2017	83 895	71 908	-16.67%
$F_{(3–6)}$ 2017	0.416	0.499	16.63%
Recr. (‘000) 2017	1 057 849	1 000 047	-5.78%
SSB (t) 2018	74 132	60 944	-21.64%
$F_{(3–6)}$ 2018	0.416	0.473	12.05%

3.9 Short-term predictions

Short-term projections are possible both as stochastic and deterministic forecasts. While SAM runs with parameter values represented by percentiles, forecasts in multifleet SAM have to

switch to a representation by means and standard deviations in order for catches in the individual fleets to add up the totals predicted. However, to be in line with the median representation, all values would have to be recalculated back from the representation by means. Although statistically correct, the HAWG did not want to perform these operations without a prior scrutinising of the effects on the presentation of the advice. Therefore, HAWG in line with all other assessments of the working group calculated deterministic predictions using that forecast option of the multifleet SAM and following the settings in the stock annex.

3.9.1 Input data

In the short-term predictions recruitment (0-winter ring, wr) is assumed to be constant, and it is calculated as the geometric mean of the last five years prior the last year model estimate (i.e. for the 2020 assessment, recruitment for the forecasts was calculated on the period 2014–2018). For all older ages, the stock numbers are projected forward from the last data year to the intermediate year according to the estimated total mortalities based on fleet wise expected catches and natural mortalities. The mean weight-at-age in the catch and in the stock as well as the maturity ogive were calculated as the arithmetic averages over the last five years of the assessment (2015–2019). Based on earlier considerations in HAWG, the different periods were chosen to reflect recent levels in recruitment and weights.

3.9.2 Intermediate year 2020

A catch constraint was assumed for the intermediate year (2020). Predicted 2020 catch by fleet is summarized in the table below and depends on two main assumptions:

- Both NSAS and WBSS herring stocks are caught in the divisions 3.a (C and D-fleets) and 4.aE (A-fleet) whereas the subdivision 22–24 catch (F-fleet) is assumed to only be WBSS herring.
- The C- and D-fleets do not use their entire TAC.

Fleets	TAC 2020 NSAS+WBSS (t)	TAC WBSS (t)	TAC WBSS given utilization (t)
A	385 008	3184	100% = 3184
C	24 528	72.84% = 17 866	50% = 8933
D	6659	33.81% = 2251	5.47% = 123
F	3150	3150	100% = 3150
Total	419 345	26 452	15 390

The amount of WBSS taken in Division 4.aE by the A-fleet in 2020 is assumed equal to the average over the last 3 years (2017–2019) corresponding to 3184 t.

The expected catch of WBSS in Division 3.a was calculated assuming the same WBSS proportions in the catch of each fleet (stock split) in 2020 as the average of 2017–2019 in Division 3.a. This resulted in 72.84% of the C-fleet catch being WBSS herring. In addition, the EU–Norway agreement allows an optional transfer of 50% of the human consumption (C-fleet) TAC for herring in Division 3.a into the Area 4 in the North Sea (A-fleet). Based on information from the fishing industry, ICES assumes that the totality of the transfer will be use this year. Therefore, a 50% TAC transfer in 2020 results in a TAC utilization for the C-fleet in Division 3.a of 50%.

Around thirty-four percent of the D-fleet 2019 catch is assumed to be WBSS herring (average NSAS/WBSS split 2017–2019). In addition, the proportion of the TAC taken in the small-meshed fishery (D-fleet) has varied largely during the last 6 years from a maximum of 94% in 2015 to the minimum of 5.4-5.5% recorded since 2017 due to choke species effects of restricting whiting quotas. The problems with bycatches under the landings obligation may persist and 5.74% utilization of the TAC in 2020 for the D-fleet is assumed as the average utilization over the last 3 years (2017-2019).

The catch by the F-fleet fishing for human consumption in subdivisions 22–24 is usually very close to the TAC (3150 t) and an utilization of 100% is assumed for the intermediate year.

Misreporting of catches from the North Sea into Division 3.a is no longer assumed to occur after 2008. Therefore, no account was taken in the compilations.

These assumptions give the expected catch by fleet summing up to 15 390 t of WBSS herring in 2020.

3.9.3 Catch scenarios for 2021-2023

The outputs of the short-term prediction, based on a catch constraint in the intermediate year 2020 of 15 390 t are given in Tables 3.9.1–3.9.15.

Different catch options for the years after the intermediate year were explored with fleet-wise selection patterns and deterministic forecasts. To most closely resemble current WBSS management, a constraint is added to the forecasts so that, after the intermediate year, for all scenarios (except for the constant 2020 TAC, the F = 0 and the catch for bycatch fleets only scenarios) the F-fleet is assumed to get 50% of the total catch of WBSS herring.

3.9.4 Exploring a range of total WBSS catches for 2021 (advice year) to 2023

ICES gives advice according to the FMSY approach for the WBSS stock. Because the forecasted SSB in 2022 is below Blim, ICES advises a zero catch for 2021.

None of the catch scenarios for 2021, including zero catch, is expected to bring SSB above Blim in 2022. Similarly to last year, besides requested standard scenarios HAWG also calculated the po- tential development of the stock projections until 2023 with different low F scenarios, where F2022 = F2021. None of these scenarios, even when F = 0, can bring the SSB above Blim in 2023.

The TAC for 2020 was set according to the agreed management rule between EU and Norway, however, ICES has not evaluated the rule after the 2018 benchmark revised the reference points for this stock. ICES advises that a recovery plan be developed for the WBSS stock, taking advantage of the fleet-wise analysis and projection for this stock.

This year two new scenarios were requested by ACOM for zero catch advice stocks: (1) the "Catch for bycatch fleets only" scenario (see Table below), and (2) a scenario where the biomass is constant between 2021 and 2022. For a stock with SSB calculated in the 1st of January (and the final year of assessment being 2019), this can be easily done because SSB in 2021 only depends on F in 2020 and F is estimated given a TAC constraint so is the same for all forecast scenarios. As a result, all scenarios tested in the short-term forecast would have the same SSB in 2021 and the F in 2021 can be estimated to obtain a SSB in 2022 equal to 2021. For WBSS, there are complications to this calculation because the advice is annual (Jan-Dec) but the SSB is calculated and reported at spawning time (Spring). This means that SSB in 2021 is in fact the result of catches assumed (agreed TACs) for the intermediate year (2020) and some catches in the first months of 2021. In other words, the SSB in 2021 depends on F in 2020 but also on a fraction of the F in 2021 which is the advice year. What to assume for the first months of 2021 is the real issue here. For instance, if a zero catch is assumed in 2021 according to the advice, it will be uninformative because the table of advice would still only show the average F in 2021 (so F = 0). If a F that makes SSB 2021 = SSB 2020 is assumed for 2021, it will be an unrealistic high F needed to compensate for the low catches assumed in 2020. Given the reasons described above, the constant SSB between 2021 and 2022 scenario could not be meaningfully run for WBSS herring and is not included among the catch scenarios presented by the EG.

Table	Basis	Total catch (2021)	$F_{3–6}$	SSB* (2021)	SSB* (2022)	% SSB change **	% advice change ***
ICES advice basis							
3.9.2	MSY approach: zero catch	0	0	66 824	87 890	32	0
Other scenarios							
3.9.3	MAP^: F = F_{MSY} × SSB_{y-1}/MSY $B_{trigger}$	10 273	0.118	65 973	77 674	18	
3.9.4	MAP^: F = $F_{MSY\ lower}$ × SSB_{y-1}/MSY $B_{trigger}$	7291	0.082	66 230	80 610	22	
3.9.5	MAP^: F = $F_{MSY\ upper}$ × SSB_{y-1}/MSY $B_{trigger}$	12 393	0.144	65 786	75 602	15	
3.9.6	F= F_{MSY}	24 535	0.31	64 618	64 275	-1	
3.9.7	F = F_{pa}	27 179	0.35	64 340	61 819	-4	
3.9.8	F = F_{lim}	33 356	0.45	63 650	56 155	-12	
SSB (2022) = B_{lim} ^^							
SSB (2022) = B_{pa} ^^							
SSB (2022) = MSY $B_{trigger}$ ^^							
3.9.9	F = F_{2020}	14 410	0.170	65 603	73 849	13	
3.9.15	Catch for bycatch fleets only ^^^	3308	0.026	66 574	85 251	28	

*** For spring-spawning stocks, the SSB is determined at spawning time and is influenced by fisheries and natural mortality between 1 January and spawning time (April).**

**** SSB (2022) relative to SSB (2021).**

***** The advised catch in 2020 was 0 tonnes.**

^ Revised Baltic MAP (2018/973) which refers to using the most recent reference points. As SSB2020 is below MSY Btrigger, the FMSY, FMSY lower and FMSY upper values in the MAP are adjusted by the SSBy-1/MSY Btrigger ratio.

^^ The Blim and Bpa cannot be achieved in 2022 even with zero catch advice.

^^^ Only the A fleet that targets NSAS herring and the D fleet that targets sprat are allowed to fish assuming the same catch as in the intermediate year 2020 (C and F fleets have 0 catch).

Table	Basis	Total catch (2021)	Total catch (2022)	F3–6 (2021)	SSB* (2021)	SSB* (2022)	SSB* (2023)	% SSB change (2021–2022)	% SSB change (2022–2023)
Medium-term catch scenarios									
3.9.10	F = 0	0	0	0	66 824	87 890	111 745	32	27
3.9.11	F = 0.05	4506	5726	0.05	66 462	83 450	102 017	26	22
3.9.12	F = 0.1	8783	10 659	0.1	66 103	79 277	93 335	20	18
3.9.13	F = 0.15	12 843	14 905	0.15	65 746	75 353	85 569	15	14
3.9.14	Constant catch 2020–2022 #	15 391	15 391	0.150	65 726	74 580	85 273	13	14

*** For spring-spawning stocks, the SSB is determined at spawning time and is influenced by fisheries and natural mortality between 1 January and spawning time (April).**

 # Assumptions for 2020 catches kept constant for 2021–2022.

3.10 Reference points

The WBSS stock was benchmarked in 2018 (ICES WKPELA, 2018) with subsequent changes of reference points. Blim was revised from 90 000 to 120 000 t to take account of the new perception that recruitment is impaired when the spawning-stock biomass (SSB) is below 120 000 t. Bpa and MSY Btrigger were subsequently set to 150 000 t. Using the EqSim software FMSY was estimated to 0.31, Flim 0.45 (5% risk to Blim) and Fpa 0.35. The values were based on stochastic simulation of recruitment generated on a combination of Beverton & Holt, Ricker and segmented regression (ICES 2014/ACOM:64).

3.11 Quality of the Assessment

The stock was benchmarked in 2018 (ICES, 2018), which led to a change in perception for the entire time-series. Similarly to what was observed in last year assessment, the 2020 assessment shows a downward revision in the SSB estimates in recent years compared to the 2019 assessment, which is supported by all the surveys, especially GerAS (see 3.6.4).

The herring assessed in subdivisions 20–24 is a complex mixture of populations predominantly spawning in spring, but with local components spawning also in autumn and winter. The population dynamics and the relative contribution of these components is currently unknown but are likely to affect the precision of the assessment. Moreover, mixing between WBSS and central Baltic herring in subdivisions 22–24 may contribute to uncertainty in the assessment.

Interannual variability of the herring migration patterns and in the distribution of the fisheries (including the optional transfer of quotas between divisions 3.a and 4) certainly add uncertainty to the assessment and forecasts of this meta-population. Since these cannot be predicted, recent average proportions between stocks are assumed in projections.

3.12 Considerations on the 2020 advice

This year assessment shows both a decrease in SSB and its further downward revision (-18% for 2018 SSB). Recruitment continues decreasing and it is estimated at its historical minimum in 2019. Under these conditions the stock is not expected to increase above Blim in the short-term (2021) nor in the medium-term (2022, contrary to what expected in the last year advice) for any level of fishing mortality (SSB2023 = 111 745 t assuming F = 0).

To explore the potential development of the stock, projections until 2023 with different low F scenarios (F = 0.05, 0.1, 0.15) are provided in the Table in section 3.9.4. The development of a rebuilding plan for this stock remains a high priority for this stock and it is recommended by HAWG.

The EU–Norway TAC-setting procedure used for herring in Division 3.a (EU–Norway, 2013) calculates the TAC for the combined WBSS and NSAS stocks in the C-fleet as 41% of the ICES MSY advice for WBSS plus 5.7% of the TAC for the A-fleet (see section 3.13 for more details). However, according to a safety clause in the procedure, the method should not apply if serious concerns exist about the status of one of the two stocks, which is the case given the severe over-exploitation of the WBSS stock.

WBSS herring is also caught in the herring fisheries operating in the eastern part of Division 4.a (so called "transfer area"). Herring catches in the transfer area were 5043 t in 2018 of which 2164 t were estimated to be WBSS, and increased to 18 308 t in 2019 with 6757 t of WBSS. Estimation of the stock composition in the transfer area is highly uncertain which has implication for the qual- ity of the input data for the assessment, but most importantly the amount and stock com-position of herring catches in the transfer area remain unpredictable and represent an inevitable source of fishing mortality on the WBSS stock without additional area and/or time restriction on the herring fishery in the North Sea.

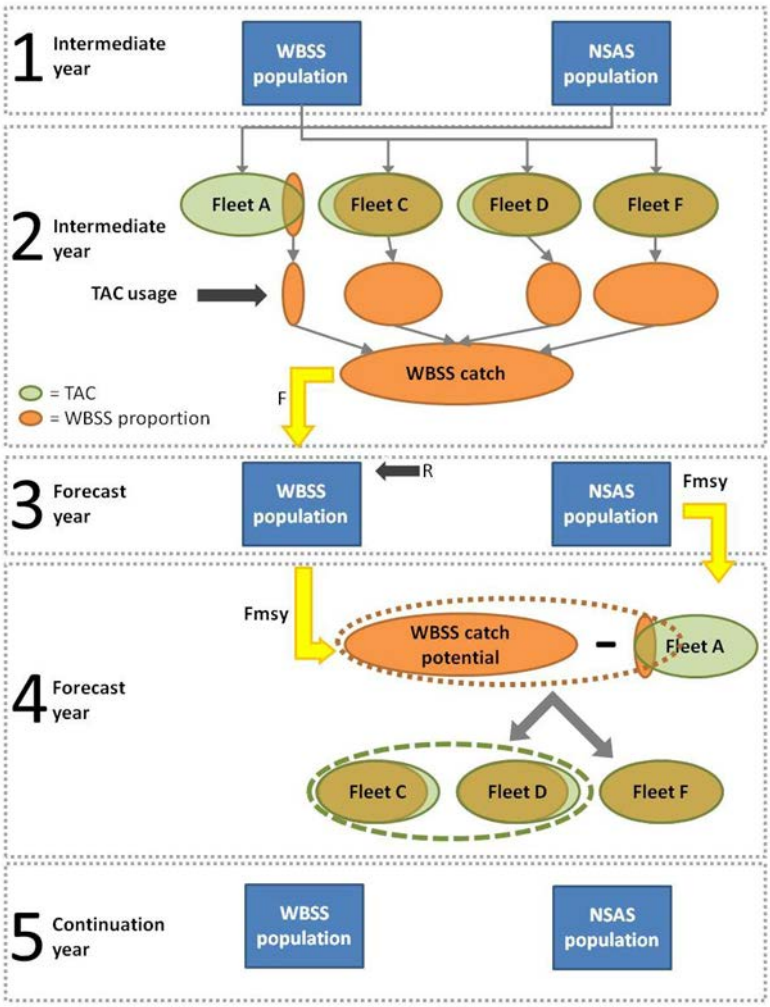
3.13 Management Considerations

Quotas in Division 3.a

The quota for the C-fleet and the bycatch quota for the D-fleet are set for both stocks of North Sea autumn spawners (NSAS) and Western Baltic spring spawners (WBSS) together (see Section 2.7). Fifty percent of the EU and Norwegian quotas for human consumption can optionally be transferred from Division 3.a and taken in Area 4 as NSAS in 2019. ICES assumes that a transfer of 50% will be applied in 2020 (cf. part 3.9).

ICES catch predictions vs. management TAC

ICES gives advice on catch scenarios for the entire distribution of the NSAS and WBSS herring stocks separately whereas herring is managed by areas (see the following text diagram). The procedure of setting TACs in ICES Division 3.a and SD 22–24 takes into account the occurrence of different fleets catches of both WBSS and NSAS herring utilization of TACs and the proportion of NSAS and WBSS that mix in the areas. In the flowchart below, a schematic is presented:



Box 1: Each year estimations of the WBSS and NSAS stock size are made using a stock assessment model. Stock size estimation together with the estimated pattern of harvesting is used as the starting point for the short-term forecast.

Box 2: To derive at a TAC proposal in the forecast year first the intermediate year (the year where the TAC has already been agreed on) catches need to be resolved. Four different fleets catch WBSS the A-fleet (within the 4.a East area where they take it as a mixture of mainly NSAS and partly WBSS) the C- and D-fleet (within the 3.a area where they take it as a mixture of mainly WBSS and partly NSAS) and the F-fleet (within area 22–24 where they only take WBSS). Each of these fleets target herring taking into account a fleet share of the total TAC. Only part of this TAC is WBSS catches and not all fleets utilize their full TAC fleet share. This results in an estimate of the intermediate year WBSS catches. Given WBSS stock size and these intermediate year catches the fishing mortality that the WBSS stock is exploited at can be estimated.

Box 3: Based on the estimated fishing mortality we can now calculate the survivors from the intermediate year to the forecast year assuming an incoming constant recruitment. The calculation of the stock size January 1st in the forecast year is needed to project catches in the forecast year.

Box 4: The management rule for the C-fleet TAC uses the potential WBSS catches calculated from the FMSY advice plus a fraction of the NSAS LTMP TAC to define the total TAC in ICES Division

3.a as well as SD22–24 (see Application of the management rule below). Dependent on the relative development of the NSAS and WBSS stocks and the quota transfer from the C-fleet to the A-fleet the realized WBSS catches may deviate from the predictions based on FMSY.

Box 5: The TAC advice from box 4 is taken into the political arena. The result of this will be taken into account to calculate the WBSS population again the year after. Hence box 5 is similar to box 1.

Application of the management rule for the herring fishery for human consumption in Division 3.a

ICES has not evaluated the agreed management rule after revision of reference points in the 2018 benchmark.

The agreed management rule has since 2014 been the basis for setting the C-fleet TAC in Division 3.a, and is calculated as the sum of 41% of the WBSS MSY advised catch and 5.7% of the North Sea herring management plan determined TAC for the A-fleet, with a further associated TAC constraint of +/-15% for the C-fleet.

However, given the new Blim, the stock has been below SSB for ten years raising serious concerns about the status of the WBSS stock. According to a safety clause, which was part of the TAC-setting procedure evaluation, the procedure itself therefore should not be applied and it should be re-evaluated.

3.14 Ecosystem considerations

Migration

Herring in Division 3.a and subdivisions 22–24 is a migratory stock. There are feeding migrations from the Western Baltic into more saline waters of Division 3.a and the eastern parts of Division 4.a. There are indications from parasite infections that yet unknown proportions of stock components spawning at the southern coast in the Baltic Sea may perform similar migrations (Podolska et al., 2006). Herring in Division 3.a and subdivisions 22–24 migrate back to Rügen area (SD 24) and other spawning areas at the beginning of winter. Moreover, there are recent indications that Central Baltic herring perform migrations into Subdivision 24 (Gröhsler et al., 2013).

Overwintering is considered to take place in the Öresund (Nielsen et al., 2001). However, recent observations on the acoustic surveys (Gröhsler and Schaber, 2018) indicate changes in distribution and it is currently unclear whether fish still aggregate in the shallow parts of the Sound or whether the density of herring accumulating in the area has changed overall. Whatever the temporal limitation of this survey are and whatever the cause for this observation might be, it may underline the need to validate the multiple-decade-old information on WBSS herring migration patterns.

Similar to the NSAS, the WBSS has produced a series of poor year classes in the last one and a half decade and the trend continues to decline. An earlier analysis on different Baltic herring stocks showed that the Baltic Sea Index (BSI) reflecting Sea Surface Temperature (SST) was the main predictor for the recruitment of WBSS (Cardinale et al., 2009), however at the moment there is no understanding of the mechanisms driving this relationship. At the current stage there are no indications of systematic changes in growth or age at maturity that could be related to environmental variability, as well as there is no clear study that linked WBSS recruitment to the abundance of prey and/or predators. The low recruitment phase appears to have been initiated before the observed occurrence of Mnemiopsis leidyi (Ctenophore) in the Western Baltic (Kube

et al., 2007). The specific reasons for this low recruitment are unknown. Further investigation of the causes of the poor recruitment will require targeted research projects.

Predation

Predation on larval herring by gelatineous plankton (*Aurelia aurita*) in the Western Baltic Sea was described to a be a major impact on recruitment strength of the population in the 1980s (Möller, 1984). Currently, in the inshore nursery grounds around Rügen the bloom of *A. aurita* is rather seasonally decoupled from major larval production periods as the jelly fish occur in large quantities during summer (July-Sept.). The same is true for the invading ctenophore *Mnemiopsis leidyi*, that appears from August on (Polte and Kotterba, pers. obs.). The seasonal peaks of jelly fish blooms, however might be subjected to change and should be kept under close surveillance as in the past two years *A. aurita* bacame more abundant during June therefore increasing the temporal overlap with WBSS larvae (Polte, pers. obs. RHLS).

Besides this potential predator, in Greifswald Bay there is evidently significant predation pressure on herring eggs by three-spined sticklebacks and- to a lower percentage by juv. Perch (*Perca fluviliatis*) and 9-spined stickleback, *Pungitius pungitius* (Kotterba *et al.,* 2014; Kotterba *et al.*, 2017a). In contrast the predation on larvae by the sticklebacks was found rather minor (Kotterba *et al.,* 2017b). Unfortunately, there are no historical baseline data available on stickleback densities in the system but they are considered to have increased speculatively by a trophic cascade including overfishing of predators (Bergstrom *et al.*, 2015).

The non-indigenous goby (*Neogobius melanostomus*) which reached extremely high abundances in the coastal Baltic Sea during recent years (Kornis *et al.*, 2012). It has been suspected to significantly increase predation pressure on herring eggs. However, a recent study revealed a minor effect by juvenile gobies that would ingest eggs when encountered but *N. melanostomus* in general is rather specialized on mollusc-prey and additionally there is a temporal mis-match among the juvenile gobies and herring spawning period (Wiegleb *et al.*, 2018).

Eutrophication

Estuarine WBSS herring spawning grounds in the Western Baltic Sea are still subject of increased nutrient levels and steady input of agricultural discharge. The resulting increased turbidity lead to a strict vertical limitation of perennial macrophytes in Greifswald Bay to the very littoral zone with a growth limit of about 3.5 m (Kanstinger *et al.*, 2018). The major spawning zone in the system is considered to be located in a range of 1-2 m water depth (Moll, 2018). Besides a potential reduction in spawning beds the depth limitation evidently results in increased exposure against storm-induced turbulence and consequently increased herring egg mortality (Moll *et al.*, 2018).

Although spring-spawning herring facultative selects other spawning substrates for egg deposition (e.g. stones), the complexity of spawning substrate as provided by macrophytes promotes egg survival by unknown mechanisms (von Nordheim *et al.*, 2018). Additionally, increased blooms of filamentous algae (*Pilayella littoralis*) promoted by elevated nutrient levels in synergy with warming spring temperatures cause significant herring egg mortality (von Nordheim *et al.*, *in press*).

3.15 Changes in the Environment

Climate drivers

There is ample indication that prevailing winter temperature- as expressed by the Baltic Sea Index (BSI) significantly affect recruitment strength of WBSS herring (Cardinale et al., 2009; Gröger et al., 2014). The exact ecological mechanisms causing this link remain widely unknown. However, for larval herring production in Greifswald Bay it could be shown that the optimal temperature window for embryonic development (Peck et al., 2012) is very important for reproduction-success and tends to have contracted in recent years (Dodson et al., 2019). There are strong indications that according to recent mild winter regimes the seasonal timing of spawning migration and reproduction has shifted and those phenology changes are responsible for limited reproduction success as expressed by larval productivity in Greifswald Bay reflected by the abundance of 1-year juveniles in the outer Western Baltic Sea as expressed by the GERAS 1-wr abundance index (Polte et al., unpublished). As currently the initial hatching cohorts are not resulting in significant numbers of larval survivors beyond the critical period after yolk-sac consumption, later cohorts are contributing most to recent recruitment patterns (Polte et al., 2014). However, this might overall result low recruitment compared to earlier years when the larvae of initial cohorts drove the numbers of survivors. Additionally, those later cohorts (hatching mid-April-early May) are exposed to a suit of different stressors: If the seasonal SST curve is steep and the shallow water heats fast during spring, those larvae are increasingly encountering physiological limits. Moyano et al. (in press) could recently show that WBSS larvae develop cardiac arrhythmia beyond a SST threshold of 16°C and that the number of days above this threshold increased in Greifswald bay during past decades. Besides those direct temperature effects, synergistic effects of eutrophication and warming (see Eutrophication above) lead to multiple cascades affecting egg survival of those later cohorts in particular.

Table 3.1.1. Western Baltic herring. Total catch (both WBSS and NSAS) in 1989–2019 (1000 tonnes). (Data provided by Working Group members 2020).

Year	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Skagerrak															
Denmark	47.4	62.3	58.7	64.7	87.8	44.9	43.7	28.7	14.3	10.3	10.1	16.0	16.2	26.0	15.5
Faroe Islands															
Germany															0.7
Lithuania															
Norway	1.6	5.6	8.1	13.9	24.2	17.7	16.7	9.4	8.8	8.0	7.4	9.7			
Sweden	47.9	56.5	54.7	88.0	56.4	66.4	48.5	32.7	32.9	46.9	36.4	45.8	30.8	26.4	25.8
Total	96.9	124.4	121.5	166.6	168.4	129.0	108.9	70.8	56.0	65.2	53.9	71.5	47.0	52.3	42.0
Kattegat															
Denmark	57.1	32.2	29.7	33.5	28.7	23.6	16.9	17.2	8.8	23.7	17.9	18.9	18.8	18.6	16.0
Sweden	37.9	45.2	36.7	26.4	16.7	15.4	30.8	27.0	18.0	29.9	14.6	17.3	16.2	7.2	10.2
Total	95.0	77.4	66.4	59.9	45.4	39.0	47.7	44.2	26.8	53.6	32.5	36.2	35.0	25.9	26.2
Subdivisions 22+24															
Denmark	21.7	13.6	25.2	26.9	38.0	39.5	36.8	34.4	30.5	30.1	32.5	32.6	28.3	13.1	6.1
Germany	56.4	45.5	15.8	15.6	11.1	11.4	13.4	7.3	12.8	9.0	9.8	9.3	11.4	22.4	18.8
Poland	8.5	9.7	5.6	15.5	11.8	6.3	7.3	6.0	6.9	6.5	5.3	6.6	9.3		4.4
Sweden	6.3	8.1	19.3	22.3	16.2	7.4	15.8	9.0	14.5	4.3	2.6	4.8	13.9	10.7	9.4
Total	92.9	76.9	65.9	80.3	77.1	64.6	73.3	56.7	64.7	49.9	50.2	53.3	62.9	46.2	38.7
Subdivision 23															
Denmark	1.5	1.1	1.7	2.9	3.3	1.5	0.9	0.7	2.2	0.4	0.5	0.9	0.6	4.6	2.3
Sweden	0.1	0.1	2.3	1.7	0.7	0.3	0.2	0.3	0.1	0.3	0.1	0.1	0.2		0.2
Total	1.6	1.2	4.0	4.6	4.0	1.8	1.1	1.0	2.3	0.7	0.6	1.0	0.8	4.6	2.6
Grand Total	**286.4**	**279.9**	**257.8**	**311.4**	**294.9**	**234.4**	**231.0**	**172.7**	**149.8**	**169.4**	**137.2**	**162.0**	**145.7**	**128.9**	**109.5**

Year	2004	2005	2006**	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019*
Skagerrak																
Denmark	11.8	14.8	5.2	3.6	3.9	12.7	5.3	3.6	3.2	4.9	6.4	4.1	3.6	2.7	0.9	0.6
Faroe Islands		0.4			0.0	0.6	0.4					0.5	0.3	0.4	0.1	
Germany	0.5	0.8	0.6	0.5	1.6	0.3	0.1	0.1	0.6	0.2	0.1	0.1	0.1	0.1	0.2	0.1
Lithuania							0.4									
Netherlands												0.03				
Norway				3.5	4.0	3.3	3.3	0.1	0.4	3.0	2.0	2.5	3.9	3.3	3.4	2.5
Sweden	21.8	32.5	26.0	19.4	16.5	12.9	17.4	9.5	16.2	16.7	12.6	12.9	13.3	11.9	11.3	8.5
Total	34.1	48.5	31.8	26.9	26.0	29.7	27.0	13.2	20.5	24.8	21.2	20.1	21.2	18.5	16.0	11.7
Kattegat																
Denmark	7.6	11.1	8.6	9.2	7.0	4.9	7.6	5.2	6.3	3.9	4.3	4.0	2.4	0.9	1.3	1.5
Sweden	9.6	10.0	10.8	11.2	5.2	3.6	2.7	1.7	0.8	2.6	3.4	3.8	6.2	7.4	6.0	1.7
Germany						0.6	0.0									
Total	17.2	21.1	19.4	20.3	12.2	9.1	10.3	6.8	7.1	6.5	7.7	7.7	8.7	8.3	7.3	3.2
Subdivisions 22+24																
Denmark	7.3	5.3	1.4	2.8	3.1	2.1	0.8	3.1	4.1	5.1	4.3	4.5	5.7	5.6	4.5	2.0
Finland															0.001	
Germany	18.5	21.0	22.9	24.6	22.8	16.0	12.2	8.2	11.2	14.6	10.2	13.3	14.4	14.7	11.3	5.6
Poland	5.5	6.3	5.5	2.9	5.5	5.2	1.8	1.8	2.4	3.1	2.4	2.6	2.9	3.3	1.8	1.1
Sweden	9.9	9.2	9.6	7.2	7.0	4.1	2.0	2.2	2.7	2.1	1.1	1.5	1.7	2.3	0.9	0.7
Total	41.2	41.8	39.4	37.6	38.5	27.4	16.8	15.3	20.4	24.8	18.0	21.9	24.7	25.9	18.5	9.5
Subdivision 23																
Denmark	0.1	1.8	1.8	2.9	5.3	2.8	0.1***	0.03	0.04	0.04	0.05	0.03	0.03	0.3	0.1	0.01
Sweden	0.3	0.4	0.7		0.3	0.8	0.9	0.5	0.7	0.6	0.3	0.2	0.3	0.4	0.4	0.4
Total	0.4	2.2	2.5	2.9	5.7	3.6	1.0	0.6	0.7	0.7	0.4	0.2	0.4	0.6	0.5	0.4
Grand Total	**92.8**	**113.6**	**93.0**	**87.7**	**82.3**	**69.9**	**55.2**	**35.9**	**48.8**	**56.7**	**47.2**	**50.0**	**55.0**	**53.3**	**42.2**	**24.7**

***Preliminary data**

****2000 t of Danish catches are missing (HAWG 2007)**

*****3103 t officially reported catches (HAWG 2011)**

Table 3.1.2 Western Baltic herring. Catch (SOP) in 2004-2019 by fleet and quarter (1000 t). (both WBSS and NSAS)

Year	Quarter	Div. IIIa		SD 22-24	Div. IIIa + SD 22-24	Year	Quarter	Div. IIIa		SD 22-24	Div. IIIa + SD 22-24
		Fleet C	Fleet D	Fleet F	Total			Fleet C	Fleet D	Fleet F	Total
2004	1	13.5	2.8	20.4	36.7	2012	1	4.5	1.8	14.0	20.3
	2	2.8	3.3	10.4	16.5		2	0.3	0.7	2.5	3.5
	3	8.2	10.8	2.4	21.4		3	12.3	1.7	1.1	15.0
	4	5.9	5.0	8.6	19.4		4	5.2	1.1	3.5	9.9
	Total	30.3	22.0	41.7	93.9		Total	22.3	5.4	21.1	48.8
2005	1	16.6	6.1	20.4	43.1	2013	1	8.5	0.8	11.7	20.9
	2	3.4	1.9	15.6	20.9		2	1.7	0.6	8.5	10.8
	3	23.4	3.4	1.9	28.7		3	8.4	1.0	1.1	10.4
	4	12.0	2.6	5.8	20.5		4	9.8	0.5	4.3	14.7
	Total	55.4	14.1	43.7	113.3		Total	28.4	2.9	25.5	56.7
2006	1	15.3	5.9	15.1	36.2	2014	1	6.2	0.2	10.8	17.3
	2	2.6	0.1	17.2	19.9		2	2.3	0.5	2.3	5.1
	3	15.7	0.8	3.0	19.5		3	10.7	2.4	0.8	14.0
	4	8.3	2.4	6.5	17.3		4	5.7	0.8	4.4	10.9
	Total	41.9	9.3	41.9	93.0		Total	24.9	4.0	18.3	47.2
2007	1	7.7	3.0	18.8	29.5	2015	1	9.0	1.9	14.2	25.1
	2	3.8	0.1	10.5	14.4		2	1.0	0.1	2.8	3.9
	3	22.4	0.8	1.7	24.9		3	7.5	1.5	0.9	9.9
	4	7.7	1.8	9.5	18.9		4	4.1	2.8	4.3	11.1
	Total	41.6	5.7	40.5	87.7		Total	21.6	6.3	22.1	50.0
2008	1	8.2	3.9	18.4	30.5	2016	1	7.9	0.7	15.5	24.0
	2	2.7	0.3	11.3	14.3		2	0.4	0.3	3.5	4.1
	3	14.9	0.6	6.0	21.5		3	15.7	1.3	1.4	18.5
	4	6.5	1.0	8.4	16.0		4	3.4	0.3	4.7	8.3
	Total	32.3	5.9	44.1	82.3		Total	27.4	2.5	25.1	55.0
2009	1	11.1	2.7	19.5	33.2	2017	1	7.5	0.0	16.8	24.3
	2	3.1	0.1	6.8	10.1		2	0.2	0.1	3.4	3.6
	3	14.3	0.9	1.4	16.6		3	12.1	0.1	1.0	13.2
	4	6.0	0.7	3.3	10.0		4	6.6	0.3	5.3	12.2
	Total	34.5	4.3	31.0	69.9		Total	26.4	0.4	26.5	53.3
2010	1	8.4	1.1	10.2	19.8	2018	1	10.0	0.0	12.0	21.9
	2	3.9	0.7	5.4	10.1		2	0.2	0.1	3.4	3.8
	3	13.4	0.4	0.4	14.3		3	10.2	0.1	0.2	10.6
	4	9.2	0.1	1.8	11.1		4	2.5	0.1	3.4	6.0
	Total	35.0	2.3	17.9	55.2		Total	22.9	0.4	19.0	42.2
2011	1	7.0	0.5	7.8	15.3	2019	1	4.4	0.1	6.0	10.5
	2	0.5	0.2	4.1	4.8		2	0.5	0.0	0.4	1.0
	3	6.5	1.0	0.8	8.3		3	6.5	0.2	0.3	7.0
	4	3.4	0.9	3.2	7.4		4	3.1	0.0	3.1	6.3
	Total	17.4	2.6	15.8	35.9		Total	14.6	0.4	9.8	24.7

Table 3.2.1. Western Baltic spring spawning herring. Catch in numbers (mill.), mean weight (g.) and SOP (t). by age as W-ringers and quarter (both WBSS and NSAS).

Division: Skagerrak Year: 2019 Country: ALL

		Fleet C		Fleet D		Total	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
1	1	34.88	27			34.88	27
	2	25.71	65			25.71	65
	3	3.31	85			3.31	85
	4	1.02	122			1.02	122
	5	0.43	87			0.43	87
	6	0.20	137			0.20	137
	7						
	8+						
	Total	65.56		0.00		65.56	
	SOP		3,087		0		3,087
		Fleet C		Fleet D		Total	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
2	1	4.98	33	0.17	23	5.16	33
	2	0.44	63			0.44	63
	3	0.35	76			0.35	76
	4	0.05	90			0.05	90
	5	0.02	49			0.02	49
	6						
	7						
	8+						
	Total	5.84		0.17		6.02	
	SOP		226		4		230
		Fleet C		Fleet D		Total	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
3	0	1.38	22	1.71	7	3.09	14
	1	38.56	57	0.42	29	38.98	56
	2	21.80	98			21.80	98
	3	8.36	135			8.36	135
	4	2.87	143			2.87	143
	5	1.23	157			1.23	157
	6	0.95	180			0.95	180
	7	0.19	202			0.19	202
	8+						
	Total	75.33		2.13		77.46	
	SOP		6,298		24		6,322
		Fleet C		Fleet D		Total	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
4	0	8.74	20			8.74	20
	1	27.73	49			27.73	49
	2	4.73	87			4.73	87
	3	0.47	99			0.47	99
	4	0.39	130			0.39	130
	5	0.13	162			0.13	162
	6						
	7						
	8+						
	Total	42.19		0.00		42.19	
	SOP		2,056		0		2,056
		Fleet C		Fleet D		Total	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
Total	0	10.12	20	1.71	7	11.83	18
	1	106.15	44	0.60	27	106.75	44
	2	52.69	81			52.69	81
	3	12.49	119			12.49	119
	4	4.33	136			4.33	136
	5	1.81	139			1.81	139
	6	1.14	173			1.14	173
	7	0.19	202			0.19	202
	8+						
	Total	188.92		2.30		191.22	
	SOP		11,666		28		11,695

Table 3.2.2 Western Baltic spring spawning herring. Catch in numbers (mill.), mean weight (g.) and SOP (t) by age as W-ringers and quarter (both WBSS and NSAS).

Division: Kattegat Year: 2019 Country: ALL

		Fleet C		Fleet D		Total	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
1	1	3.46	30	2.35	26	5.81	28
	2	13.60	53	0.57	39	14.18	53
	3	5.75	71	0.13	65	5.87	70
	4	0.48	91			0.48	91
	5	0.13	128			0.13	128
	6	0.11	39			0.11	39
	7						
	8+						
	Total	23.53		3.05		26.58	
	SOP		1,297		91		1,388
		Fleet C		Fleet D		Total	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
2	1	4.4554	33	0.70	23	5.1539	32
	2	0.6500	59			0.6500	59
	3	0.2351	81			0.2351	81
	4	0.2643	103			0.2643	103
	5	0.2370	125			0.2370	125
	6	0.1737	138			0.1737	138
	7	0.1446	149			0.1446	149
	8+	0.0212	166			0.0212	166
	Total	6.1812		0.70		6.8797	
	SOP		310.072		16.066		326.138
		Fleet C		Fleet D		Total	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
3	0	0.28	26	12.69	7	12.96	8
	1	1.94	48	3.12	29	5.06	36
	2	0.78	73			0.78	73
	3	0.30	87			0.30	87
	4	0.03	97			0.03	97
	5	0.06	89			0.06	89
	6	0.00	93			0.00	93
	7						
	8+	0.00	159			0.00	159
	Total	3.39		15.80		19.19	
	SOP		193		181		375
		Fleet C		Fleet D		Total	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
4	0	1.05	26	3.19	12	4.24	15
	1	9.02	50	0.15	24	9.18	49
	2	4.53	78	0.02	60	4.55	78
	3	1.85	95			1.85	95
	4	0.46	97			0.46	97
	5	0.38	78			0.38	78
	6	0.06	93			0.06	93
	7						
	8+	0.03	159			0.03	159
	Total	17.39		3.37		20.76	
	SOP		1,092		43		1,135
		Fleet C		Fleet D		Total	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
Total	0	1.32	26	15.88	8	17.20	10
	1	18.88	42	6.32	27	25.20	38
	2	19.56	60	0.59	39	20.15	59
	3	8.13	77	0.13	65	8.26	77
	4	1.25	96			1.25	96
	5	0.81	101			0.81	101
	6	0.34	99			0.34	99
	7	0.14	149			0.14	149
	8+	0.06	161			0.06	161
	Total	50.49		22.92		73.41	
	SOP		2,892		332		3,224

Table 3.2.3. Western Baltic spring spawning herring. Catch in numbers (mill.), mean weight (g.) and SOP (t) by age as W-ringers and quarter (WBSS).

Subdivisions: 22–24 Year: 2019 Country: ALL

Quarter	W-rings	Sub-division 22		Sub-division 23		Sub-division 24		Total	
		Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
1	0								
	1	0.00	17			5.03	25	5.03	25
	2	0.01	53			13.62	49	13.63	49
	3	0.03	84	0.03	171	8.77	75	8.84	75
	4	0.07	125	0.02	178	7.67	120	7.76	120
	5	0.03	138	0.08	198	4.90	147	5.01	148
	6	0.09	166	0.05	207	11.17	171	11.31	171
	7	0.03	174	0.01	207	2.90	178	2.94	178
	8+	0.02	185	0.00	186	2.40	189	2.43	189
	Total	0.28		0.19		56.47		56.95	
	SOP		40		37		5,969		6,046

Quarter	W-rings	Sub-division 22		Sub-division 23		Sub-division 24		Total	
		Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
2	1					0.002	42	0.002	42
	2	0.001	59			0.25	50	0.25	50
	3	0.003	73	0.0001	171	0.28	68	0.29	68
	4	0.002	107	0.0001	178	0.22	96	0.22	96
	5	0.01	159	0.0003	198	0.77	145	0.78	146
	6	0.01	161	0.0002	207	1.10	157	1.11	158
	7	0.01	165	0.0000	207	0.37	163	0.38	163
	8+	0.00	176	0.0000	186	0.16	159	0.17	160
	Total	0.04		0.0008		3.15		3.19	
	SOP		6		0.2		424		430

Quarter	W-rings	Sub-division 22		Sub-division 23		Sub-division 24		Total	
		Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
3	0	0.0002	19					0.00	19
	1	0.0010	55					0.00	55
	2	0.0025	66			0.32	54	0.32	54
	3	0.0019	72	0.15	171	0.23	61	0.38	105
	4	0.0006	77	0.08	178	0.21	79	0.29	108
	5	0.0007	160	0.37	198	0.24	57	0.61	143
	6	0.0006	162	0.23	207	0.15	61	0.37	150
	7	0.0007	165	0.04	207	0.42	71	0.46	84
	8+	0.0002	176	0.02	186	0.13	84	0.15	96
	Total	0.0084		0.89		1.68		2.58	
	SOP		0.8		172		110		283

Quarter	W-rings	Sub-division 22		Sub-division 23		Sub-division 24		Total	
		Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
4	0	0.00	19			0.27	17	0.27	17
	1	0.00	54			1.84	46	1.84	46
	2	0.01	66			6.45	75	6.46	74
	3	0.01	73	0.13	171	5.93	94	6.07	96
	4	0.00	100	0.07	178	4.96	131	5.04	132
	5	0.02	161	0.32	198	3.59	121	3.93	127
	6	0.02	162	0.20	207	2.86	145	3.08	149
	7	0.02	165	0.04	207	2.20	91	2.26	94
	8+	0.00	176	0.02	186	0.76	110	0.78	112
	Total	0.08		0.78		28.85		29.72	
	SOP		11		151		2,909		3,072

Quarter	W-rings	Sub-division 22		Sub-division 23		Sub-division 24		Total	
		Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
Total	0	0.00	19			0.27	17	0.27	17
	1	0.01	43			6.87	31	6.88	31
	2	0.02	61			20.65	57	20.67	57
	3	0.04	81	0.31	171	15.21	82	15.56	84
	4	0.07	123	0.17	178	13.05	123	13.30	124
	5	0.06	149	0.77	198	9.50	135	10.33	140
	6	0.12	165	0.47	207	15.27	164	15.87	166
	7	0.06	169	0.09	207	5.89	137	6.03	138
	8+	0.03	183	0.04	186	3.45	166	3.52	167
	Total	0.42		1.86		90.16		92.44	
	SOP		59		360		9,412		9,831

Table 3.2.4 Western Baltic spring spawning herring. Samples of commercial catch by quarter and area for 2019 available to the Working Group.

	Country	Fleet	Quarter	Landings ('000 tons)	Numbers of samples	Numbers of fish meas.	Numbers of fish aged
Skagerrak	Denmark	C	1	0.00003	No data available		
		C	2	0.00005	No data available		
		C	3	0.56413	No data available		
		C	4	0.00001	No data available		
	Total	Total		0.56422	0	0	0
	Denmark	D	1	0.000		-	
		D	2	0.004	No data available		
		D	3	0.024	No data available		
		D	4	0.000		-	
	Total	Total		0.028	0	0	0
	Germany	C	1	0.000		-	
		C	2	0.000		-	
		C	3	0.121	No data available		
		C	4	0.000		-	
	Total	Total		0.121			
	Norway	C	1	0.647	No data available		
		C	2	0.101	No data available		
		C	3	1.691	1	50	50
		C	4	0.033	No data available		
	Total	Total		2.472	1	50	50
	Faroe Islands	C	1	0.000		-	
		C	2	0.000		-	
		C	3	0.000		-	
		C	4	0.000		-	
	Total	Total		0.000	0	0	0
	Sweden	C	1	2.440	3	579	579
		C	2	0.125	1	250	250
		C	3	3.921	5	512	511
		C	4	2.023	3	434	434
	Total	Total		8.509	12	1,775	1,774
Kattegat	Denmark	C	1	0.584	No data available		
		C	2	0.0001	No data available		
		C	3	0.146	No data available		
		C	4	0.437	2	469	199
	Total	Total		1.167	2	469	199
	Denmark	D	1	0.091	2	48	48
		D	2	0.016	2	7	7
		D	3	0.181	8	476	275
		D	4	0.043	5	170	160
	Total	Total		0.332	17	701	490
	Sweden	C	1	0.712	2	440	440
		C	2	0.310	3	574	571
		C	3	0.047	No data available		
		C	4	0.655	4	512	512
	Total	Total		1.725	9	1,526	1,523

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Table 3.2.4 (continued) Western Baltic spring spawning herring. Samples of commercial catch by quarter and area for 2019 available to the Working Group.

	Country	Fleet	Quarter	Landings ('000 tons)	Numbers of samples	Numbers of fish meas.	Numbers of fish aged
Subdivision 22	Denmark	F	1	0.001	No data available		
		F	2	0.0025	No data available		
		F	3	0.000	No data available		
		F	4	0.002	1	104	52
	Total	Total		0.005	1	104	52
	Sweden	F	1	0.000		-	
		F	2	0.000		-	
		F	3	0.000		-	
		F	4	0.000		-	
	Total	Total		0.000	0	0	0
	Germany	F	1	0.0398	2	859	137
		F	2	0.0037	2	866	139
		F	3	0.0004	No data available		
		F	4	0.0099	No data available		
	Total	Total		0.0537	4	1,725	276
Subdivision 23	Denmark	F	1	0.001	No data available		
		F	2	0.0002	No data available		
		F	3	0.006	No data available		
		F	4	0.002	1	189	49
	Total	Total		0.009	1	189	49
	Sweden	F	1	0.036	No data available		
		F	2	0.000		-	
		F	3	0.166	No data available		
		F	4	0.149	No data available		
	Total	Total		0.351	0	0	0
Subdivision 24	Denmark	F	1	1.374	4	1,083	175
		F	2	0.001	1	141	47
		F	3	0.001	No data available		
		F	4	0.660	7	1,253	231
	Total	Total		2.036	12	2,477	453
	Finland	F	1	0.000		-	
		F	2	0.000		-	
		F	3	0.000		-	
		F	4	0.000		-	
	Total	Total		0.000	0	0	0
	Germany	F	1	4.3410	16	6,059	1,212
		F	2	0.1081	1	591	105
		F	3	0.0009	No data available		
		F	4	1.0668	3	1,430	369
	Total	Total		5.5168	20	8,080	1,686
	Poland	F	1	0.253	4	715	196
		F	2	0.314	8	1,420	421
		F	3	0.108	1	190	65
		F	4	0.454	No data available		
	Total	Total		1.130	13	2,325	682
	Sweden	F	1	0.000		-	
		F	2	0.000		-	
		F	3	0.001	No data available		
		F	4	0.728	9	1,089	1,087
	Total	Total		0.729	9	1,089	1,087
Total	Skagerrak	C	1-4	**11.666**	**13**	**1,825**	**1,824**
		D	1-4	**0.028**	**0**	**0**	**0**
	Kattegat	C	1-4	**2.892**	**11**	**1,995**	**1,722**
		D	1-4	**0.332**	**17**	**701**	**490**
	Subdivision 22	F	1-4	**0.059**	**5**	**1,829**	**328**
	Subdivision 23	F	1-4	**0.360**	**1**	**189**	**49**
	Subdivision 24	F	1-4	**9.412**	**54**	**13,971**	**3,908**
	Total	Total	1-4	**24.750**	**101**	**20,510**	**8,321**

Table 3.2.5. Western Baltic spring spawning herring. Samples of catch by quarter and area used to estimate catch in numbers and mean weight at age as W-ringers for 2019.

	Country	Quarter	Fleet	Sampling
Skagerrak	**Denmark**	**1**	**C**	Sweden Q1 27.3.a.20 fleet-C
		2	**C**	Sweden Q2 27.3.a.20 fleet-C
		3	**C**	Sweden Q3 27.3.a.20 fleet-C
		4	**C**	Sweden Q4 27.3.a.20 fleet-C
	Germany	**1**	**C**	No landings
		2	**C**	No landings
		3	**C**	Sweden Q3 27.3.a.20 fleet-C
		4	**C**	No landings
	Sweden	**1**	**C**	Sweden Q1 27.3.a.20 fleet-C
		2	**C**	Sweden Q2 27.3.a.20 fleet-C
		3	**C**	Sweden Q3 27.3.a.20 fleet-C
		4	**C**	Sweden Q4 27.3.a.20 fleet-C
	Denmark	**1**	**D**	No landings
		2	**D**	Denmark Q2 27.3.a.21 fleet-D
		3	**D**	Denmark Q3 27.3.a.21 fleet-D
		4	**D**	No landings
	Netherlands	**1**	**C**	No landings
		2	**C**	No landings
		3	**C**	No landings
		4	**C**	No landings
	Faroe Islands	**1**	**C**	No landings
		2	**C**	No landings
		3	**C**	No landings
		4	**C**	No landings
	Norway	**1**	**C**	Sweden Q1 27.3.a.20 fleet-C
		2	**C**	Sweden Q2 27.3.a.20 fleet-C
		3	**C**	Norway Q3 27.3.a.20 fleet-C
		4	**C**	Sweden Q4 27.3.a.20 fleet-C
Kattegat	**Denmark**	**1**	**C**	Sweden Q1 27.3.a.21 fleet-C
		2	**C**	Sweden Q2 27.3.a.21 fleet-C
		3	**C**	Denmark Q4 27.3.a.21 fleet-C
		4	**C**	Denmark Q4 27.3.a.21 fleet-C
	Sweden	**1**	**C**	Sweden Q1 27.3.a.21 fleet-C
		2	**C**	Sweden Q2 27.3.a.21 fleet-C
		3	**C**	Sweden Q4 27.3.a.21 fleet-C
		4	**C**	Sweden Q4 27.3.a.21 fleet-C
	Germany	**1**	**C**	No landings
		2	**C**	No landings
		3	**C**	No landings
		4	**C**	No landings
	Denmark	**1**	**D**	Denmark Q1 27.3.a.21 fleet-D
		2	**D**	Denmark Q2 27.3.a.21 fleet-D
		3	**D**	Denmark Q3 27.3.a.21 fleet-D
		4	**D**	Denmark Q4 27.3.a.21 fleet-D
Subdivision 22	**Denmark**	**1**	**F**	Germany Q1 27.3.c.22 fleet-F
		2	**F**	Germany Q2 27.3.c.22 fleet-F
		3	**F**	Denmark Q4 27.3.c.22 fleet-F
		4	**F**	Denmark Q4 27.3.c.22 fleet-F
	Sweden	**1**	**F**	No landings
		2	**F**	No landings
		3	**F**	No landings
		4	**F**	No landings
	Germany	**1**	**F**	Germany Q1 27.3.c.22 fleet-F
		2	**F**	Germany Q2 27.3.c.22 fleet-F
		3	**F**	National imputation as in WD Gröhsler
		4	**F**	National imputation as in WD Gröhsler

Fleet C = Human consumption, Fleet D= Industrial catch, Fleet F= All catch from Subdivisions 22–24.

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Table 3.2.5. (continued) Western Baltic spring spawning herring. Samples of catch by quarter and area used to estimate catch in numbers and mean weight at age as W-ringers for 2019.

	Country	Quarter	Fleet	Sampling
Subdivision 23	**Denmark**	**1**	**F**	Denmark Q4 27.3.b.23 fleet-F
		2	**F**	Denmark Q4 27.3.b.23 fleet-F
		3	**F**	Denmark Q4 27.3.b.23 fleet-F
		4	**F**	Denmark Q4 27.3.b.23 fleet-F
	Sweden	**1**	**F**	Denmark Q4 27.3.b.23 fleet-F
		2	**F**	No landings
		3	**F**	Denmark Q4 27.3.b.23 fleet-F
		4	**F**	Denmark Q4 27.3.b.23 fleet-F
Subdivision 24	**Denmark**	**1**	**F**	Denmark Q1 27.3.d.24 fleet-F
		2	**F**	Denmark Q2 27.3.d.24 fleet-F
		3	**F**	Poland Q3 27.3.d.24 fleet-F
		4	**F**	Denmark Q4 27.3.d.24 fleet-F
	Finland	**1**	**F**	No landings
		2	**F**	No landings
		3	**F**	No landings
		4	**F**	No landings
	Germany	**1**	**F**	Germany Q1 27.3.d.24 fleet-F
		2	**F**	Germany Q2 27.3.d.24 fleet-F
		3	**F**	National imputation as in WD Gröhsler
		4	**F**	Germany Q4 27.3.d.24 fleet-F
	Poland	**1**	**F**	Poland Q1 27.3.d.24 fleet-F
		2	**F**	Poland Q2 27.3.d.24 fleet-F
		3	**F**	Poland Q3 27.3.d.24 fleet-F
		4	**F**	Poland Q3 27.3.d.24 fleet-F
	Sweden	**1**	**F**	No landings
		2	**F**	No landings
		3	**F**	Poland Q3 27.3.d.24 fleet-F
		4	**F**	Sweden Q4 27.3.d.24 fleet-F

Fleet C = Human consumption, Fleet D= Industrial catch, Fleet F = All catch from Subdivisions 22–24.

Table 3.2.6 Western Baltic spring spawning herring. Proportion of North Sea autumn spawners (NSAS) and Western Baltic spring spawners (WBSS) given in % in Skagerrak and Kattegat by age as W-ringers and quarter.

Year: 2019

		Skagerrak			Kattegat		
Quarter	W-rings	NSAS	WBSS	n	NSAS	WBSS	n
1	1	94.00%	6.00%	50	96.79%	3.21%	122
	2	40.00%	60.00%	50	53.60%	46.40%	67
	3	10.00%	90.00%	30	51.63%	48.37%	54
	4	7.69%	92.31%	9	0.00%	100.00%	7
	5	7.69%	92.31%	3	0.00%	100.00%	2
	6	7.69%	92.31%	1	0.00%	100.00%	1
	7	7.69%	92.31%	0	0.00%	100.00%	0
	8+	7.69%	92.31%	0	0.00%	100.00%	0
		Skagerrak			Kattegat		
Quarter	W-rings	NSAS	WBSS	n	NSAS	WBSS	n
2	1	91.84%	8.16%	49	94.60%	5.40%	64
	2	10.53%	89.47%	19	19.61%	80.39%	51
	3	6.67%	93.33%	15	14.29%	85.71%	21
	4	5.56%	94.44%	2	0.00%	100.00%	13
	5	5.56%	94.44%	1	0.00%	100.00%	17
	6	5.56%	94.44%	0	0.00%	100.00%	11
	7	5.56%	94.44%	0	0.00%	100.00%	7
	8+	5.56%	94.44%	0	0.00%	100.00%	1
		Skagerrak			Kattegat		
Quarter	W-rings	NSAS	WBSS	n	NSAS	WBSS	n
3	0	100.00%	0.00%	0	100.00%	0.00%	496
	1	82.76%	17.24%	29	76.19%	23.81%	42
	2	2.38%	97.62%	42	7.84%	92.16%	0
	3	9.09%	90.91%	44	3.85%	96.15%	0
	4	0.00%	100.00%	29	2.13%	97.87%	0
	5	5.00%	95.00%	10	2.13%	97.87%	0
	6	5.00%	95.00%	9	2.13%	97.87%	0
	7	5.00%	95.00%	1	2.13%	97.87%	0
	8	5.00%	95.00%	0	2.13%	97.87%	0
		Skagerrak			Kattegat		
Quarter	W-rings	NSAS	WBSS	n	NSAS	WBSS	n
4	0	40.43%	59.57%	47	97.64%	2.36%	350
	1	38.00%	62.00%	50	72.35%	27.65%	314
	2	0.00%	100.00%	49	26.49%	73.51%	180
	3	0.00%	100.00%	5	20.12%	79.88%	99
	4	0.00%	100.00%	4	3.85%	96.15%	26
	5	0.00%	100.00%	1	8.00%	92.00%	21
	6	0.00%	100.00%	0	8.00%	92.00%	3
	7	0.00%	100.00%	0	8.00%	92.00%	0
	8	0.00%	100.00%	0	8.00%	92.00%	1

when *n for an age <12 data were borrowed according to the below table borrowing either a mean of age groups or ages borrowed individually

Q	ages	Skagerrak	ages	Kattegat
1	4-8+	mean(4-8+)	5-8+	mean(5-8+)
2	4-8+	mean(3-5+)	7-8+	mean(6-8+)
3	5-8+	mean(5-8+)	2-8+	Q3 IBTS Kat
4	5-8+	mean(3-5+)	5-8+	mean(5-8+)

Table 3.2.7 Western Baltic spring spawning herring. Catch in numbers (mill.), mean weight (g.) and SOP (t) by age as W-ringers, quarter and fleet. North Sea Autumn spawners

Division: Kattegat Year: 2019 Country: All

		Fleet C		Fleet D		Total	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
1	1	3.35	30	2.28	26	5.62	28
	2	7.29	53	0.31	39	7.60	53
	3	2.97	71	0.07	65	3.03	70
	4					0.00	
	5					0.00	
	6					0.00	
	7					0.00	
	8+					0.00	
	Total	13.61		2.65		16.25	
	SOP		697.5		75.1		772.6
		Fleet C		Fleet D		Total	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
2	1	4.21	33	0.66	23	4.88	32
	2	0.13	59			0.13	59
	3	0.03	81			0.03	81
	4					0.00	
	5					0.00	
	6					0.00	
	7					0.00	
	8+					0.00	
	Total	4.376		0.66		5.04	
	SOP		149.3		15.2		164.5
		Fleet C		Fleet D		Total	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
3	0	0.28	26	12.69	7	12.96	8
	1	1.48	48	2.38	29	3.86	36
	2	0.06	73			0.06	73
	3	0.01	87			0.01	87
	4	0.001	97			0.001	97
	5	0.001	89			0.001	89
	6	0.0001	93			0.0001	93
	7					0.00	
	8+	0.0001	159			0.0001	159
	Total	1.83		15.06		16.89	
	SOP		84.4		160.1		244.4
		Fleet C		Fleet D		Total	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
4	0	1.02	26	3.12	12	4.14	15
	1	6.53	50	0.11	24	6.64	49
	2	1.20	78	0.01	60	1.20	78
	3	0.37	95			0.37	95
	4	0.02	97			0.02	97
	5	0.03	78			0.03	78
	6	0.005	93			0.005	93
	7					0.00	
	8+	0.003	159			0.003	159
	Total	9.18		3.24		12.42	
	SOP		486.2		40.3		526.5
		Fleet C		Fleet D		Total	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
Total	0	1.30	26	15.80	8	17.10	10
	1	15.57	41	5.43	27	21.00	37
	2	8.68	57	0.31	39	8.99	56
	3	3.38	73	0.07	65	3.45	73
	4	0.02	97	0.00		0.02	97
	5	0.03	79	0.00		0.03	79
	6	0.005	93	0.00		0.005	93
	7	0.00		0.00		0.00	
	8+	0.003	159	0.00		0.003	159
	Total	28.99		21.61		50.60	
	SOP		1,417.4		291		1,708

Table 3.2.8 Western Baltic spring spawning herring. Catch in numbers (mill.), mean weight (g.) and SOP (t) by age as W-ringers, quarter and fleet. North Sea Autumn spawners

Division: Skagerrak Year: 2019 Country: All

		Fleet C		Fleet D		Total	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
1	1	32.79	27			32.79	27
	2	10.28	65			10.28	65
	3	0.33	85			0.33	85
	4	0.08	122			0.08	122
	5	0.03	87			0.03	87
	6	0.02	137			0.02	137
	7					0.00	
	8+					0.00	
	Total	43.53		0.00		43.53	
	SOP		1,596.2		0.0		1,596.2
		Fleet C		Fleet D		Total	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
2	1	4.58	33	0.16	23	4.74	33
	2	0.05	63			0.05	63
	3	0.02	76			0.02	76
	4	0.003	90			0.003	90
	5	0.001	49			0.001	49
	6					0.00	
	7					0.00	
	8+					0.00	
	Total	4.65		0.16		4.81	
	SOP		157.8		3.7		161.5
		Fleet C		Fleet D		Total	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
3	0	1.38	22	1.71	7	3.09	14
	1	31.91	57	0.35	29	32.26	56
	2	0.52	98			0.52	98
	3	0.76	135			0.76	135
	4					0.00	
	5	0.06	157			0.06	157
	6	0.05	180			0.05	180
	7	0.01	202			0.01	202
	8+					0.00	
	Total	34.68		2.06		36.74	
	SOP		2,014.1		22.4		2,036.5
		Fleet C		Fleet D		Total	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
4	0	3.53	20			3.53	20
	1	10.54	49			10.54	49
	2					0.00	
	3					0.00	
	4					0.00	
	5					0.00	
	6					0.00	
	7					0.00	
	8+					0.00	
	Total	14.07		0.00		14.07	
	SOP		584.2		0.0		584.2
		Fleet C		Fleet D		Total	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
Total	0	4.91	21	1.71	7	6.62	17
	1	79.81	42	0.51	27	80.32	42
	2	10.85	67	0.00		10.85	67
	3	1.11	119	0.00		1.11	119
	4	0.08	121	0.00		0.08	121
	5	0.10	131	0.00		0.10	131
	6	0.06	170	0.00		0.06	170
	7	0.01	202	0.00		0.01	202
	8+	0.00		0.00		0.00	
	Total	96.94		2.22		99.16	
	SOP		4,352		26		4,378

Table 3.2.9 Western Baltic spring spawning herring. Catch in numbers (mill.), mean weight (g.) and SOP (t) by age as W-ringers, quarter and fleet. Baltic Spring spawners

Division: Kattegat Year: 2019 Country: All

		Fleet C		Fleet D		Total	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
1	1	0.11	30	0.08	26	0.19	28
	2	6.31	53	0.27	39	6.58	53
	3	2.78	71	0.06	65	2.84	70
	4	0.48	91			0.48	91
	5	0.13	128			0.13	128
	6	0.11	39			0.11	39
	7					0.00	
	8+					0.00	
	Total	9.92		0.40		10.33	
	SOP		599.4		16.2		615.6
		Fleet C		Fleet D		Total	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
2	1	0.24	33	0.04	23	0.28	32
	2	0.52	59			0.52	59
	3	0.20	81			0.20	81
	4	0.26	103			0.26	103
	5	0.24	125			0.24	125
	6	0.17	138			0.17	138
	7	0.14	149			0.14	149
	8+	0.02	166			0.02	166
	Total	1.81		0.04		1.84	
	SOP		160.7		0.9		161.6
		Fleet C		Fleet D		Total	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
3	0					0.00	
	1	0.46	48	0.74	29	1.20	36
	2	0.72	73			0.72	73
	3	0.29	87			0.29	87
	4	0.03	97			0.03	97
	5	0.06	89			0.06	89
	6	0.004	93			0.00	93
	7					0.00	
	8+	0.00	159			0.00	159
	Total	1.56		0.74		2.30	
	SOP		108.8		21.3		130.1
		Fleet C		Fleet D		Total	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
4	0	0.02	26	0.08	12	0.10	15
	1	2.50	50	0.04	24	2.54	49
	2	3.33	78	0.01	60	3.34	78
	3	1.48	95			1.48	95
	4	0.45	97			0.45	97
	5	0.35	78			0.35	78
	6	0.05	93			0.05	93
	7					0.00	
	8+	0.03	159			0.03	159
	Total	8.21		0.13		8.34	
	SOP		606.0		2.8		608.8
		Fleet C		Fleet D		Total	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
Total	0	0.02	26	0.08	12	0.10	15
	1	3.31	48	0.90	28	4.21	44
	2	10.88	62	0.28	40	11.16	62
	3	4.75	80	0.06	65	4.81	79
	4	1.23	96	0.00		1.23	96
	5	0.78	102	0.00		0.78	102
	6	0.33	100	0.00		0.33	100
	7	0.14	149	0.00		0.14	149
	8+	0.05	162	0.00		0.05	162
	Total	21.49745		1.32		22.81	
	SOP		1,475		41		1,516

Table 3.2.10 Western Baltic spring spawning herring. Catch in numbers (mill.), mean weight (g.) and SOP (t) by age as W-ringers, quarter and fleet. Baltic Spring spawners

Division: Skagerrak Year: 2019 Country: All

		Fleet C		Fleet D		Total	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
1	1	2.09	27			2.09	27
	2	15.43	65			15.43	65
	3	2.98	85			2.98	85
	4	0.95	122			0.95	122
	5	0.39	87			0.39	87
	6	0.18	137			0.18	137
	7					0.00	
	8+					0.00	
	Total	22.02		0.00		22.02	
	SOP		1,490.3		0		1,490.3
		Fleet C		Fleet D		Total	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
2	1	0.41	33	0.01	23	0.42	33
	2	0.40	63			0.40	63
	3	0.32	76			0.32	76
	4	0.04	90			0.04	90
	5	0.02	49			0.02	49
	6					0.00	
	7					0.00	
	8+					0.00	
	Total	1.19		0.01		1.21	
	SOP		68.1		0.3		68.5
		Fleet C		Fleet D		Total	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
3	0					0.00	
	1	6.65	57	0.07	29	6.72	56
	2	21.28	98			21.28	98
	3	7.60	135			7.60	135
	4	2.87	143			2.87	143
	5	1.16	157			1.16	157
	6	0.90	180			0.90	180
	7	0.18	202			0.18	202
	8+					0.00	
	Total	40.64		0.07		40.72	
	SOP		4,283.4		2.1		4,285.5
		Fleet C		Fleet D		Total	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
4	0	5.21	20			5.21	20
	1	17.19	49			17.19	49
	2	4.73	87			4.73	87
	3	0.47	99			0.47	99
	4	0.39	130			0.39	130
	5	0.13	162			0.13	162
	6					0.00	
	7					0.00	
	8+					0.00	
	Total	28.12		0.00		28.12	
	SOP		1,471.8		0.0		1,471.8
		Fleet C		Fleet D		Total	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
Total	0	5.21	20	0.00		5.21	20
	1	26.34	49	0.09	28	26.43	49
	2	41.84	84	0.00		41.84	84
	3	11.38	119	0.00		11.38	119
	4	4.25	137	0.00		4.25	137
	5	1.71	140	0.00		1.71	140
	6	1.08	173	0.00		1.08	173
	7	0.18	202	0.00		0.18	202
	8+	0.00		0.00		0.00	
	Total	91.98		0.09		92.07	
	SOP		7,314		2		7,316

Table 3.2.11 Western Baltic spring spawning herring. Catch in numbers (mill.), mean weight (g.) and SOP (t) by age as W-ringers, quarter and fleet. North Sea Autumn spawners

Division: 3.a Year: 2019 Country: All

		Fleet C		Fleet D		Total	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
1	1	36.14	27	2.28	26	38.41	27
	2	17.58	60	0.31	39	17.88	60
	3	3.30	72	0.07	65	3.36	72
	4	0.08	122			0.08	122
	5	0.03	87			0.03	87
	6	0.02	137			0.02	137
	7					0.00	
	8+					0.00	
	Total	57.14		2.65		59.79	
	SOP		2,293.7		75.1		2,368.8
		Fleet C		Fleet D		Total	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
2	1	8.79	33	0.82	23	9.61	32
	2	0.17	60			0.17	60
	3	0.06	79			0.06	79
	4	0.003	90			0.00	90
	5	0.001	49			0.001	49
	6					0.00	
	7					0.00	
	8+					0.00	
	Total	9.03		0.82		9.85	
	SOP		307.2		18.9		326.1
		Fleet C		Fleet D		Total	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
3	0	1.65	23	14.39	7	16.05	9
	1	33.39	56	2.72	29	36.11	54
	2	0.58	95			0.58	95
	3	0.77	135			0.77	135
	4	0.001	97			0.00	97
	5	0.06	155			0.06	155
	6	0.05	180			0.05	180
	7	0.01	202			0.01	202
	8+	0.0001	159			0.00	159
	Total	36.51		17.12		53.63	
	SOP		2,098.5		182.4		2,280.9
		Fleet C		Fleet D		Total	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
4	0	4.56	21	3.12	12	7.68	18
	1	17.07	49	0.11	24	17.18	49
	2	1.20	78	0.01	60	1.20	78
	3	0.37	95			0.37	95
	4	0.02	97			0.02	97
	5	0.03	78			0.03	78
	6	0.005	93			0.00	93
	7					0.00	
	8+	0.003	159			0.003	159
	Total	23.25		3.24		26.49	
	SOP		1,070.4		40.3		1,110.7
		Fleet C		Fleet D		Total	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
Total	0	6.21	22	17.51	8	23.72	12
	1	95.38	42	5.93	27	101.32	41
	2	19.53	62	0.31	39	19.84	62
	3	4.50	85	0.07	65	4.56	84
	4	0.10	116	0.00		0.10	116
	5	0.13	118	0.00		0.13	118
	6	0.07	165	0.00		0.07	165
	7	0.01	202	0.00		0.01	202
	8+	0.003	159	0.00		0.003	159
	Total	125.93		23.83		149.75	
	SOP		5,770		317		6,087

Table 3.2.12 Western Baltic spring spawning herring. Catch in numbers (mill.), mean weight (g.) and SOP (t) by age as W-ringers, quarter and fleet. Baltic Spring spawners

Division: 3.a Year: 2019 Country: All

		Fleet C		Fleet D		Total	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
1	1	2.20	27	0.08	26	2.28	27
	2	21.74	62	0.27	39	22.00	61
	3	5.76	78	0.06	65	5.82	78
	4	1.43	111			1.43	111
	5	0.52	97			0.52	97
	6	0.29	101			0.29	101
	7					0.00	
	8+					0.00	
	Total	31.95		0.40		32.35	
	SOP		2,089.8		16.2		2,105.9
		Fleet C		Fleet D		Total	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
2	1	0.65	33	0.05	23	0.70	32
	2	0.92	61			0.92	61
	3	0.52	78			0.52	78
	4	0.31	101			0.31	101
	5	0.26	118			0.26	118
	6	0.17	138			0.17	138
	7	0.14	149			0.14	149
	8+	0.02	166			0.02	166
	Total	3.00		0.05		3.05	
	SOP		228.9		1.2		230.1
		Fleet C		Fleet D		Total	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
3	0					0.00	
	1	7.11	56	0.82	29	7.92	53
	2	22.00	97			22.00	97
	3	7.89	134			7.89	134
	4	2.90	143			2.90	143
	5	1.22	153			1.22	153
	6	0.90	180			0.90	180
	7	0.18	202			0.18	202
	8+	0.002	159			0.002	159
	Total	42.20		0.82		43.02	
	SOP		4,392		23.3		4,415.5
		Fleet C		Fleet D		Total	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
4	0	5.23	20	0.08	12	5.31	20
	1	19.69	49	0.04	24	19.73	49
	2	8.06	83	0.01	60	8.08	83
	3	1.95	96			1.95	96
	4	0.83	112			0.83	112
	5	0.48	101			0.48	101
	6	0.05	93			0.05	93
	7					0.00	
	8+	0.03	159			0.03	159
	Total	36.33		0.13		36.46	
	SOP		2,077.8		2.8		2,080.6
		Fleet C		**Fleet D**		Total	
Quarter	W-rings	**Numbers**	**Mean W.**	**Numbers**	**Mean W.**	Numbers	Mean W.
Total	0	**5.23**	**20**	**0.08**	**12**	5.31	20
	1	**29.65**	**49**	**0.99**	**28**	30.63	48
	2	**52.72**	**80**	**0.28**	**40**	53.00	80
	3	**16.13**	**107**	**0.06**	**65**	16.19	107
	4	**5.47**	**128**	**0.00**		5.47	128
	5	**2.49**	**128**	**0.00**		2.49	128
	6	**1.41**	**156**	**0.00**		1.41	156
	7	**0.33**	**178**	**0.00**		0.33	178
	8+	**0.05**	**162**	**0.00**		0.05	162
	Total	113.48		1.40		114.88	
	SOP		**8,789**		**43**		8,832

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Table 3.2.13 Western Baltic spring spawning herring. Total catch in numbers (mill) and mean weight (g), SOP (tonnes) of *Western Baltic Spring spawners* in Division 3.a and the North Sea in the years 1993–2019.

Year/	W-rings	0	1	2	3	4	5	6	7	8+	Total
1993	Numbers	161.25	371.50	315.82	219.05	94.08	59.43	40.97	21.71	8.22	1,292.03
	Mean W.	15.1	25.9	81.4	127.5	150.1	171.1	195.9	209.1	239.0	
	SOP	2,435	9,612	25,696	27,936	14,120	10,167	8,027	4,541	1,966	104,498
1994	Numbers	60.62	153.11	261.14	221.64	130.97	77.30	44.40	14.39	8.62	972.19
	Mean W.	20.2	42.6	94.8	122.7	150.3	168.7	194.7	209.9	220.2	
	SOP	1,225	6,524	24,767	27,206	19,686	13,043	8,642	3,022	1,898	106,013
1995	Numbers	50.31	302.51	204.19	97.93	90.86	30.55	21.28	12.01	7.24	816.86
	Mean W.	17.9	41.5	97.8	138.0	163.1	198.5	207.0	228.8	234.3	
	SOP	902	12,551	19,970	13,517	14,823	6,065	4,404	2,747	1,696	76,674
1996	Numbers	166.23	228.05	317.74	75.60	40.41	30.63	12.58	6.73	5.63	883.60
	Mean W.	10.5	27.6	90.1	134.9	164.9	186.6	204.1	208.5	220.2	
	SOP	1,748	6,296	28,618	10,197	6,665	5,714	2,568	1,402	1,241	64,449
1997	Numbers	25.97	73.43	158.71	180.06	30.15	14.15	4.77	1.75	2.31	491.31
	Mean W.	19.2	49.7	76.7	127.2	154.4	175.8	184.4	192.0	208.0	
	SOP	498	3,648	12,176	22,913	4,656	2,489	879	337	480	48,075
1998	Numbers	36.26	175.14	315.15	94.53	54.72	11.19	8.72	2.19	2.09	699.98
	Mean W.	27.8	51.3	71.5	108.8	142.6	171.7	194.4	184.2	230.0	
	SOP	1,009	8,980	22,542	10,287	7,804	1,922	1,695	403	481	55,121
1999	Numbers	41.34	190.29	155.67	122.26	43.16	22.21	4.42	3.02	2.40	584.77
	Mean W.	11.5	51.0	83.6	114.9	121.2	145.2	169.6	123.8	152.3	
	SOP	477	9,698	13,012	14,048	5,232	3,225	749	373	366	47,179
2000	Numbers	114.83	318.22	302.10	99.88	50.85	18.76	8.21	1.35	1.40	915.60
	Mean W.	22.6	31.9	67.4	107.7	140.2	170.0	157.0	185.0	210.1	
	SOP	2,601	10,145	20,357	10,756	7,131	3,189	1,288	249	294	56,010
2001	Numbers	121.68	36.63	208.10	111.08	32.06	19.67	9.84	4.17	2.42	545.65
	Mean W.	9.0	51.2	76.2	108.9	145.3	171.4	188.2	187.2	203.3	
	SOP	1,096	1,875	15,863	12,093	4,657	3,371	1,852	780	492	42,079
2002	Numbers	69.63	577.69	168.26	134.60	53.09	12.05	7.48	2.43	2.02	1,027.26
	Mean W.	10.2	20.4	78.2	117.7	143.8	169.8	191.9	198.2	215.5	
	SOP	709	11,795	13,162	15,848	7,632	2,046	1,435	481	435	53,544
2003	Numbers	52.11	63.02	182.53	65.45	64.37	21.47	6.26	4.35	1.81	461.38
	Mean W.	13.0	37.4	76.5	113.3	132.7	142.2	153.5	169.9	162.2	
	SOP	678	2,355	13,957	7,416	8,540	3,053	961	740	294	37,994
2004	Numbers	25.67	209.34	96.02	93.98	18.24	16.84	4.51	1.51	0.59	466.71
	Mean W.	27.1	43.2	81.9	117.1	145.4	157.4	170.7	184.4	187.1	
	SOP	695	9,047	7,869	11,005	2,652	2,651	769	279	111	35,078
2005	Numbers	95.3	96.9	203.3	75.4	46.9	9.3	11.5	3.5	1.4	543.51
	Mean W.	14.1	54.9	85.6	121.6	148.3	162.7	176.3	178.3	200.6	
	SOP	1,341	5,319	17,415	9,163	6,961	1,519	2,028	618	282	44,645
2006 c	Numbers	7.3	104.1	115.6	114.2	48.9	55.7	11.1	10.3	5.2	472.49
	Mean W.	16.6	36.9	82.9	113.0	142.5	175.2	198.2	209.5	220.0	
	SOP	121	3,847	9,584	12,907	6,972	9,765	2,199	2,159	1,134	48,688
2007	Numbers	1.6	103.9	90.9	36.9	30.8	12.8	9.4	6.2	2.7	295.22
	Mean W.	25.2	65.6	85.0	115.7	138.4	159.2	190.8	178.6	211.9	
	SOP	41	6,816	7,723	4,269	4,265	2,035	1,802	1,114	567	28,632
2008	Numbers	4.9	101.8	71.1	38.9	13.5	15.1	7.7	4.5	1.3	258.80
	Mean W.	19.2	71.5	91.1	114.5	142.2	171.2	181.4	200.0	196.4	98.02
	SOP	94	7,281	6,472	4,456	1,917	2,590	1,402	900	256	25,368
2009	Numbers	14.8	149.6	132.3	45.9	24.4	10.9	7.8	7.7	5.3	398.63
	Mean W.	13.4	52.0	90.3	118.6	167.5	181.4	213.9	228.9	259.5	90.89
	SOP	199	7,783	11,946	5,436	4,094	1,974	1,669	1,757	1,371	36,230
2010	Numbers	9.1	48.6	106.1	45.2	20.8	8.6	5.9	7.2	5.9	257.38
	Mean W.	8.2	59.3	84.7	129.8	165.9	196.2	221.8	234.3	257.2	106.71
	SOP	75	2,878	8,991	5,870	3,445	1,686	1,311	1,696	1,513	27,465
2011	Numbers	6.2	83.1	29.9	21.0	13.4	6.0	3.0	1.0	1.1	164.56
	Mean W.	8.4	33.7	89.0	120.4	140.2	170.2	185.9	216.3	211.8	72.57
	SOP	52	2,797	2,660	2,522	1,878	1,020	554	222	237	11,941
2012	Numbers	1.5	30.5	94.3	20.7	9.5	7.1	4.2	2.2	8.6	178.68
	Mean W.	9.3	47.0	76.1	134.2	165.1	182.0	204.1	222.0	225.6	98.24
	SOP	14	1,434	7,180	2,780	1,570	1,290	858	495	1,931	17,553
2013	Numbers		12.0	51.7	71.4	11.3	4.4	1.4	0.5	1.0	153.62
	Mean W.		59.5	94.2	131.8	162.6	195.0	207.8	247.9	238.1	119.29
	SOP		716	4,872	9,409	1,830	848	290	118	242	18,325
2014	Numbers	25.3	31.5	22.4	24.2	44.6	7.6	4.6	2.3	2.9	165.42
	Mean W.	9.3	52.2	98.5	137.4	178.2	199.2	211.7	225.1	227.0	114.98
	SOP	236	1,647	2,203	3,332	7,942	1,513	964	524	659	19,020
2015	Numbers	3.3	57.8	59.9	21.0	14.1	14.6	4.9	2.7	3.9	182.10
	Mean W.	16.0	31.8	67.9	115.2	152.4	172.8	193.4	198.7	212.9	84.28
	SOP	53	1,838	4,067	2,418	2,150	2,521	939	532	830	15,348
2016	Numbers	23.9	27.2	161.7	43.0	13.3	12.1	13.2	3.6	6.6	304.65
	Mean W.	7.1	40.1	63.8	126.1	160.7	175.1	200.8	212.8	235.0	86.08
	SOP	170	1,091	10,312	5,426	2,142	2,119	2,661	765	1,539	26,224
2017	Numbers	1.4	48.4	42.2	42.8	34.2	10.2	10.9	7.4	2.9	200.41
	Mean W.	30.5	44.1	61.3	113.2	141.8	162.8	171.2	182.9	169.9	98.93
	SOP	44	2,137	2,585	4,848	4,844	1,668	1,863	1,345	493	19,827
2018	Numbers	0.3	20.5	179.1	17.6	15.2	22.3	6.8	3.9	3.1	268.88
	Mean W.	10.3	55.7	55.3	109.3	154.4	179.7	195.0	194.9	206.4	82.07
	SOP	3	1,140	9,902	1,927	2,346	4,007	1,334	761	647	22,066
2019	Numbers	5.3	38.2	59.2	21.0	8.2	9.7	11.1	3.0	2.6	158.51
	Mean W.	20.0	52.8	85.0	118.9	138.4	166.1	183.3	193.9	211.4	98.35
	SOP	106	2,019	5,036	2,502	1,138	1,619	2,035	577	557	15,589

Data for 1995 to 2001 was revised in 2003.

[c] values have been corrected in 2007.

Table 3.2.14 Western Baltic spring spawning herring. Catch in numbers (mill.), mean weight (g.) and SOP (t) by age as W-ringers, quarter and fleet. Western Baltic Spring spawners (values from the North Sea, see tables 2.2.1–2.2.5)

Division: 4 + 3.a + 22–24 Year: 2019 Country: All

		Division IV		Division IIIa		Subdivision 22-24		Total	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
1	0							0.00	
	1	0.0012	71.00	2.28	27.03	5.03	24.96	7.32	25.61
	2	0.065	134.00	22.00	61.48	13.63	48.81	35.70	56.77
	3	0.185	149.00	5.82	77.71	8.84	75.21	14.84	77.11
	4	0.092	164.00	1.43	111.23	7.76	119.84	9.28	118.96
	5	0.897	180.00	0.52	97.05	5.01	147.73	6.43	148.10
	6	0.499	188.00	0.29	101.22	11.31	171.44	12.10	170.46
	7					2.94	177.84	2.94	177.84
	8+	0.278	209.60			2.43	188.82	2.70	190.96
	Total	2.018		32.35		56.95		91.31	
	SOP		365.1		2,105.9		6,045.7		8,516.8
		Division IV		**Division IIIa**		**Subdivision 22-24**		**Total**	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
2	1	5.085	72.25	0.70	32.49	0.00	41.57	5.79	67.43
	2	4.618	130.87	0.92	60.67	0.25	50.17	5.79	116.21
	3	3.495	158.56	0.52	77.97	0.29	67.70	4.31	142.71
	4	1.982	159.62	0.31	100.75	0.22	96.14	2.51	146.87
	5	4.757	179.14	0.26	117.93	0.78	145.60	5.80	171.87
	6	6.541	185.58	0.17	137.90	1.11	157.53	7.82	180.54
	7	1.982	195.86	0.14	148.50	0.38	162.95	2.50	188.17
	8+	0.991	194.03	0.02	166.30	0.17	159.62	1.18	188.65
	Total	29.452		3.05		3.19		35.70	
	SOP		4,488.9		230.1		430.0		5,148.9
		Division IV		**Division IIIa**		**Subdivision 22-24**		**Total**	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
3	0					0.00	19.25	0.00	19.25
	1	2.51	72.25	7.92	53.35	0.00	54.51	10.44	57.90
	2	1.56	130.87	22.00	97.20	0.32	54.07	23.88	98.81
	3	1.18	158.56	7.89	133.55	0.38	104.64	9.44	135.51
	4	0.67	159.62	2.90	142.78	0.29	107.69	3.86	143.07
	5	1.60	179.14	1.22	153.49	0.61	143.45	3.43	163.71
	6	2.20	185.58	0.90	179.92	0.37	149.69	3.48	180.26
	7	0.67	195.86	0.18	202.20	0.46	83.57	1.31	157.22
	8+	0.33	194.03	0.00	158.50	0.15	96.24	0.48	164.26
	Total	10.72		43.02		2.58		56.32	
	SOP		1,570.4		4,415.5		283.4		6,269.4
		Division IV		**Division IIIa**		**Subdivision 22-24**		**Total**	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
4	0			5.31	20.01	0.27	16.69	5.58	19.85
	1			19.73	48.80	1.84	46.35	21.57	48.59
	2			8.08	83.24	6.46	74.50	14.54	79.35
	3			1.95	95.86	6.07	95.57	8.02	95.64
	4	0.008	210.80	0.83	112.46	5.04	131.54	5.88	128.94
	5			0.48	101.15	3.93	127.38	4.41	124.51
	6	0.443	221.20	0.05	93.40	3.08	149.08	3.57	157.21
	7					2.26	93.86	2.26	93.86
	8+	0.980	238.11	0.03	158.50	0.78	112.25	1.79	182.02
	Total	1.430		36.46		29.72		67.61	
	SOP		332.8		2,080.6		3,071.8		5,485.3
		Division IV		**Division IIIa**		**Subdivision 22-24**		**Total**	
Quarter	W-rings	**Numbers**	**Mean W.**	Numbers	Mean W.	**Numbers**	**Mean W.**	Numbers	Mean W.
Total	0	**0.00**		5.31	20.01	**0.27**	**16.69**	5.577	19.85
	1	**7.60**	**72.25**	30.63	47.98	**6.88**	**30.70**	45.114	49.44
	2	**6.24**	**130.90**	53.00	79.61	**20.67**	**56.94**	79.906	77.75
	3	**4.86**	**158.19**	16.19	107.12	**15.56**	**83.72**	36.610	103.95
	4	**2.75**	**159.91**	5.47	127.54	**13.30**	**123.62**	21.524	129.26
	5	**7.26**	**179.25**	2.49	127.74	**10.33**	**139.58**	20.077	152.45
	6	**9.69**	**187.33**	1.41	155.64	**15.87**	**165.62**	26.969	172.89
	7	**2.65**	**195.86**	0.33	178.39	**6.03**	**138.32**	9.010	156.69
	8+	**2.58**	**212.43**	0.05	161.55	**3.52**	**166.67**	6.154	185.83
	Total	43.62		114.88		92.44		250.94	
	SOP		**6,757**		8,832		**9,831**		25,420

single fleet assessment input

multifleet assessment input

Table 3.2.15 Western Baltic spring spawning herring. Total catch in numbers (mill) of *Western Baltic Spring Spawners* in Division 3.a + North Sea + Subdivisions 22–24 in the years 1993–2019.

Year	W-rings / Area	0	1	2	3	4	5	6	7	8+	Total
1993	**Div. IV+Div. IIIa**	161.3	371.5	315.8	219.0	94.1	59.4	41.0	21.7	8.2	1130.8
	Subdiv. 22-24	44.9	159.2	180.1	196.1	166.9	151.1	61.8	42.2	16.3	973.7
1994	**Div. IV+Div. IIIa**	60.6	153.1	261.1	221.6	131.0	77.3	44.4	14.4	8.6	911.6
	Subdiv. 22-24	202.6	96.3	103.8	161.0	136.1	90.8	74.0	35.1	24.5	721.6
1995	**Div. IV+Div. IIIa**	50.3	302.5	204.2	97.9	90.9	30.6	21.3	12.0	7.2	816.9
	Subdiv. 22-24	491.0	1,358.2	233.9	128.9	104.0	53.6	38.8	20.9	13.2	1951.5
1996	**Div. IV+Div. IIIa**	166.2	228.1	317.7	75.6	40.4	30.6	12.6	6.7	5.6	883.6
	Subdiv. 22-24	4.9	410.8	82.8	124.1	103.7	99.5	52.7	24.0	19.5	917.1
1997	**Div. IV+Div. IIIa**	26.0	73.4	158.7	180.1	30.2	14.2	4.8	1.8	2.3	491.3
	Subdiv. 22-24	350.8	595.2	130.6	96.9	45.1	29.0	35.1	19.5	21.8	973.2
1998	**Div. IV+Div. IIIa**	36.3	175.1	315.1	94.5	54.7	11.2	8.7	2.2	2.1	700.0
	Subdiv. 22-24	513.5	447.9	115.8	88.3	92.0	34.1	15.0	13.2	12.0	818.4
1999	**Div. IV+Div. IIIa**	41.3	190.3	155.7	122.3	43.2	22.2	4.4	3.0	2.4	584.8
	Subdiv. 22-24	528.3	425.8	178.7	123.9	47.1	33.7	11.1	6.5	3.7	830.5
2000	**Div. IV+Div. IIIa**	114.83	318.22	302.10	99.88	50.85	18.76	8.21	1.35	1.40	915.6
	Subdiv. 22-24	37.7	616.3	194.3	86.7	77.8	53.0	30.1	12.4	9.3	1079.9
2001	**Div. IV+Div. IIIa**	121.7	36.6	208.1	111.1	32.1	19.7	9.8	4.2	2.4	545.6
	Subdiv. 22-24	634.6	486.5	280.7	146.8	76.0	48.7	29.3	14.1	4.3	1721.0
2002	**Div. IV+Div. IIIa**	69.6	577.7	168.3	134.6	53.1	12.0	7.5	2.4	2.0	1027.3
	Subdiv. 22-24	80.6	81.4	113.6	186.7	119.2	45.1	31.1	11.4	6.3	675.4
2003	**Div. IV+Div. IIIa**	52.1	63.0	182.5	64.0	62.2	20.3	5.9	3.8	1.6	455.5
	Subdiv. 22-24	1.4	63.9	82.3	95.8	125.1	82.2	22.9	13.1	7.0	493.6
2004	**Div. IV+Div. IIIa**	25.7	209.3	96.0	94.0	18.2	16.8	4.5	1.5	0.6	466.7
	Subdiv. 22-24	217.9	248.4	101.8	70.8	75.0	74.4	44.5	13.4	10.4	856.5
2005	**Div. IV+Div. IIIa**	95.3	96.9	203.3	75.4	46.9	9.3	11.5	3.5	1.4	543.5
	Subdiv. 22-24	11.6	207.6	115.9	102.5	83.5	51.3	54.2	27.8	11.2	665.5
2006 c	**Div. IV+Div. IIIa**	7.3	104.1	115.6	114.2	48.9	55.7	11.1	10.3	5.2	472.5
	Subdiv. 22-24	0.6	44.8	72.1	119.0	101.7	43.0	31.4	22.1	12.2	446.8
2007	**Div. IV+Div. IIIa**	1.6	103.9	90.9	36.9	30.8	12.8	9.4	6.2	2.7	295.2
	Subdiv. 22-24	19.0	668.5	158.3	169.7	112.8	65.1	24.6	5.9	1.8	1206.8
2008	**Div. IV+Div. IIIa**	4.9	101.8	71.1	38.9	13.5	15.1	7.7	4.5	1.3	258.8
	Subdiv. 22-24	19.0	668.5	158.3	169.7	112.8	65.1	24.6	5.9	1.8	1206.8
2009	**Div. IV+Div. IIIa**	14.8	149.6	132.3	45.9	24.4	10.9	7.8	7.7	5.3	398.6
	Subdiv. 22-24	5.9	31.5	110.7	55.5	45.5	37.2	31.9	13.2	7.2	338.7
2010	**Div. IV+Div. IIIa**	9.1	48.6	106.1	45.2	20.8	8.6	5.9	7.2	5.9	257.4
	Subdiv. 22-24	3.3	26.5	31.3	39.3	28.5	22.4	13.9	8.0	7.5	180.6
2011	**Div. IV+Div. IIIa**	6.2	83.1	29.9	21.0	13.4	6.0	3.0	1.0	1.1	164.6
	Subdiv. 22-24	5.6	15.5	16.4	17.8	35.9	21.6	19.6	11.2	8.2	152.0
2012	**Div. IV+Div. IIIa**	1.5	30.5	94.3	20.7	9.5	7.1	4.2	2.2	8.6	178.7
	Subdiv. 22-24	0.5	46.3	36.5	43.8	37.8	28.4	14.0	9.0	8.4	224.6
2013	**Div. IV+Div. IIIa**		12.0	51.7	71.4	11.3	4.4	1.4	0.5	1.0	153.6
	Subdiv. 22-24	1.0	60.6	37.1	43.3	55.9	28.7	25.3	11.5	11.0	274.5
2014	**Div. IV+Div. IIIa**	25.3	31.5	22.4	24.2	44.6	7.6	4.6	2.3	2.9	165.4
	Subdiv. 22-24	5.8	35.3	37.7	42.1	37.5	19.0	11.2	6.5	6.2	201.4
2015	**Div. IV+Div. IIIa**	3.3	57.8	59.9	21.0	14.1	14.6	4.9	2.7	3.9	182.1
	Subdiv. 22-24	26.7	46.2	72.8	38.5	48.4	29.8	14.9	7.9	9.1	294.3
2016	**Div. IV+Div. IIIa**	23.9	27.2	161.7	43.0	13.3	12.1	13.2	3.6	6.6	304.6
	Subdiv. 22-24	20.0	22.3	37.2	93.9	45.7	30.5	17.4	10.5	8.3	285.8
2017	**Div. IV+Div. IIIa**	1.4	48.4	42.2	42.8	34.2	10.2	10.9	7.4	2.9	200.4
	Subdiv. 22-24	0.1	9.4	32.8	38.5	78.3	38.5	26.9	13.5	10.2	248.3
2018	**Div. IV+Div. IIIa**	0.3	20.5	179.1	17.6	15.2	22.3	6.8	3.9	3.1	268.9
	Subdiv. 22-24	0.4	48.4	18.5	34.6	23.1	51.3	16.3	8.8	4.5	205.8
2019	**Div. IV+Div. IIIa**	5.3	38.2	59.2	21.0	8.2	9.7	11.1	3.0	2.6	158.5
	Subdiv. 22-24	0.3	6.9	20.7	15.6	13.3	10.3	15.9	6.0	3.5	92.4

Data for 1995–2001 for the North Sea and Division 3.a was revised in 2003.

[c] values have been corrected in 2007.

Table 3.2.16 Western Baltic spring spawning herring. Mean weight (g) and SOP (t) of *Western Baltic Spring Spawners* in Division IV/North Sea + 3.a and Subdivisions 22–24 in the years 1993–2019.

Year	W-rings / Area	0	1	2	3	4	5	6	7	8+	SOP
1993	Div. IV+Div. IIIa	15.1	25.9	81.4	127.5	150.1	171.1	195.9	209.1	239.0	104,498
	Subdiv. 22-24	16.2	24.5	44.5	73.6	94.1	122.4	149.4	168.5	178.7	80,512
1994	Div. IV+Div. IIIa	20.2	42.6	94.8	122.7	150.3	168.7	194.7	209.9	220.2	106,013
	Subdiv. 22-24	12.9	28.2	54.2	76.4	95.0	117.7	133.6	154.3	173.9	66,425
1995	Div. IV+Div. IIIa	17.9	41.5	97.8	138.0	163.1	198.5	207.0	228.8	234.3	76,674
	Subdiv. 22-24	9.3	16.3	42.8	68.3	88.9	125.4	150.4	193.3	207.4	74,157
1996	Div. IV+Div. IIIa	10.5	27.6	90.1	134.9	164.9	186.6	204.1	208.5	220.2	64,449
	Subdiv. 22-24	12.1	22.9	45.8	74.0	92.1	116.3	120.8	139.0	182.5	56,817
1997	Div. IV+Div. IIIa	19.2	49.7	76.7	127.2	154.4	175.8	184.4	192.0	208.0	48,075
	Subdiv. 22-24	30.4	24.7	58.4	101.0	120.7	155.2	181.3	197.1	208.8	67,513
1998	Div. IV+Div. IIIa	27.8	51.3	71.5	108.8	142.6	171.7	194.4	184.2	230.0	55,121
	Subdiv. 22-24	13.3	26.3	52.2	78.6	103.0	125.2	150.0	162.1	179.5	51,911
1999	Div. IV+Div. IIIa	11.5	51.0	83.6	114.9	121.2	145.2	169.6	123.8	152.3	47,179
	Subdiv. 22-24	11.1	26.9	50.4	81.6	112.0	148.4	151.4	167.8	161.0	50,060
2000	Div. IV+Div. IIIa	22.6	31.9	67.4	107.7	140.2	170.0	157.0	185.0	210.1	56,010
	Subdiv. 22-24	16.5	22.2	42.8	80.4	123.5	133.2	143.4	155.4	151.4	53,904
2001	Div. IV+Div. IIIa	9.0	51.2	76.2	108.9	145.3	171.4	188.2	187.2	203.3	42,079
	Subdiv. 22-24	12.9	22.3	46.8	69.0	93.5	150.8	145.1	146.3	153.1	63,724
2002	Div. IV+Div. IIIa	10.2	20.4	78.2	117.7	143.8	169.8	191.9	198.2	215.5	53,544
	Subdiv. 22-24	10.8	27.3	57.8	81.7	108.8	132.1	186.6	177.8	157.7	52,647
2003	Div. IV+Div. IIIa	13.0	37.4	76.5	112.7	132.1	140.8	151.9	167.4	158.2	37,075
	Subdiv. 22-24	22.4	25.8	46.4	75.3	95.2	117.2	125.9	157.1	162.6	40,315
2004	Div. IV+Div. IIIa	27.1	43.2	81.9	117.1	145.4	157.4	170.7	184.4	187.1	35,078
	Subdiv. 22-24	3.7	14.3	47.4	77.7	96.4	125.5	150.4	165.8	151.0	41,736
2005	Div. IV+Div. IIIa	14.1	54.9	85.6	121.6	148.3	162.7	176.3	178.3	200.6	50,765
	Subdiv. 22-24	13.6	14.2	48.3	73.3	89.3	115.5	143.6	159.9	170.2	37,013
2006 c	Div. IV+Div. IIIa	16.6	36.9	82.9	113.0	142.5	175.2	198.2	209.5	220.0	25,965
	Subdiv. 22-24	21.2	34.0	56.7	84.0	102.2	125.3	143.9	175.8	170.0	70,911
2007	Div. IV+Div. IIIa	25.2	65.6	85.0	115.7	138.4	159.2	190.8	178.6	211.9	28,632
	Subdiv. 22-24	11.9	27.8	57.3	74.9	106.3	121.3	140.8	162.7	185.5	39,548
2008	Div. IV+Div. IIIa	19.2	71.5	91.1	114.5	142.2	171.2	181.4	200.0	196.4	25,368
	Subdiv. 22-24	16.3	49.5	65.2	88.1	110.5	133.2	140.3	156.7	172.2	43,116
2009	Div. IV+Div. IIIa	13.4	52.0	90.3	118.6	167.5	181.4	213.9	228.9	259.5	36,230
	Subdiv. 22-24	10.5	28.3	48.1	90.5	123.7	145.2	160.4	171.2	181.8	31,032
2010	Div. IV+Div. IIIa	8.2	59.3	84.7	129.8	165.9	196.2	221.8	234.3	257.2	27,465
	Subdiv. 22-24	12.2	22.2	52.2	87.1	119.8	154.8	170.6	191.9	194.1	17,917
2011	Div. IV+Div. IIIa	8.4	33.7	89.0	120.4	140.2	170.2	185.9	216.3	211.8	11,941
	Subdiv. 22-24	12.4	23.0	55.1	78.1	113.2	136.6	147.6	161.2	168.0	15,830
2012	Div. IV+Div. IIIa	9.3	47.0	76.1	134.2	165.1	182.0	204.1	222.0	225.6	17,553
	Subdiv. 22-24	18.1	15.9	55.0	95.4	115.1	150.3	167.6	177.4	191.2	21,095
2013	Div. IV+Div. IIIa		59.5	94.2	131.8	162.6	195.0	207.8	247.9	238.1	18,325
	Subdiv. 22-24	13.7	17.8	54.1	86.8	129.4	136.9	145.3	159.1	179.8	25,504
2014	Div. IV+Div. IIIa	9.3	52.2	98.5	137.4	178.2	199.2	211.7	225.1	227.0	19,020
	Subdiv. 22-24	16.5	30.0	59.0	82.3	122.1	158.4	156.0	163.0	175.5	18,338
2015	Div. IV+Div. IIIa	16.0	31.8	67.9	115.2	152.4	172.8	193.4	198.7	212.9	15,348
	Subdiv. 22-24	7.1	15.9	50.4	79.3	107.6	144.7	170.6	135.6	149.4	22,144
2016	Div. IV+Div. IIIa	7.1	40.1	63.8	126.1	160.7	175.1	200.8	212.8	235.0	26,224
	Subdiv. 22-24	10.3	34.1	51.7	84.6	95.0	129.5	160.4	168.1	169.2	25,073
2017	Div. IV+Div. IIIa	30.5	44.1	61.3	113.2	141.8	162.8	171.2	182.9	169.9	19,827
	Subdiv. 22-24	18.1	34.3	57.7	82.8	117.9	123.5	137.6	147.5	139.8	26,513
2018	Div. IV+Div. IIIa	10.3	55.7	55.3	109.3	154.4	179.7	195.0	194.9	206.4	22,066
	Subdiv. 22-24	15.9	14.5	51.8	87.2	108.4	142.7	143.4	157.7	170.1	18,992
2019	Div. IV+Div. IIIa	20.0	52.8	85.0	118.9	138.4	166.1	183.3	193.9	211.4	15,589
	Subdiv. 22-24	16.7	30.7	56.9	83.7	123.6	139.6	165.6	138.3	166.7	9,831

Data for 1995–2001 for the North Sea and Division 3.a was revised in 2003.

[C] values have been corrected in 2007.

Table 3.2.17. Western Baltic spring spawning herring. Transfers of *North Sea autumn spawners* from Div. 3.a to the North Sea. Numbers (millions) and mean weight (g), SOP (tonnes) in 1993–2019.

Year	W-Rings	0	1	2	3	4	5	6	7	8+	Total
1993	**Number**	2,795.4	2,032.5	237.6	26.5	7.7	3.6	2.7	2.2	0.7	5,109.0
	Mean W.	12.5	28.6	79.7	141.4	132.3	233.4	238.5	180.6	203.1	
	SOP	34,903	58,107	18,939	3,749	1,016	850	647	390	133	118,734
1994	**Number**	481.6	1,086.5	201.4	26.9	6.0	2.9	1.6	0.4	0.2	1,807.5
	Mean W.	16.0	42.9	83.4	110.7	138.3	158.6	184.6	199.1	213.9	
	SOP	7,723	46,630	16,790	2,980	831	460	287	75	37	75,811
1995	**Number**	1,144.5	1,189.2	161.5	13.3	3.5	1.1	0.6	0.4	0.3	2,514.4
	Mean W.	11.2	39.1	88.3	145.7	165.5	204.5	212.2	236.4	244.3	
	SOP	12,837	46,555	14,267	1,940	573	225	133	86	65	76,680
1996	**Number**	516.1	961.1	161.4	17.0	3.4	1.6	0.7	0.4	0.3	1,661.9
	Mean W.	11.0	23.4	80.2	126.6	165.0	186.5	216.1	216.3	239.1	
	SOP	5,697	22,448	12,947	2,151	565	307	145	77	66	44,403
1997	**Number**	67.6	305.3	131.7	21.2	1.7	0.8	0.2	0.1	0.1	528.7
	Mean W.	19.3	47.7	68.5	124.4	171.5	184.7	188.7	188.7	192.4	
	SOP	1,304	14,571	9,025	2,643	285	146	40	16	25	28,057
1998	**Number**	51.3	745.1	161.5	26.6	19.2	3.0	3.1	1.2	0.5	1,011.6
	Mean W.	27.4	56.4	79.8	117.8	162.9	179.7	197.2	178.9	226.3	
	SOP	1,409	41,994	12,896	3,137	3,136	547	608	211	108	64,045
1999	**Number**	598.8	303.0	148.6	47.2	13.4	6.2	1.2	0.5	0.5	1,119.4
	Mean W.	10.4	50.5	87.7	113.7	137.4	156.5	188.1	187.3	198.8	
	SOP	6,255	15,297	13,037	5,369	1,841	974	230	90	92	43,186
2000	**Number**	235.3	984.3	116.0	21.9	22.9	7.5	3.3	0.6	0.1	1,391.8
	Mean W.	21.3	28.5	76.1	108.8	163.1	190.3	183.9	189.4	200.2	
	SOP	5,005	28,012	8,825	2,377	3,731	1,436	601	114	13	50,115
2001	**Number**	807.8	563.6	150.0	17.2	1.4	0.3	0.5	0.0	0.0	1,540.8
	Mean W.	8.7	49.4	75.3	108.2	130.1	147.1	219.1	175.8	198.1	
	SOP	7,029	27,849	11,300	1,856	177	43	109	8	5	48,376
2002	**Number**	478.5	362.6	56.7	5.6	0.7	0.2	0.1	0.0	0.0	904.5
	Mean W.	12.2	38.0	100.6	121.5	142.7	160.9	178.7	177.4	218.6	
	SOP	5,859	13,790	5,705	684	106	26	21	8	5	26,205
2003	**Number**	21.6	445.0	182.3	13.0	16.2	1.8	1.1	1.2	0.2	682.4
	Mean W.	20.5	33.7	67.0	123.2	150.3	163.5	190.2	214.6	186.8	
	SOP	442	14,992	12,219	1,606	2,436	293	213	264	33	32,498
2004	**Number**	88.4	70.9	179.9	20.7	6.0	9.7	1.8	2.0	0.9	380.4
	Mean W.	22.5	55.3	70.2	120.6	140.9	151.7	170.6	186.6	178.5	
	SOP	1,993	3,921	12,638	2,498	851	1,479	312	367	154	24,214
2005	**Number**	96.4	307.5	159.2	16.2	5.4	2.4	2.3	0.5	0.2	589.9
	Mean W.	16.5	50.5	71.0	105.9	154.6	173.5	184.5	200.2	208.9	
	SOP	1,595	15,527	11,304	1,712	828	412	420	95	34	31,927
2006	**Number**	35.1	150.1	50.2	10.2	3.3	3.3	0.6	0.4	0.2	253.3
	Mean W.	14.3	53.5	79.2	117.6	140.2	185.5	190.4	215.6	206.9	
	SOP	503	8,035	3,975	1,200	456	620	107	81	37	15,015
2007	**Number**	67.7	189.3	76.9	2.1	0.4	1.4	0.3	0.6	0.0	338.7
	Mean W.	26.7	62.6	71.1	108.1	124.4	151.7	183.7	174.7	153.8	
	SOP	1,807	11,857	5,464	224	55	219	48	110	3	19,788
2008	**Number**	85.7	86.6	72.0	1.9	0.3	0.1	0.1	0.3	0.1	247.0
	Mean W.	16.2	57.6	86.4	109.1	138.7	167.7	175.4	203.1	197.7	
	SOP	1,386	4,986	6,222	205	35	25	10	67	13	12,949
2009	**Number**	116.8	77.5	7.0	0.4	0.2	0.0	0.0	0.0	0.1	202.0
	Mean W.	9.4	59.8	101.0	81.3	206.4	0.0	0.0	0.0	268.5	
	SOP	1,095	4,635	710	29	46	0	0	0	28	6,542
2010	**Number**	48.6	197.0	43.3	0.3	0.1	0.1	0.0	0.1	0.0	289.6
	Mean W.	7.5	50.6	76.8	122.3	149.3	191.3	221.5	216.3	204.5	
	SOP	364	9,975	3,325	35	22	19	4	13	3	13,759
2011	**Number**	203.8	35.4	61.5	3.2	0.3	0.2	0.1	0.1	0.0	304.6
	Mean W.	7.5	35.1	83.6	113.3	133.9	191.5	193.2	234.3	248.3	
	SOP	1,524	1,244	5,137	364	37	33	23	22	5	8,388
2012	**Number**	145.83	174.74	43.05	1.85	1.14	0.19	0.20	0.11	0.03	367.1
	Mean W.	12.29	39.70	66.75	123.69	169.16	174.56	199.39	219.78	215.93	
	SOP	1,792	6,937	2,873	229	193	33	39	24	6	12,128
2013	**Number**	0.90	86.19	85.82	2.39	0.36	0.28				175.9
	Mean W.	33.66	75.39	74.64	133.88	160.14	200.37				
	SOP	30	6,498	6,405	320	57	56				13,367
2014	**Number**	284.74	61.13	80.21	5.90	0.54	0.50	0.17	0.03	0.06	433.3
	Mean W.	8.98	56.96	73.62	108.56	162.38	190.94	209.02	221.12	227.82	
	SOP	2,557	3,482	5,905	641	88	95	36	6	13	12,823
2015	**Number**	30.71	169.58	97.57	6.96	1.25	4.89	1.11	1.20	0.35	313.6
	Mean W.	15.79	29.72	68.01	132.87	157.09	179.85	195.87	197.22	214.93	
	SOP	485	5,040	6,636	925	197	880	218	238	75	14,692
2016	**Number**	133.30	23.33	47.56	5.95	0.53	0.30	0.22	0.03	0.06	211.3
	Mean W.	6.74	37.42	59.01	123.13	149.08	156.65	207.97	209.50	234.59	
	SOP	899	873	2,807	733	79	47	46	7	15	5,506
2017	**Number**	0.15	75.99	34.43	6.91	2.97	1.20	0.07	0.05	0.03	121.8
	Mean W.	30.81	48.55	67.62	102.48	138.67	172.88	170.96	184.78	161.99	
	SOP	5	3,690	2,328	709	412	208	12	8	5	7,375
2018	**Number**	14.51	19.17	28.49	1.13	1.79	1.04	0.18	0.12	0.09	66.5
	Mean W.	10.05	48.67	57.48	102.82	155.48	179.69	189.49	186.69	202.12	
	SOP	146	933	1,638	116	279	187	35	22	17	3,372
2019	**Number**	23.72	101.32	19.84	4.56	0.10	0.13	0.07	0.01	0.003	149.8
	Mean W.	11.66	41.00	62.01	84.37	116.20	118.10	164.56	202.20	158.50	
	SOP	277	4,154	1,230	385	12	15	11	2	0.4	6,087

Corrections for the years 1991–1998 was made in HAWG 2001, but are NOT included in the North Sea assessment.

Table 3.3.1 Western Baltic spring spawning herring. German acoustic survey (GERAS) on the Spring Spawning Herring in Subdivisions 21 (Southern Kattegat, 41G0–42G2) – 24 in autumn 1993–2019 (September/October).

Year	1993	1994	1995	1996	1997	1998	1999	2000	* 2001	** 2002	2003	2004	*** 2005	*** 2006
W-rings/Numbers in millions														
0	893.140	5,474.540	5,107.780	1,833.130	2,859.220	2,490.090	5,993.820	1,008.910	2,477.972	4,102.595	3,776.780	2,554.680	3,055.595	4,159.311
1	491.880	415.730	1,675.340	1,439.460	1,955.400	801.350	1,338.710	1,429.880	1,125.716	837.557	1,238.480	968.860	750.199	940.892
2	436.550	883.810	328.610	590.010	738.180	678.530	287.240	453.980	1,226.932	421.396	222.530	592.360	590.756	226.959
3	529.670	559.720	357.960	434.090	394.530	394.070	232.510	328.960	844.088	575.358	217.270	346.230	295.659	279.618
4	403.400	443.730	353.850	295.170	162.430	236.830	155.950	201.590	366.841	341.120	260.350	163.150	142.778	212.201
5	125.140	189.420	253.510	305.550	118.910	100.190	51.940	78.930	131.430	63.678	96.960	143.320	78.541	139.813
6	55.290	60.400	126.760	119.260	99.290	50.980	8.130	38.610	85.690	24.520	38.040	79.030	79.018	97.261
7	28.030	23.510	46.430	46.980	33.280	23.640	1.470	5.920	19.471	9.690	8.580	22.600	25.564	66.937
8+	12.940	2.330	27.240	18.910	47.850	9.330	2.100	4.190	9.683	13.380	9.890	11.770	15.013	27.789
Total	2,976.040	8,053.190	8,277.480	5,082.560	6,409.090	4,785.010	8,071.870	3,550.970	6,287.823	6,389.293	5,868.880	4,882.000	5,033.123	6,150.781
3+ group	1,154.470	1,279.110	1,165.750	1,219.960	856.290	815.040	452.100	658.200	1,457.203	1,027.746	631.090	766.100	636.573	823.619
W-rings/Biomass ('000 tonnnes)														
0	12.765	66.889	58.540	16.564	28.497	23.760	71.814	13.784	31.163	38.209	33.928	23.074	32.794	42.958
1	19.520	14.466	58.620	46.643	76.396	39.899	51.117	57.530	48.177	34.165	44.791	35.885	29.790	38.230
2	21.696	40.972	20.939	29.127	43.461	50.085	22.016	28.431	75.879	29.957	16.089	34.542	46.478	18.013
3	33.838	40.749	30.091	31.035	35.942	35.280	27.484	27.740	77.137	56.769	22.008	27.726	31.876	31.946
4	25.674	43.038	40.104	21.174	22.291	28.049	16.664	24.065	37.936	40.360	34.167	18.364	20.414	31.253
5	12.695	24.198	27.268	37.141	16.743	11.430	6.768	9.259	18.458	9.029	14.561	17.348	12.772	24.876
6	7.058	12.313	14.915	16.056	13.998	6.157	0.867	5.620	13.267	3.497	5.715	12.225	13.820	17.959
7	2.269	5.294	9.269	6.101	5.333	3.716	0.350	1.210	3.866	1.075	1.343	3.413	5.111	13.431
8+	1.781	0.627	6.570	2.930	10.636	2.170	0.458	0.757	2.101	1.908	1.615	1.991	3.447	6.344
Total	137.296	248.545	266.316	206.771	253.297	200.547	197.537	168.395	307.984	214.967	174.218	174.568	196.503	225.010
3+ group	83.315	126.218	128.217	114.438	104.943	86.802	52.590	68.651	152.765	112.637	79.410	81.067	87.441	125.809
W-rings/Mean weight (g)														
0	14.3	12.2	11.5	9.0	10.0	9.5	12.0	13.7	12.6	9.3	9.0	9.0	10.7	10.3
1	39.7	34.8	35.0	32.4	39.1	49.8	38.2	40.2	42.8	40.8	36.2	37.0	39.7	40.6
2	49.7	46.4	63.7	49.4	58.9	73.8	76.6	62.6	61.8	71.1	72.3	58.3	78.7	79.4
3	63.9	72.8	84.1	71.5	91.1	89.5	118.2	84.3	91.4	98.7	101.3	80.1	107.8	114.2
4	63.6	97.0	113.3	71.7	137.2	118.4	106.9	119.4	103.4	118.3	131.2	112.6	143.0	147.3
5	101.4	127.7	107.6	121.6	140.8	114.1	130.3	117.3	140.4	141.8	150.2	121.0	162.6	177.9
6	127.7	203.9	117.7	134.6	141.0	120.8	106.6	145.5	154.8	142.6	150.2	154.7	174.9	184.6
7	81.0	225.2	199.6	129.9	160.2	157.2	237.9	204.5	198.6	110.9	156.6	151.0	199.9	200.6
8+	137.7	269.1	241.2	154.9	222.3	232.6	217.9	180.7	217.0	142.6	163.3	169.2	229.6	228.3
Total	46.1	30.9	32.2	40.7	39.5	41.9	24.5	47.4	49.0	33.6	29.7	35.8	39.0	36.6

Year	*** 2007	*** 2008	*** 2009	*** 2010	*** 2011	*** 2012	*** 2013	*** 2014	**** 2015	***** 2016	*** 2017	*** 2018	5* 2019
W-rings/Numbers in millions													
0	2,588.922	2,150.306	2,821.022	4,561.405	2,929.434	4,103.180	8,996.225	5,473.400	888.081	2,638.277	1,290.650	2,635.830	1,816.647
1	558.851	392.737	270.959	534.633	1,206.762	755.034	893.837	769.320	440.738	493.366	463.940	428.530	247.870
2	260.402	165.347	95.866	305.540	360.354	294.242	456.204	242.590	509.769	155.417	145.360	89.280	122.948
3	117.412	166.301	43.553	214.539	210.455	193.974	307.567	279.650	221.344	196.061	123.230	41.160	47.727
4	76.782	102.018	17.761	107.364	115.984	124.548	262.908	332.660	129.795	60.953	137.500	20.240	24.244
5	43.919	82.174	9.016	85.635	57.840	70.135	87.114	317.240	95.579	30.490	46.550	17.570	17.488
6	12.144	29.727	3.227	47.140	50.844	45.017	32.684	211.600	86.150	14.980	21.230	4.940	16.802
7	9.262	11.443	1.947	25.021	29.234	22.520	22.565	85.630	47.093	3.300	2.130	1.060	1.540
8+	8.839	9.262	1.704	15.309	14.774	21.404	11.300	56.590	37.886	0.000	1.790	1.100	0.600
Total	3,676.532	3,109.314	3,265.055	5,896.586	4,975.682	5,630.054	11,070.405	7,768.680	2,456.435	3,592.844	2,232.380	3,239.710	2,295.867
3+ group	268.357	400.924	77.208	495.007	479.131	477.597	724.139	1,283.370	617.846	305.784	332.430	86.070	108.402
W-rings/Biomass ('000 tonnnes)													
0	25.202	23.699	29.449	36.791	35.064	46.955	85.185	61.640	8.179	24.072	13.623	32.010	23.081
1	22.782	17.602	10.473	21.336	46.384	29.825	38.404	30.369	16.822	18.553	18.296	18.825	9.767
2	20.202	10.446	7.069	24.593	29.560	20.380	30.587	21.490	38.573	10.579	10.159	5.797	6.761
3	11.366	15.297	4.433	23.540	24.382	22.068	27.349	32.448	22.841	18.068	11.511	3.323	3.630
4	9.679	11.077	1.961	15.193	16.361	18.653	27.350	58.819	15.196	5.859	17.427	1.785	2.700
5	6.724	11.584	1.385	15.433	9.867	11.450	10.934	63.755	14.581	3.417	6.711	2.239	2.625
6	2.001	4.823	0.616	9.018	8.391	7.985	4.849	45.705	14.304	1.723	3.175	0.719	2.673
7	1.703	1.756	0.384	4.728	5.295	4.448	3.751	18.709	8.433	0.450	0.257	0.182	0.260
8+	1.798	1.303	0.284	3.013	3.015	3.876	1.821	13.498	7.108	0.000	0.190	0.203	0.060
Total	101.456	97.588	56.055	153.646	178.320	165.640	230.231	346.433	146.035	82.722	81.349	65.083	51.557
3+ group	33.270	45.840	9.064	70.926	67.312	68.480	76.055	232.933	82.462	29.518	39.271	8.451	11.948
W-rings/Mean weight (g)													
0	9.7	11.0	10.4	8.1	12.0	11.4	9.5	11.3	9.2	9.1	10.6	12.1	12.7
1	40.8	44.8	38.7	39.9	38.4	39.5	43.0	39.5	38.2	37.6	39.4	43.9	39.4
2	77.6	63.2	73.7	80.5	82.0	69.3	67.0	88.6	75.7	68.1	69.9	64.9	55.0
3	96.8	92.0	101.8	109.7	115.9	113.8	88.9	116.0	103.2	92.2	93.4	80.7	76.1
4	126.1	108.6	110.4	141.5	141.1	149.8	104.0	176.8	117.1	96.1	126.7	88.2	111.4
5	153.1	141.0	153.6	180.2	170.6	163.3	125.5	201.0	152.5	112.1	144.2	127.4	150.1
6	164.8	162.2	190.9	191.3	165.0	177.4	148.4	216.0	166.0	115.0	149.5	145.6	159.1
7	183.8	153.5	197.4	189.0	181.1	197.5	166.2	218.5	179.1	136.4	120.5	172.0	168.7
8+	203.4	140.7	166.9	196.8	204.1	181.1	161.1	238.5	187.6	-	106.4	184.2	100.3
Total	27.6	31.4	17.2	26.1	35.8	29.4	20.8	44.6	59.5	23.0	36.4	20.1	22.5

small revision in 2015

small revision in 2017

*incl. mean for Sub-division 23, which was not covered by RV SOLEA (<0.5 %)

**incl. mean for Sub-division 21, which was not covered by RV SOLEA

small revision in 2018

***** excl. Central Baltic Herring in SD 24 (SD 23) based on SF (Gröhsler et al. 2013)**

****** excl. Central Baltic Herring in SD 22, SD 24 (SD 23) based on SF & excl. mature herring in SD 23 (stages>=6)**

******* excl. Central Baltic Herring in SD 22, SD 24 (SD 23) based on SF**

5* excl. Central Baltic Herring in SDs 21-24 based on SF

Table 3.3.2 Western Baltic spring spawning herring. Acoustic surveys (HERAS) on the Western Baltic Spring Spawning Herring in the North Sea/Division 3.a in 1991–2019 (July).

Year	1991	1992 *	1993 *	1994 *	1995 *	1996 *	1997	1998	1999 **	2000	2001	2002	2003	2004
W-rings/Numbers in millions														
0		3,853	372	964										
1		277	103	5	2,199	1,091	128	138	1,367	1,509	66	3,346	1,833	1,669
2	1,864	2,092	2,768	413	1,887	1,005	715	1,682	1,143	1,891	641	1,577	1,110	930
3	1,927	1,799	1,274	935	1,022	247	787	901	523	674	452	1,393	395	726
4	866	1,593	598	501	1,270	141	166	282	135	364	153	524	323	307
5	350	556	434	239	255	119	67	111	28	186	96	88	103	184
6	88	197	154	186	174	37	69	51	3	56	38	40	25	72
7	72	122	63	62	39	20	80	31	2	7	23	18	12	22
8+	10	20	13	34	21	13	77	53	1	10	12	17	5	18
Total	5,177	10,509	5,779	3,339	6,867	2,673	2,088	3,248	3,201	4,696	1,481	7,002	3,807	3,926
3+ group	5,177	4,287	2,536	1,957	2,781	577	1,245	1,428	691	1,295	774	2,079	864	1,328
W-rings/Biomass ('000 tonnnes)														
0		34.3	1	8.7										
1		26.8	7	0.4	77.4	52.9	4.7	7.1	74.8	61.4	3.5	137.2	79.0	63.9
2	177.1	169.0	139	33.2	108.9	87.0	52.2	136.1	101.6	138.1	55.8	107.2	91.5	75.6
3	219.7	206.3	112	114.7	102.6	27.6	81.0	84.8	59.5	68.8	51.2	126.9	41.4	89.4
4	116.0	204.7	69	76.7	145.5	17.9	21.5	35.2	14.7	45.3	21.5	55.9	41.7	41.5
5	51.1	83.3	65	41.8	33.9	17.8	9.8	13.1	3.4	25.1	17.9	12.8	13.9	29.3
6	19.0	36.6	26	38.1	27.4	5.8	9.8	6.9	0.5	10.0	6.9	7.4	4.2	11.7
7	13.0	24.4	16	13.1	6.7	3.3	14.9	4.8	0.3	1.4	4.7	3.5	2.0	4.1
8+	2.0	5.0	2	7.8	3.8	2.7	13.6	9.0	0.1	1.3	2.7	3.1	0.9	3.2
Total	597.9	756.1	436.5	325.8	506.2	215.1	207.5	297.0	254.9	351.4	164.2	454.0	274.5	318.8
3+ group	420.9	560.3	291.0	292.3	319.9	75.2	150.6	153.7	78.5	151.9	104.9	209.6	104.0	179.3
W-rings/Mean weight (g)														
0		8.9	4.0	9.0										
1		96.8	66.3	80.0	35.2	48.5	36.9	51.9	54.7	40.7	54.0	41.0	43.1	38.3
2	95.0	80.8	50.1	80.3	57.7	86.6	73.0	80.9	88.9	73.1	87.0	68.0	82.5	81.3
3	114.0	114.7	87.9	122.7	100.4	111.9	103.0	94.1	113.8	102.2	113.2	91.1	104.9	123.2
4	134.0	128.5	116.2	153.0	114.6	126.8	129.6	124.7	109.1	124.4	140.5	106.6	128.8	135.2
5	146.0	149.8	149.9	175.1	132.9	149.4	145.0	118.7	120.0	135.4	185.2	145.8	134.2	159.4
6	216.0	185.7	169.6	205.0	157.2	157.3	143.1	135.8	179.9	179.2	182.6	186.5	165.4	162.9
7	181.0	199.7	256.9	212.0	172.9	166.8	185.6	156.4	179.9	208.8	206.3	198.7	167.2	191.6
8+	200.0	252.0	164.2	230.3	183.1	212.9	178.0	168.0	181.7	135.2	226.9	183.4	170.3	178.0
Total	115.6	123.9	75.8	100.2	73.7	80.5	99.4	91.4	78.5	74.8	110.9	64.8	72.1	81.2

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
W-rings/Numbers in millions															
0				112				1		314	2	203	1		2
1	2,687	2,081	3,918	5,852	565	999	2,980	1,018	49	513	1,949	425	696	106	418
2	1,342	2,217	3,621	1,160	398	511	473	1,081	627	415	1,244	255	424	224	591
3	464	1,780	933	843	205	254	259	236	525	176	446	381	661	271	315
4	201	490	499	333	161	115	163	87	53	248	224	99	401	175	109
5	103	180	154	274	82	65	70	76	30	28	171	40	94	169	67
6	84	27	34	176	86	24	53	33	12	37	82	40	53	50	52
7	37	10	26	45	39	28	22	14	8	26	89	12	52	35	19
8+	21	0.1	14	44	65	34	46	60	15	42	115	28	92	44	13
Total	**4,939**	**6,786**	**9,199**	**8,839**	**1,601**	**2,030**	**4,066**	**2,606**	**1,319**	**1,799**	**4,322**	**1,483**	**2,474**	**1,074**	**1,586**
3+ group	**910**	**2,487**	**1,660**	**1,715**	**638**	**520**	**613**	**506**	**643**	**557**	**1,127**	**600**	**1,353**	**744**	**575**
W-rings/Biomass ('000 tonnnes)															
0								0.0		1.0	0.03	1.00	0.00		0.00
1	105.9	112.6	193.2	284.4	26.8	53.0	90.0	44.0	3.0	26.0	61.5	16.0	31.0	4.0	15.0
2	100.1	160.5	273.4	100.9	48.8	34.0	47.0	87.0	51.0	48.0	106.2	20.0	41.0	19.0	49.0
3	46.6	158.6	90.9	101.8	30.6	28.0	31.0	26.0	59.0	21.0	54.7	51.0	101.0	28.0	32.0
4	28.9	56.3	59.6	47.1	29.4	17.0	25.0	12.0	7.0	43.0	33.8	15.0	63.0	25.0	15.0
5	16.5	23.7	18.5	45.3	17.5	11.0	12.0	13.0	4.0	6.0	30.3	7.0	16.0	28.0	12.0
6	14.9	4.1	4.6	30.9	21.4	5.0	10.0	6.0	2.0	8.0	16.7	8.0	10.0	9.0	9.0
7	7.5	1.6	2.6	9.4	10.6	6.0	5.0	3.0	1.0	6.0	17.7	3.0	11.0	7.0	3.0
8+	4.9	0.0	1.9	8.7	19.8	8.0	10.0	14.0	3.0	11.0	25.2	6.0	20.0	10.0	3.0
Total	325.3	517.5	644.7	628.5	204.9	162.0	230.0	205.0	130.0	169.0	346.0	126.0	293.0	130.0	138.0
3+ group	119.3	244.4	178.2	243.2	129.3	75.0	93.0	74.0	76.0	95.0	178.3	90.0	221.0	107.0	74.0
W-rings/Mean weight (g)															
0				6.3				3.0		4.3	14.2	4.0	23.0		4.0
1	39.4	54.1	49.3	48.6	47.5	52.7	30.2	42.9	58.1	51.6	31.5	37.0	45.0	42.0	35.8
2	74.6	72.4	75.5	87.0	122.7	65.8	98.8	80.4	80.8	114.9	85.4	79.0	97.1	82.9	82.7
3	100.5	89.1	97.4	120.8	149.1	111.4	121.2	110.6	111.7	122.4	122.7	134.0	153.4	104.6	102.1
4	143.7	114.8	119.5	141.4	182.9	150.9	150.6	142.9	128.5	175.0	150.9	151.0	157.3	145.4	139.6
5	160.9	131.6	120.0	165.5	213.3	175.6	168.7	170.8	138.3	210.6	177.1	173.0	173.4	164.9	170.8
6	177.7	153.2	136.6	175.6	248.3	198.0	190.8	182.0	157.2	220.2	202.3	194.0	182.0	172.6	178.6
7	202.3	169.2	101.5	208.5	272.1	215.9	211.0	194.0	155.5	213.3	198.9	214.0	202.7	187.3	187.5
8+	229.2	178.0	138.3	196.7	304.7	234.8	228.5	228.6	198.5	244.1	218.9	215.0	221.2	236.4	221.8
Total	65.9	76.3	70.1	71.1	128.0	79.8	56.6	78.5	97.9	94.6	80.1	50.0	118.8	121.3	87.2

* revised in 1997

**the survey only covered the Skagerrak area by Norway. Additional estimates for the Kattegat area were added (see ICES 2000/ACFM:10, Table 3.5.8)

Table 3.3.3. Western Baltic spring-spawning herring. N_{20} Larval Abundance Index. Estimation of 0-Group herring reaching 20 mm in length in Greifswalder Bodden and adjacent waters (March/April to June).

Year	N_{20} (millions)
1992	1,060
1993	3,044
1994	12,515
1995	7,930
1996	21,012
1997	4,872
1998	16,743
1999	20,364
2000	3,026
2001	4,845
2002	11,324
2003	5,507
2004	5,640
2005	3,887
2006	3,774
2007*	1,829
2008*	1,622
2009	6,464
2010	7,037
2011	4,444
2012	1,140
2013	3,021
2014	539
2015	2,478
2016	442
2017	1,247

2018	1,563
2019	1,317

*** small revision during HAWG 2010**

Table 3.6.1.a. Western Baltic Spring-spawning Herring. *Multi fleet - Fleet A.* Catch in number (CANUM, thousands)

	0	1	2	3	4	5	6	7	8
2000	0	0	8161	9752	10223	5660	2466	605	778
2001	0	454	11344	10224	6123	7151	2664	1556	410
2002	0	0	7589	14825	10583	3349	2877	969	620
2003	0	0	30	3130	5992	3502	1167	1305	605
2004	0	0	15140	27898	3520	4110	1002	456	146
2005	0	0	6569	17434	12680	2573	3787	1084	714
2006	0	129	3514	8783	13962	22370	5102	5258	3055
2007	0	0	74	2627	1253	596	806	377	613
2008	0	0	70	87	167	77	81	182	35
2009	0	0	1017	2075	3375	1423	1733	4471	3144
2010	0	26	32	518	985	389	518	270	1018
2011	0	0	63	442	400	235	69	109	298
2012	0	0	16	214	359	0	1432	0	7395
2013	0	0	53	409	172	494	312	67	645
2014	0	34	2451	3369	5406	802	2116	1045	1573
2015	0	20	95	868	1404	3872	1837	1446	2170
2016	0	20	1209	4109	1033	1137	1182	689	1210
2017	0	2.858	46.79	2368	1013	245.2	90.16	108.3	136.3
2018	0	28.6	329.8	900.6	2277	4270	1744	860.9	623.1
2019	0	7599	6239	4857	2750	7257	9687	2650	2583

Table 3.6.1.b. Western Baltic Spring-spawning Herring. *Multi fleet - Fleet C.* Catch in number (CANUM, thousands)

	0	1	2	3	4	5	6	7	8
2000	59181	209579	294752	99060	55666	20361	7311	978	772
2001	2924	22479	184831	97597	25224	12059	5979	1672	882
2002	1207	108742	133960	118066	40768	8532	4442	1459	1345
2003	4704	27998	155177	57513	54639	16425	4427	2786	1051
2004	6559	78442	56286	42645	9927	7987	2586	671	290
2005	5318	62322	175515	53573	30534	6613	7336	2142	692
2006	2105	41760	91008	86554	29334	26306	4849	4390	1833
2007	230	90083	79527	31939	26596	11189	7371	5701	1931
2008	824	92818	60484	34255	12424	14454	7281	4175	1121
2009	442	91310	119936	41373	20153	9000	5845	3043	1921
2010	230	41741	96890	42943	17084	7087	4177	2768	2739
2011	89	41858	28489	19924	12990	5756	2913	915	822
2012	0	15350	81497	20357	9152	7091	2774	2230	1166
2013	0	6260	40605	68642	10640	3858	1085	409	372
2014	49	23096	16886	18895	39169	6795	2439	1283	1329
2015	115	17357	47337	19590	12579	10401	3016	1232	1727
2016	0	13761	146136	38528	12298	10290	12066	2906	5340
2017	1427	47128	36117	40438	33155	10000	10792	7246	2762
2018	2.36	18967	176762	16634	12912	18031	5096	3041	2511
2019	5231	29648	52720	16127	5473	2488	1414	326	54.23

Table 3.6.1.c. Western Baltic Spring-spawning Herring. *Multi fleet - Fleet D.* Catch in number (CANUM, thousands)

	0	1	2	3	4	5	6	7	8
2000	58480	109337	13888	5033	555	156	87	18	10
2001	118759	13695	11926	3256	711	460	1197	938	1130
2002	68427	468952	26715	1707	1742	169	160	0	53
2003	47410	35021	27318	4810	3741	1543	665	263	158
2004	19111	130900	24598	23435	4794	4746	918	387	156
2005	90002	35287	21250	4344	3718	149	377	238	0
2006	1551	47777	17551	14152	3926	5720	652	428	234
2007	1395	13772	11277	2346	2960	997	1270	161	133
2008	4079	8946	10511	4583	888	598	366	141	148
2009	14358	58292	11338	2404	913	457	224	164	219
2010	8879	6826	8183	202	310	83	0	0	0
2011	6080	41200	1317	590	0	0	0	0	0
2012	1521	15193	12792	138	0	0	0	0	0
2013	0	5770	11071	2313	444	0	0	0	0
2014	25267	8397	3039	1979	0	0	0	0	0
2015	3195	40377	12506	526	121	313	0	0	0
2016	23879	13397	14390	391	0	674	0	0	0
2017	0	1294	6017	18.3	0	0	0	0	0
2018	285.3	1471	2047	85.05	0	0	0	0	0
2019	75.4	985.6	279.9	61.46	0	0	0	0	0

Table 3.6.1.d. Western Baltic Spring-spawning Herring. *Multi fleet - Fleet F.* Catch in number (CANUM, thousands)

	0	1	2	3	4	5	6	7	8
2000	37749	616321	194300	86731	77777	52964	30056	12428	9291
2001	634631	498179	283245	147601	75897	47807	28743	13928	4188
2002	80637	81436	113576	186714	119192	45110	31053	11414	6310
2003	1374	63857	82330	95798	125060	82178	22858	13098	7006
2004	217885	248412	101789	70788	74972	74400	44450	13363	10422
2005	11586	207562	115890	102482	83461	51304	54195	27767	11214
2006	650	44762	72070	118995	101731	43005	31364	22110	12157
2007	9095	68189	93857	106993	96054	52215	20752	15017	12082
2008	4707	73668	68438	98131	75655	70738	37572	13260	18475
2009	5934	31481	110715	55478	45495	37211	31948	13230	7244
2010	3285	26490	31314	39307	28455	22420	13894	7958	7505
2011	5643	15458	16413	17831	35934	21639	19649	11212	8214
2012	479	46311	36497	43760	37810	28353	13964	9008	8440
2013	1029	60576	37098	43312	55919	28716	25322	11498	10987
2014	5840	35272	37735	42119	37499	19023	11196	6541	6186
2015	26670	46242	72781	38506	48439	29846	14860	7857	9120
2016	20012	22342	37247	93863	45681	30535	17423	10455	8256
2017	51.79	9435	32839	38541	78328	38496	26936	13463	10170
2018	367.8	48383	18459	34635	23065	51273	16259	8843	4507
2019	270.3	6881	20667	15565	13301	10333	15868	6034	3517

Table 3.6.2.a. Western Baltic Spring-spawning Herring. *Multi fleet - Fleet A.* Weight-at-age as W-ringers in the catch (WECA, kg)

	0	1	2	3	4	5	6	7	8
2000	0.0000	0.0000	0.1407	0.1652	0.1839	0.2070	0.2024	0.2176	0.2663
2001	0.0000	0.0790	0.1275	0.1514	0.1784	0.1884	0.1982	0.2208	0.2666
2002	0.0000	0.0000	0.1431	0.1542	0.1652	0.1864	0.1976	0.2075	0.2235
2003	0.0000	0.0000	0.1014	0.1356	0.1414	0.1632	0.1752	0.1846	0.1923
2004	0.0000	0.0000	0.1206	0.1328	0.1639	0.1659	0.1748	0.1843	0.2079
2005	0.0000	0.0000	0.1071	0.1539	0.1676	0.1793	0.1887	0.1864	0.2084
2006	0.0000	0.0247	0.1246	0.1488	0.1641	0.1752	0.2140	0.2243	0.2367
2007	0.0000	0.0000	0.1566	0.1482	0.1565	0.1850	0.1858	0.1993	0.2248
2008	0.0000	0.0000	0.1418	0.1647	0.1657	0.1680	0.1922	0.1994	0.2158
2009	0.0000	0.0000	0.1381	0.1701	0.2111	0.2110	0.2481	0.2484	0.2845
2010	0.0000	0.0678	0.1323	0.1573	0.2003	0.2056	0.2109	0.2190	0.2352
2011	0.0000	0.0000	0.1497	0.1670	0.1828	0.2078	0.2130	0.2106	0.2188
2012	0.0000	0.0000	0.1396	0.1846	0.2053	0.0000	0.2131	0.0000	0.2264
2013	0.0000	0.0000	0.1350	0.1542	0.2143	0.1956	0.2206	0.2433	0.2530
2014	0.0000	0.1036	0.1478	0.1595	0.1666	0.1957	0.1997	0.2116	0.2215
2015	0.0000	0.1147	0.1367	0.1436	0.1624	0.1809	0.2028	0.2040	0.2161
2016	0.0000	0.1218	0.1213	0.1537	0.1742	0.1819	0.2099	0.2198	0.2247
2017	0.0000	0.1013	0.1231	0.1460	0.1660	0.1801	0.2001	0.1973	0.2109
2018	0.0000	0.0964	0.1275	0.1626	0.1827	0.1974	0.2134	0.2236	0.2387
2019	0.0000	0.0722	0.1309	0.1582	0.1599	0.1792	0.1873	0.1959	0.2124

Table 3.6.2.b. Western Baltic Spring-spawning Herring. *Multi fleet - Fleet C.* Weight-at-age as W-ringers in the catch (WECA, kg)

	0	1	2	3	4	5	6	7	8
2000	0.0216	0.0402	0.0685	0.1072	0.1390	0.1600	0.1463	0.1767	0.1554
2001	0.0244	0.0644	0.0744	0.1049	0.1377	0.1623	0.1906	0.1682	0.1987
2002	0.0095	0.0453	0.0856	0.1129	0.1382	0.1633	0.1887	0.1921	0.2132
2003	0.0130	0.0554	0.0808	0.1136	0.1327	0.1407	0.1553	0.1652	0.1473
2004	0.0237	0.0569	0.0736	0.1133	0.1392	0.1546	0.1677	0.1870	0.1774
2005	0.0230	0.0667	0.0863	0.1121	0.1413	0.1565	0.1711	0.1748	0.1926
2006	0.0262	0.0560	0.0842	0.1103	0.1343	0.1744	0.1816	0.1922	0.1962
2007	0.0472	0.0708	0.0881	0.1142	0.1379	0.1587	0.1912	0.1775	0.2078
2008	0.0362	0.0740	0.0925	0.1149	0.1421	0.1712	0.1809	0.1999	0.1967
2009	0.0227	0.0740	0.0902	0.1153	0.1605	0.1772	0.2039	0.2015	0.2247
2010	0.0279	0.0662	0.0880	0.1280	0.1592	0.1942	0.2109	0.2117	0.2257
2011	0.0215	0.0509	0.0910	0.1208	0.1389	0.1687	0.1853	0.2170	0.2093
2012	0.0000	0.0662	0.0818	0.1340	0.1635	0.1820	0.1994	0.2220	0.2206
2013	0.0000	0.0937	0.0994	0.1324	0.1628	0.1949	0.2041	0.2487	0.2123
2014	0.0141	0.0633	0.1046	0.1411	0.1798	0.1996	0.2221	0.2361	0.2336
2015	0.0175	0.0409	0.0747	0.1145	0.1500	0.1706	0.1877	0.1924	0.2089
2016	0.0000	0.0563	0.0659	0.1236	0.1595	0.1807	0.1999	0.2112	0.2374
2017	0.0305	0.0449	0.0673	0.1113	0.1410	0.1624	0.1710	0.1827	0.1679
2018	0.0216	0.0570	0.0553	0.1068	0.1495	0.1755	0.1887	0.1868	0.1984
2019	0.0201	0.0487	0.0798	0.1073	0.1275	0.1277	0.1556	0.1784	0.1616

Table 3.6.2.c. Western Baltic Spring-spawning Herring. *Multi fleet - Fleet D.* Weight at age as W-ringers in the catch (WECA, kg)

	0	1	2	3	4	5	6	7	8
2000	0.0236	0.0161	0.0658	0.1304	0.1549	0.1669	0.1937	0.0804	0.1499
2001	0.0086	0.0287	0.0564	0.0940	0.1276	0.1440	0.1540	0.1655	0.1840
2002	0.0102	0.0146	0.0230	0.1363	0.1427	0.1700	0.1797	0.0000	0.1790
2003	0.0130	0.0229	0.0516	0.0951	0.1184	0.1102	0.1043	0.1469	0.1469
2004	0.0282	0.0350	0.0772	0.1053	0.1448	0.1548	0.1746	0.1800	0.1855
2005	0.0135	0.0340	0.0738	0.1093	0.1402	0.1490	0.1531	0.1727	0.0000
2006	0.0142	0.0245	0.0721	0.1123	0.1368	0.1824	0.1961	0.2195	0.2047
2007	0.0215	0.0316	0.0624	0.0997	0.1355	0.1502	0.1915	0.1682	0.2107
2008	0.0158	0.0465	0.0826	0.1102	0.1396	0.1717	0.1884	0.2042	0.1896
2009	0.0132	0.0176	0.0871	0.1296	0.1607	0.1728	0.2103	0.2068	0.2058
2010	0.0077	0.0166	0.0399	0.0940	0.0410	0.1110	0.0000	0.0000	0.0000
2011	0.0082	0.0162	0.0448	0.0711	0.0000	0.0000	0.0000	0.0000	0.0000
2012	0.0093	0.0275	0.0398	0.0852	0.0000	0.0000	0.0000	0.0000	0.0000
2013	0.0000	0.0224	0.0748	0.1114	0.1378	0.0000	0.0000	0.0000	0.0000
2014	0.0093	0.0216	0.0244	0.0643	0.0000	0.0000	0.0000	0.0000	0.0000
2015	0.0159	0.0279	0.0415	0.0971	0.2840	0.1470	0.0000	0.0000	0.0000
2016	0.0071	0.0234	0.0375	0.0805	0.0000	0.0780	0.0000	0.0000	0.0000
2017	0.0000	0.0150	0.0250	0.0750	0.0000	0.0000	0.0000	0.0000	0.0000
2018	0.0102	0.0385	0.0427	0.0480	0.0000	0.0000	0.0000	0.0000	0.0000
2019	0.0120	0.0279	0.0397	0.0645	0.0000	0.0000	0.0000	0.0000	0.0000

Table 3.6.2.d. Western Baltic Spring-spawning Herring. *Multi fleet - Fleet F.* Weight-at-age as W-ringers in the catch (WECA, kg)

	0	1	2	3	4	5	6	7	8
2000	0.0165	0.0222	0.0428	0.0804	0.1235	0.1332	0.1434	0.1554	0.1514
2001	0.0129	0.0221	0.0467	0.0689	0.0933	0.1504	0.1445	0.1455	0.1522
2002	0.0108	0.0273	0.0578	0.0817	0.1088	0.1321	0.1866	0.1778	0.1577
2003	0.0224	0.0258	0.0464	0.0753	0.0952	0.1172	0.1259	0.1571	0.1626
2004	0.0037	0.0143	0.0474	0.0777	0.0964	0.1255	0.1504	0.1658	0.1510
2005	0.0136	0.0142	0.0483	0.0733	0.0893	0.1156	0.1436	0.1599	0.1702
2006	0.0212	0.0340	0.0567	0.0840	0.1022	0.1253	0.1439	0.1758	0.1700
2007	0.0119	0.0278	0.0573	0.0749	0.1063	0.1213	0.1407	0.1627	0.1855
2008	0.0163	0.0369	0.0649	0.0877	0.1103	0.1332	0.1406	0.1583	0.1748
2009	0.0105	0.0283	0.0480	0.0905	0.1238	0.1452	0.1604	0.1712	0.1818
2010	0.0122	0.0222	0.0522	0.0871	0.1198	0.1548	0.1706	0.1919	0.1941
2011	0.0124	0.0230	0.0551	0.0781	0.1132	0.1366	0.1476	0.1612	0.1680
2012	0.0181	0.0159	0.0550	0.0954	0.1151	0.1503	0.1676	0.1774	0.1912
2013	0.0137	0.0178	0.0541	0.0868	0.1294	0.1369	0.1453	0.1591	0.1798
2014	0.0165	0.0300	0.0590	0.0823	0.1221	0.1584	0.1560	0.1630	0.1755
2015	0.0071	0.0159	0.0504	0.0793	0.1076	0.1447	0.1706	0.1356	0.1494
2016	0.0103	0.0341	0.0517	0.0846	0.0950	0.1295	0.1604	0.1681	0.1692
2017	0.0220	0.0342	0.0577	0.0828	0.1179	0.1235	0.1376	0.1475	0.1398
2018	0.0159	0.0145	0.0518	0.0872	0.1084	0.1427	0.1434	0.1577	0.1701
2019	0.0167	0.0307	0.0569	0.0837	0.1236	0.1396	0.1656	0.1383	0.1667

Table 3.6.3. Western Baltic Spring-spawning Herring. *Multi fleet.* Weight-at-age as W-ringers in the stock (WEST, kg)

	0	1	2	3	4	5	6	7	8
1991	0.0001	0.0308	0.0528	0.0787	0.1041	0.1245	0.1449	0.1594	0.1640
1992	0.0001	0.0203	0.0451	0.0818	0.1075	0.1313	0.1593	0.1710	0.1869
1993	0.0001	0.0156	0.0402	0.0967	0.1079	0.1409	0.1672	0.1827	0.1891
1994	0.0001	0.0186	0.0529	0.0836	0.1077	0.1392	0.1566	0.1768	0.2028
1995	0.0001	0.0130	0.0459	0.0708	0.1327	0.1674	0.1892	0.2097	0.2338
1996	0.0001	0.0182	0.0546	0.0905	0.1170	0.1197	0.1538	0.1467	0.1280
1997	0.0001	0.0131	0.0515	0.1063	0.1333	0.1662	0.1943	0.2090	0.2264
1998	0.0001	0.0221	0.0558	0.0829	0.1128	0.1338	0.1678	0.1683	0.1843
1999	0.0001	0.0211	0.0567	0.0870	0.1081	0.1480	0.1601	0.1439	0.1504
2000	0.0001	0.0140	0.0431	0.0837	0.1250	0.1436	0.1629	0.1650	0.1831
2001	0.0001	0.0169	0.0509	0.0783	0.1159	0.1690	0.1763	0.1681	0.1805
2002	0.0001	0.0164	0.0637	0.0905	0.1239	0.1736	0.1983	0.1980	0.2036
2003	0.0001	0.0144	0.0445	0.0793	0.1051	0.1268	0.1506	0.1729	0.1847
2004	0.0001	0.0131	0.0456	0.0811	0.1092	0.1440	0.1628	0.1932	0.2076
2005	0.0001	0.0126	0.0514	0.0800	0.1066	0.1322	0.1573	0.1677	0.1820
2006	0.0001	0.0185	0.0621	0.0953	0.1174	0.1659	0.1710	0.1858	0.1871
2007	0.0001	0.0150	0.0550	0.0800	0.1140	0.1430	0.1710	0.1750	0.1880
2008	0.0001	0.0180	0.0680	0.0860	0.1100	0.1390	0.1430	0.1410	0.1580
2009	0.0001	0.0230	0.0520	0.0900	0.1300	0.1560	0.1740	0.1850	0.1990
2010	0.0001	0.0140	0.0626	0.0974	0.1283	0.1618	0.1813	0.2023	0.2045
2011	0.0001	0.0090	0.0580	0.0950	0.1260	0.1560	0.1730	0.1850	0.1920
2012	0.0001	0.0120	0.0500	0.0920	0.1140	0.1580	0.1780	0.1910	0.2010
2013	0.0001	0.0140	0.0560	0.0950	0.1290	0.1430	0.1610	0.1790	0.1990
2014	0.0001	0.0160	0.0520	0.0810	0.1300	0.1650	0.1740	0.1900	0.2050
2015	0.0001	0.0150	0.0490	0.0880	0.1160	0.1570	0.1800	0.1690	0.1940
2016	0.0001	0.0138	0.0415	0.0811	0.1057	0.1366	0.1735	0.1824	0.1903
2017	0.0001	0.0177	0.0479	0.0815	0.1181	0.1324	0.1558	0.1731	0.1751

2018	0.0001	0.0125	0.0491	0.0828	0.1091	0.1432	0.1544	0.1696	0.1853
2019	0.0001	0.0256	0.0568	0.0771	0.1190	0.1481	0.1705	0.1778	0.1910

Table 3.6.4- Western Baltic Spring-spawning Herring. *Multi fleet.* Natural mortality (NATMOR)

	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
1991	0.3	0.5	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1992	0.3	0.5	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1993	0.3	0.5	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1994	0.3	0.5	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1995	0.3	0.5	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1996	0.3	0.5	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1997	0.3	0.5	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1998	0.3	0.5	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1999	0.3	0.5	0.2	0.2	0.2	0.2	0.2	0.2	0.2
2000	0.3	0.5	0.2	0.2	0.2	0.2	0.2	0.2	0.2
2001	0.3	0.5	0.2	0.2	0.2	0.2	0.2	0.2	0.2
2002	0.3	0.5	0.2	0.2	0.2	0.2	0.2	0.2	0.2
2003	0.3	0.5	0.2	0.2	0.2	0.2	0.2	0.2	0.2
2004	0.3	0.5	0.2	0.2	0.2	0.2	0.2	0.2	0.2
2005	0.3	0.5	0.2	0.2	0.2	0.2	0.2	0.2	0.2
2006	0.3	0.5	0.2	0.2	0.2	0.2	0.2	0.2	0.2
2007	0.3	0.5	0.2	0.2	0.2	0.2	0.2	0.2	0.2
2008	0.3	0.5	0.2	0.2	0.2	0.2	0.2	0.2	0.2
2009	0.3	0.5	0.2	0.2	0.2	0.2	0.2	0.2	0.2
2010	0.3	0.5	0.2	0.2	0.2	0.2	0.2	0.2	0.2
2011	0.3	0.5	0.2	0.2	0.2	0.2	0.2	0.2	0.2
2012	0.3	0.5	0.2	0.2	0.2	0.2	0.2	0.2	0.2
2013	0.3	0.5	0.2	0.2	0.2	0.2	0.2	0.2	0.2
2014	0.3	0.5	0.2	0.2	0.2	0.2	0.2	0.2	0.2

2015	0.3	0.5	0.2	0.2	0.2	0.2	0.2	0.2	0.2
2016	0.3	0.5	0.2	0.2	0.2	0.2	0.2	0.2	0.2
2017	0.3	0.5	0.2	0.2	0.2	0.2	0.2	0.2	0.2
2018	0.3	0.5	0.2	0.2	0.2	0.2	0.2	0.2	0.2
2019	0.3	0.5	0.2	0.2	0.2	0.2	0.2	0.2	0.2

Table 3.6.5. Western Baltic Spring-spawning Herring. *Multi fleet.* Proportion mature (MATPROP)

	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
1991	0	0	0.2	0.75	0.9	1	1	1	1
1992	0	0	0.2	0.75	0.9	1	1	1	1
1993	0	0	0.2	0.75	0.9	1	1	1	1
1994	0	0	0.2	0.75	0.9	1	1	1	1
1995	0	0	0.2	0.75	0.9	1	1	1	1
1996	0	0	0.2	0.75	0.9	1	1	1	1
1997	0	0	0.2	0.75	0.9	1	1	1	1
1998	0	0	0.2	0.75	0.9	1	1	1	1
1999	0	0	0.2	0.75	0.9	1	1	1	1
2000	0	0	0.2	0.75	0.9	1	1	1	1
2001	0	0	0.2	0.75	0.9	1	1	1	1
2002	0	0	0.2	0.75	0.9	1	1	1	1
2003	0	0	0.2	0.75	0.9	1	1	1	1
2004	0	0	0.2	0.75	0.9	1	1	1	1
2005	0	0	0.2	0.75	0.9	1	1	1	1
2006	0	0	0.2	0.75	0.9	1	1	1	1
2007	0	0	0.2	0.75	0.9	1	1	1	1
2008	0	0	0.2	0.75	0.9	1	1	1	1
2009	0	0	0.2	0.75	0.9	1	1	1	1
2010	0	0	0.2	0.75	0.9	1	1	1	1
2011	0	0	0.2	0.75	0.9	1	1	1	1

2012	0	0	0.2	0.75	0.9	1	1	1	1
2013	0	0	0.2	0.75	0.9	1	1	1	1
2014	0	0	0.2	0.75	0.9	1	1	1	1
2015	0	0	0.2	0.75	0.9	1	1	1	1
2016	0	0	0.2	0.75	0.9	1	1	1	1
2017	0	0	0.2	0.75	0.9	1	1	1	1
2018	0	0	0.2	0.75	0.9	1	1	1	1
2019	0	0	0.2	0.75	0.9	1	1	1	1

Table 3.6.6. Western Baltic Spring-spawning Herring. *Multi fleet.* Fraction of harvest before spawning (FPROP)

	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
1991	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
1992	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
1993	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
1994	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
1995	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
1996	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
1997	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
1998	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
1999	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
2000	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
2001	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
2002	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
2003	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
2004	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
2005	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
2006	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
2007	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
2008	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1

2009	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
2010	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
2011	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
2012	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
2013	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
2014	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
2015	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
2016	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
2017	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
2018	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
2019	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1

Table 3.6.7. Western Baltic Spring-spawning Herring. *Multi fleet.* Fraction of natural mortality before spawning (MPROP)

	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
1991	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
1992	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
1993	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
1994	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
1995	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
1996	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
1997	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
1998	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
1999	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
2000	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
2001	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
2002	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
2003	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
2004	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
2005	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25

2006	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
2007	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
2008	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
2009	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
2010	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
2011	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
2012	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
2013	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
2014	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
2015	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
2016	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
2017	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
2018	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
2019	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25

Table 3.6.8.a. Western Baltic Spring-spawning Herring. *Multi fleet.* Survey indices: HERAS (number)

	3	4	5	6
1991	1927000	866000	350000	88000
1992	1799000	1593000	556000	197000
1993	1274000	598000	434000	154000
1994	935000	501000	239000	186000
1995	1022000	1270000	255000	174000
1996	247000	141000	119000	37000
1997	787000	166000	67000	69000
1998	901000	282000	111000	51000
1999	NA	NA	NA	NA
2000	673600	363900	185700	55600
2001	452300	153100	96400	37600
2002	1392800	524300	87500	39500

2003	394600	323400	103400	25200
2004	726000	306900	183700	72100
2005	463500	201300	102500	83600
2006	1780400	490000	180400	27000
2007	933000	499000	154000	34000
2008	843000	333000	274000	176000
2009	205000	161000	82000	86000
2010	254000	115000	65000	24000
2011	259000	163000	70000	53000
2012	236000	87000	76000	33000
2013	525000	53000	30000	12000
2014	176000	248000	28000	37000
2015	446000	224000	171000	82000
2016	381000	99000	40000	40000
2017	661000	401000	94000	53000
2018	271000	175000	169000	50000
2019	315000	109000	67000	52000

Table 3.6.8.b. Western Baltic Spring-spawning Herring, continued. *Multi fleet.* Survey indices: GerAS (number in thousands)

	1	**2**	**3**	**4**
1994	415730	883810	559720	443730
1995	1675340	328610	357960	353850
1996	1439460	590010	434090	295170
1997	1955400	738180	394530	162430
1998	801350	678530	394070	236830
1999	1338710	287240	232510	155950
2000	1429880	453980	328960	201590
2001	NA	NA	NA	NA
2002	837549	421393	575356	341119

2003	1238480	222530	217270	260350
2004	968860	592360	346230	163150
2005	750199	590756	295659	142778
2006	940892	226959	279618	212201
2007	558851	260402	117412	76782
2008	392737	165347	166301	102018
2009	270959	95866	43553	17761
2010	534633	305540	214539	107364
2011	1206762	360354	210455	115984
2012	755034	294242	193974	124548
2013	893837	456204	307567	262908
2014	769320	242590	279650	332660
2015	440738	509769	221344	129795
2016	493366	155417	196061	60953
2017	463940	145360	123230	137500
2018	428530	89280	41160	20240
2019	247870	122948	47727	24244

Table 3.6.8.c. Western Baltic Spring-spawning Herring, continued. *Multi fleet.* Survey indices: N20 (number in millions)

	0
1992	1060
1993	3044
1994	12515
1995	7930
1996	21012
1997	4872
1998	16743
1999	20364
2000	3026
2001	4845
2002	11324
2003	5507
2004	5640
2005	3887
2006	3774
2007	1829
2008	1622
2009	6464
2010	7037
2011	4444
2012	1140
2013	3021
2014	539
2015	2478
2016	442
2017	1247
2018	1563

2019	1317

Table 3.6.8.d. Western Baltic Spring-spawning Herring, continued. *Multi fleet*. Survey indices: IBTS+BITS-Q1 (number per hour)

	1	2	3
2002	1253526	52049	11578
2003	597562	106389	3185
2004	308141	62014	12337
2005	217604	107178	6352
2006	137387	26839	5972
2007	206041	31787	2974
2008	174691	30464	3747
2009	618446	34226	1103
2010	266187	67641	8802
2011	161067	61937	11777
2012	345880	71190	3522
2013	165769	66426	12310
2014	135127	16529	3075
2015	279696	58286	1850
2016	199430	90532	5677
2017	441987	64496	10594
2018	103137	56666	2753
2019	431838	34486	4548

Table 3.6.8.e. Western Baltic Spring-spawning Herring, continued. *Multi fleet*. Survey indices: IBTS+BITS-Q3.4 (number per hour)

	2	3
2002	3024	1278
2003	6140	1381
2004	3289	1205
2005	3319	587.8
2006	2600	1156
2007	3531	633.3
2008	2215	1138
2009	2976	541.4
2010	3691	1104
2011	2629	630.2
2012	5397	782.5
2013	4876	1371
2014	1187	1178
2015	9256	1384
2016	7714	2110
2017	5056	1521
2018	5091	1002
2019	8107	2798

Table 3.6.9 - Western Baltic Spring-spawning Herring. *Multi fleet.* SAM software version

Model version: [0.5.4 , 0.5.4 , 0.5.4]

Model SHA: [e2a30d42316c , e2a30d42316c , e2a30d42316c]

Table 3.6.10. Western Baltic Spring-spawning Herring. *Multi fleet.* SAM configuration settings

Configuration saved: Tue Feb 13 12:34:28 2018

Where a matrix is specified rows corresponds to fleets and columns to ages.

Same number indicates same parameter used

Numbers (integers) starts from zero and must be consecutive

$minAge

The minimium age class in the assessment 0

$maxAge

The maximum age class in the assessment 8

$maxAgePlusGroup

Is last age group considered a plus group (1 yes, or 0 no). 1

$keyLogFsta

Coupling of the fishing mortality states (nomally only first row is used).

-1 0 1 2 3 4 5 6 6

7 8 9 10 11 12 13 14 14

15 16 17 18 19 20 21 22 22

23 24 25 26 27 28 29 30 30

-1 -1 -1 -1 -1 -1 -1 -1 -1

-1 -1 -1 -1 -1 -1 -1 -1 -1

-1 -1 -1 -1 -1 -1 -1 -1 -1

-1 -1 -1 -1 -1 -1 -1 -1 -1

-1 -1 -1 -1 -1 -1 -1 -1 -1

-1 -1 -1 -1 -1 -1 -1 -1 -1

$corFlag

Correlation of fishing mortality across ages (0 independent, 1 compound symmetry, or 2 AR(1)

0 2 2 2

$keyLogFpar

Coupling of the survey catchability parameters (nomally first row is not used, as that is covered by fishing mortality).

-1 -1 -1 -1 -1 -1 -1 -1 -1

-1 -1 -1 -1 -1 -1 -1 -1 -1 -1

-1 -1 -1 -1 -1 -1 -1 -1 -1 -1

-1 -1 -1 -1 -1 -1 -1 -1 -1 -1

-1 -1 -1 0 1 2 3 -1 -1

-1 4 5 6 7 -1 -1 -1 -1

8 -1 -1 -1 -1 -1 -1 -1 -1

-1 9 10 11 -1 -1 -1 -1 -1

-1 -1 12 13 -1 -1 -1 -1 -1

-1 -1 -1 -1 -1 -1 -1 -1 -1

$keyQpow

Density-dependent catchability power parameters (if any).

-1 -1 -1 -1 -1 -1 -1 -1 -1

-1 -1 -1 -1 -1 -1 -1 -1 -1

-1 -1 -1 -1 -1 -1 -1 -1 -1

-1 -1 -1 -1 -1 -1 -1 -1 -1

-1 -1 -1 -1 -1 -1 -1 -1 -1

-1 -1 -1 -1 -1 -1 -1 -1 -1

-1 -1 -1 -1 -1 -1 -1 -1 -1

-1 -1 -1 -1 -1 -1 -1 -1 -1

-1 -1 -1 -1 -1 -1 -1 -1 -1

-1 -1 -1 -1 -1 -1 -1 -1 -1

continued

Table 3.6.10. Western Baltic Spring-spawning Herring continued

```
$keyVarF
# Coupling of process variance parameters for log(F)-process (nomally only first row is used)
 -1  0  0  0  0  0  0  0  0
  1  1  1  1  1  1  1  1  1
  2  2  2  2  2  2  2  2  2
  3  3  3  3  3  3  3  3  3
 -1 -1 -1 -1 -1 -1 -1 -1 -1
 -1 -1 -1 -1 -1 -1 -1 -1 -1
 -1 -1 -1 -1 -1 -1 -1 -1 -1
 -1 -1 -1 -1 -1 -1 -1 -1 -1
 -1 -1 -1 -1 -1 -1 -1 -1 -1
 -1 -1 -1 -1 -1 -1 -1 -1 -1
$keyVarLogN
# Coupling of process variance parameters for log(N)-process
 0 1 1 1 1 1 1 1 1
$keyVarObs
# Coupling of the variance parameters for the observations.
 -1 0 1 1 1 1 1 1 1
  2 3 4 4 4 4 4 4 4
  5 6 6 6 6 6 6 6 6
  7 8 8 8 8 8 8 8 8
 -1 -1 -1 9 9 9 9 -1 -1
 -1 10 10 10 10 -1 -1 -1 -1
  11 -1 -1 -1 -1 -1 -1 -1 -1
 -1 12 12 12 -1 -1 -1 -1 -1
 -1 -1 13 13 -1 -1 -1 -1 -1
 -1 -1 -1 -1 -1 -1 -1 -1 -1
$obsCorStruct
# Covariance structure for each fleet ("ID" independent, "AR" AR(1), or "US" for unstructured). |
Possible values are: "ID" "AR" "US"
 "ID" "AR" "ID" "AR" "AR" "AR" "ID" "AR" "US" "NA"
$keyCorObs
# Coupling of correlation parameters can only be specified if the AR(1) structure is chosen above.
```

NA's indicate where correlation parameters can be specified (-1 where they cannot).

#0-1 1-2 2-3 3-4 4-5 5-6 6-7 7-8

NA NA NA NA NA NA NA NA

3 3 3 3 4 4 4 4

NA NA NA NA NA NA NA NA

3 3 3 3 4 4 4 4

-1 -1 -1 0 0 1 -1 -1

-1 2 1 0 -1 -1 -1 -1

-1 -1 -1 -1 -1 -1 -1 -1

-1 2 1 -1 -1 -1 -1 -1

-1 -1 NA -1 -1 -1 -1 -1

-1 -1 -1 -1 -1 -1 -1 -1

$stockRecruitmentModelCode

Stock recruitment code (0 for plain random walk, 1 for Ricker, and 2 for Beverton-Holt). 0

$noScaledYears

Number of years where catch scaling is applied. 0

$keyScaledYears

A vector of the years where catch scaling is applied.

$keyParScaledYA

A matrix specifying the couplings of scale parameters (nrow = no scaled years, ncols = no ages).

$fbarRange

lowest and higest age included in Fbar 3 6

$keyBiomassTreat

To be defined only if a biomass survey is used (0 SSB index, 1 catch index, and 2 FSB index).

-1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1

$obsLikelihoodFlag

Option for observational likelihood | Possible values are: "LN" "ALN"

"LN" "LN" "LN" "LN" "LN" "LN" "LN" "LN" "LN" "LN"

$fixVarToWeight

If weight attribute is supplied for observations this option sets the treatment (0 relative weight, 1 fix variance to weight). 0

Table 3.6.11. Western Baltic Spring-spawning Herring. *Multi fleet.* Stock summary - Estimated recruitment (1000), spawning-stock biomass (SSB) (tonnes), average fishing mortality and total-stock biomass (TSB) (tonnes).

Year	R(age 0)	Low	High	SSB	Low	High	$F_{bar(3-6)}$	Low	High	TSB	Low	High
1991	4799683	3606013	6388484	296049	237411	369171	0.481	0.368	0.629	593617	492727	715166
1992	3569967	2789432	4568909	291869	238821	356702	0.517	0.422	0.634	504745	424702	599873
1993	3044671	2325112	3986913	276270	227054	336154	0.559	0.463	0.675	439318	369089	522911
1994	4380591	3378901	5679237	222218	183770	268708	0.590	0.491	0.709	366505	310022	433278
1995	4168930	3256947	5336279	192232	158708	232838	0.612	0.509	0.735	311642	264354	367389
1996	4186855	3277449	5348598	131342	109638	157342	0.631	0.524	0.761	274104	234705	320116
1997	3534281	2721940	4589058	147484	123158	176615	0.621	0.518	0.745	279504	238601	327419
1998	4460258	3480288	5716166	120118	100572	143464	0.605	0.506	0.724	265591	227461	310112
1999	4735476	3689806	6077482	120658	100978	144174	0.569	0.474	0.683	268044	230224	312076
2000	2955711	2315206	3773413	121179	101793	144256	0.574	0.481	0.684	251113	215841	292150
2001	2733279	2175782	3433623	133819	113004	158469	0.565	0.472	0.677	271699	233649	315945
2002	2658828	2115568	3341592	161101	136016	190813	0.517	0.429	0.622	286795	246580	333569
2003	2851159	2245718	3619824	126813	106940	150380	0.490	0.402	0.598	217762	187622	252745
2004	2043286	1613439	2587651	127885	107828	151672	0.498	0.412	0.601	218223	187891	253452
2005	1737092	1376675	2191867	116818	98547	138476	0.510	0.427	0.608	205948	176527	240271
2006	1361046	1071176	1729357	130128	109556	154564	0.512	0.429	0.610	221643	189500	259239
2007	1409637	1113736	1784154	104089	87222	124219	0.534	0.447	0.637	170611	145228	200430
2008	1171340	926411	1481026	85831	72462	101668	0.543	0.445	0.662	150842	129365	175885
2009	1156949	913876	1464675	78832	66726	93135	0.510	0.415	0.625	138189	119287	160086
2010	1470035	1162734	1858553	74002	62667	87386	0.433	0.354	0.529	123627	106548	143445
2011	1367582	1085691	1722663	67657	57224	79994	0.369	0.289	0.471	111973	96212	130317
2012	1169338	922063	1482927	68569	57939	81150	0.376	0.305	0.463	119651	102840	139211
2013	1581113	1180798	2117143	78598	66338	93123	0.383	0.311	0.471	133931	114786	156268
2014	1161332	903540	1492675	82818	69291	98985	0.378	0.305	0.468	138927	118887	162345
2015	937438	716843	1225917	81485	67778	97964	0.423	0.347	0.514	139013	117843	163986
2016	939669	705783	1251061	77854	64693	93691	0.475	0.374	0.604	121671	102202	144848
2017	1000047	715616	1397529	71908	58822	87907	0.499	0.366	0.681	114324	94944	137661

2018	783319	509261	1204860	60944	46696	79539	0.473	0.338	0.661	97762	77151	123881
2019	778899	423940	1431060	56621	40271	79611	0.382	0.249	0.584	101574	75349	136927

Table 3.6.12.a. Western Baltic Spring-spawning Herring. *Multi fleet.* Estimated fishing mortality - Sum all fleets

Year Age	0	1	2	3	4	5	6	7	8
1991	0.027	0.217	0.340	0.391	0.453	0.507	0.574	0.637	0.637
1992	0.027	0.222	0.355	0.413	0.483	0.545	0.628	0.703	0.703
1993	0.034	0.251	0.381	0.443	0.521	0.589	0.684	0.767	0.767
1994	0.041	0.282	0.407	0.466	0.550	0.620	0.724	0.812	0.812
1995	0.064	0.361	0.444	0.490	0.569	0.640	0.749	0.838	0.838
1996	0.047	0.307	0.430	0.493	0.585	0.665	0.783	0.883	0.883
1997	0.049	0.302	0.421	0.482	0.572	0.653	0.777	0.896	0.896
1998	0.052	0.308	0.423	0.474	0.558	0.636	0.752	0.885	0.885
1999	0.037	0.255	0.399	0.449	0.525	0.598	0.704	0.835	0.835
2000	0.029	0.232	0.393	0.448	0.529	0.603	0.714	0.851	0.851
2001	0.030	0.229	0.379	0.433	0.519	0.594	0.714	0.844	0.844
2002	0.028	0.213	0.355	0.399	0.475	0.543	0.651	0.773	0.773
2003	0.025	0.201	0.334	0.375	0.450	0.515	0.621	0.738	0.738
2004	0.025	0.204	0.331	0.377	0.458	0.522	0.632	0.751	0.751
2005	0.017	0.179	0.331	0.385	0.473	0.533	0.646	0.767	0.767
2006	0.016	0.185	0.360	0.402	0.479	0.532	0.634	0.746	0.746
2007	0.013	0.174	0.369	0.418	0.502	0.556	0.658	0.762	0.762
2008	0.012	0.175	0.380	0.424	0.510	0.567	0.669	0.766	0.766
2009	0.013	0.187	0.386	0.405	0.477	0.529	0.627	0.716	0.716
2010	0.008	0.133	0.311	0.339	0.406	0.449	0.537	0.616	0.616
2011	0.006	0.104	0.247	0.279	0.345	0.385	0.467	0.539	0.539
2012	0.006	0.100	0.232	0.273	0.350	0.396	0.485	0.557	0.557
2013	0.006	0.101	0.231	0.271	0.355	0.406	0.499	0.578	0.578
2014	0.005	0.097	0.230	0.269	0.349	0.402	0.492	0.579	0.579

2015	0.007	0.120	0.270	0.299	0.387	0.451	0.553	0.666	0.666
2016	0.006	0.122	0.306	0.342	0.431	0.507	0.621	0.766	0.766
2017	0.005	0.113	0.314	0.361	0.447	0.532	0.657	0.827	0.827
2018	0.004	0.104	0.290	0.336	0.420	0.506	0.629	0.815	0.815
2019	0.003	0.081	0.227	0.266	0.336	0.408	0.516	0.689	0.689

Table 3.6.12.b. Western Baltic Spring-spawning Herring. *Multi fleet.* Estimated fishing mortality - Fleet A

Year Age	0	1	2	3	4	5	6	7	8
1991	0.000	0.000	0.003	0.015	0.016	0.018	0.019	0.021	0.021
1992	0.000	0.000	0.003	0.015	0.016	0.018	0.020	0.022	0.022
1993	0.000	0.000	0.003	0.015	0.016	0.018	0.020	0.023	0.023
1994	0.000	0.000	0.003	0.015	0.016	0.018	0.021	0.024	0.024
1995	0.000	0.000	0.003	0.015	0.016	0.018	0.022	0.025	0.025
1996	0.000	0.000	0.003	0.015	0.017	0.019	0.023	0.028	0.028
1997	0.000	0.000	0.003	0.015	0.017	0.019	0.023	0.031	0.031
1998	0.000	0.000	0.003	0.015	0.017	0.020	0.023	0.035	0.035
1999	0.000	0.000	0.003	0.015	0.018	0.021	0.024	0.038	0.038
2000	0.000	0.000	0.003	0.015	0.018	0.022	0.026	0.041	0.041
2001	0.000	0.000	0.003	0.014	0.019	0.022	0.027	0.042	0.042
2002	0.000	0.000	0.002	0.014	0.018	0.021	0.026	0.042	0.042
2003	0.000	0.000	0.002	0.013	0.017	0.019	0.025	0.041	0.041
2004	0.000	0.000	0.002	0.013	0.016	0.017	0.023	0.037	0.037
2005	0.000	0.000	0.002	0.011	0.015	0.015	0.023	0.038	0.038
2006	0.000	0.000	0.001	0.009	0.014	0.014	0.021	0.038	0.038
2007	0.000	0.000	0.001	0.007	0.011	0.010	0.019	0.031	0.031
2008	0.000	0.000	0.001	0.006	0.010	0.008	0.017	0.027	0.027
2009	0.000	0.000	0.001	0.005	0.009	0.007	0.017	0.030	0.030
2010	0.000	0.000	0.001	0.005	0.008	0.006	0.016	0.027	0.027
2011	0.000	0.000	0.001	0.005	0.008	0.006	0.016	0.024	0.024

2012	0.000	0.000	0.000	0.004	0.008	0.005	0.018	0.023	0.023
2013	0.000	0.000	0.001	0.005	0.008	0.006	0.019	0.026	0.026
2014	0.000	0.000	0.001	0.005	0.009	0.008	0.022	0.034	0.034
2015	0.000	0.000	0.001	0.006	0.009	0.010	0.023	0.041	0.041
2016	0.000	0.000	0.001	0.007	0.009	0.011	0.024	0.046	0.046
2017	0.000	0.000	0.001	0.007	0.010	0.012	0.023	0.052	0.052
2018	0.000	0.000	0.001	0.008	0.011	0.014	0.026	0.067	0.067
2019	0.000	0.000	0.001	0.008	0.012	0.016	0.029	0.077	0.077

Table 3.6.12.c. Western Baltic Spring-spawning Herring. *Multi fleet.* Estimated fishing mortality - Fleet C

Year Age	0	1	2	3	4	5	6	7	8
1991	0.000	0.039	0.135	0.110	0.087	0.077	0.072	0.073	0.073
1992	0.000	0.040	0.139	0.113	0.090	0.079	0.074	0.075	0.075
1993	0.000	0.041	0.144	0.117	0.093	0.082	0.077	0.078	0.078
1994	0.000	0.043	0.152	0.123	0.098	0.087	0.081	0.082	0.082
1995	0.000	0.046	0.160	0.130	0.103	0.091	0.086	0.086	0.086
1996	0.000	0.046	0.160	0.130	0.103	0.091	0.086	0.086	0.086
1997	0.000	0.046	0.159	0.129	0.103	0.091	0.085	0.086	0.086
1998	0.000	0.048	0.168	0.136	0.108	0.096	0.090	0.090	0.090
1999	0.000	0.050	0.174	0.141	0.112	0.099	0.093	0.094	0.094
2000	0.000	0.051	0.179	0.145	0.116	0.102	0.096	0.097	0.097
2001	0.000	0.048	0.167	0.136	0.108	0.095	0.089	0.090	0.090
2002	0.000	0.048	0.170	0.138	0.110	0.097	0.091	0.091	0.091
2003	0.000	0.044	0.152	0.123	0.098	0.087	0.081	0.082	0.082
2004	0.000	0.038	0.134	0.109	0.087	0.076	0.072	0.072	0.072
2005	0.000	0.043	0.149	0.121	0.096	0.085	0.080	0.080	0.080
2006	0.000	0.049	0.172	0.139	0.111	0.098	0.092	0.092	0.092
2007	0.000	0.054	0.188	0.152	0.121	0.107	0.100	0.101	0.101
2008	0.000	0.057	0.199	0.162	0.129	0.114	0.107	0.107	0.107

2009	0.000	0.060	0.210	0.170	0.136	0.120	0.112	0.113	0.113
2010	0.000	0.055	0.193	0.156	0.125	0.110	0.103	0.104	0.104
2011	0.000	0.044	0.153	0.124	0.099	0.087	0.082	0.082	0.082
2012	0.000	0.037	0.130	0.106	0.084	0.074	0.070	0.070	0.070
2013	0.000	0.034	0.118	0.096	0.077	0.068	0.063	0.064	0.064
2014	0.000	0.036	0.126	0.102	0.082	0.072	0.068	0.068	0.068
2015	0.000	0.041	0.142	0.115	0.092	0.081	0.076	0.076	0.076
2016	0.000	0.053	0.185	0.150	0.120	0.106	0.099	0.100	0.100
2017	0.000	0.061	0.212	0.172	0.137	0.121	0.114	0.114	0.114
2018	0.000	0.056	0.195	0.158	0.126	0.111	0.105	0.105	0.105
2019	0.000	0.043	0.151	0.123	0.098	0.086	0.081	0.082	0.082

Table 3.6.12.d. Western Baltic Spring-spawning Herring. *Multi fleet.* Estimated fishing mortality - Fleet D

Year Age	0	1	2	3	4	5	6	7	8
1991	0.014	0.042	0.017	0.008	0.004	0.003	0.004	0.004	0.004
1992	0.014	0.037	0.015	0.008	0.004	0.003	0.004	0.003	0.003
1993	0.020	0.054	0.021	0.010	0.005	0.004	0.005	0.004	0.004
1994	0.026	0.076	0.029	0.013	0.006	0.004	0.006	0.005	0.005
1995	0.049	0.149	0.052	0.021	0.009	0.006	0.008	0.006	0.006
1996	0.032	0.090	0.031	0.013	0.006	0.004	0.006	0.005	0.005
1997	0.034	0.090	0.030	0.012	0.005	0.004	0.006	0.005	0.005
1998	0.037	0.101	0.033	0.013	0.006	0.004	0.005	0.005	0.005
1999	0.023	0.060	0.021	0.008	0.004	0.003	0.004	0.003	0.003
2000	0.016	0.040	0.014	0.006	0.003	0.002	0.003	0.003	0.003
2001	0.018	0.048	0.020	0.008	0.005	0.005	0.009	0.009	0.009
2002	0.018	0.055	0.022	0.007	0.004	0.003	0.004	0.003	0.003
2003	0.016	0.059	0.032	0.015	0.009	0.008	0.010	0.008	0.008
2004	0.016	0.067	0.044	0.023	0.014	0.012	0.012	0.009	0.009
2005	0.008	0.038	0.026	0.012	0.007	0.005	0.004	0.003	0.003

2006	0.008	0.048	0.043	0.023	0.013	0.013	0.011	0.009	0.009
2007	0.005	0.032	0.030	0.015	0.008	0.009	0.008	0.007	0.007
2008	0.005	0.033	0.033	0.014	0.005	0.006	0.005	0.006	0.006
2009	0.007	0.055	0.048	0.015	0.004	0.004	0.003	0.003	0.003
2010	0.003	0.021	0.015	0.003	0.000	0.000	0.000	0.000	0.000
2011	0.001	0.013	0.008	0.001	0.000	0.000	0.000	0.000	0.000
2012	0.001	0.012	0.009	0.001	0.000	0.000	0.000	0.000	0.000
2013	0.001	0.015	0.017	0.002	0.000	0.000	0.000	0.000	0.000
2014	0.001	0.014	0.014	0.002	0.000	0.000	0.000	0.000	0.000
2015	0.002	0.029	0.030	0.003	0.000	0.000	0.000	0.000	0.000
2016	0.001	0.019	0.021	0.002	0.000	0.000	0.000	0.000	0.000
2017	0.000	0.004	0.005	0.000	0.000	0.000	0.000	0.000	0.000
2018	0.000	0.003	0.004	0.000	0.000	0.000	0.000	0.000	0.000
2019	0.000	0.002	0.003	0.000	0.000	0.000	0.000	0.000	0.000

Table 3.6.12.e. Western Baltic Spring-spawning Herring. *Multi fleet.* Estimated fishing mortality - Fleet F

Year Age	0	1	2	3	4	5	6	7	8
1991	0.013	0.137	0.185	0.258	0.346	0.408	0.479	0.540	0.540
1992	0.013	0.145	0.198	0.277	0.374	0.445	0.530	0.603	0.603
1993	0.014	0.156	0.213	0.301	0.407	0.485	0.581	0.663	0.663
1994	0.015	0.163	0.223	0.315	0.429	0.511	0.615	0.701	0.701
1995	0.015	0.167	0.229	0.324	0.440	0.524	0.633	0.720	0.720
1996	0.015	0.172	0.236	0.335	0.459	0.551	0.668	0.764	0.764
1997	0.015	0.166	0.229	0.325	0.446	0.539	0.663	0.774	0.774
1998	0.014	0.159	0.219	0.311	0.427	0.516	0.634	0.755	0.755
1999	0.013	0.145	0.201	0.285	0.392	0.475	0.583	0.699	0.699
2000	0.013	0.141	0.197	0.282	0.392	0.477	0.590	0.711	0.711
2001	0.012	0.133	0.189	0.275	0.388	0.472	0.588	0.703	0.703
2002	0.010	0.109	0.161	0.240	0.344	0.423	0.531	0.636	0.636

2003	0.009	0.098	0.148	0.224	0.326	0.401	0.505	0.608	0.608
2004	0.009	0.098	0.151	0.233	0.341	0.416	0.525	0.632	0.632
2005	0.009	0.098	0.154	0.241	0.355	0.428	0.539	0.646	0.646
2006	0.008	0.088	0.144	0.230	0.341	0.408	0.510	0.607	0.607
2007	0.008	0.089	0.150	0.243	0.362	0.430	0.531	0.622	0.622
2008	0.007	0.085	0.147	0.243	0.366	0.439	0.541	0.626	0.626
2009	0.006	0.071	0.128	0.214	0.328	0.398	0.496	0.569	0.569
2010	0.005	0.056	0.102	0.174	0.272	0.333	0.418	0.485	0.485
2011	0.004	0.047	0.086	0.149	0.238	0.293	0.370	0.433	0.433
2012	0.004	0.050	0.092	0.161	0.259	0.317	0.397	0.464	0.464
2013	0.004	0.051	0.095	0.168	0.271	0.332	0.416	0.488	0.488
2014	0.004	0.048	0.090	0.160	0.259	0.322	0.402	0.477	0.477
2015	0.004	0.050	0.097	0.176	0.286	0.361	0.454	0.548	0.548
2016	0.004	0.050	0.099	0.183	0.302	0.390	0.498	0.619	0.619
2017	0.004	0.048	0.096	0.181	0.300	0.399	0.520	0.660	0.660
2018	0.004	0.045	0.090	0.170	0.282	0.381	0.498	0.643	0.643
2019	0.003	0.036	0.072	0.135	0.226	0.306	0.406	0.530	0.530

Table 3.6.13. Western Baltic Spring-spawning Herring. *Multi fleet.* Estimated stock numbers (1000) at age

Year Age	0	1	2	3	4	5	6	7	8
1991	4799683	4174759	2186131	1870774	928444	562652	166842	49793	17549
1992	3569967	3521375	2021391	1279546	1036927	478681	275550	77865	29738
1993	3044671	2581178	1755580	1144063	703619	522153	225230	120472	43874
1994	4380591	2120126	1216349	1010532	589265	349455	235315	92720	62361
1995	4168930	3177171	975586	648126	544227	266447	157370	92360	56092
1996	4186855	2883667	1352501	515604	321277	250212	114769	60911	52631
1997	3534281	2968223	1278394	736759	257897	144496	102581	42800	39119
1998	4460258	2436104	1325852	687712	377186	119424	62473	37353	27400
1999	4735476	3150323	1067716	702067	352129	179507	51248	24619	21245

2000	2955711	3462052	1486267	580043	362202	173091	80939	20906	16269
2001	2733279	2084759	1674773	838734	297189	174754	76734	32948	12958
2002	2658828	1951842	974695	945021	462062	141364	79900	29809	16362
2003	2851159	1888386	959614	548903	519624	238700	66485	34255	17416
2004	2043286	2108998	941827	568359	309115	268970	117214	29425	20108
2005	1737092	1453665	1061415	567051	316643	160420	130562	51330	19107
2006	1361046	1268081	713708	628723	328604	159499	79122	55274	26895
2007	1409637	975647	647680	403456	339228	171108	73451	36249	31342
2008	1171340	1048473	485007	367541	215377	167503	82439	31006	26129
2009	1156949	850770	544397	270334	192009	107590	76392	35035	21849
2010	1470035	826687	427510	299061	149794	99298	52355	31975	23134
2011	1367582	1093372	431500	252757	172770	81697	52878	25333	24006
2012	1169338	1006185	614223	274568	154090	100165	45690	27262	23664
2013	1581113	846261	541988	411077	170838	89215	54446	23321	24047
2014	1161332	1218578	446035	345162	262371	95598	49091	27103	22381
2015	937438	856495	711048	290662	212931	144359	53392	24394	23478
2016	939669	678053	459083	461559	177708	117195	71846	25228	20623
2017	1000047	694091	359716	265469	279192	96516	57956	30457	17522
2018	783319	757396	382503	210383	142002	153186	47911	24196	16606
2019	778899	572243	416601	235197	120698	76241	75469	21652	14073

Table 3.6.14.a. Western Baltic Spring-spawning Herring. *Multi fleet.* Predicted catch in numbers - Sum fleets

	0	1	2	3	4	5	6	7	8
1991	111420.97	681425.48	625862.72	603490.90	334413.09	220688.56	72051.70	23250.56	8194.35
1992	82764.60	584671.41	600903.63	432048.44	393902.99	198968.39	127380.53	39126.08	14943.11
1993	88882.06	484060.11	558115.29	411167.81	284562.18	230744.05	111136.58	64562.08	23512.51
1994	154899.94	445379.35	411332.43	380780.73	249659.88	161087.95	121395.19	51856.74	34877.63
1995	226695.01	846411.39	359974.86	256063.24	238014.86	126369.86	83579.40	53053.39	32220.29
1996	169243.09	658138.55	481486.92	203948.42	143169.64	121932.21	62753.33	36206.09	31284.88
1997	148209.15	667143.63	446558.41	285619.83	112882.45	69469.39	55782.45	25735.78	23522.35

1998	196528.90	557829.09	466264.98	263848.10	162523.80	56489.72	33332.50	22411.71	16439.87
1999	148739.86	601753.08	354531.60	257202.71	144756.44	81199.09	26129.79	14268.14	12312.79
2000	73054.62	603133.18	486343.29	211832.22	149949.63	78980.01	41802.68	12318.36	9586.08
2001	69611.00	359211.27	530569.39	297334.89	121055.60	78697.07	39651.24	19341.26	7606.62
2002	63086.37	315415.86	290961.09	311699.68	175012.77	59328.02	38504.84	16413.81	9009.29
2003	61229.72	288049.51	272136.72	171879.13	188003.10	95743.65	30848.63	18199.45	9253.04
2004	43039.92	326643.41	265813.88	178874.43	113239.03	108621.84	54872.18	15706.92	10733.44
2005	25714.35	197924.96	297600.23	181137.39	118974.06	65815.39	61997.26	27834.16	10361.03
2006	19030.61	179509.07	217361.93	210046.78	125822.70	66098.46	37502.78	29737.34	14469.28
2007	15687.14	129435.36	200620.62	139183.95	134923.73	73338.38	35817.46	19799.92	17119.45
2008	12504.06	139963.48	154594.24	128561.40	86789.81	72833.00	40670.42	16991.53	14318.76
2009	13325.93	121496.67	176464.62	90780.22	73379.93	44368.06	35989.09	18359.95	11450.11
2010	9953.40	84373.90	112000.25	84944.71	49650.60	35596.48	21753.96	14868.61	10757.60
2011	6875.93	87573.25	91185.97	59901.46	49259.62	25481.70	19428.00	10480.80	9932.00
2012	5742.84	77452.82	122643.66	63573.13	44304.47	31752.48	17189.48	11480.15	9965.01
2013	7822.79	65818.58	108031.76	94516.29	49487.13	28766.00	20890.22	10078.56	10392.42
2014	5405.46	91664.60	88560.65	79080.03	75141.29	30673.74	18701.69	11824.47	9764.20
2015	5291.97	79286.09	164715.54	73556.73	66965.69	51313.65	22421.66	11936.18	11487.61
2016	4762.54	63867.71	118936.69	132244.21	61924.09	46378.69	33438.20	13881.65	11347.44
2017	4064.12	60049.84	94357.99	79900.81	100932.78	39999.67	28332.78	17875.12	10283.42
2018	2970.04	60752.72	93343.60	59409.34	48524.91	60825.49	22613.36	14128.69	9697.01
2019	2344.22	35929.14	80659.03	53461.17	33705.22	25107.51	30274.27	11141.45	7241.25

Table 3.6.14.b. Western Baltic Spring-spawning Herring. *Multi fleet.* Predicted catch in numbers - Fleet A

	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
1991	0.00	13.26	5556.77	25424.73	12946.89	9185.91	2861.90	923.57	325.50
1992	0.00	11.19	5142.37	17333.29	14488.46	7705.56	4848.31	1517.49	579.56
1993	0.00	8.20	4452.68	15616.04	9981.02	8376.90	4087.12	2462.69	896.87
1994	0.00	6.73	3085.10	13667.96	8613.09	5622.00	4428.46	1991.71	1339.57

1995	0.00	10.09	2470.78	8813.26	8042.61	4374.32	3077.18	2094.63	1272.11
1996	0.00	9.16	3412.29	6999.14	4808.91	4235.95	2316.11	1499.87	1296.01
1997	0.00	9.43	3218.26	9972.75	3902.68	2492.68	2108.75	1189.52	1087.22
1998	0.00	7.74	3343.48	9217.53	5835.66	2156.24	1287.34	1168.26	856.96
1999	0.00	10.01	2690.95	9483.90	5539.57	3417.48	1094.70	841.21	725.92
2000	0.00	11.00	3733.99	7756.14	6000.62	3424.79	1850.31	764.26	594.75
2001	0.00	6.96	3971.04	10758.13	4939.33	3448.99	1829.06	1236.06	486.12
2002	0.00	6.24	2033.60	11707.90	7390.06	2647.03	1865.46	1121.06	615.33
2003	0.00	6.00	1613.89	6418.11	7895.16	4067.89	1468.70	1235.88	628.35
2004	0.00	6.92	1592.10	6457.39	4477.12	4175.08	2437.46	978.04	668.35
2005	0.00	5.12	1571.60	5701.35	4382.08	2232.68	2658.34	1721.87	640.95
2006	0.00	4.96	845.43	5260.27	4006.21	1966.44	1510.52	1851.18	900.73
2007	0.00	3.94	559.22	2693.45	3411.42	1581.36	1243.55	1006.86	870.55
2008	0.00	4.49	339.79	1932.35	1855.95	1221.99	1227.08	761.03	641.32
2009	0.00	3.99	335.37	1321.19	1608.26	713.12	1164.30	942.40	587.73
2010	0.00	4.37	214.98	1312.46	1148.60	568.49	770.94	771.55	558.23
2011	0.00	6.25	196.02	1038.69	1213.26	409.96	763.25	534.22	506.25
2012	0.00	6.47	267.28	1097.95	1044.50	450.44	738.58	552.25	479.37
2013	0.00	6.37	264.25	1744.01	1175.69	505.27	942.90	544.81	561.78
2014	0.00	11.15	265.57	1682.07	2022.38	676.70	952.27	811.75	670.31
2015	0.00	9.29	451.63	1546.84	1720.97	1247.93	1097.07	888.89	855.48
2016	0.00	8.57	338.32	2758.26	1500.01	1126.28	1513.48	1037.18	847.83
2017	0.00	10.03	283.19	1743.81	2495.72	1014.48	1206.75	1397.40	803.91
2018	0.00	12.83	353.70	1456.39	1422.14	1906.24	1117.05	1422.30	976.18
2019	0.00	11.16	450.91	1738.54	1282.46	1069.72	1955.23	1461.07	949.61

Table 3.6.14.c. Western Baltic Spring-spawning Herring. *Multi fleet.* Predicted catch in numbers - Fleet C

	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
1991	830.11	124807.26	251197.44	176429.51	70542.62	37888.80	10562.36	3174.88	1118.94

1992	634.36	108108.33	238221.00	123804.85	80853.78	33085.10	17906.07	5096.22	1946.36
1993	560.27	82012.09	213762.08	114419.84	56731.44	37324.52	15138.24	8155.24	2970.01
1994	850.74	71020.23	155722.37	106336.68	50019.85	26305.92	16657.91	6610.59	4446.13
1995	853.01	112013.56	131088.87	71631.42	48549.86	21084.90	11712.50	6923.06	4204.50
1996	856.36	101628.18	181670.84	56964.42	28650.15	19792.77	8538.62	4563.99	3943.64
1997	720.64	104290.37	171223.92	81159.68	22929.82	11395.90	7608.92	3197.33	2922.34
1998	956.81	89956.00	186105.02	79449.27	35192.11	9886.56	4864.79	2929.42	2148.84
1999	1052.35	120415.53	154820.33	83828.81	33971.41	15368.91	4127.52	1996.95	1723.28
2000	677.85	136466.05	221829.42	71323.25	35999.96	15270.60	6717.85	1747.54	1359.92
2001	584.35	76727.05	234354.06	96589.25	27638.62	14419.67	5955.65	2575.60	1012.94
2002	576.68	72854.20	138210.97	110302.35	43560.83	11825.38	6287.10	2362.53	1296.76
2003	555.26	63431.35	123176.43	57907.64	44218.70	18013.03	4718.03	2448.66	1244.96
2004	350.51	62547.24	107398.71	53181.67	23298.36	17966.14	7360.35	1861.36	1271.97
2005	331.17	47821.65	133575.14	58631.83	26402.54	11860.99	9077.25	3595.13	1338.26
2006	298.63	47872.52	102287.10	74178.38	31318.44	13491.02	6295.27	4430.48	2155.74
2007	338.62	40241.76	100858.52	51793.35	35222.34	15776.73	6372.40	3168.26	2739.34
2008	298.50	45811.19	79700.49	49839.20	23642.47	16335.29	7566.22	2866.92	2415.95
2009	310.64	39112.76	93793.10	38469.07	22137.15	11024.30	7368.05	3404.17	2123.00
2010	362.57	34989.35	68203.75	39350.36	15948.58	9390.63	4659.37	2866.87	2074.21
2011	267.11	36836.60	55550.28	26744.63	14747.90	6185.79	3765.23	1817.45	1722.28
2012	194.85	29004.79	68180.16	25001.53	11300.24	6510.77	2791.95	1678.62	1457.08
2013	239.40	22201.52	54978.85	34171.72	11427.25	5287.19	3032.80	1309.00	1349.76
2014	187.45	34044.96	48055.78	30495.84	18664.87	6027.41	2909.76	1618.80	1336.74
2015	169.83	26804.98	85365.55	28654.91	16922.62	10174.57	3538.89	1629.26	1568.03
2016	222.64	27596.91	70624.90	58526.98	18226.20	10676.51	6159.96	2179.44	1781.57
2017	271.10	32211.32	62533.43	38125.93	32496.69	9987.81	5647.10	2990.01	1720.13
2018	195.64	32453.02	61740.63	28013.56	15304.94	14670.07	4318.84	2197.59	1508.28
2019	150.50	19077.75	53109.61	24639.37	10200.16	5715.86	5321.59	1538.44	999.89

Table 3.6.14.d. Western Baltic Spring-spawning Herring. *Multi fleet.* Predicted catch in numbers - Fleet D

	0	1	2	3	4	5	6	7	8
1991	59028.81	134119.75	33140.08	13946.54	3430.16	1528.37	653.61	159.69	56.28
1992	41575.25	99966.32	27754.56	8708.89	3547.37	1223.53	1039.15	244.09	93.22
1993	51248.35	106343.69	33002.68	10282.32	3080.03	1661.30	1040.20	454.53	165.53
1994	98700.44	122141.92	31175.08	11703.19	3230.07	1350.89	1296.93	410.03	275.78
1995	172002.60	347550.23	44777.90	12366.80	4561.34	1488.24	1197.09	541.93	329.12
1996	112903.86	195620.66	37428.24	6088.92	1745.51	955.93	625.72	269.01	232.44
1997	102201.86	202337.33	34047.01	8027.75	1274.79	503.68	514.76	178.47	163.12
1998	141037.20	184222.31	39158.37	7754.87	1875.39	413.08	306.42	154.44	113.29
1999	94912.90	145053.63	20213.02	5157.35	1168.18	430.46	179.95	76.17	65.73
2000	40505.18	107362.81	19224.02	2922.82	851.40	304.24	215.51	50.98	39.67
2001	41268.69	77742.55	29520.89	6286.90	1358.12	769.80	627.15	279.81	110.05
2002	40194.44	83098.75	18905.74	6247.05	1601.41	369.14	268.05	77.58	42.58
2003	39306.60	85878.96	27686.65	7192.59	4233.27	1686.14	575.09	234.64	119.29
2004	27344.64	107931.90	36581.09	11765.90	3990.22	2954.65	1298.59	242.98	166.04
2005	12515.45	43159.87	24617.85	6284.55	1920.38	747.84	519.27	141.38	52.63
2006	9648.71	47093.85	27008.15	12891.02	3920.39	1929.49	808.97	440.50	214.33
2007	5945.89	23847.51	17358.54	5477.97	2448.27	1401.49	543.02	243.28	210.35
2008	4771.80	27031.26	14220.39	4592.13	1060.62	925.92	375.34	158.56	133.62
2009	6788.27	36068.28	23069.13	3569.21	669.22	379.54	179.45	105.41	65.74
2010	3306.40	13599.63	5951.54	792.03	54.75	27.74	6.84	5.63	4.07
2011	1716.14	11094.77	3205.63	247.50	11.24	4.03	1.44	1.25	1.18
2012	1125.68	9601.40	5181.70	262.12	7.10	3.56	0.90	1.09	0.95
2013	1485.79	10148.32	8088.25	827.60	15.45	5.96	1.59	1.32	1.36
2014	1072.24	13003.78	5456.45	477.35	12.88	5.23	1.07	1.20	0.99
2015	1600.53	19362.97	19328.77	824.20	25.03	27.98	2.93	2.32	2.23
2016	1016.70	10010.19	8645.25	690.58	9.87	16.32	3.22	2.25	1.84
2017	217.13	2098.98	1541.18	82.13	3.13	3.02	0.98	1.46	0.84

2018	148.70	1932.57	1380.22	60.98	1.43	4.10	0.86	1.43	0.98
2019	103.03	981.47	959.35	50.25	0.97	1.70	1.25	1.29	0.84

Table 3.6.14.e. Western Baltic Spring-spawning Herring. *Multi fleet.* Predicted catch in numbers - Fleet F

	0	1	2	3	4	5	6	7	8
1991	51562.05	422485.21	335968.43	387690.12	247493.42	172085.48	57973.83	18992.42	6693.63
1992	40554.99	376585.57	329785.70	282201.41	295013.38	156954.20	103587.00	32268.28	12323.97
1993	37073.44	295696.13	306897.85	270849.61	214769.69	183381.33	90871.02	53489.62	19480.10
1994	55348.76	252210.47	221349.88	249072.90	187796.87	127809.14	99011.89	42844.41	28816.15
1995	53839.40	386837.51	181637.31	163251.76	176861.05	99422.40	67592.63	43493.77	26414.56
1996	55482.87	360880.55	258975.55	133895.94	107965.07	96947.56	51272.88	29873.22	25812.79
1997	45286.65	360506.50	238069.22	186459.65	84775.16	55077.13	45550.02	21170.46	19349.67
1998	54534.89	283643.04	237658.11	167426.43	119620.64	44033.84	26873.95	18159.59	13320.78
1999	52774.61	336273.91	176807.30	158732.65	104077.28	61982.24	20727.62	11353.81	9797.86
2000	31871.59	359293.32	241555.86	129830.01	107097.65	59980.38	33019.01	9755.58	7591.74
2001	27757.96	204734.71	262723.40	183700.61	87119.53	60058.61	31239.38	15249.79	5997.51
2002	22315.25	159456.67	131810.78	183442.38	122460.47	44486.47	30084.23	12852.64	7054.62
2003	21367.86	138733.20	119659.75	100360.79	131655.97	71976.59	24086.81	14280.27	7260.44
2004	15344.77	156157.35	120241.98	107469.47	81473.33	83525.97	43775.78	12624.54	8627.08
2005	12867.73	106938.32	137835.64	110519.66	86269.06	50973.88	49742.40	22375.78	8329.19
2006	9083.27	84537.74	87221.25	117717.11	86577.66	48711.51	28888.02	23015.18	11198.48
2007	9402.63	65342.15	81844.34	79219.18	93841.70	54578.80	27658.49	15381.52	13299.21
2008	7433.76	67116.54	60333.57	72197.72	60230.77	54349.80	31501.78	13205.02	11127.87
2009	6227.02	46311.64	59267.02	47420.75	48965.30	32251.10	27277.29	13907.97	8673.64
2010	6284.43	35780.55	37629.98	43489.86	32498.67	25609.62	16316.81	11224.56	8121.09
2011	4892.68	39635.63	32234.04	31870.64	33287.22	18881.92	14898.08	8127.88	7702.29
2012	4422.31	38840.16	49014.52	37211.53	31952.63	24787.71	13658.05	9248.19	8027.61
2013	6097.60	33462.37	44700.41	57772.96	36868.74	22967.58	16912.93	8223.43	8479.52
2014	4145.77	44604.71	34782.85	46424.77	54441.16	23964.40	14838.59	9392.72	7756.16

2015	3521.61	33108.85	59569.59	42530.78	48297.07	39863.17	17782.77	9415.71	9061.87
2016	3523.20	26252.04	39328.22	70268.39	42188.01	34559.58	25761.54	10662.78	8716.20
2017	3575.89	25729.51	30000.19	39948.94	65937.24	28994.36	21477.95	13486.25	7758.54
2018	2625.70	26354.30	29869.05	29878.41	31796.40	44245.08	17176.61	10507.37	7211.57
2019	2090.69	15858.76	26139.16	27033.01	22221.63	18320.23	22996.20	8140.65	5290.91

Table 3.9.1. Western Baltic Spring-spawning Herring. *Multi fleet.* Input table for short-term predictions.

2019						
wr	N	M	Mat	PM	PF	SWt
0	778899	0.3	0.00	0.25	0.1	0.0001
1	572243	0.5	0.00	0.25	0.1	0.0256
2	416602	0.2	0.20	0.25	0.1	0.0568
3	235197	0.2	0.75	0.25	0.1	0.0771
4	120698	0.2	0.90	0.25	0.1	0.1190
5	76241	0.2	1.00	0.25	0.1	0.1481
6	75469	0.2	1.00	0.25	0.1	0.1705
7	21652	0.2	1.00	0.25	0.1	0.1778
8+	14073	0.2	1.00	0.25	0.1	0.1910

2020						
wr	N	M	Mat	PM	PF	SWt
0	964361	0.3	0.00	0.25	0.1	0.0001
1		0.5	0.00	0.25	0.1	0.0169
2		0.2	0.20	0.25	0.1	0.0488
3		0.2	0.75	0.25	0.1	0.0821
4		0.2	0.90	0.25	0.1	0.1136
5		0.2	1.00	0.25	0.1	0.1435
6		0.2	1.00	0.25	0.1	0.1668
7		0.2	1.00	0.25	0.1	0.1744
8+		0.2	1.00	0.25	0.1	0.1871

2021						
wr	N	M	Mat	PM	PF	SWt
0	964361	0.3	0.00	0.25	0.1	0.0001
1		0.5	0.00	0.25	0.1	0.0169
2		0.2	0.20	0.25	0.1	0.0488
3		0.2	0.75	0.25	0.1	0.0821
4		0.2	0.90	0.25	0.1	0.1136
5		0.2	1.00	0.25	0.1	0.1435
6		0.2	1.00	0.25	0.1	0.1668
7		0.2	1.00	0.25	0.1	0.1744
8+		0.2	1.00	0.25	0.1	0.1871

Input units are thousands and kg

M =	Natural mortality
MAT =	Maturity ogive
PF =	Proportion of F before spawning
PM =	Proportion of M before spawning
SWt =	Weight in stock (kg)

N_{2019} wr 0-8+:	Populations numbers from the assessment
$N_{2020/2021}$ wr 0:	Average of wr 0 for the years 2014-2018
Natural Mortality (M):	Constant
Weight in the Stock 2020-2021 (SWt):	Average for 2015-2019

Table 3.9.2. Western Baltic Spring-spawning Herring. *Multi fleet.* Forecast table. MSY approach (zero catch).

Year	2019	2020	2021	2022	2023
fbar:Estimate	0.382	0.170	0.000	0.000	0.000
fbar:low	0.382	0.170	0.000	0.000	0.000
fbar:high	0.382	0.170	0.000	0.000	0.000
rec:Estimate	778899	964361	964361	964361	964361
rec:low	778899	964361	964361	964361	964361
rec:high	778899	964361	964361	964361	964361
ssb:Estimate	56621	57124	66824	87890	111745
ssb:low	56621	57124	66824	87890	111745
ssb:high	56621	57124	66824	87890	111745
catch:Estimate	26223	15391	0	0	0
catch:low	26223	15391	0	0	0
catch:high	26223	15391	0	0	0

Per fleet

Year	2019	2020	2021	2022	2023
Fleet A : Estimate	1296	3184	0	0	0
Fleet C : Estimate	10283	8933	0	0	0
Fleet D : Estimate	65	123	0	0	0
Fleet F : Estimate	14579	3150	0	0	0

Table 3.9.3. Western Baltic Spring-spawning Herring. *Multi fleet.* Forecast table. MAP 2018: $F=F_{MSY}(0.31)*SSB_{y-1}/MSYB_{trigger}$

Year	2019	2020	2021	2022	2023
fbar:Estimate	0.382	0.170	0.118	0.136	0.161
fbar:low	0.382	0.170	0.118	0.136	0.161
fbar:high	0.382	0.170	0.118	0.136	0.161
rec:Estimate	778899	964361	964361	964361	964361
rec:low	778899	964361	964361	964361	964361
rec:high	778899	964361	964361	964361	964361
ssb:Estimate	56621	57124	65973	77674	88478
ssb:low	56621	57124	65973	77674	88478
ssb:high	56621	57124	65973	77674	88478
catch:Estimate	26223	15391	10273	14032	18667
catch:low	26223	15391	10273	14032	18667
catch:high	26223	15391	10273	14032	18667

Per fleet

Year	2019	2020	2021	2022	2023
Fleet A : Estimate	1296	3184	1396	1975	2812
Fleet C : Estimate	10283	8933	3688	4972	6439
Fleet D : Estimate	65	123	52	68	82
Fleet F : Estimate	14579	3150	5137	7016	9333

Table 3.9.4. Western Baltic Spring-spawning Herring. *Multi fleet.* Forecast table. MAP 2018: F=FMSYlower(0.216)*SSBy-1/MSYBtrigger

Year	2019	2020	2021	2022	2023
fbar:Estimate	0.382	0.170	0.082	0.095	0.116
fbar:low	0.382	0.170	0.082	0.095	0.116
fbar:high	0.382	0.170	0.082	0.095	0.116
rec:Estimate	778899	964361	964361	964361	964361
rec:low	778899	964361	964361	964361	964361
rec:high	778899	964361	964361	964361	964361
ssb:Estimate	56621	57124	66230	80610	94749
ssb:low	56621	57124	66230	80610	94749
ssb:high	56621	57124	66230	80610	94749
catch:Estimate	26223	15391	7291	10353	14727
catch:low	26223	15391	7291	10353	14727
catch:high	26223	15391	7291	10353	14727

Per fleet

Year	2019	2020	2021	2022	2023
Fleet A : Estimate	1296	3184	998	1491	2307
Fleet C : Estimate	10283	8933	2611	3636	4996
Fleet D : Estimate	65	123	37	49	61
Fleet F : Estimate	14579	3150	3645	5176	7364

Table 3.9.5. Western Baltic Spring-spawning Herring. *Multi fleet.* Forecast table. MAP 2018: F=FMSYupper(0.379)*SSBy-1/MSYBtrigger

Year	2019	2020	2021	2022	2023
fbar:Estimate	0.382	0.170	0.144	0.166	0.191
fbar:low	0.382	0.170	0.144	0.166	0.191
fbar:high	0.382	0.170	0.144	0.166	0.191
rec:Estimate	778899	964361	964361	964361	964361
rec:low	778899	964361	964361	964361	964361
rec:high	778899	964361	964361	964361	964361
ssb:Estimate	56621	57124	65786	75602	84241
ssb:low	56621	57124	65786	75602	84241
ssb:high	56621	57124	65786	75602	84241
catch:Estimate	26223	15391	12393	16460	20896
catch:low	26223	15391	12393	16460	20896
catch:high	26223	15391	12393	16460	20896

Per fleet

Year	2019	2020	2021	2022	2023
Fleet A : Estimate	1296	3184	1676	2279	3061
Fleet C : Estimate	10283	8933	4457	5869	7292
Fleet D : Estimate	65	123	63	82	95
Fleet F : Estimate	14579	3150	6197	8230	10448

Table 3.9.6. Western Baltic Spring-spawning Herring. *Multi fleet.* Forecast table. F=F_{MSY}=0.31

Year	2019	2020	2021	2022	2023
fbar:Estimate	0.382	0.170	0.310	0.310	0.310
fbar:low	0.382	0.170	0.310	0.310	0.310
fbar:high	0.382	0.170	0.310	0.310	0.310
rec:Estimate	778899	964361	964361	964361	964361
rec:low	778899	964361	964361	964361	964361
rec:high	778899	964361	964361	964361	964361
ssb:Estimate	56621	57124	64618	64275	65660
ssb:low	56621	57124	64618	64275	65660
ssb:high	56621	57124	64618	64275	65660
catch:Estimate	26223	15391	24535	24855	25434
catch:low	26223	15391	24535	24855	25434
catch:high	26223	15391	24535	24855	25434

Per fleet

Year	2019	2020	2021	2022	2023
Fleet A : Estimate	1296	3184	3218	3123	3217
Fleet C : Estimate	10283	8933	8919	9164	9359
Fleet D : Estimate	65	123	131	141	141
Fleet F : Estimate	14579	3150	12267	12428	12717

Table 3.9.7. Western Baltic Spring-spawning Herring. *Multi fleet.* Forecast table. F=F_{pa}=0.35

Year	2019	2020	2021	2022	2023
fbar:Estimate	0.382	0.170	0.350	0.350	0.350
fbar:low	0.382	0.170	0.350	0.350	0.350
fbar:high	0.382	0.170	0.350	0.350	0.350
rec:Estimate	778899	964361	964361	964361	964361
rec:low	778899	964361	964361	964361	964361
rec:high	778899	964361	964361	964361	964361
ssb:Estimate	56621	57124	64340	61819	61637
ssb:low	56621	57124	64340	61819	61637
ssb:high	56621	57124	64340	61819	61637
catch:Estimate	26223	15391	27179	26657	26651
catch:low	26223	15391	27179	26657	26651
catch:high	26223	15391	27179	26657	26651

Per fleet

Year	2019	2020	2021	2022	2023
Fleet A : Estimate	1296	3184	3540	3269	3240
Fleet C : Estimate	10283	8933	9904	9903	9931
Fleet D : Estimate	65	123	146	156	155
Fleet F : Estimate	14579	3150	13589	13328	13326

Table 3.9.8. Western Baltic Spring-spawning Herring. *Multi fleet.* Forecast table. F=F_{lim}=0.45

Year	2019	2020	2021	2022	2023
fbar:Estimate	0.382	0.170	0.450	0.450	0.450
fbar:low	0.382	0.170	0.450	0.450	0.450
fbar:high	0.382	0.170	0.450	0.450	0.450
rec:Estimate	778899	964361	964361	964361	964361
rec:low	778899	964361	964361	964361	964361
rec:high	778899	964361	964361	964361	964361
ssb:Estimate	56621	57124	63650	56155	52884
ssb:low	56621	57124	63650	56155	52884
ssb:high	56621	57124	63650	56155	52884
catch:Estimate	26223	15391	33356	30253	28688
catch:low	26223	15391	33356	30253	28688
catch:high	26223	15391	33356	30253	28688

Per fleet

Year	2019	2020	2021	2022	2023
Fleet A : Estimate	1296	3184	4270	3493	3160
Fleet C : Estimate	10283	8933	12225	11443	10998
Fleet D : Estimate	65	123	183	191	185
Fleet F : Estimate	14579	3150	16678	15127	14344

Table 3.9.9. Western Baltic Spring-spawning Herring. *Multi fleet.* Forecast table. F=F_{2020}=0.17

Year	2019	2020	2021	2022	2023
fbar:Estimate	0.382	0.170	0.170	0.170	0.170
fbar:low	0.382	0.170	0.170	0.170	0.170
fbar:high	0.382	0.170	0.170	0.170	0.170
rec:Estimate	778899	964361	964361	964361	964361
rec:low	778899	964361	964361	964361	964361
rec:high	778899	964361	964361	964361	964361
ssb:Estimate	56621	57124	65603	73849	82693
ssb:low	56621	57124	65603	73849	82693
ssb:high	56621	57124	65603	73849	82693
catch:Estimate	26223	15391	14410	16432	18421
catch:low	26223	15391	14410	16432	18421
catch:high	26223	15391	14410	16432	18421

Per fleet

Year	2019	2020	2021	2022	2023
Fleet A : Estimate	1296	3184	1939	2249	2678
Fleet C : Estimate	10283	8933	5191	5884	6448
Fleet D : Estimate	65	123	74	83	85
Fleet F : Estimate	14579	3150	7205	8216	9210

Table 3.9.10. Western Baltic Spring-spawning Herring. *Multi fleet.* Forecast table. F=0

Year	2019	2020	2021	2022	2023
fbar:Estimate	0.382	0.170	0.000	0.000	0.000
fbar:low	0.382	0.170	0.000	0.000	0.000
fbar:high	0.382	0.170	0.000	0.000	0.000
rec:Estimate	778899	964361	964361	964361	964361
rec:low	778899	964361	964361	964361	964361
rec:high	778899	964361	964361	964361	964361
ssb:Estimate	56621	57124	66824	87890	111745
ssb:low	56621	57124	66824	87890	111745
ssb:high	56621	57124	66824	87890	111745
catch:Estimate	26223	15391	0	0	0
catch:low	26223	15391	0	0	0
catch:high	26223	15391	0	0	0

Per fleet

Year	2019	2020	2021	2022	2023
Fleet A : Estimate	1296	3184	0	0	0
Fleet C : Estimate	10283	8933	0	0	0
Fleet D : Estimate	65	123	0	0	0
Fleet F : Estimate	14579	3150	0	0	0

Table 3.9.11. Western Baltic Spring-spawning Herring. *Multi fleet.* Forecast table. F=0.05

Year	2019	2020	2021	2022	2023
fbar:Estimate	0.382	0.170	0.050	0.050	0.050
fbar:low	0.382	0.170	0.050	0.050	0.050
fbar:high	0.382	0.170	0.050	0.050	0.050
rec:Estimate	778899	964361	964361	964361	964361
rec:low	778899	964361	964361	964361	964361
rec:high	778899	964361	964361	964361	964361
ssb:Estimate	56621	57124	66462	83450	102017
ssb:low	56621	57124	66462	83450	102017
ssb:high	56621	57124	66462	83450	102017
catch:Estimate	26223	15391	4506	5726	7037
catch:low	26223	15391	4506	5726	7037
catch:high	26223	15391	4506	5726	7037

Per fleet

Year	2019	2020	2021	2022	2023
Fleet A : Estimate	1296	3184	621	844	1151
Fleet C : Estimate	10283	8933	1610	1993	2340
Fleet D : Estimate	65	123	22	26	27
Fleet F : Estimate	14579	3150	2253	2863	3518

Table 3.9.12. Western Baltic Spring-spawning Herring. *Multi fleet.* Forecast table. F=0.1

Year	2019	2020	2021	2022	2023
fbar:Estimate	0.382	0.170	0.100	0.100	0.100
fbar:low	0.382	0.170	0.100	0.100	0.100
fbar:high	0.382	0.170	0.100	0.100	0.100
rec:Estimate	778899	964361	964361	964361	964361
rec:low	778899	964361	964361	964361	964361
rec:high	778899	964361	964361	964361	964361
ssb:Estimate	56621	57124	66103	79277	93335
ssb:low	56621	57124	66103	79277	93335
ssb:high	56621	57124	66103	79277	93335
catch:Estimate	26223	15391	8783	10659	12586
catch:low	26223	15391	8783	10659	12586
catch:high	26223	15391	8783	10659	12586

Per fleet

Year	2019	2020	2021	2022	2023
Fleet A : Estimate	1296	3184	1198	1523	1960
Fleet C : Estimate	10283	8933	3149	3756	4280
Fleet D : Estimate	65	123	44	51	52
Fleet F : Estimate	14579	3150	4391	5329	6293

Table 3.9.13. Western Baltic Spring-spawning Herring. *Multi fleet.* Forecast table. F=0.15

Year	2019	2020	2021	2022	2023
fbar:Estimate	0.382	0.170	0.150	0.150	0.150
fbar:low	0.382	0.170	0.150	0.150	0.150
fbar:high	0.382	0.170	0.150	0.150	0.150
rec:Estimate	778899	964361	964361	964361	964361
rec:low	778899	964361	964361	964361	964361
rec:high	778899	964361	964361	964361	964361
ssb:Estimate	56621	57124	65746	75353	85569
ssb:low	56621	57124	65746	75353	85569
ssb:high	56621	57124	65746	75353	85569
catch:Estimate	26223	15391	12843	14905	16951
catch:low	26223	15391	12843	14905	16951
catch:high	26223	15391	12843	14905	16951

Per fleet

Year	2019	2020	2021	2022	2023
Fleet A : Estimate	1296	3184	1735	2065	2513
Fleet C : Estimate	10283	8933	4621	5313	5886
Fleet D : Estimate	65	123	66	74	76
Fleet F : Estimate	14579	3150	6422	7452	8476

Table 3.9.14. Western Baltic Spring-spawning Herring. *Multi fleet.* Forecast table. Constant 2020 TAC

Year	2019	2020	2021	2022	2023
fbar:Estimate	0.382	0.170	0.150	0.130	0.113
fbar:low	0.382	0.170	0.150	0.130	0.113
fbar:high	0.382	0.170	0.150	0.130	0.113
rec:Estimate	778899	964361	964361	964361	964361
rec:low	778899	964361	964361	964361	964361
rec:high	778899	964361	964361	964361	964361
ssb:Estimate	56621	57124	65726	74580	85273
ssb:low	56621	57124	65726	74580	85273
ssb:high	56621	57124	65726	74580	85273
catch:Estimate	26223	15391	15391	15391	15391
catch:low	26223	15391	15391	15391	15391
catch:high	26223	15391	15391	15391	15391

Per fleet

Year	2019	2020	2021	2022	2023
Fleet A : Estimate	1296	3184	3184	3184	3184
Fleet C : Estimate	10283	8933	8933	8933	8933
Fleet D : Estimate	65	123	123	123	123
Fleet F : Estimate	14579	3150	3150	3150	3150

Table 3.9.15. Western Baltic Spring-spawning Herring. *Multi fleet.* Forecast table. Catch for bycatch fleets only

Year	2019	2020	2021	2022	2023
fbar:Estimate	0.382	0.170	0.026	0.019	0.014
fbar:low	0.382	0.170	0.026	0.019	0.014
fbar:high	0.382	0.170	0.026	0.019	0.014
rec:Estimate	778899	964361	964361	964361	964361
rec:low	778899	964361	964361	964361	964361
rec:high	778899	964361	964361	964361	964361
ssb:Estimate	56621	57124	66574	85251	106832
ssb:low	56621	57124	66574	85251	106832
ssb:high	56621	57124	66574	85251	106832
catch:Estimate	26223	15391	3308	3308	3308
catch:low	26223	15391	3308	3308	3308
catch:high	26223	15391	3308	3308	3308

Per fleet

Year	2019	2020	2021	2022	2023
Fleet A : Estimate	1296	3184	3184	3184	3184
Fleet C : Estimate	10283	8933	0	0	0
Fleet D : Estimate	65	123	123	123	123
Fleet F : Estimate	14579	3150	0	0	0

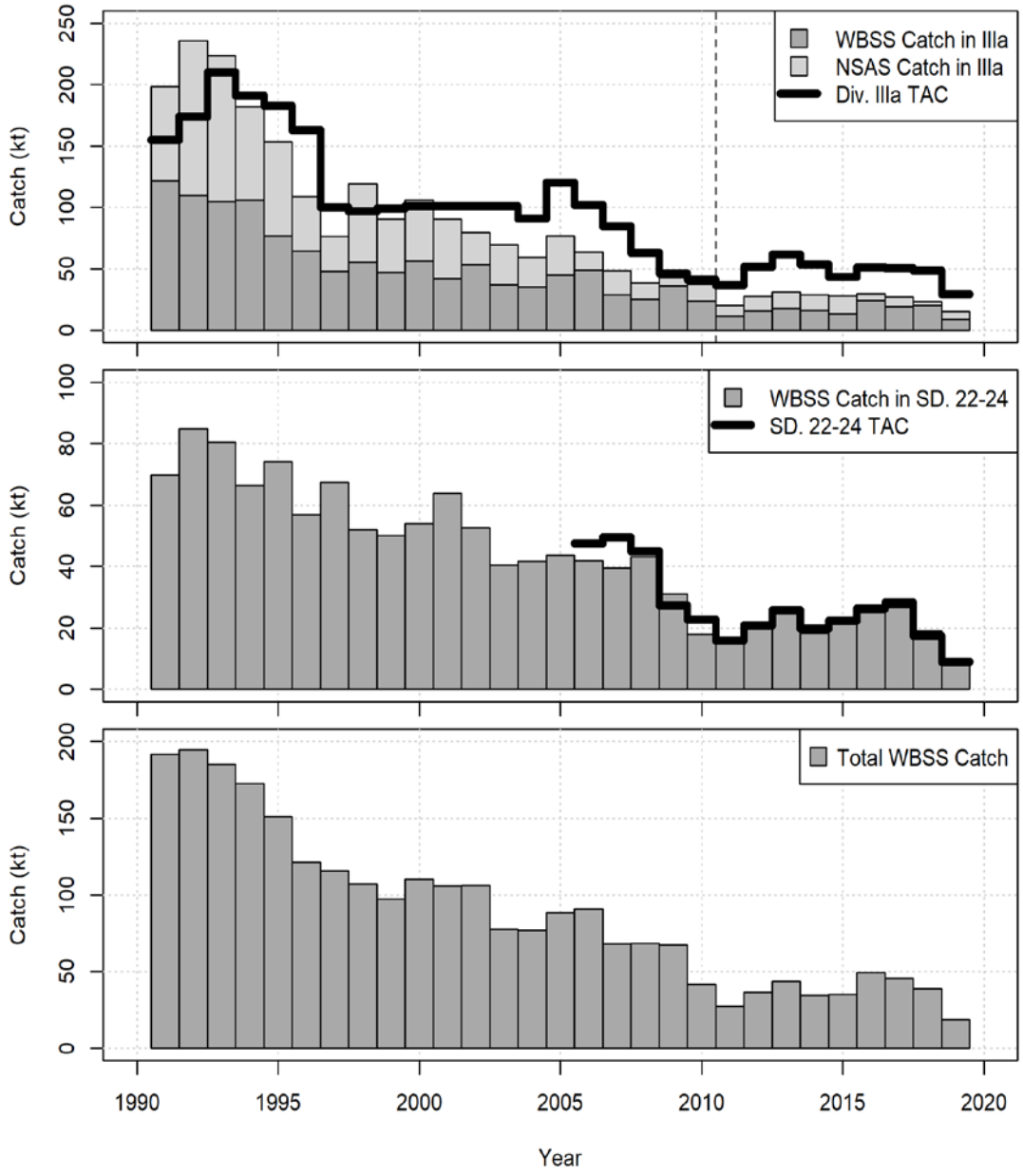

Figure 3.1.1. Western Baltic Spring-spawning Herring. CATCH and TACs (1000 t) by area. Note, the TAC for 3.a excludes the bycatch TAC, while the CATCH includes the bycatch.

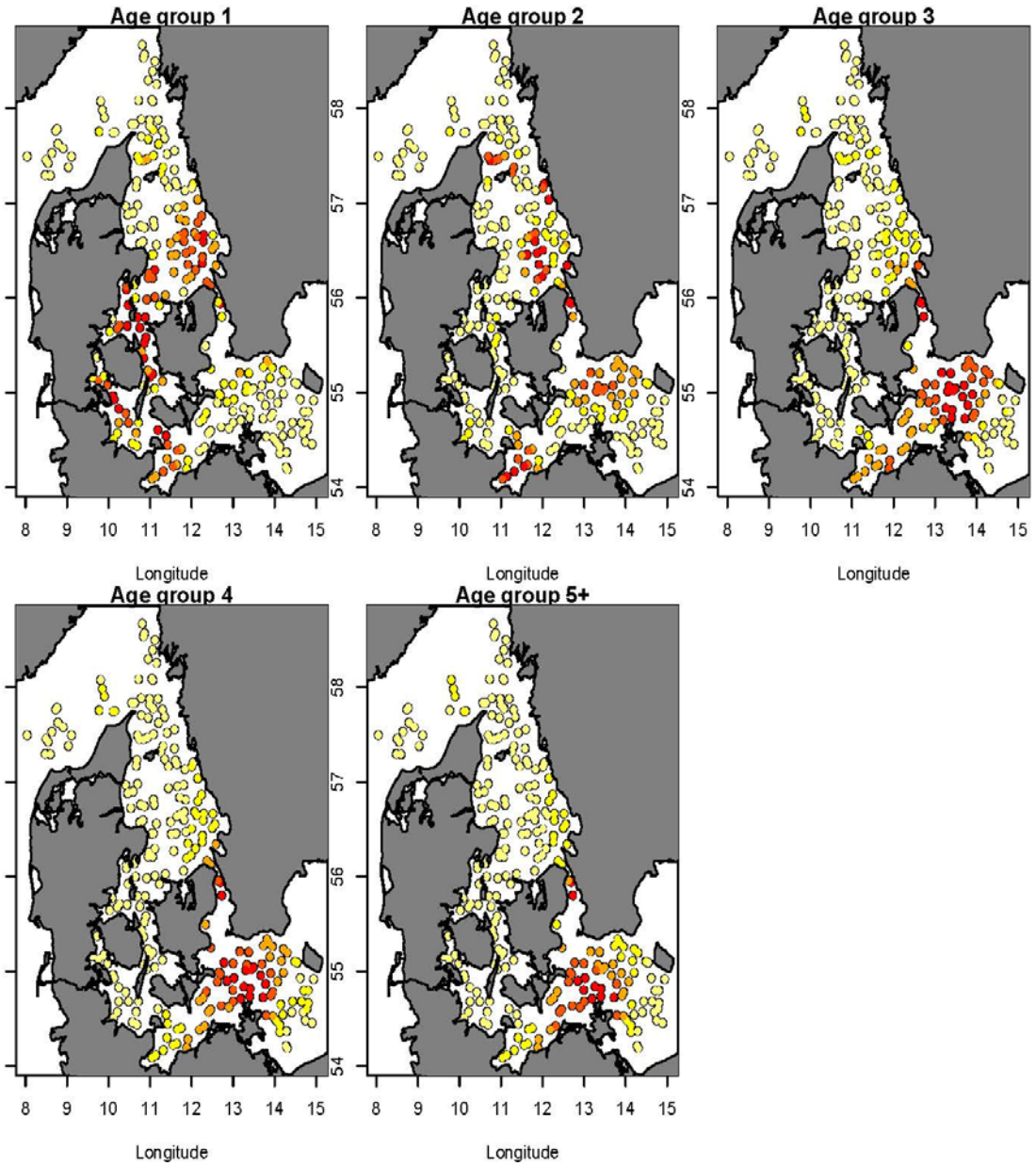

Figure 3.3.1.Western Baltic Spring-spawning Herring. Map showing distribution of hauls and the density of fish per age in the IBTS+BITS-Q1 survey.

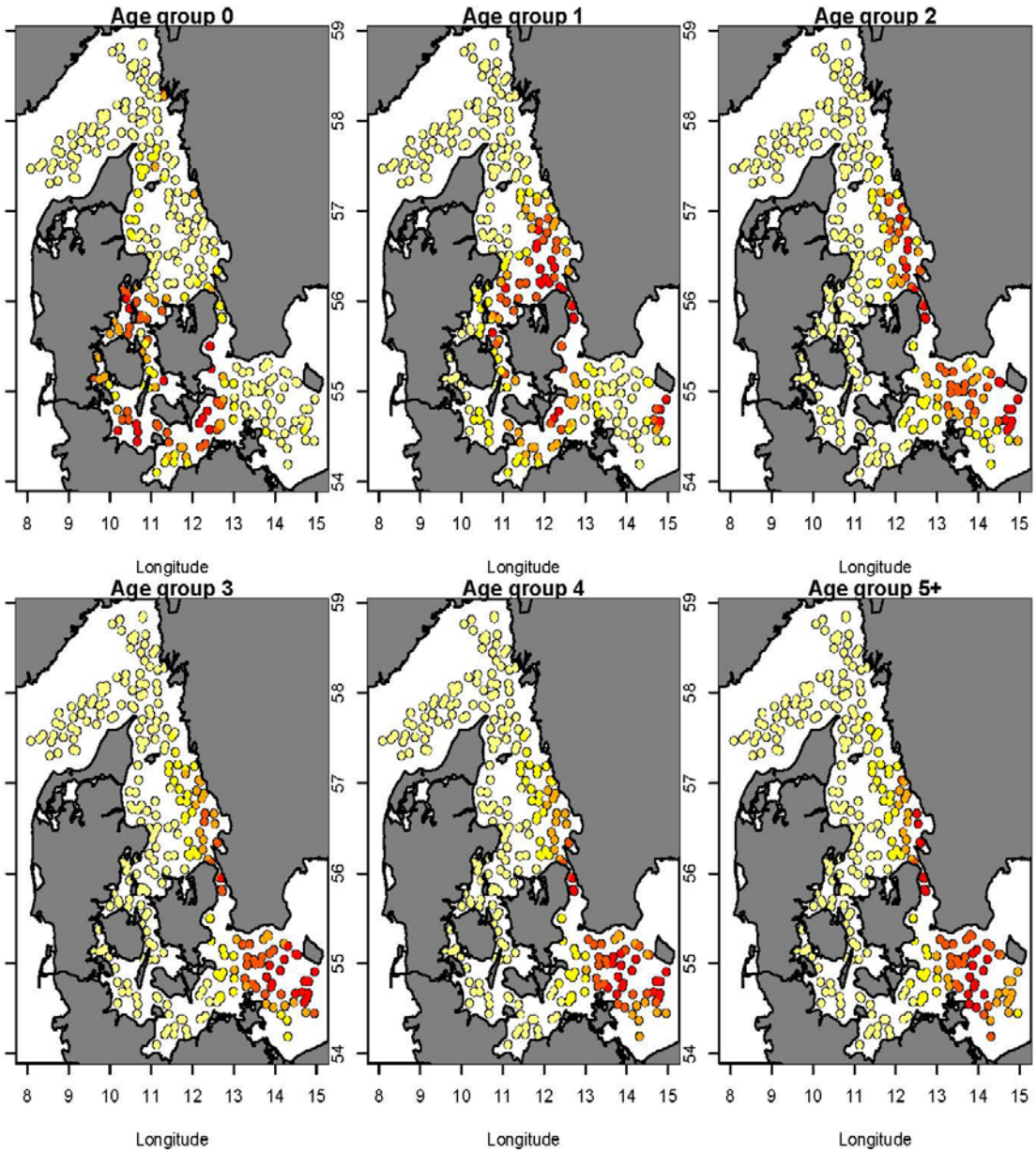

Figure 3.3.2. Western Baltic Spring-spawning Herring. Map showing distribution of hauls and the density of fish per age in the IBTS+BITS-Q3.4 survey.

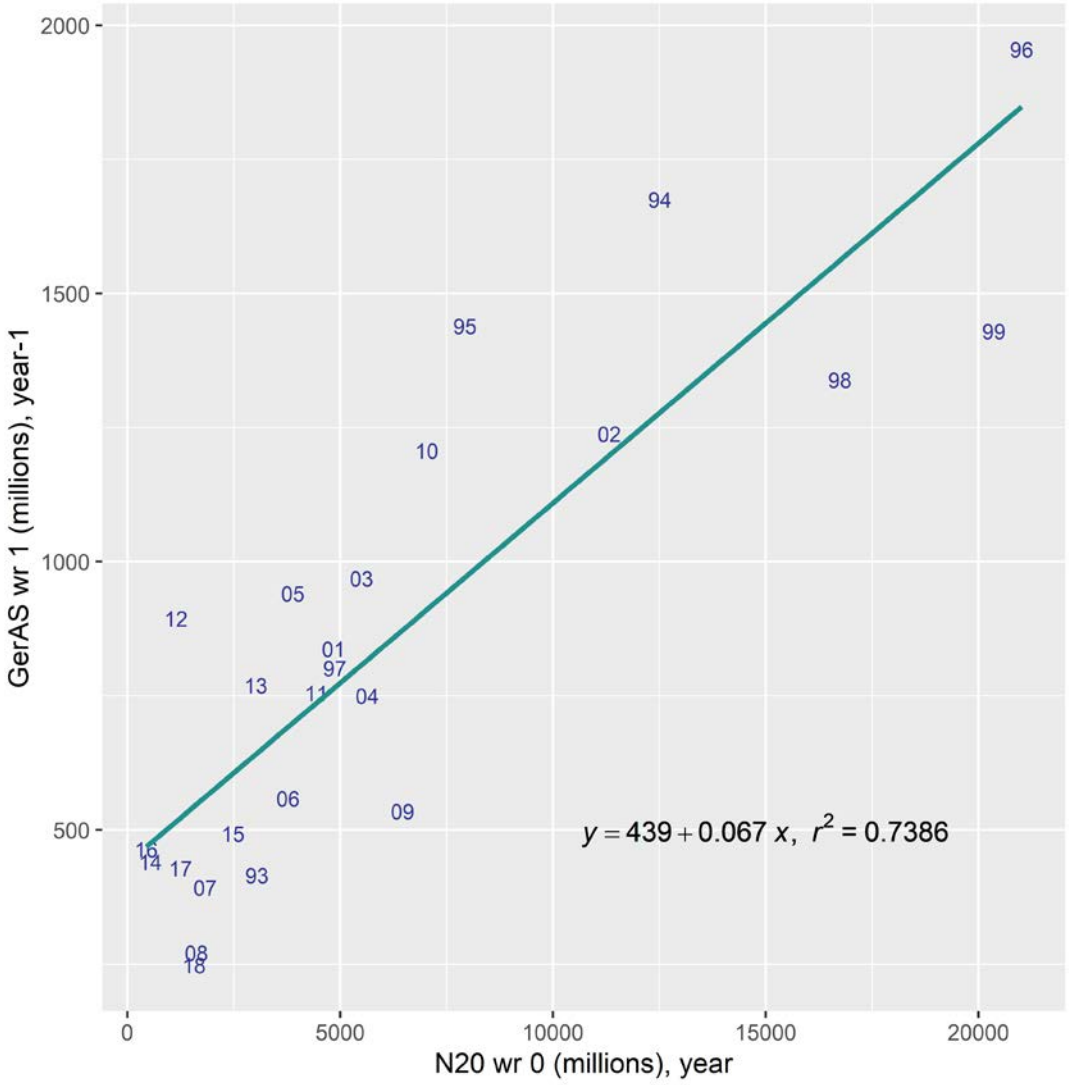

Figure 3.5.1. Western Baltic Spring-spawning Herring. Correlation of 1 wr herring from GERAS with the N20 larvae index. Note the year lag between surveys. Labels show the year of the N_{20}.

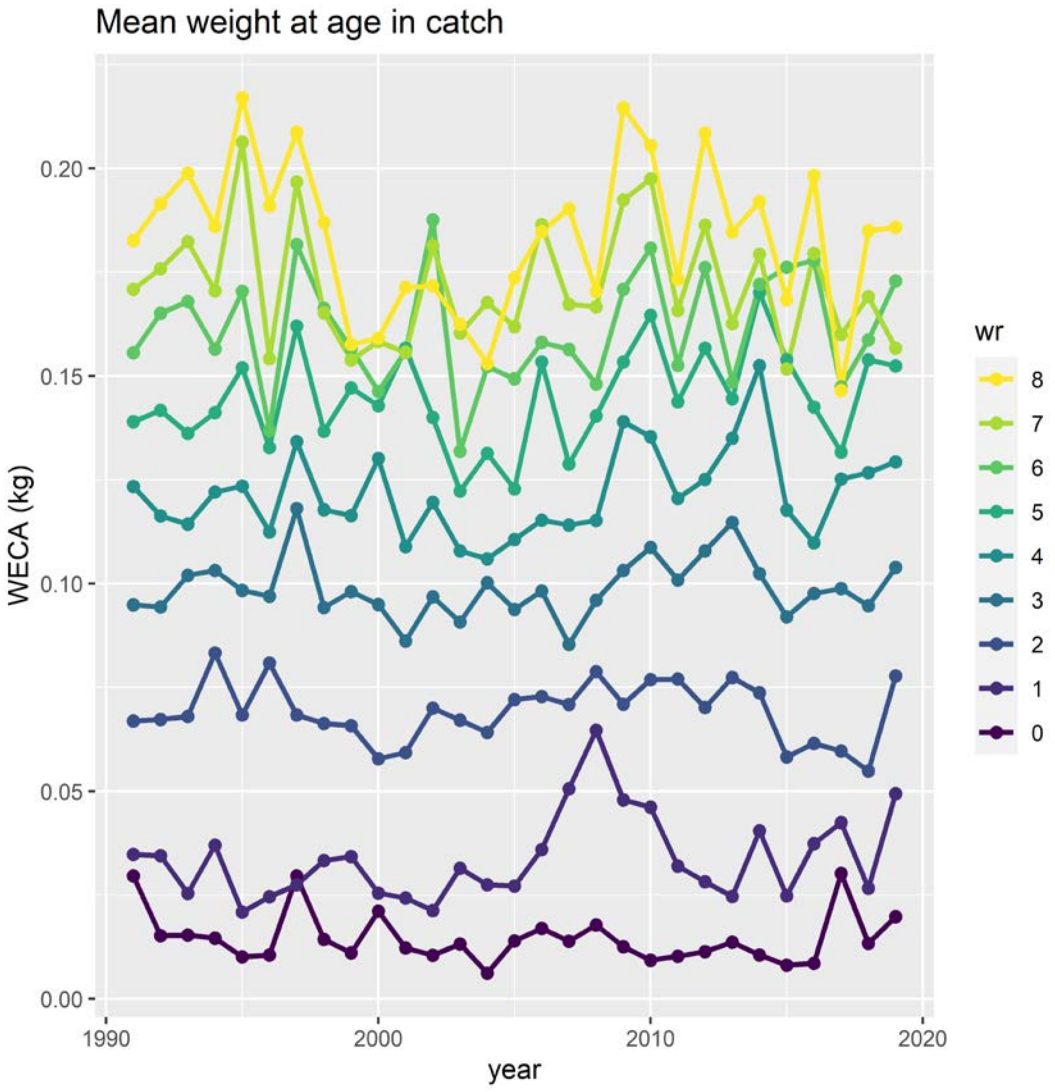

Figure 3.6.1.1. Western Baltic Spring-spawning Herring. Weight (kg) at age as W-ringers (wr) in the catch (WECA).

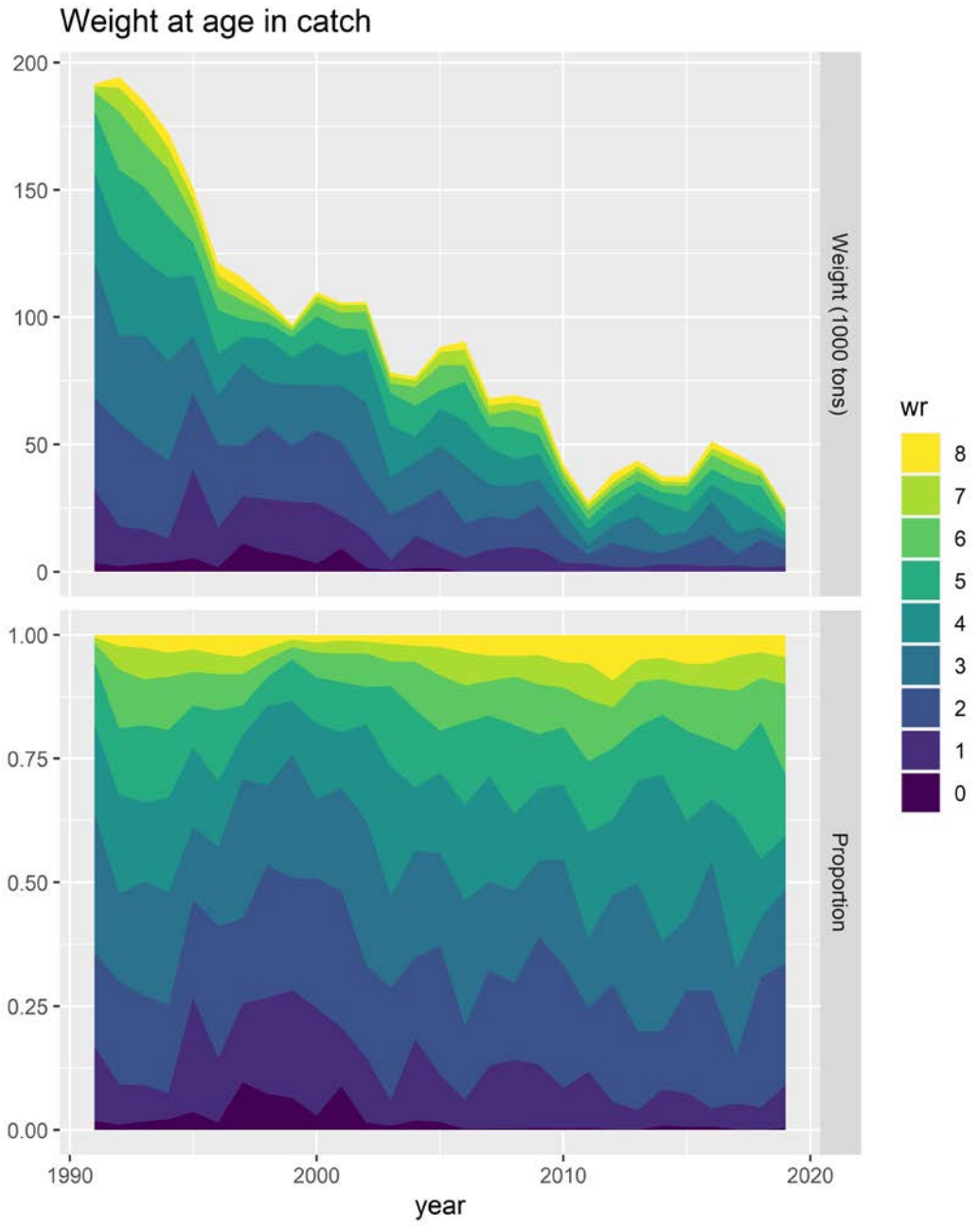

Figure 3.6.1.2. Western Baltic Spring-spawning Herring. Catch in weight. Upper panel: Catch in weight (1000 tonnes) at age as W-ringers (wr). Lower panel: Proportion (by weight) of a given age as W-ringers (wr) in the catch.

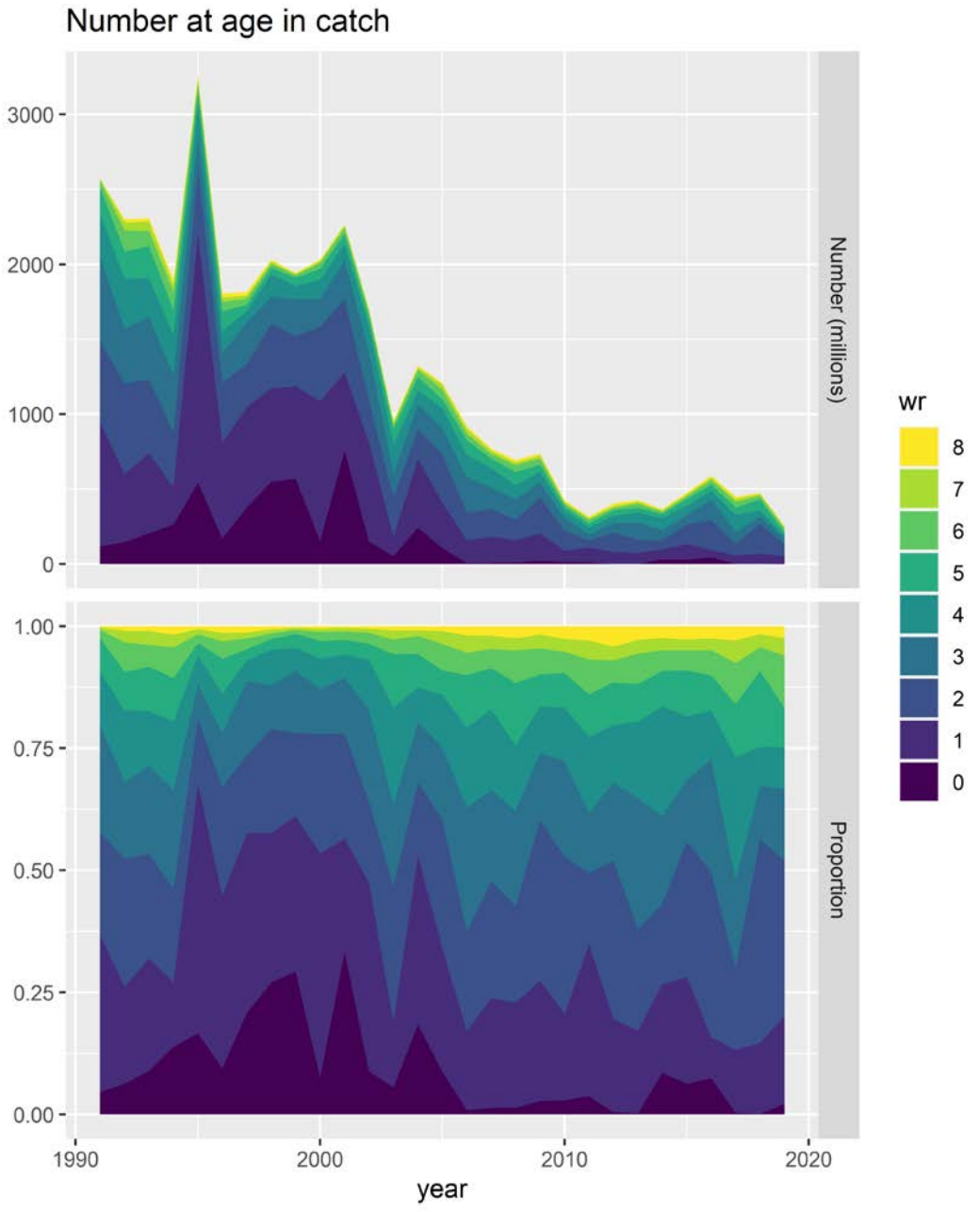

Figure 3.6.1.3. Western Baltic Spring-spawning Herring. Catch in Numbers. Upper panel: Catch in numbers (millions) at age as W-ringers (wr). Lower panel: Proportion (by number) of a given age as W-ringers (wr) in the catch.

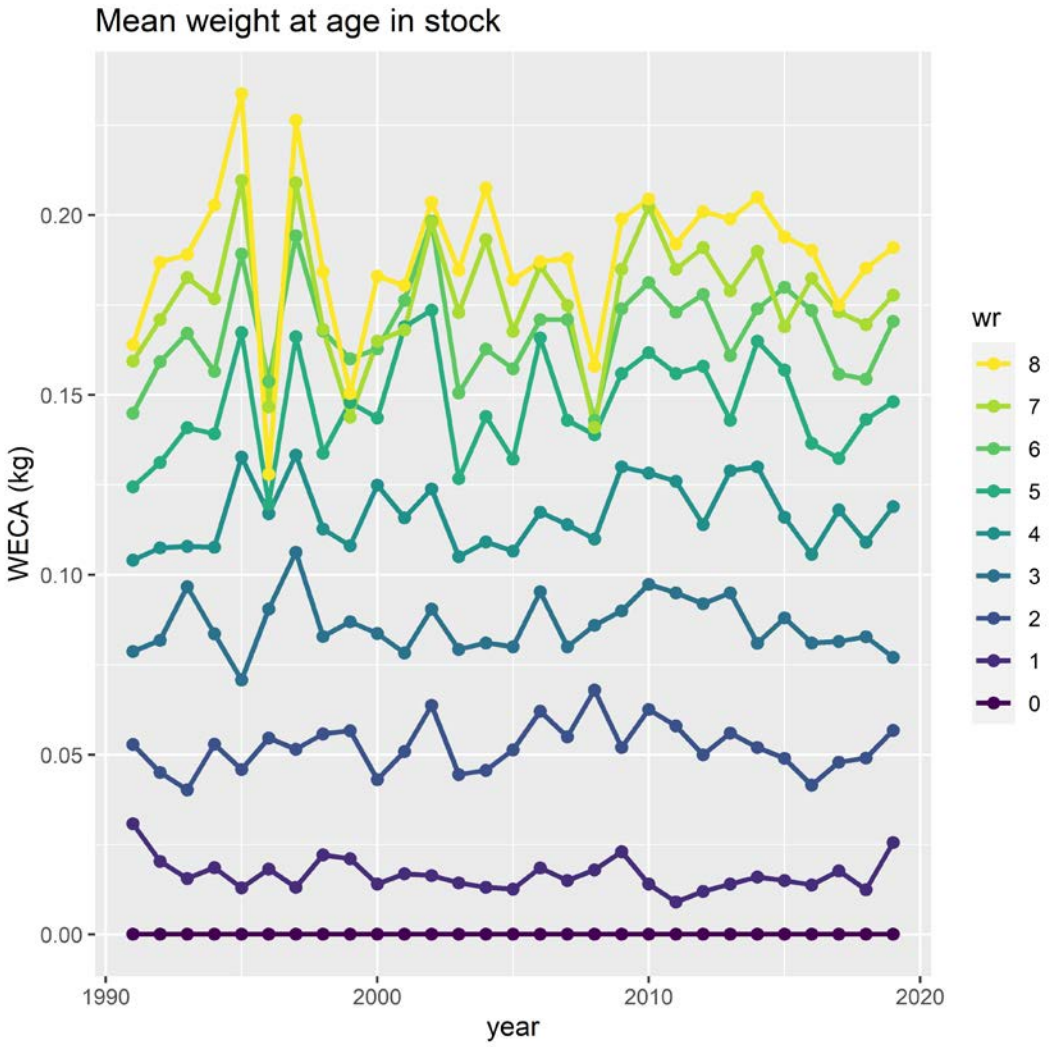

Figure 3.6.1.4. Western Baltic Spring-spawning Herring. Weight (kg) at age as W-ringers (wr) in the catch (WEST).

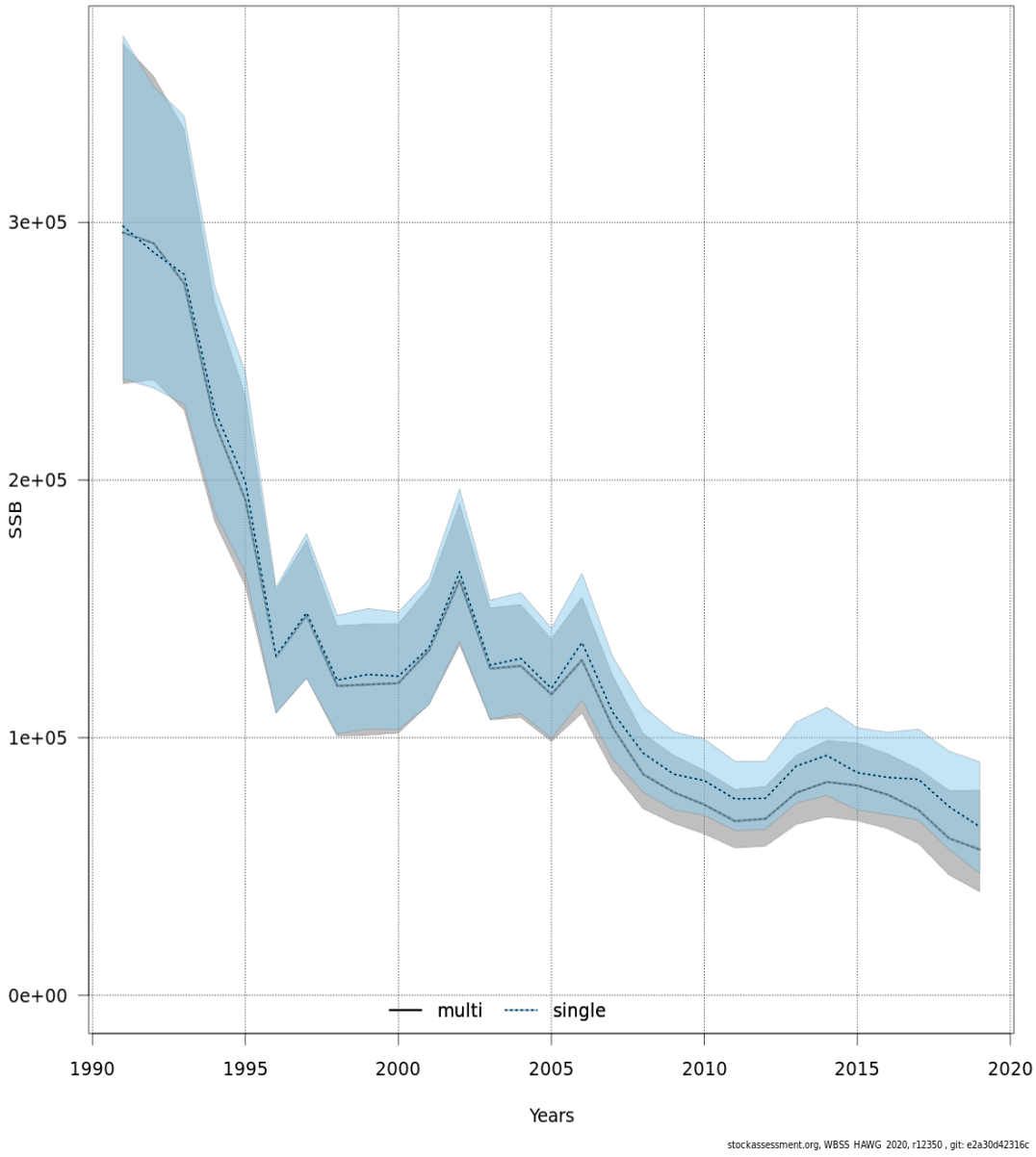

Figure 3.6.4.1. Western Baltic Spring-spawning Herring. Stock summary plot. Spawning-stock biomass (SSB). Estimates from the WBSS multi fleet (multi) and the WBSS single fleet (single) assessment runs and point wise 95% confidence intervals are shown by line and shaded area.

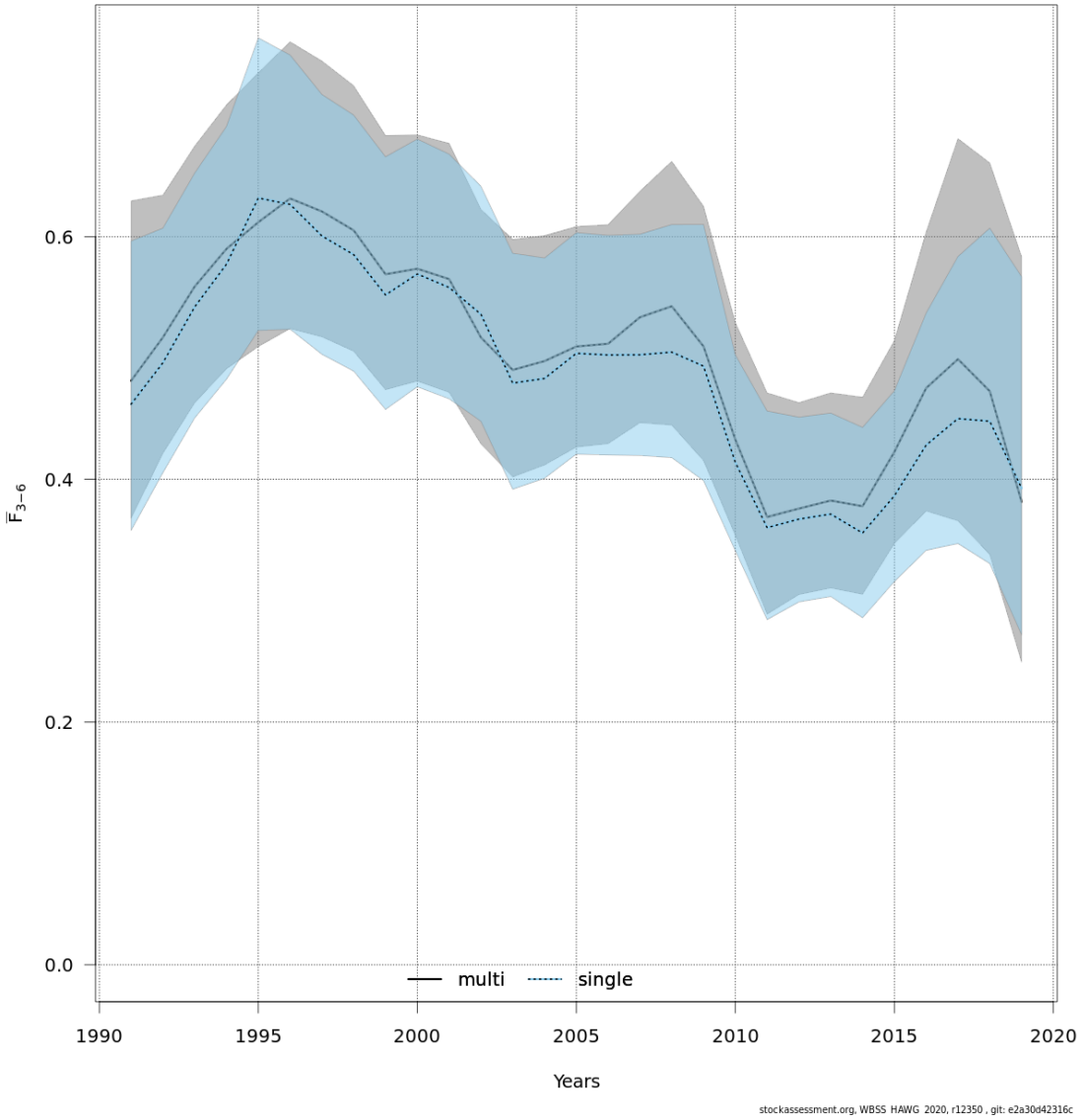

Figure 3.6.4.2. Western Baltic Spring-spawning Herring. Stock summary plot. Average fishing mortality (F) for the shown age range. Estimates from the WBSS multi fleet (multi) and the WBSS single fleet (single) assessment runs and point wise 95% confidence intervals are shown by line and shaded area.

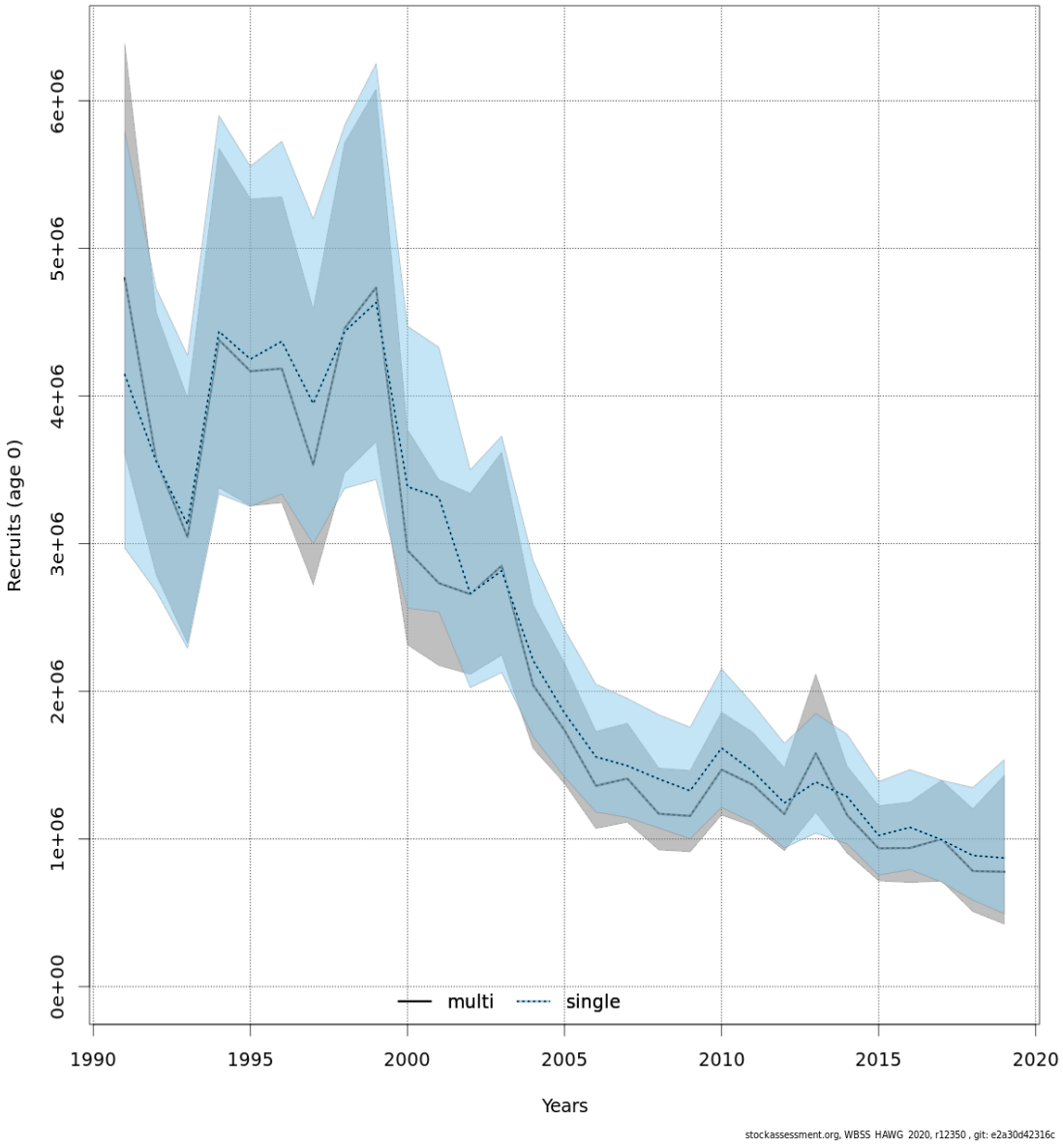

Figure 3.6.4.3. Western Baltic Spring-spawning Herring. Stock summary plot. Yearly recruitment (age 0 equal 0 W-ringers). Estimates from the WBSS multi fleet (multi) and the WBSS single fleet (single) assessment runs and point wise 95% confidence intervals are shown by line and shaded area.

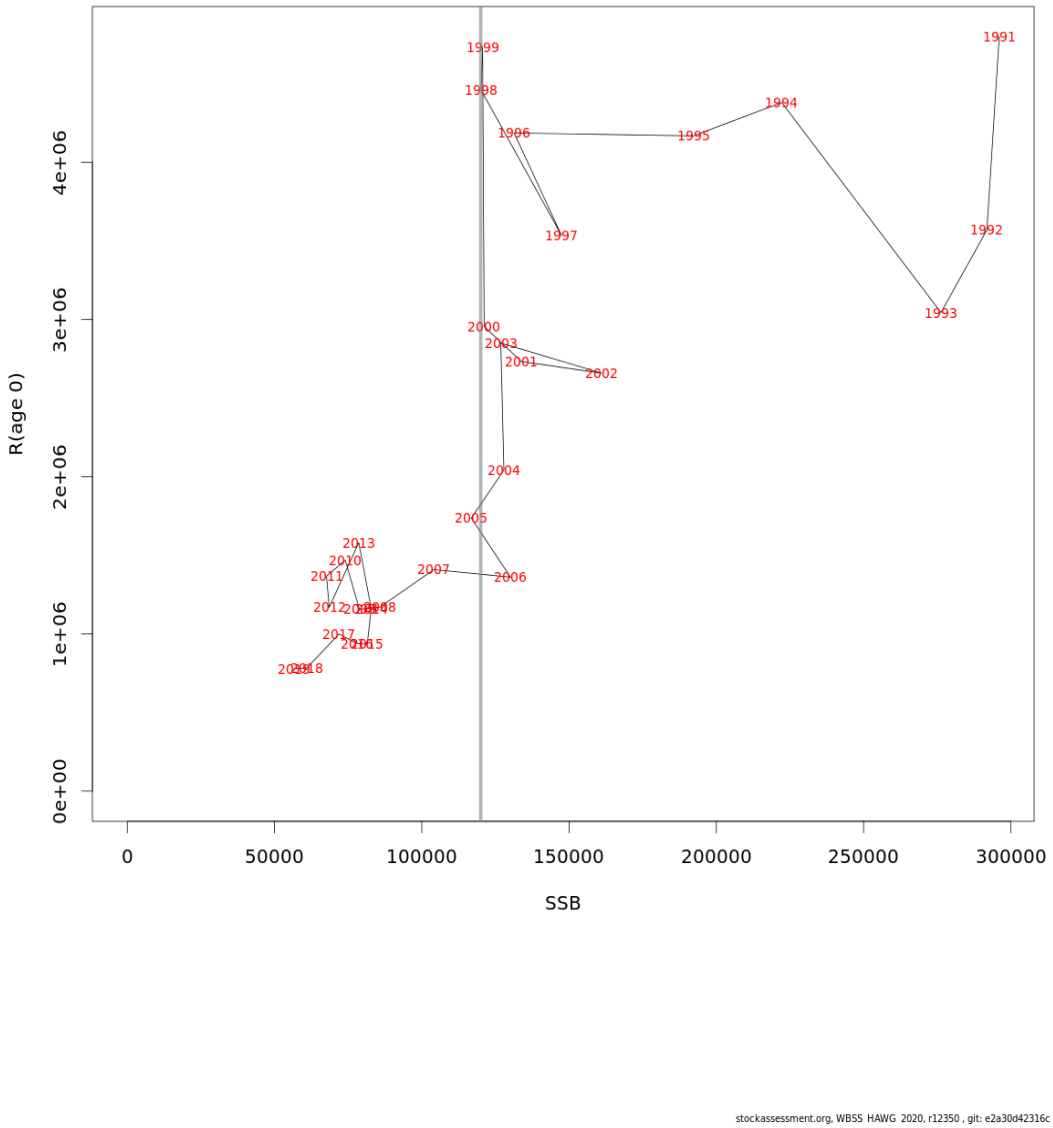

Figure 3.6.4.4. Western Baltic Spring-spawning Herring. Recruitment-at-age 0-wr (in thousands) is plotted against spawning-stock biomass (tonnes) as estimated by the assessment.

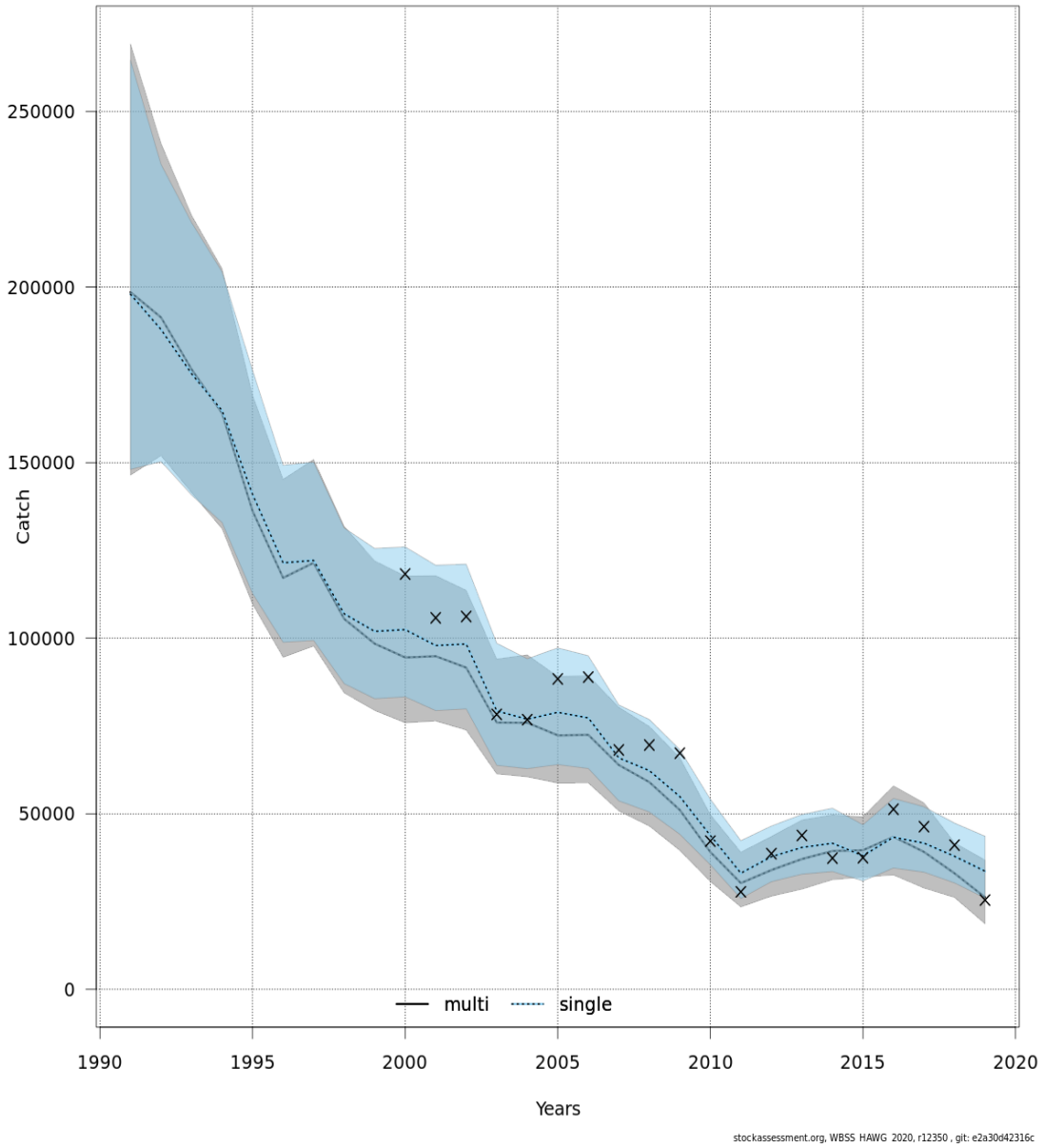

Figure 3.6.4.5. WESTERN BALTIC SPRING-SPAWNING HERRING. Total catch in weight (tonnes). Prediction from the WBSS multi fleet (multi) and the WBSS single fleet (single) assessment runs and point wise 95% confidence intervals are shown by line and shaded area. The yearly observed total catch weight (crosses) are calculated sum of catch per fleet.

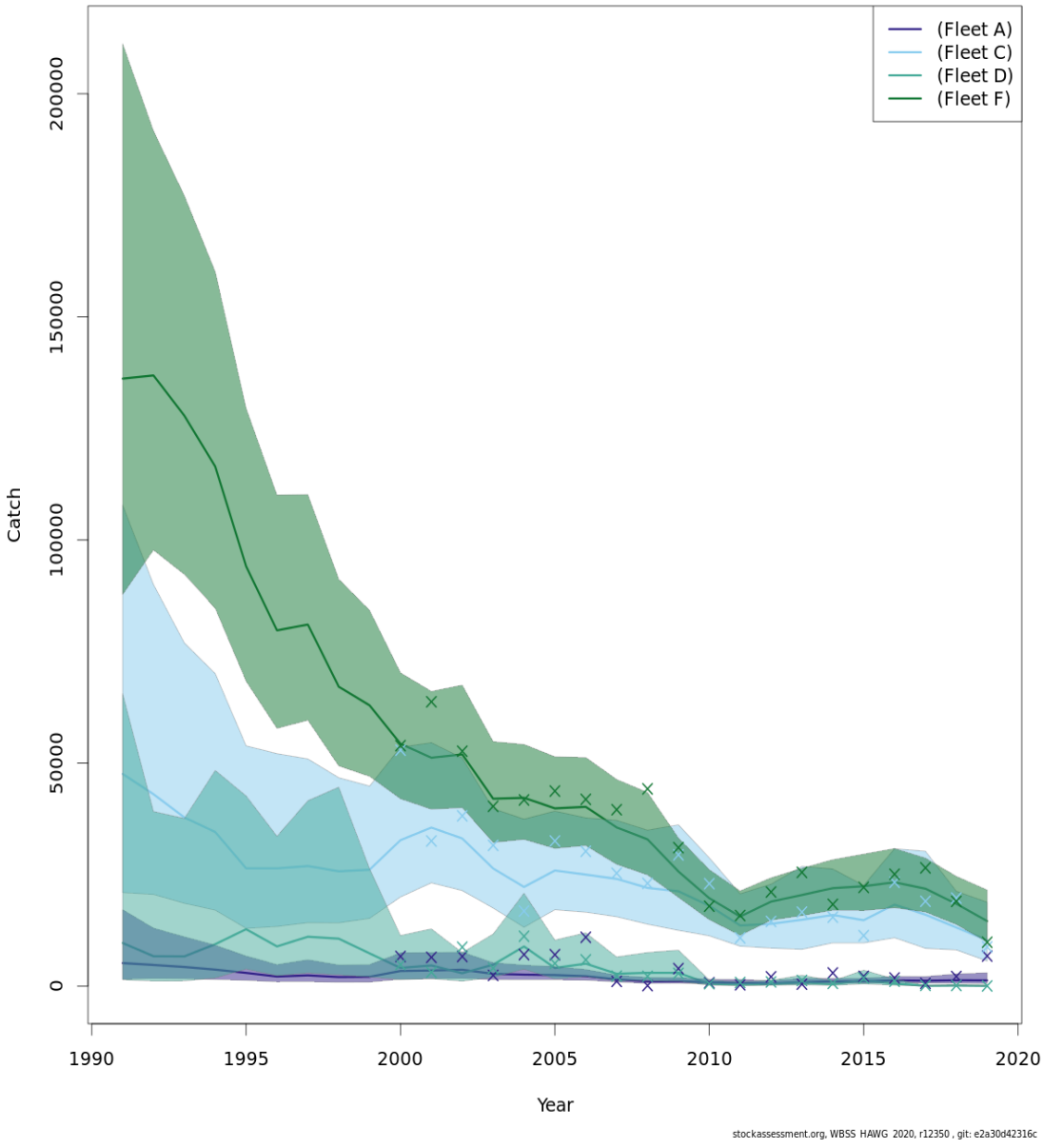

Figure 3.6.4.6. Western Baltic Spring-spawning Herring. Total catch in weight (tonnes) by fleet. Prediction from the WBSS multi fleet assessment run and point wise 95% confidence intervals are shown by line and shaded area. The plot also show the observed total catch weight per fleet (crosses).

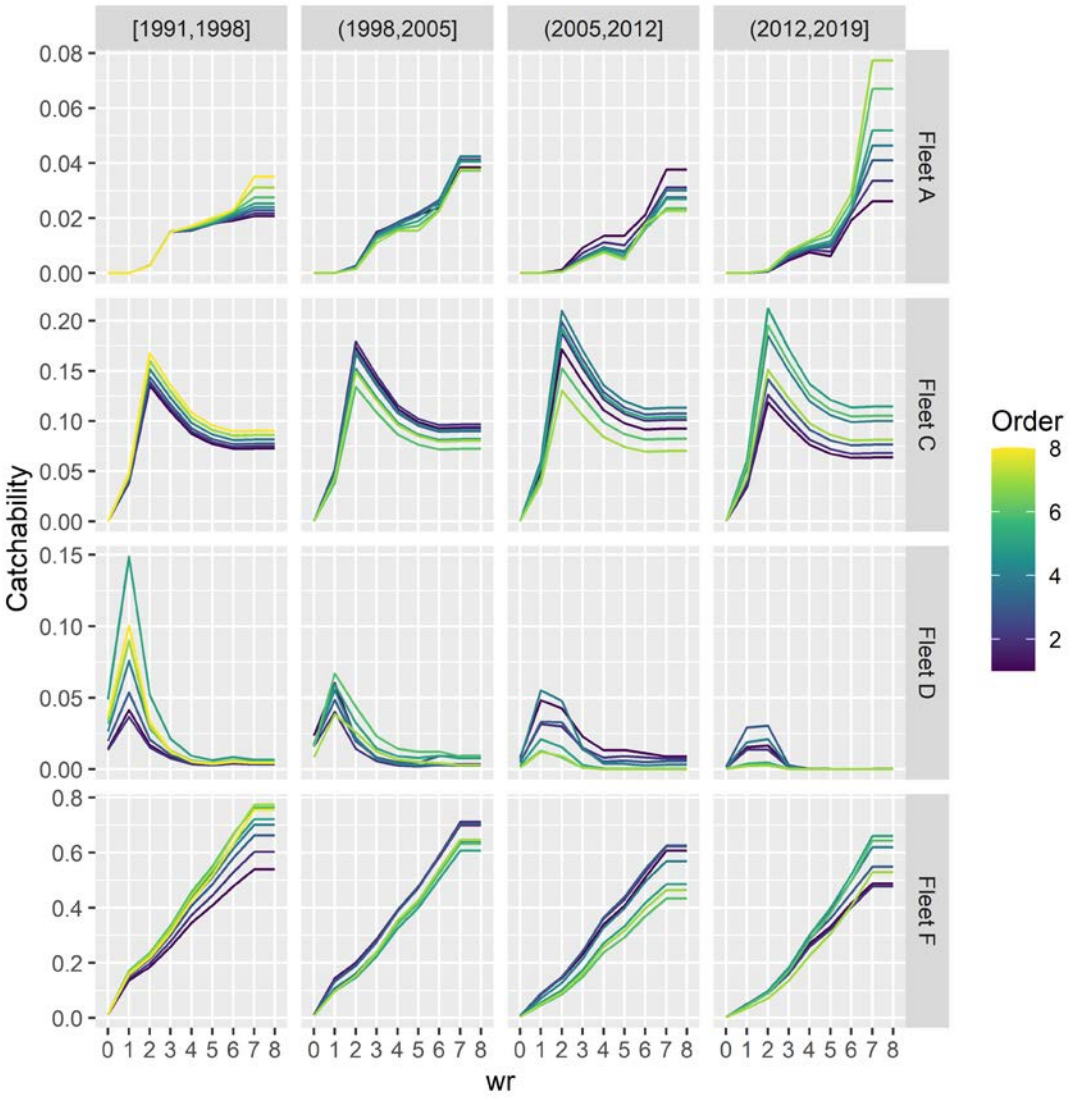

Figure 3.6.4.7. Western Baltic Spring-spawning Herring. Estimated selection pattern at age as W-ringers (wr) per fleet and year. Order: 1 equal 1st year in the respective time span.

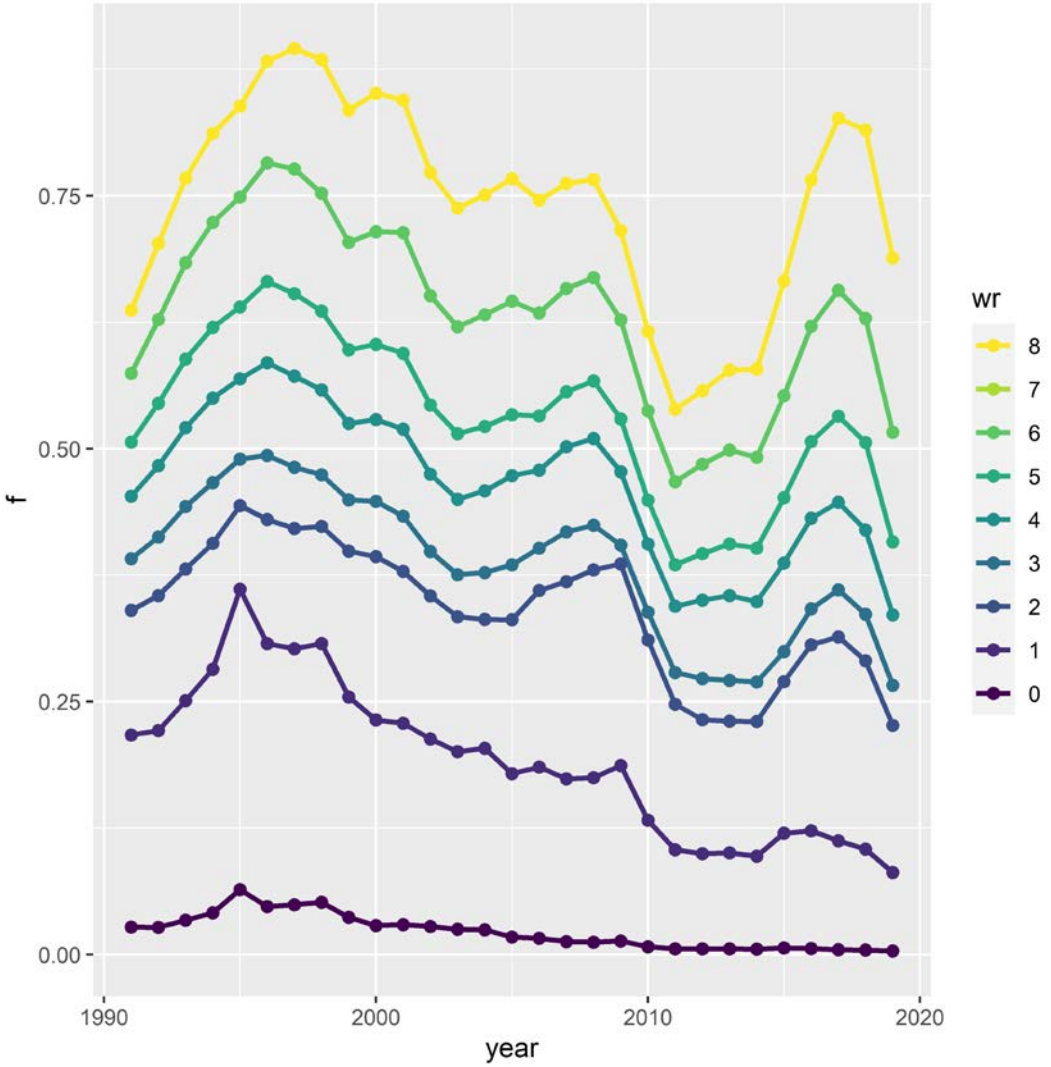

Figure 3.6.4.8. Western Baltic Spring-spawning Herring. Time-series of estimated fishing mortality-at-age as W-ringers (wr).

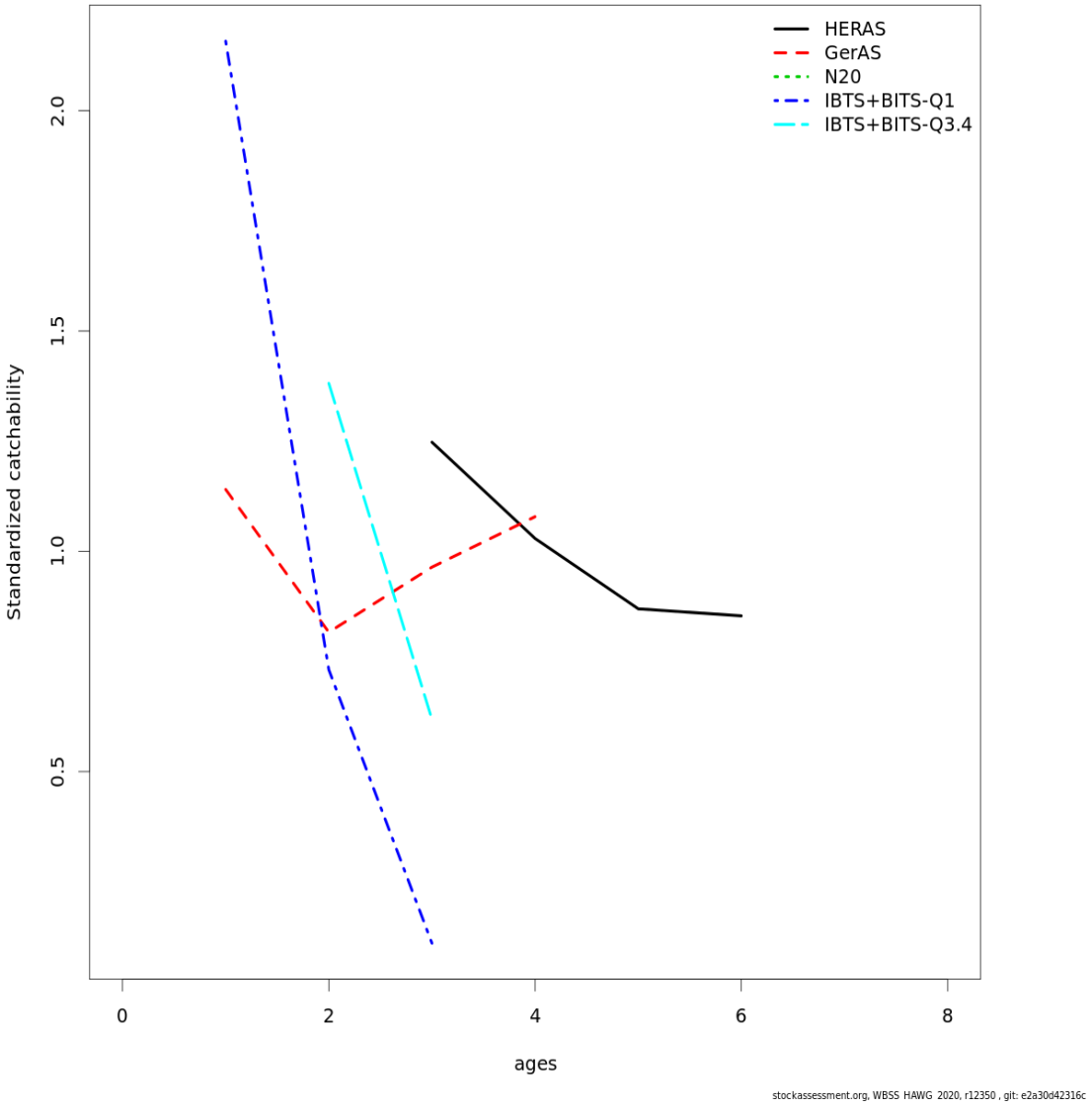

Figure 3.6.4.9. Western Baltic Spring-spawning Herring. Estimated survey catchabilities. N20 only covers a age 0 and therefore no line.

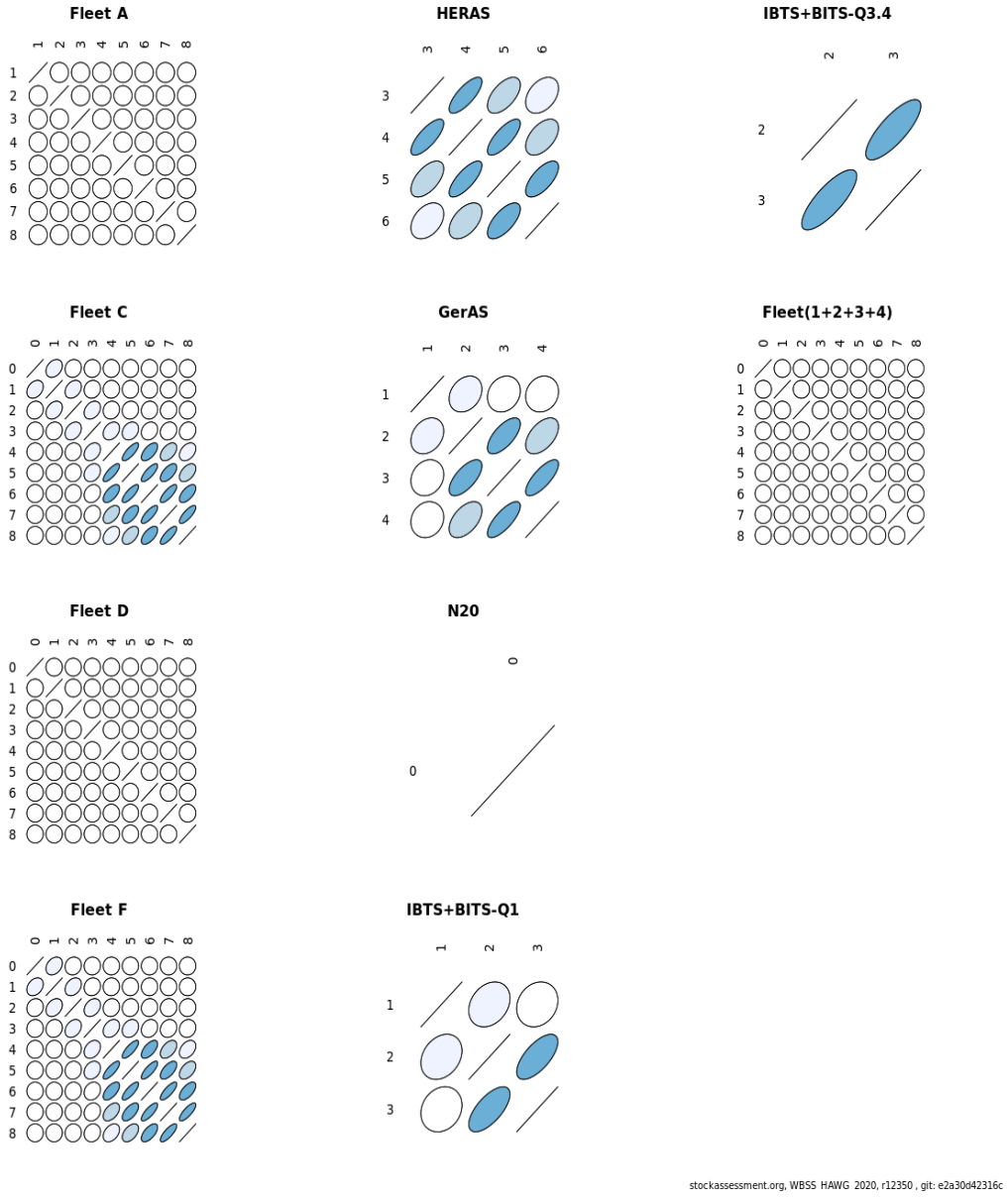

Figure 3.6.4.10. Western Baltic Spring-spawning Herring. Estimates correlations between age groups for each fleet.

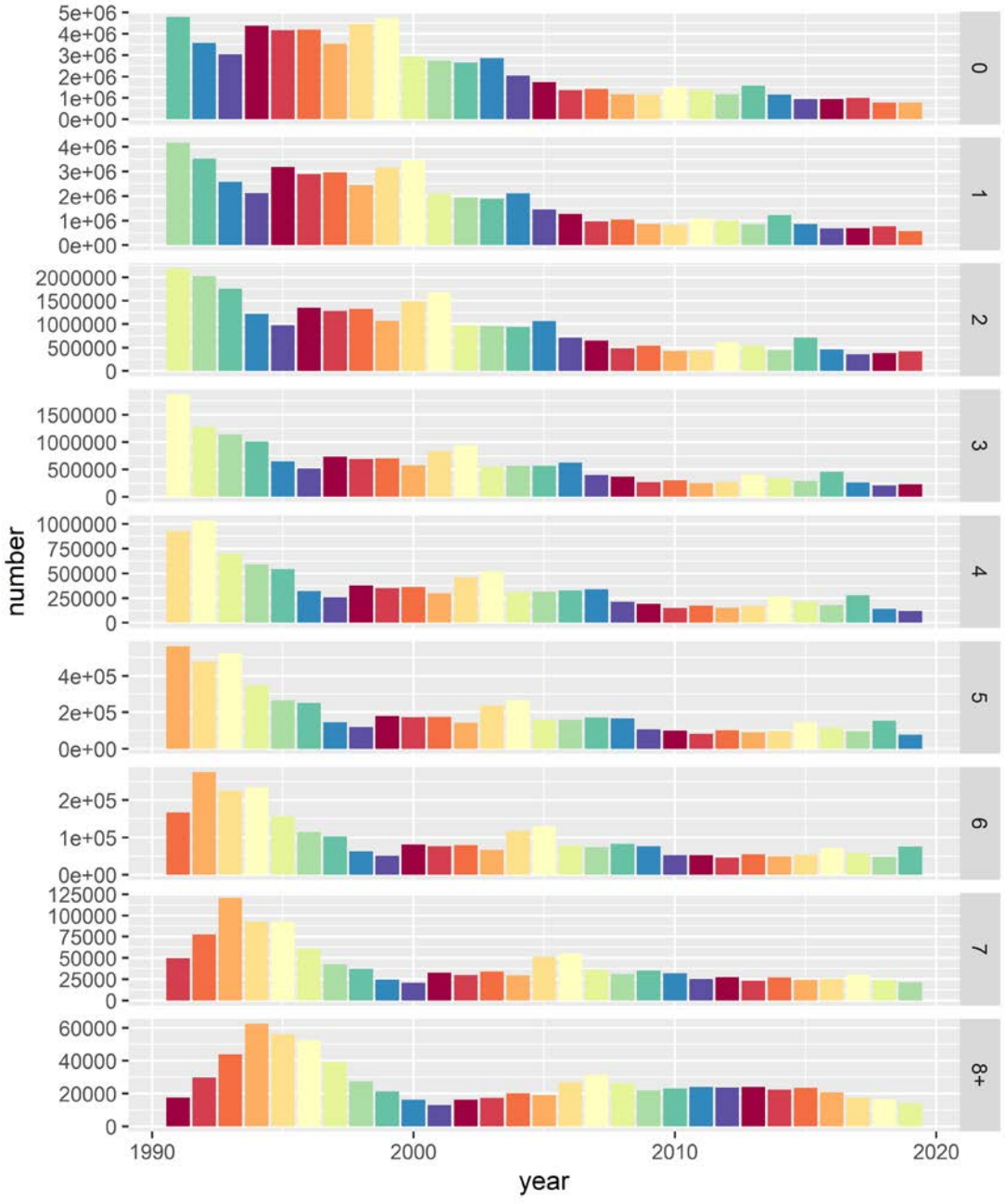

Figure 3.6.4.11. Western Baltic Spring-spawning Herring. Estimated age distribution in the stock. Colours represent a cohort

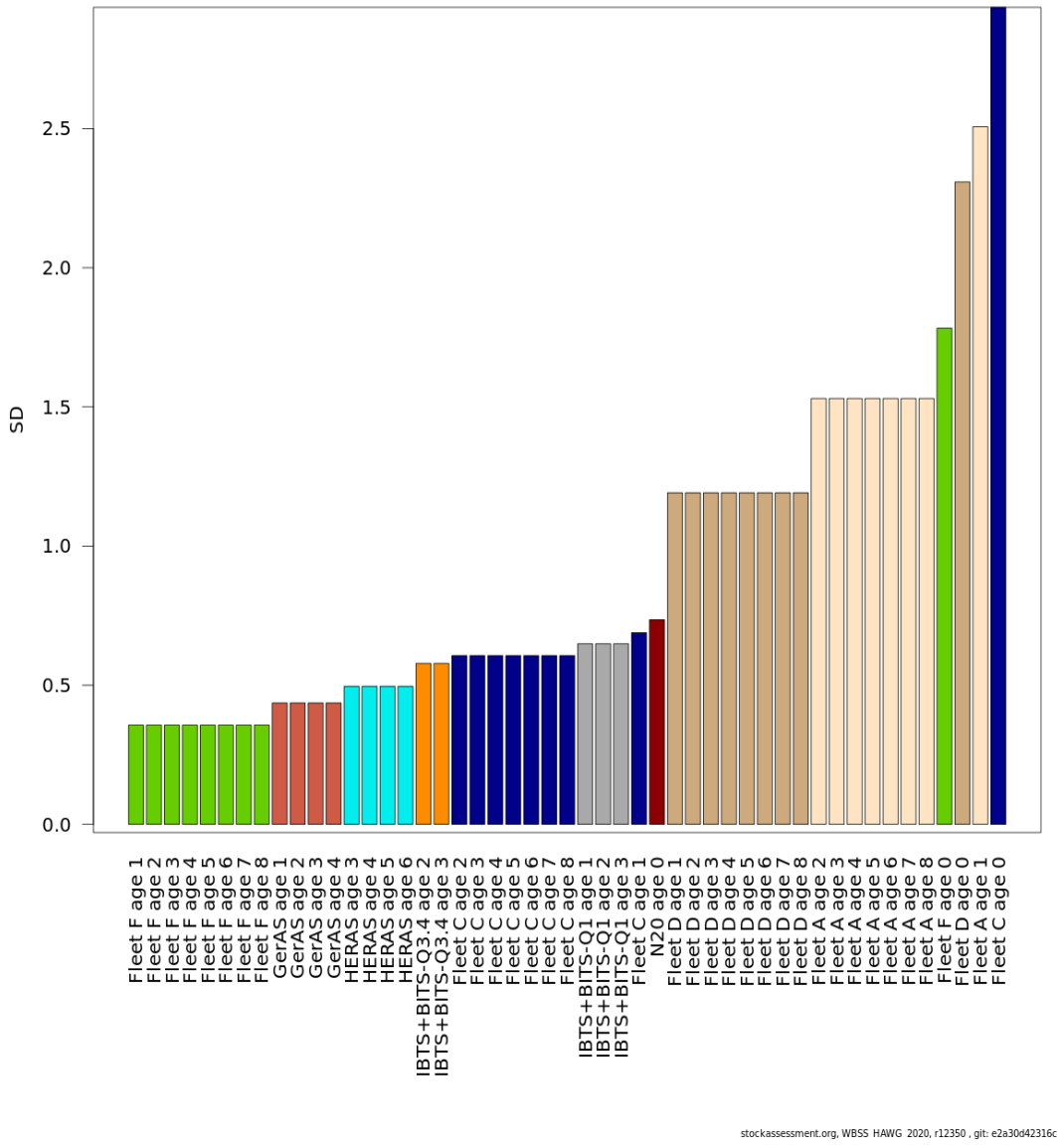

Figure 3.6.4.12. Western Baltic Spring-spawning Herring. Estimated observation variance in the WBSS multi fleet assessment run.

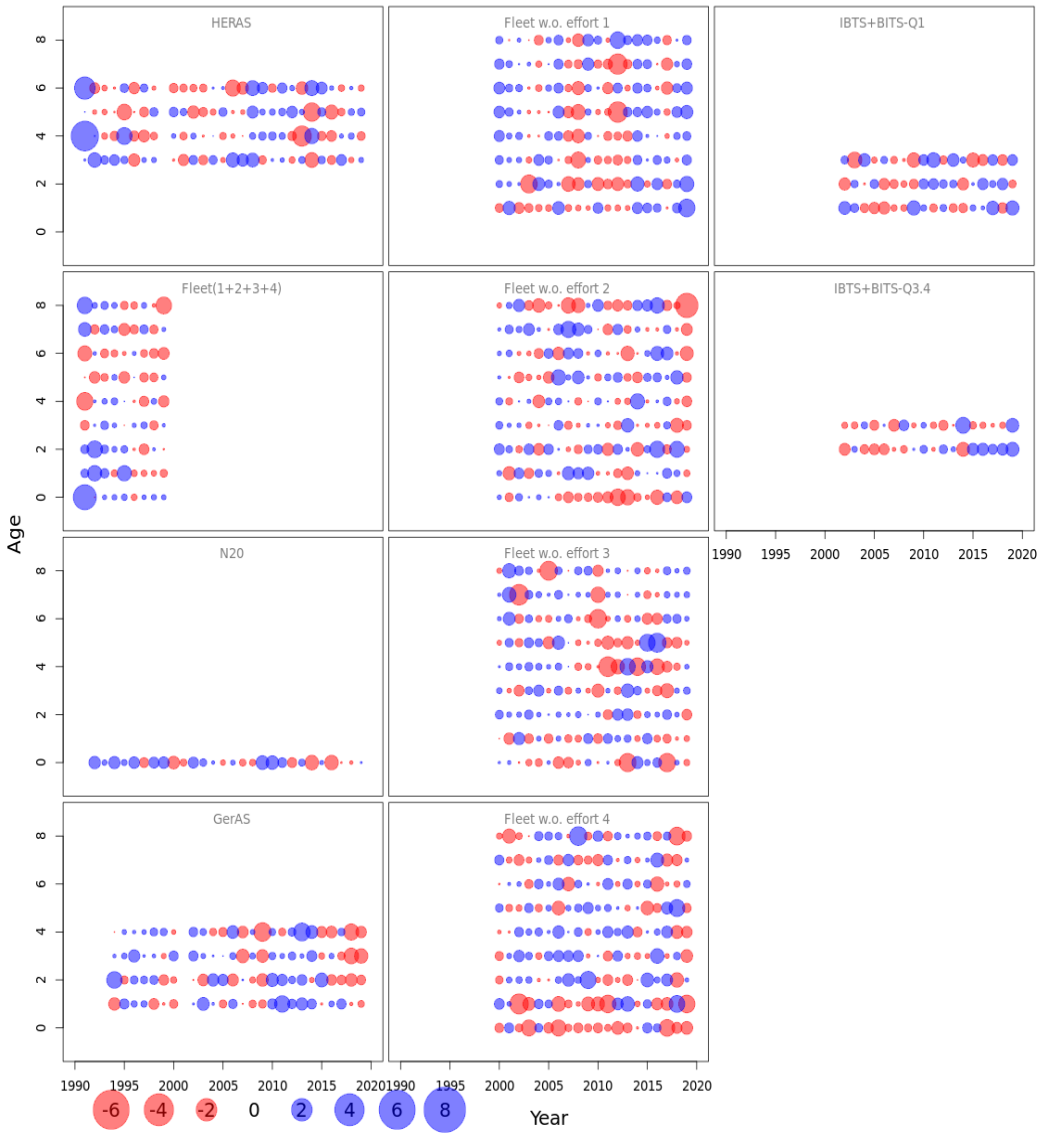

Figure 3.6.4.13. Western Baltic Spring-spawning Herring. BUBBLE PLOT. Standardized one-observation-ahead residuals from multi fleet run.

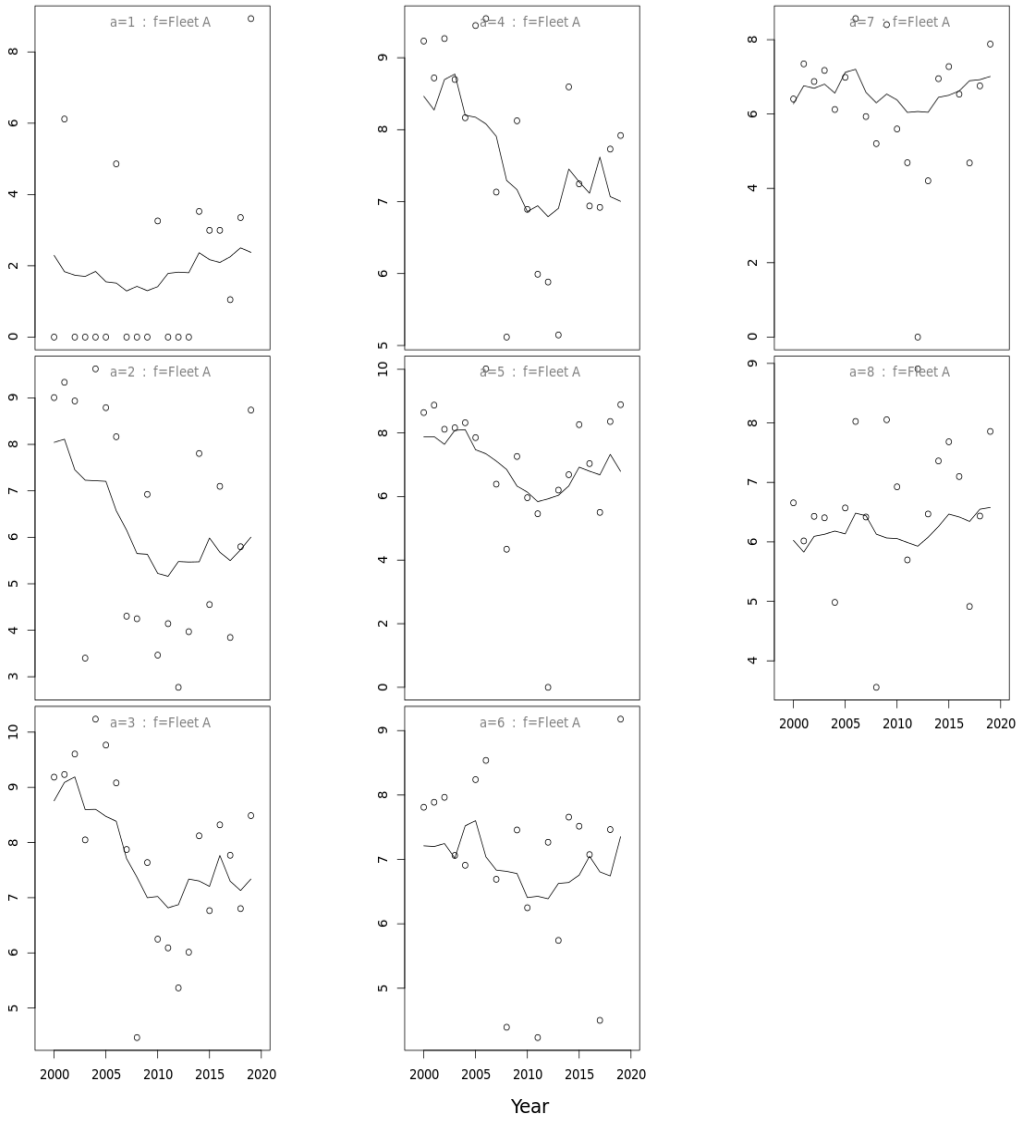

Figure 3.6.4.14. Western Baltic Spring-spawning Herring. Diagnostics of commercial catches fit per fleet. Fleet A. Plot of predicted (line) and observed (points) catches (log scale) per W-ringers (a) and year.

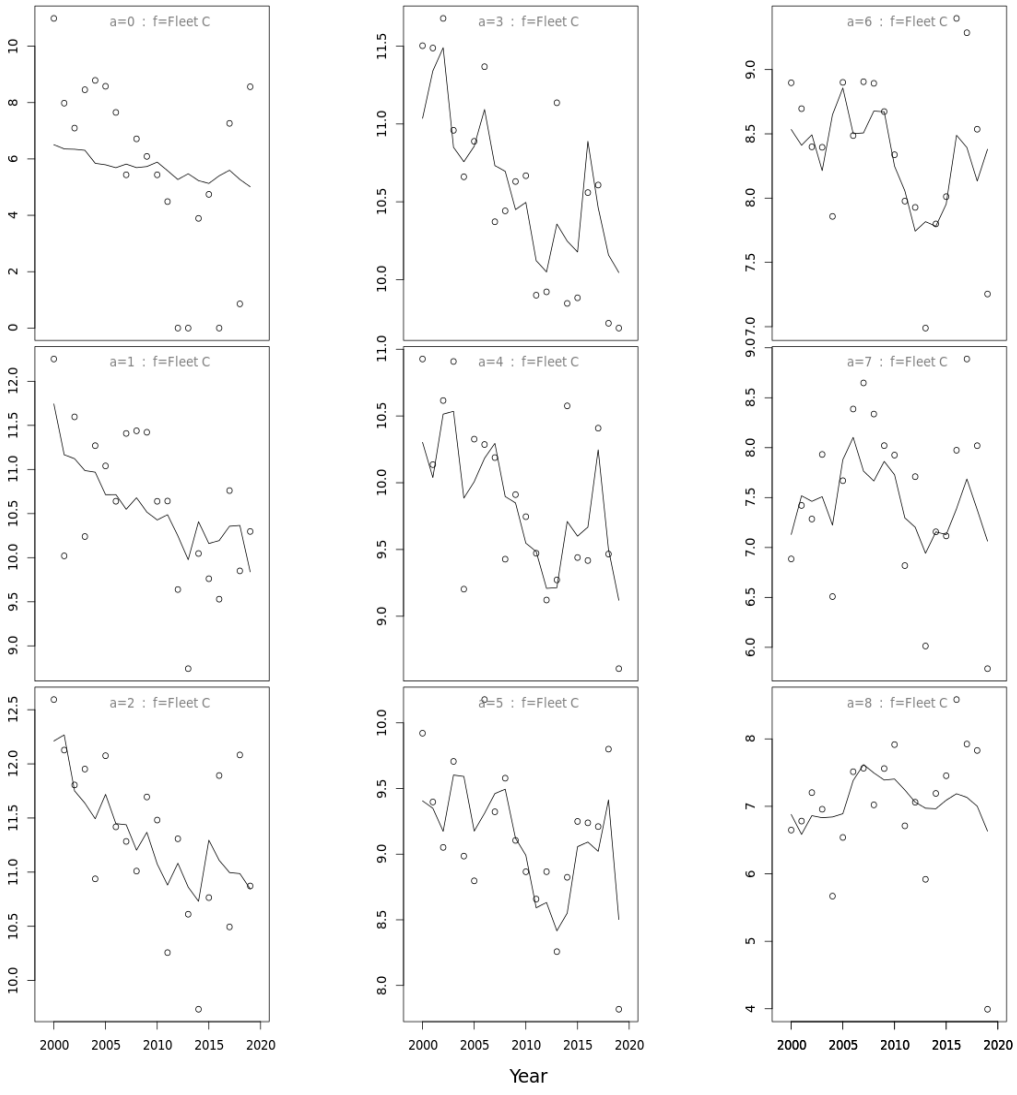

Figure 3.6.4.15. Western Baltic Spring-spawning Herring. Diagnostics of commercial catches fit per fleet. Fleet C. Plot of predicted (line) and observed (points) catches (log scale) per W-ringers (a) and year.

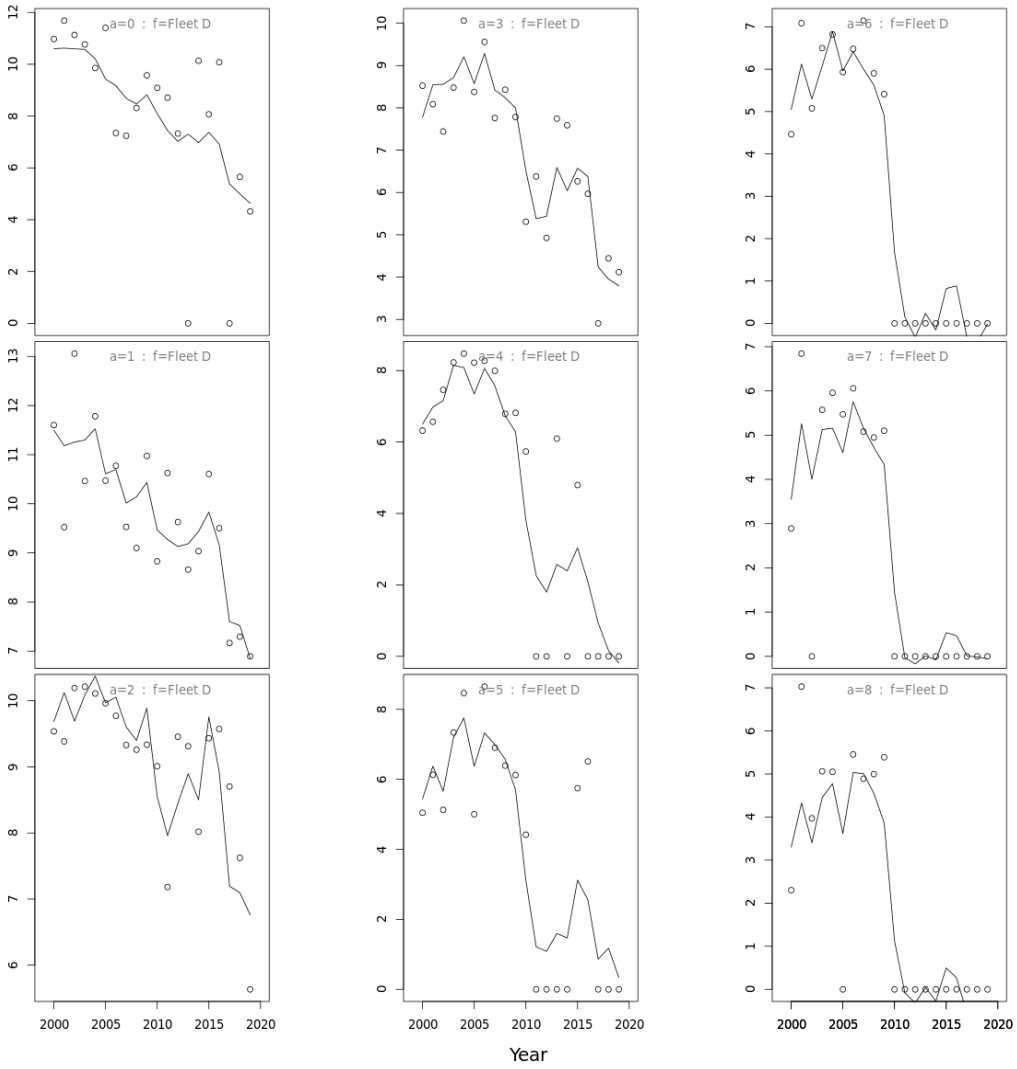

Figure 3.6.4.16. Western Baltic Spring-spawning Herring. Diagnostics of commercial catches fit per fleet. Fleet D. Plot of predicted (line) and observed (points) catches (log scale) per W-ringers (a) and year.

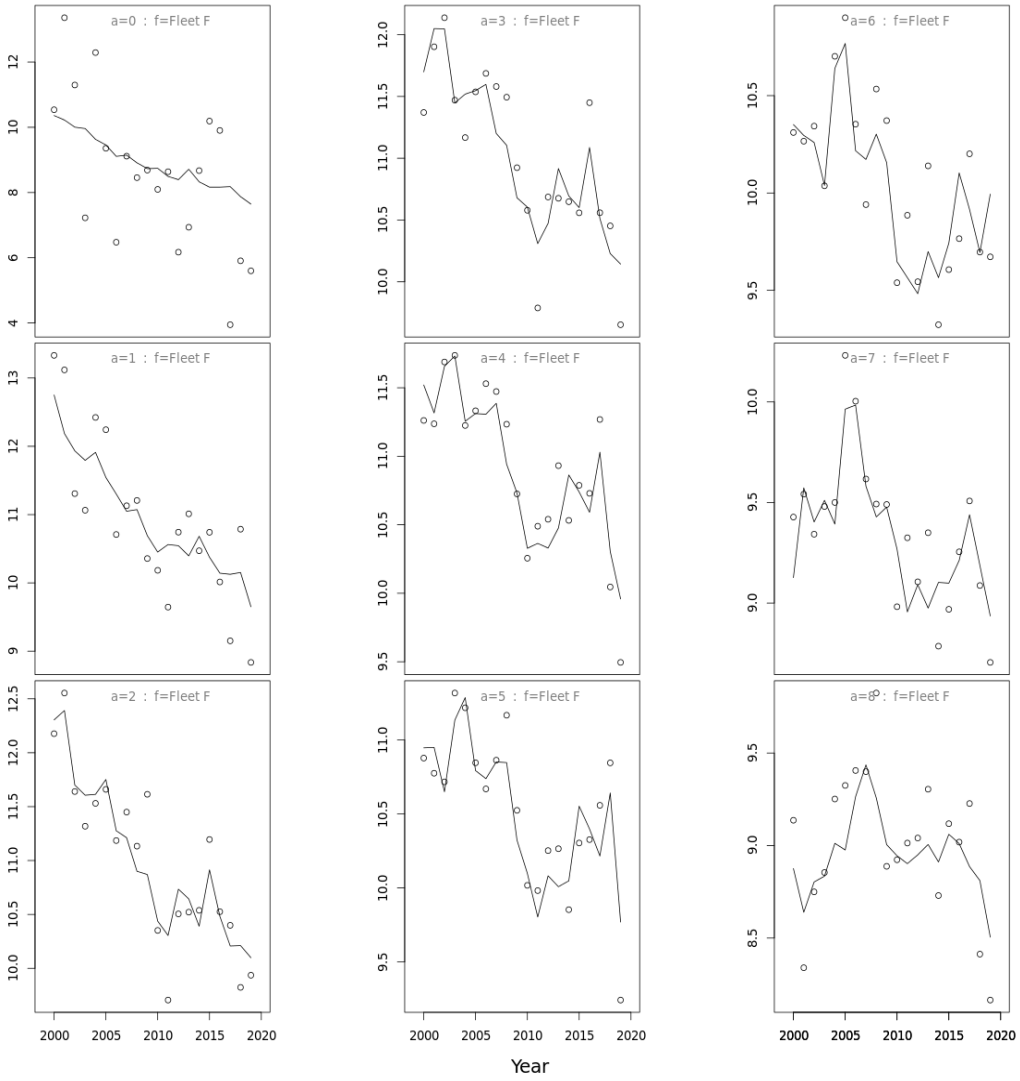

Figure 3.6.4.17. Western Baltic Spring-spawning Herring. Diagnostics of commercial catches fit per fleet. Fleet F. Plot of predicted (line) and observed (points) catches (log scale) per W-ringers (a) and year.

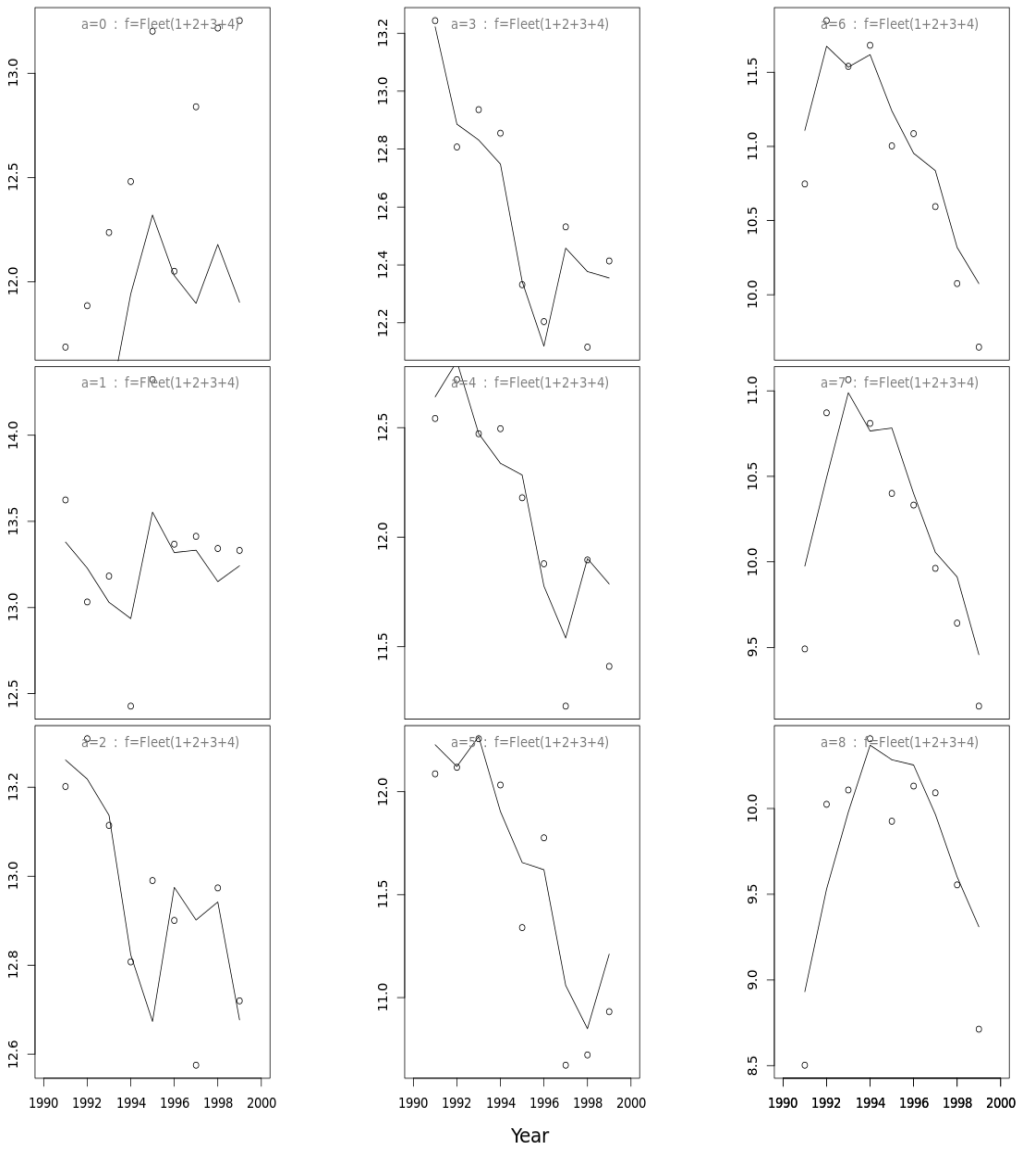

Figure 3.6.4.18, Western Baltic Spring-spawning Herring. Diagnostics of commercial catches fit per fleet. Sum of fleets Plot of predicted (line) and observed (points) catches (log scale) per W-ringers (a) and year.

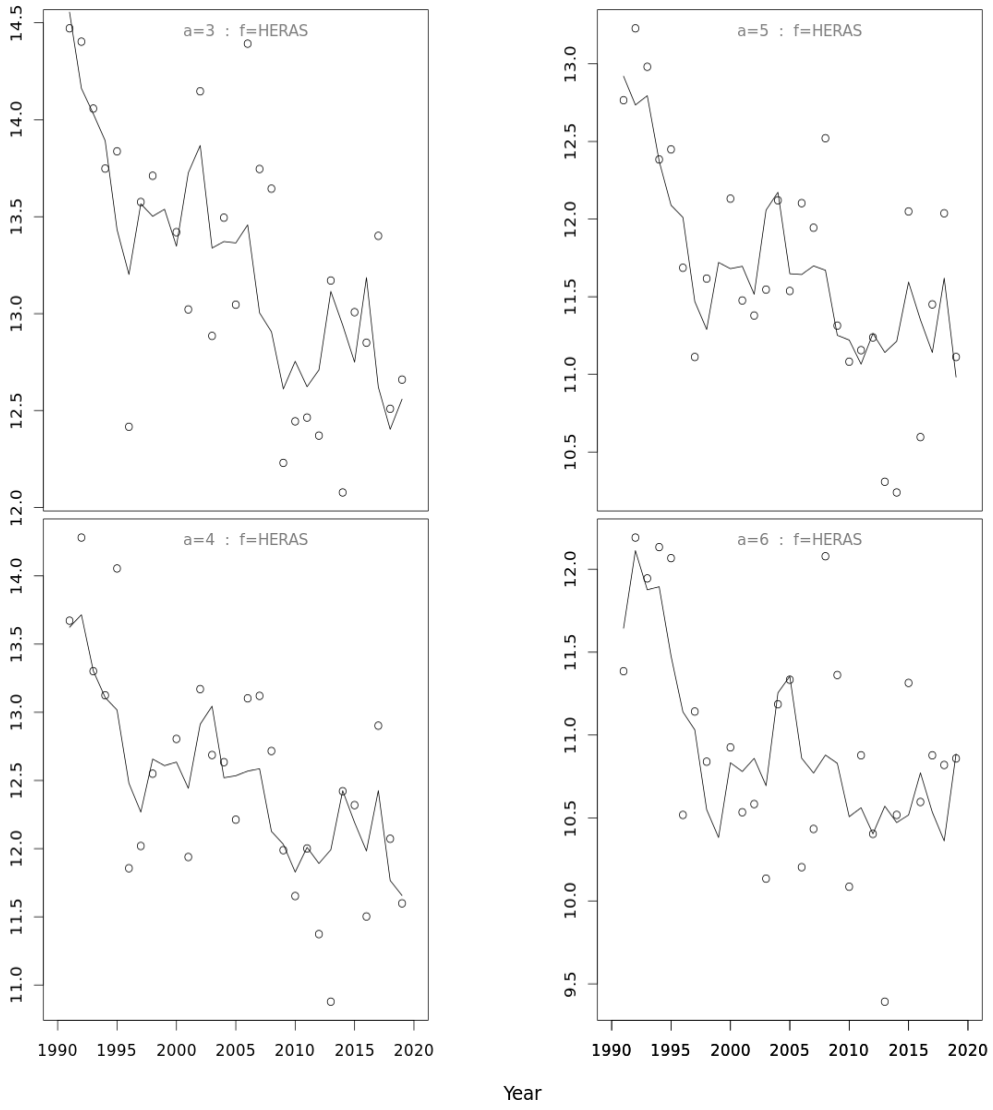

Figure 3.6.4.19. Western Baltic Spring-spawning Herring. Diagnostics of the HERAS index. Plot of predicted (line) and observed (points) index (log scale) per W-ringers (a) and year.

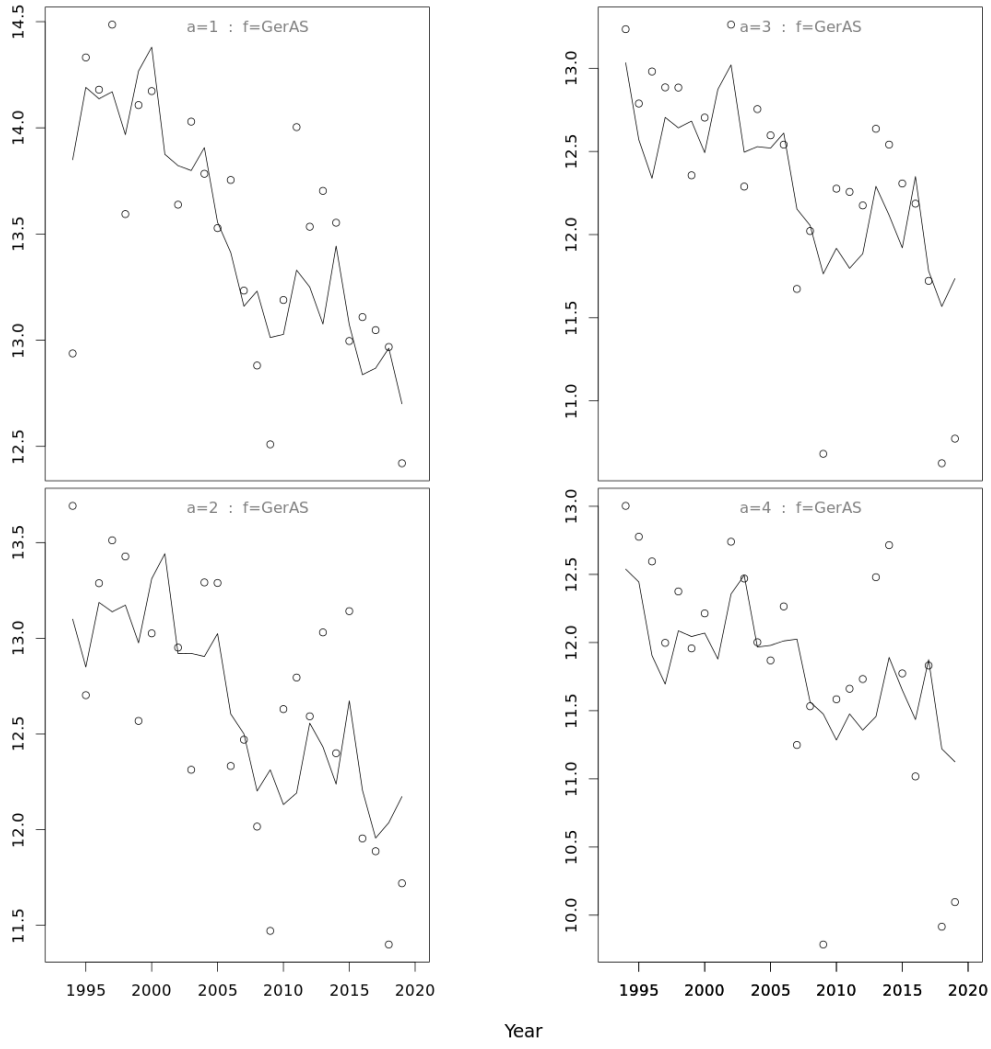

Figure 3.6.4.20. Western Baltic Spring-spawning Herring. Diagnostics of the GerAs index. Plot of predicted (line) and observed (points) index (log scale) per W-ringers (a) and year.

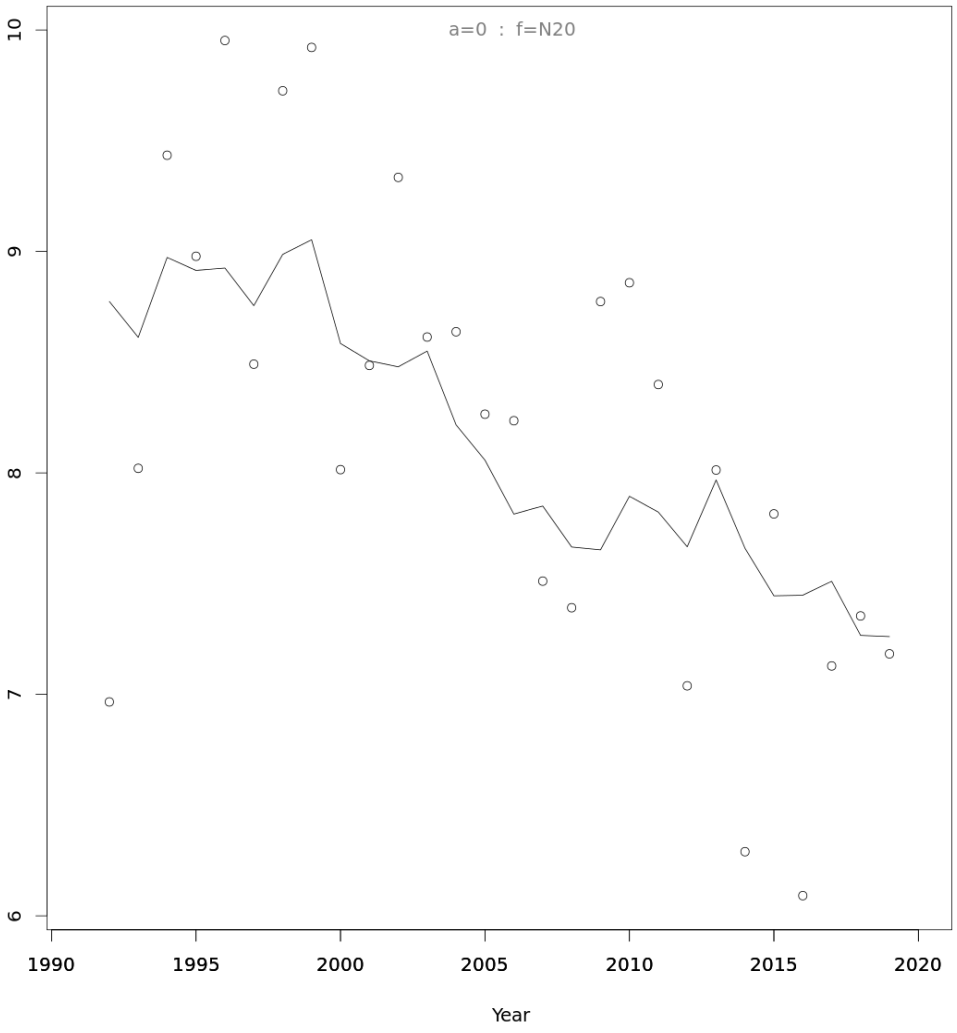

Figure 3.6.4.21. Western Baltic Spring-spawning Herring. Diagnostics of the N20 index. Plot of predicted (line) and observed (points) index (log scale) per W-ringers (a) and year.

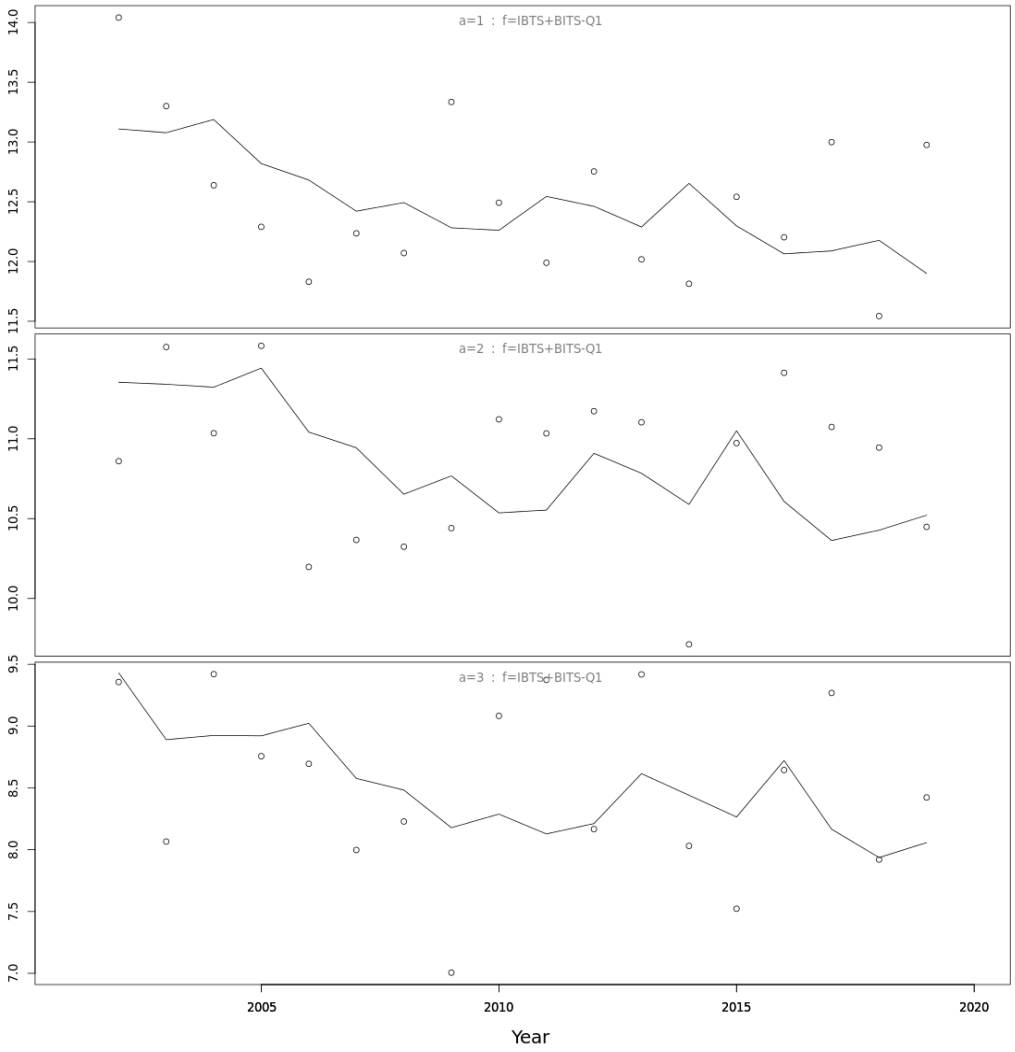

Figure 3.6.4.22. Western Baltic Spring-spawning Herring. Diagnostics of the IBTS+BITS-Q1 index. Plot of predicted (line) and observed (points) index (log scale) per W-ringers (a) and year.

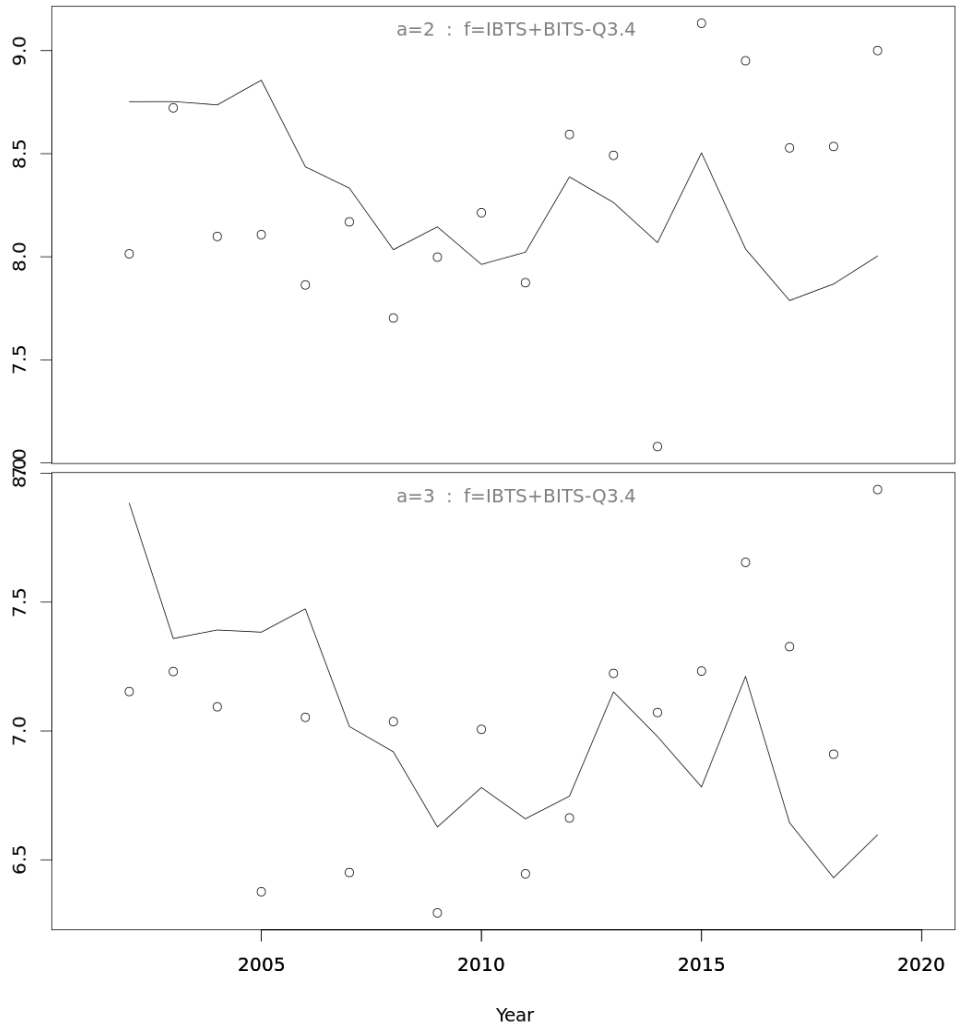

Figure 3.6.4.23. Western Baltic Spring-spawning Herring. Diagnostics of the IBTS+BITS-Q3.4 index. Plot of predicted (line) and observed (points) index (log scale) per W-ringers (a) and year.

Figure 3.6.4.24. Western Baltic Spring-spawning Herring. Analytical retrospective pattern over 5 years from multi fleet run. Spawning-stock biomass.

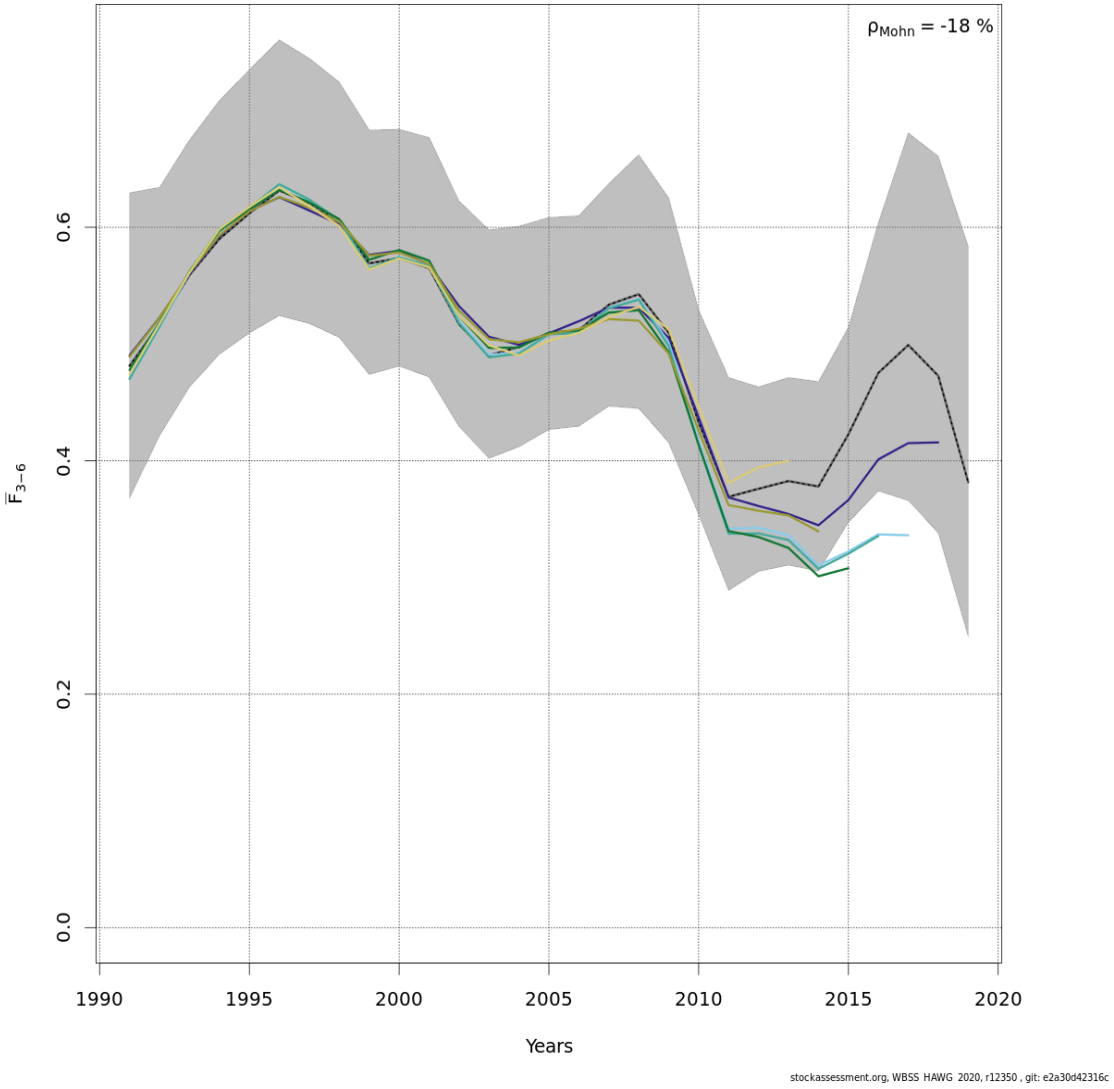

Figure 3.6.4.25. Western Baltic Spring-spawning Herring. Analytical retrospective pattern over 5 years from multi fleet run. Average fishing mortality for the shown age range.

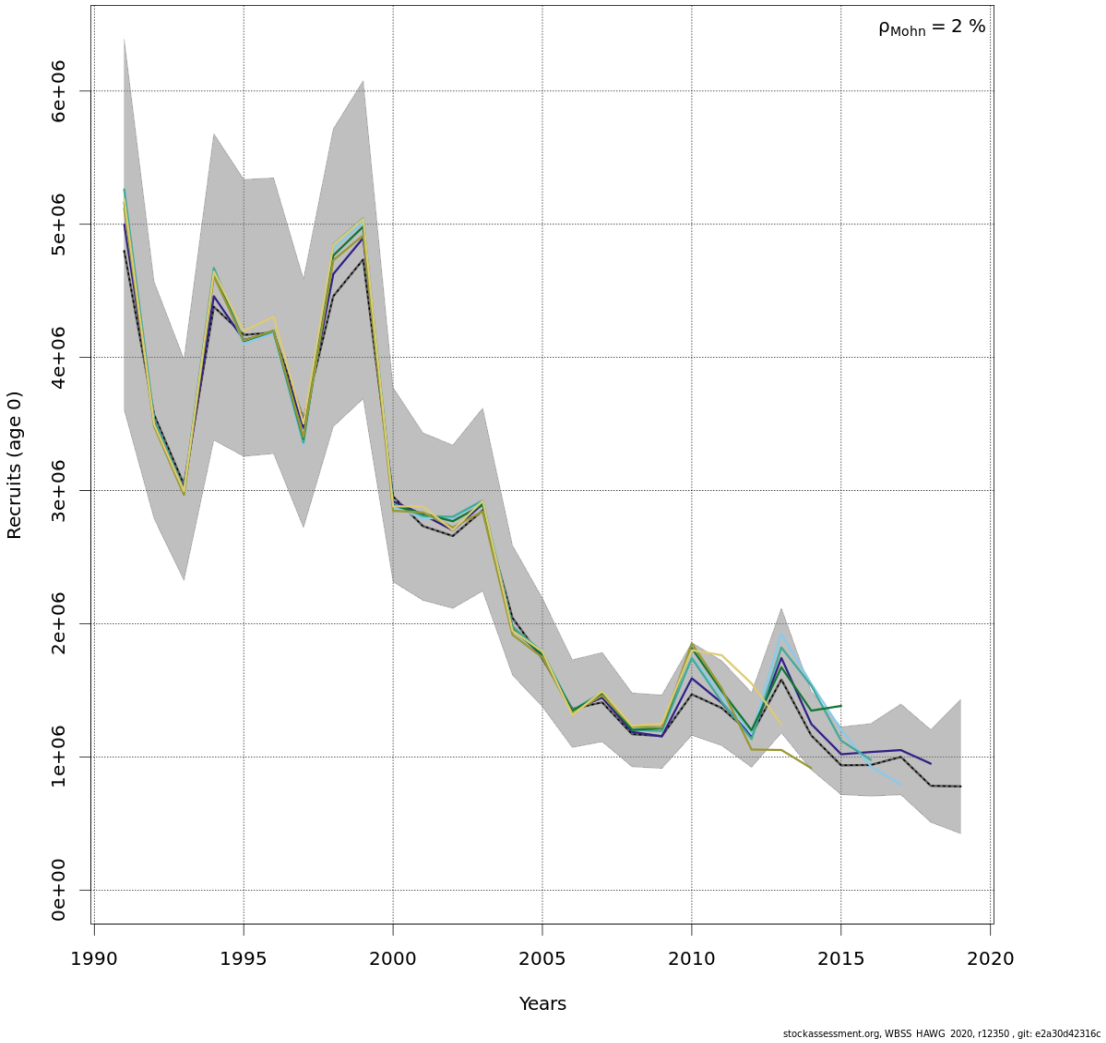

Figure 3.6.4.26. Western Baltic Spring-spawning Herring. Analytical retrospective pattern over 5 years from multi fleet run. Recruitment.

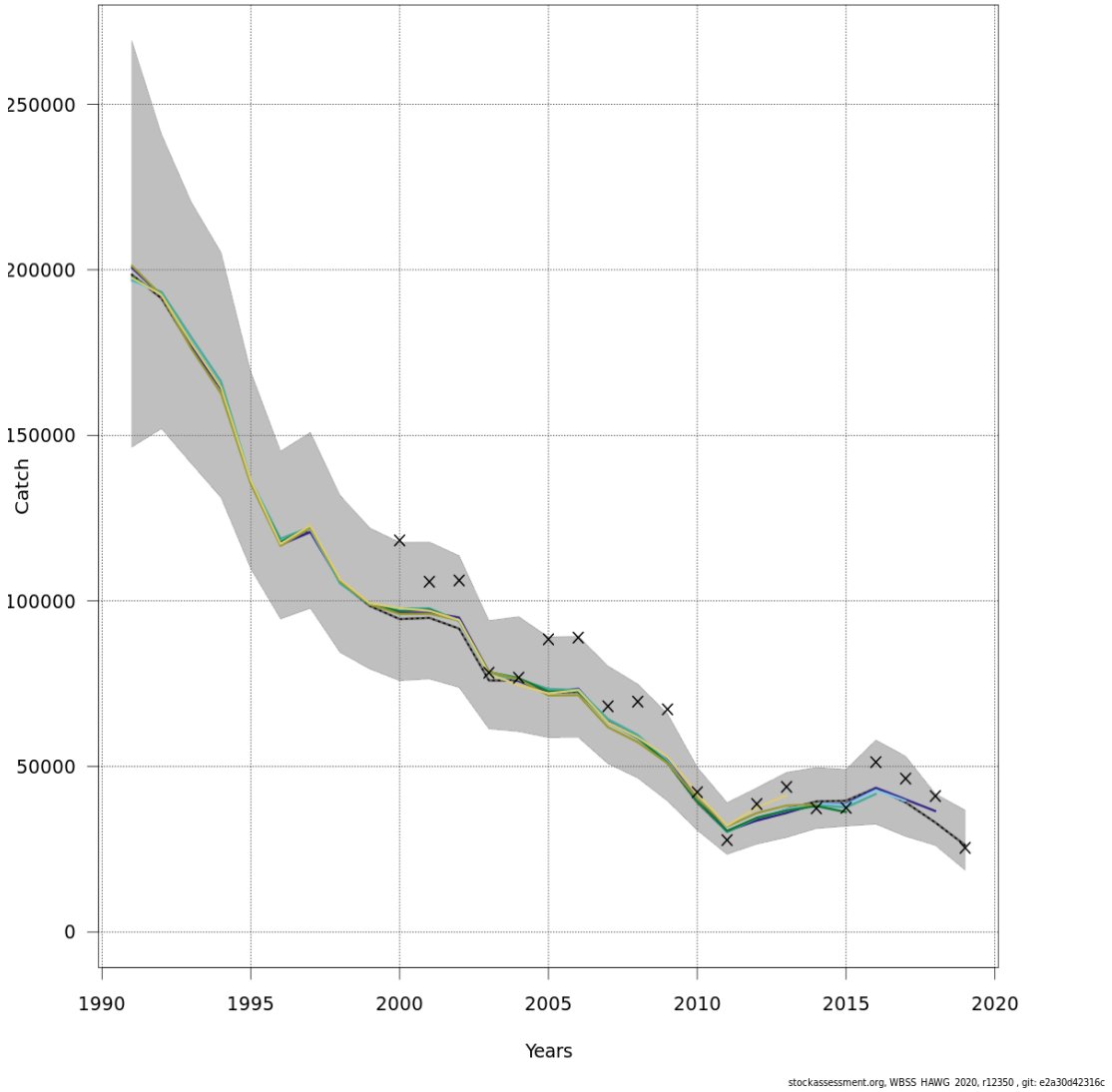

Figure 3.6.4.27.Western Baltic Spring-spawning Herring. Analytical retrospective pattern over 5 years from multi fleet run. Catch.

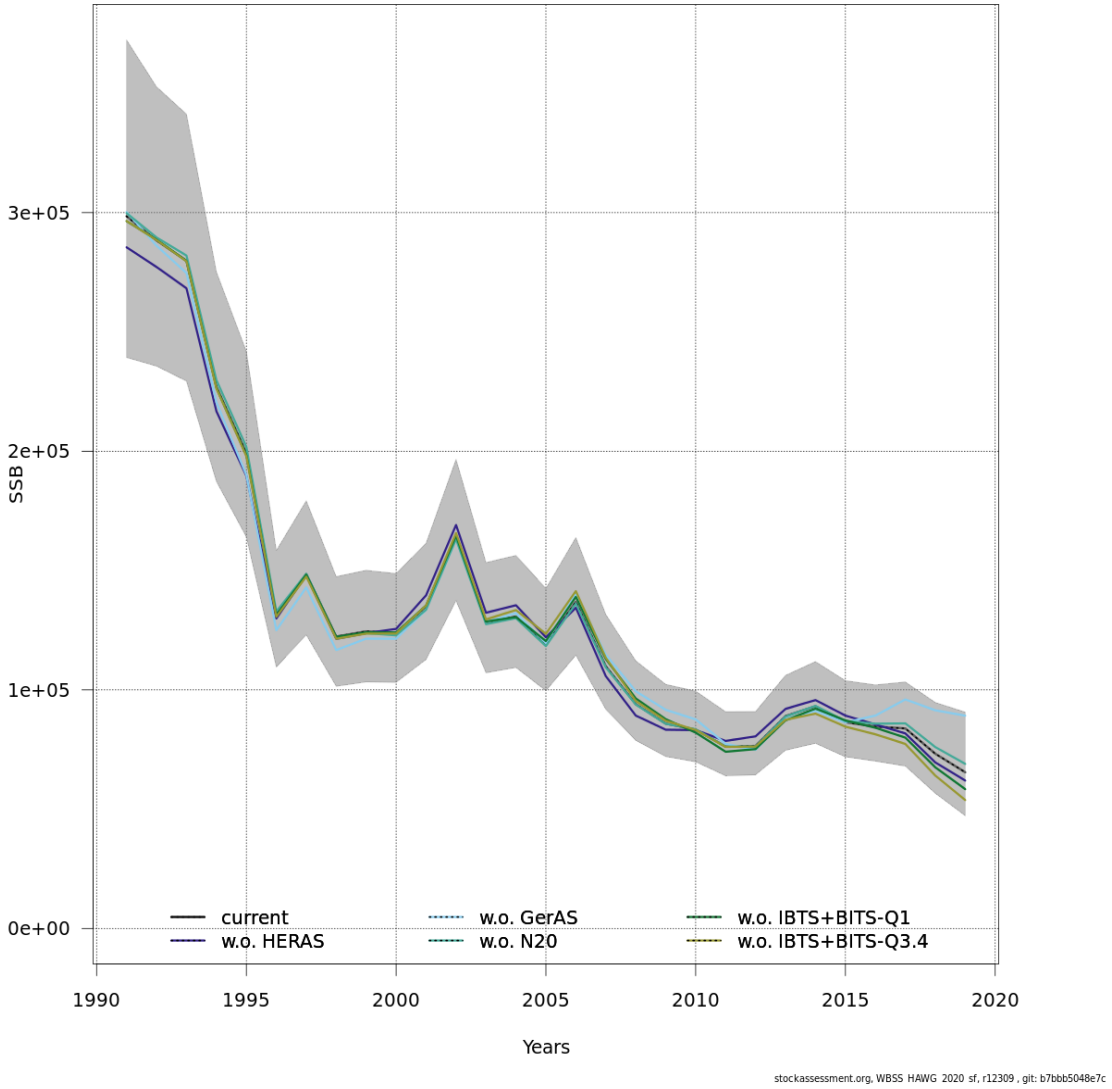

Figure 3.6.4.28. Western Baltic Spring-spawning Herring. Leave-one out from single fleet run. Spawning-stock biomass.

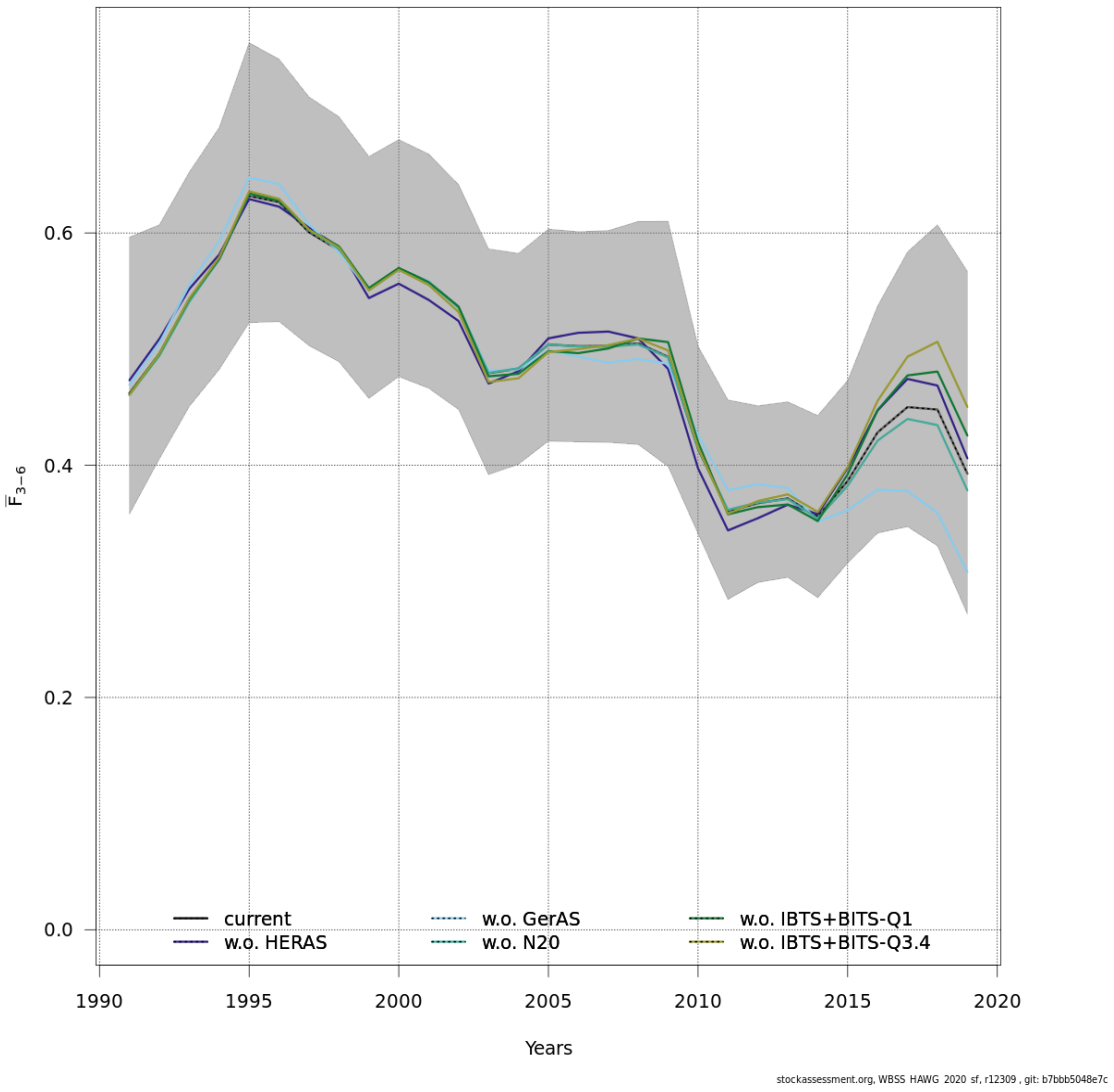

Figure 3.6.4.29. Western Baltic Spring-spawning Herring. Leave-one out from single fleet run. Average fishing mortality for the shown age range.

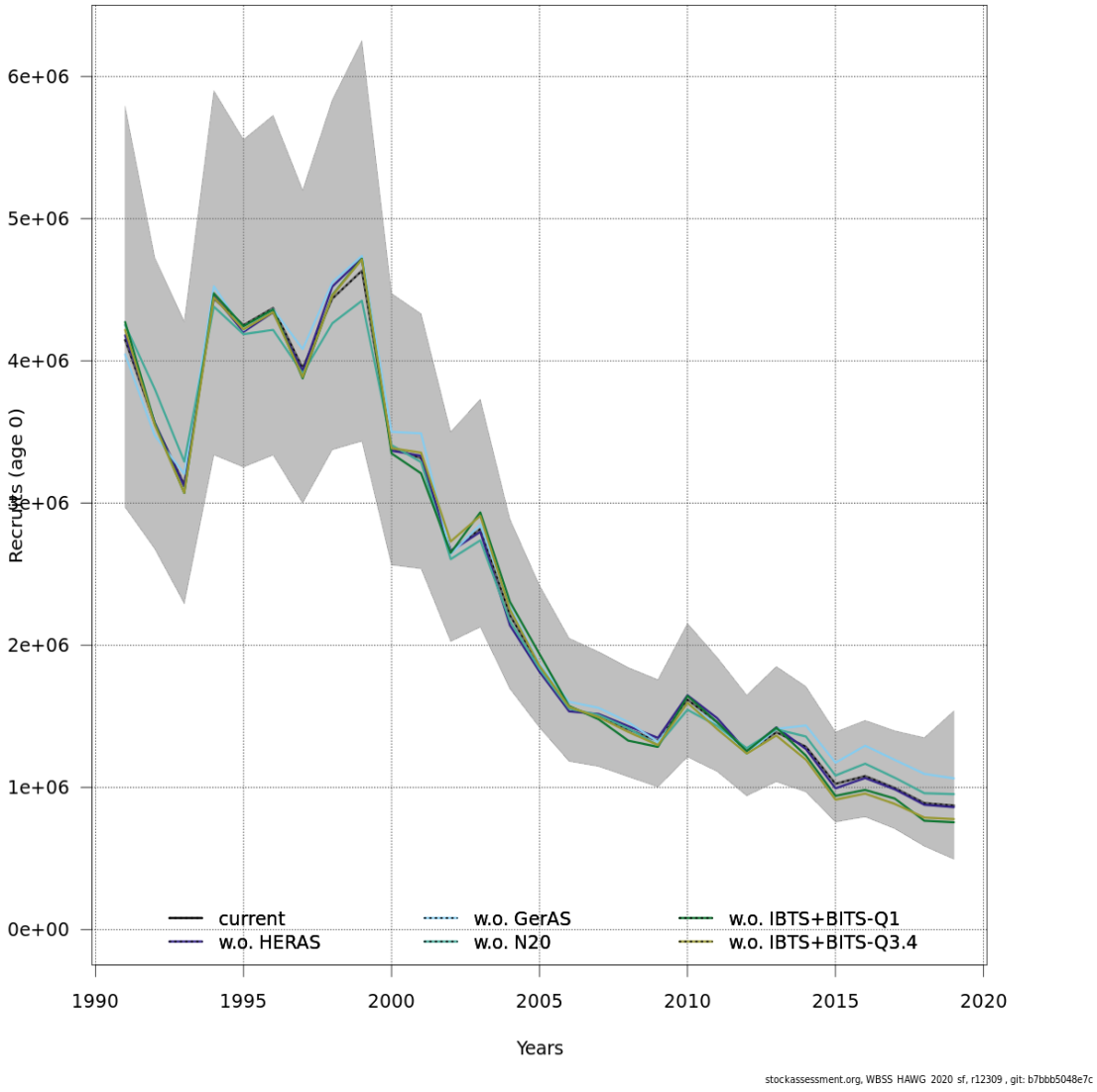

Figure 3.6.4.30. Western Baltic Spring-spawning Herring. Leave-one out from single fleet run. Recruitment.

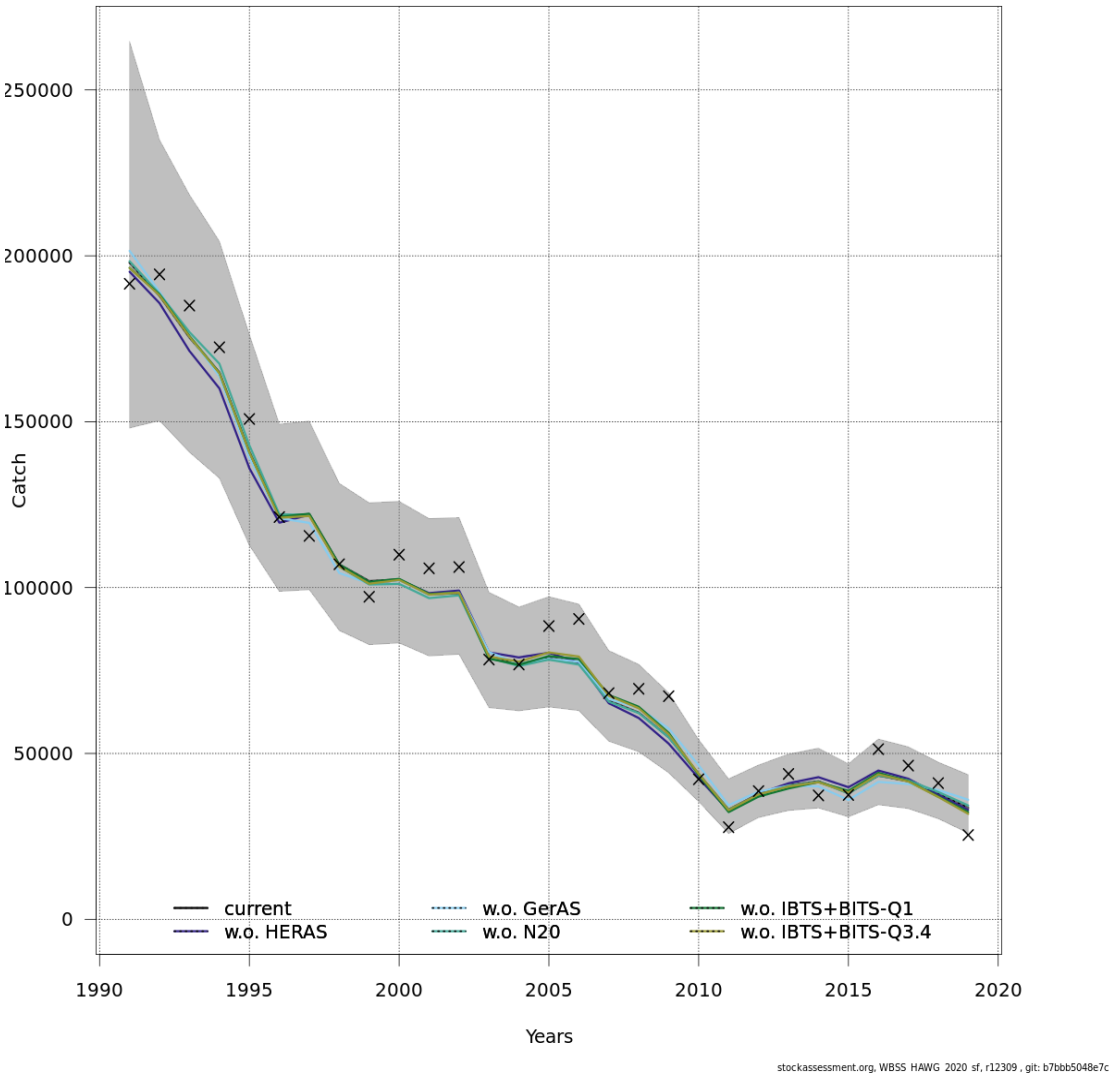

Figure 3.6.4.31. Western Baltic Spring-spawning Herring. Leave-one out from single fleet run. Catch.

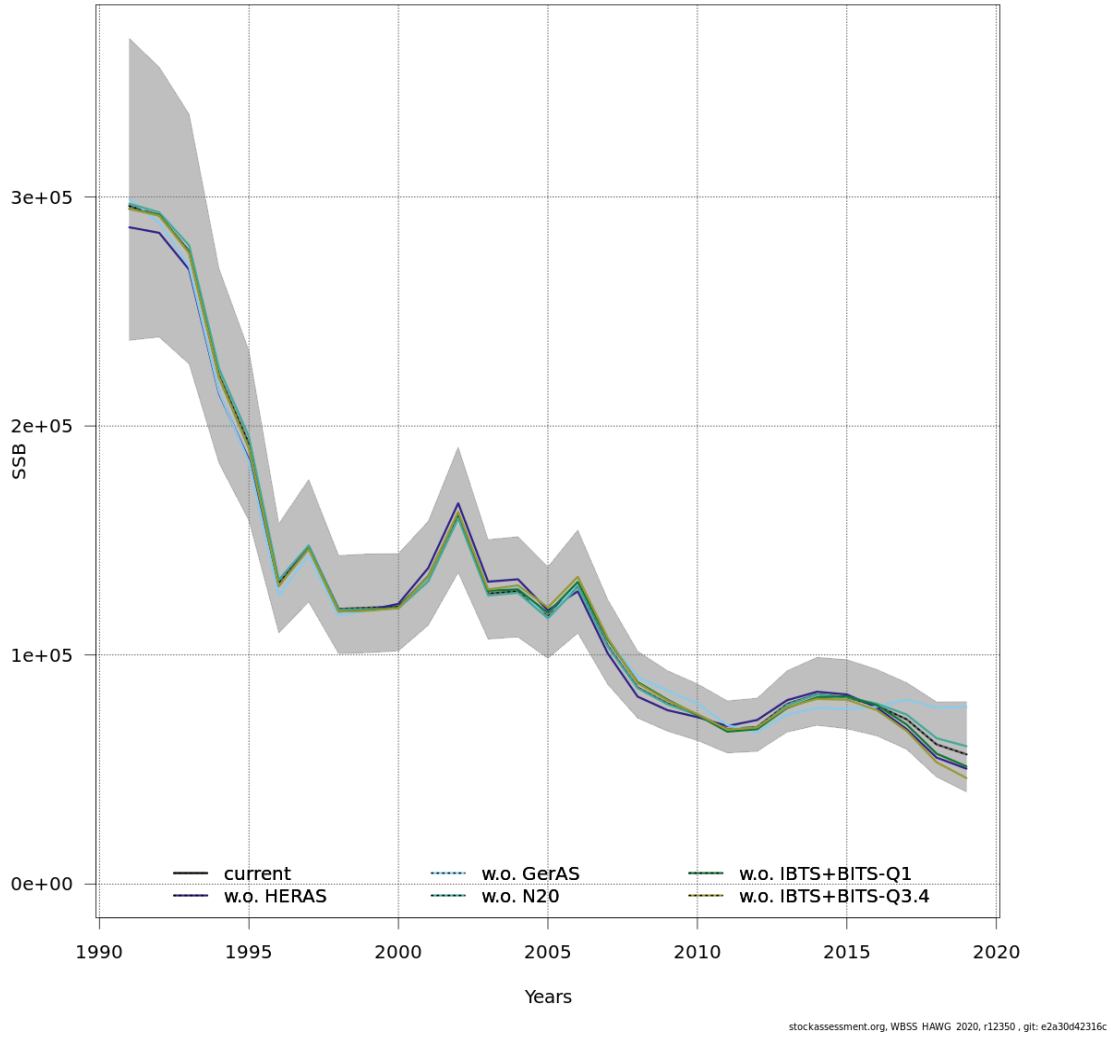

Figure 3.6.4.32. Western Baltic Spring-spawning Herring. Leave-one out from multi fleet run. Spawning-stock biomass.

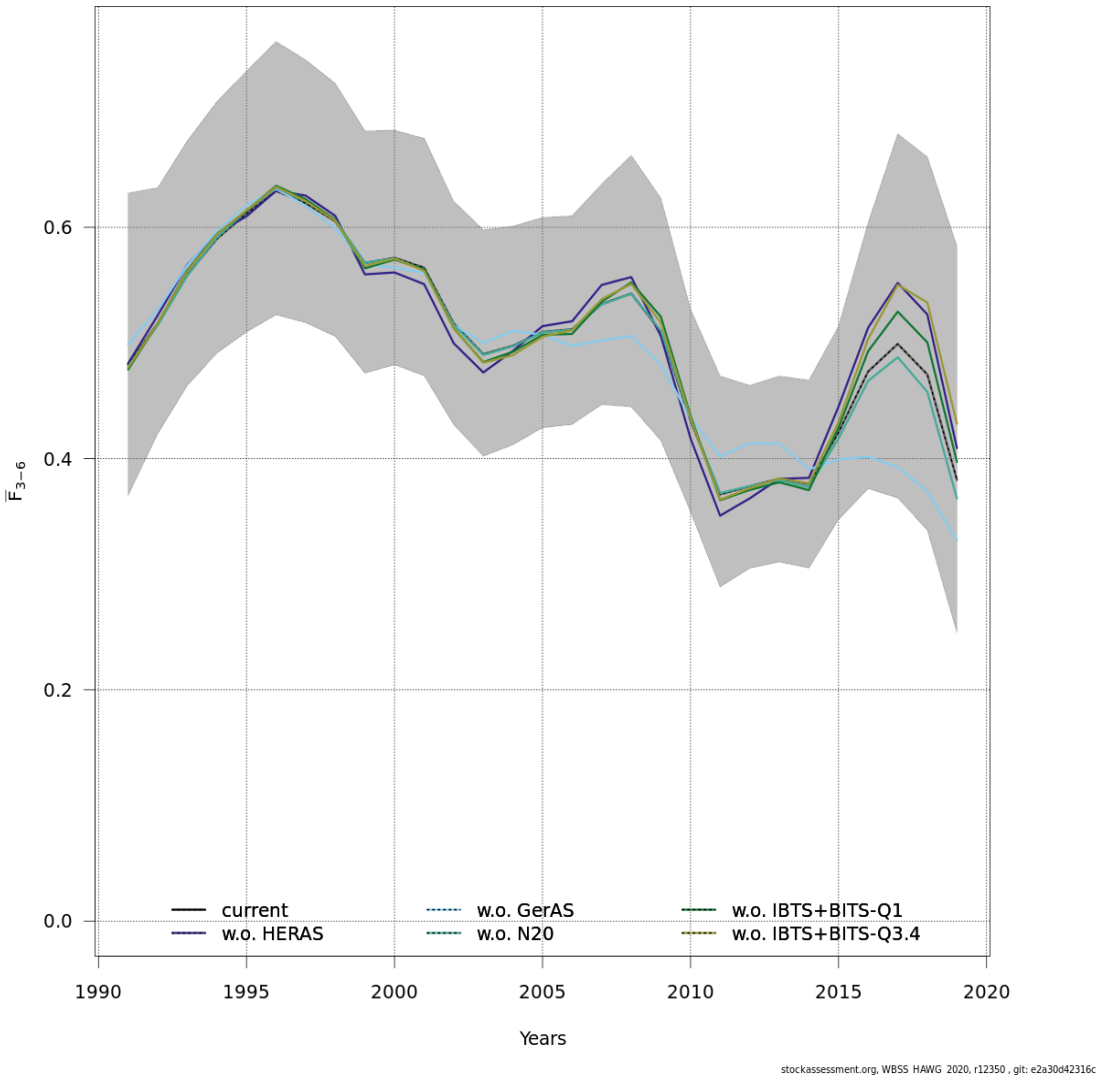

Figure 3.6.4.33. Western Baltic Spring-spawning Herring. Leave-one out from multi fleet run. Average fishing mortality for the shown age range.

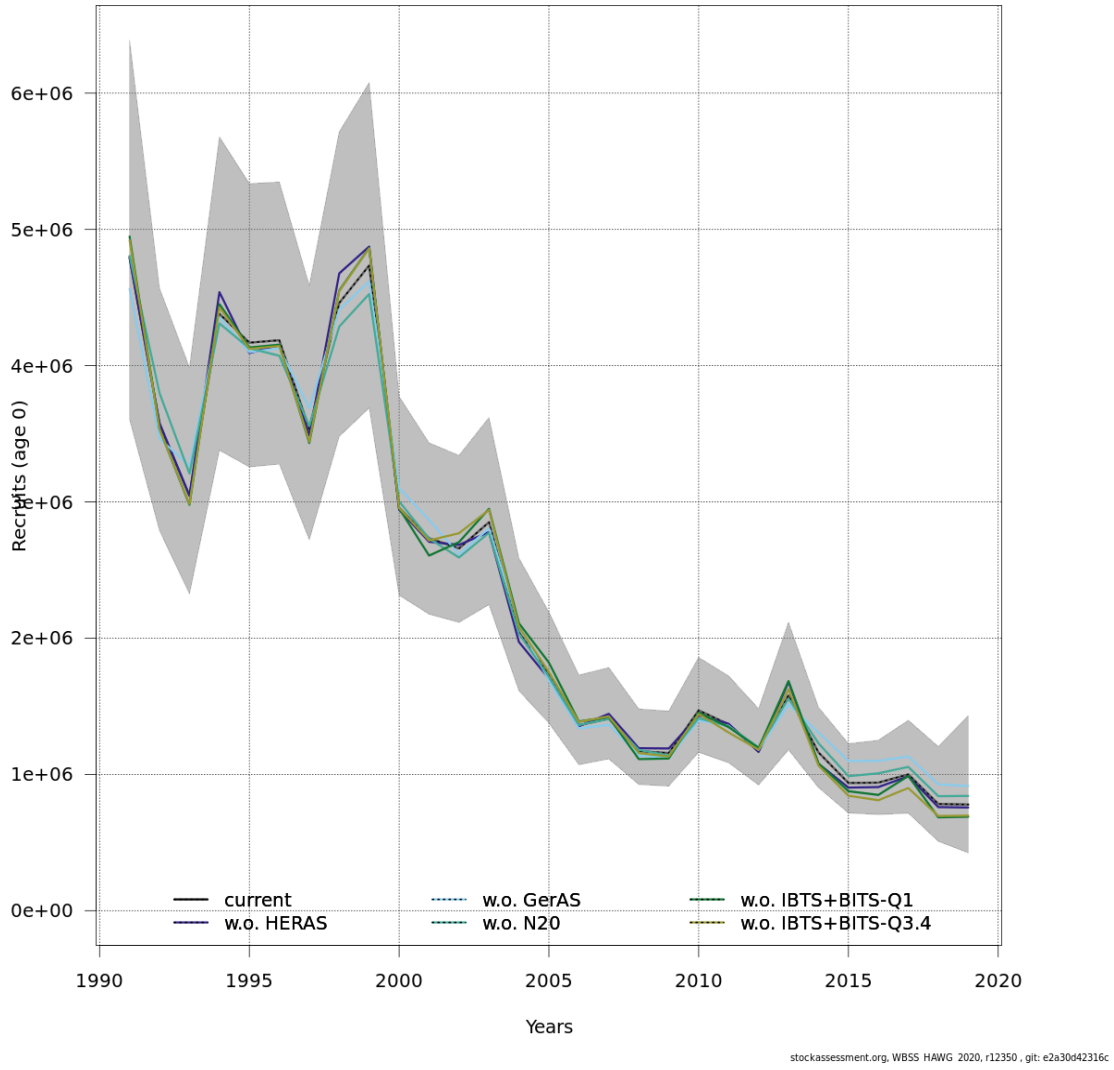

Figure 3.6.4.34. Western Baltic Spring-spawning Herring. Leave-one out from multi fleet run. Recruitment.

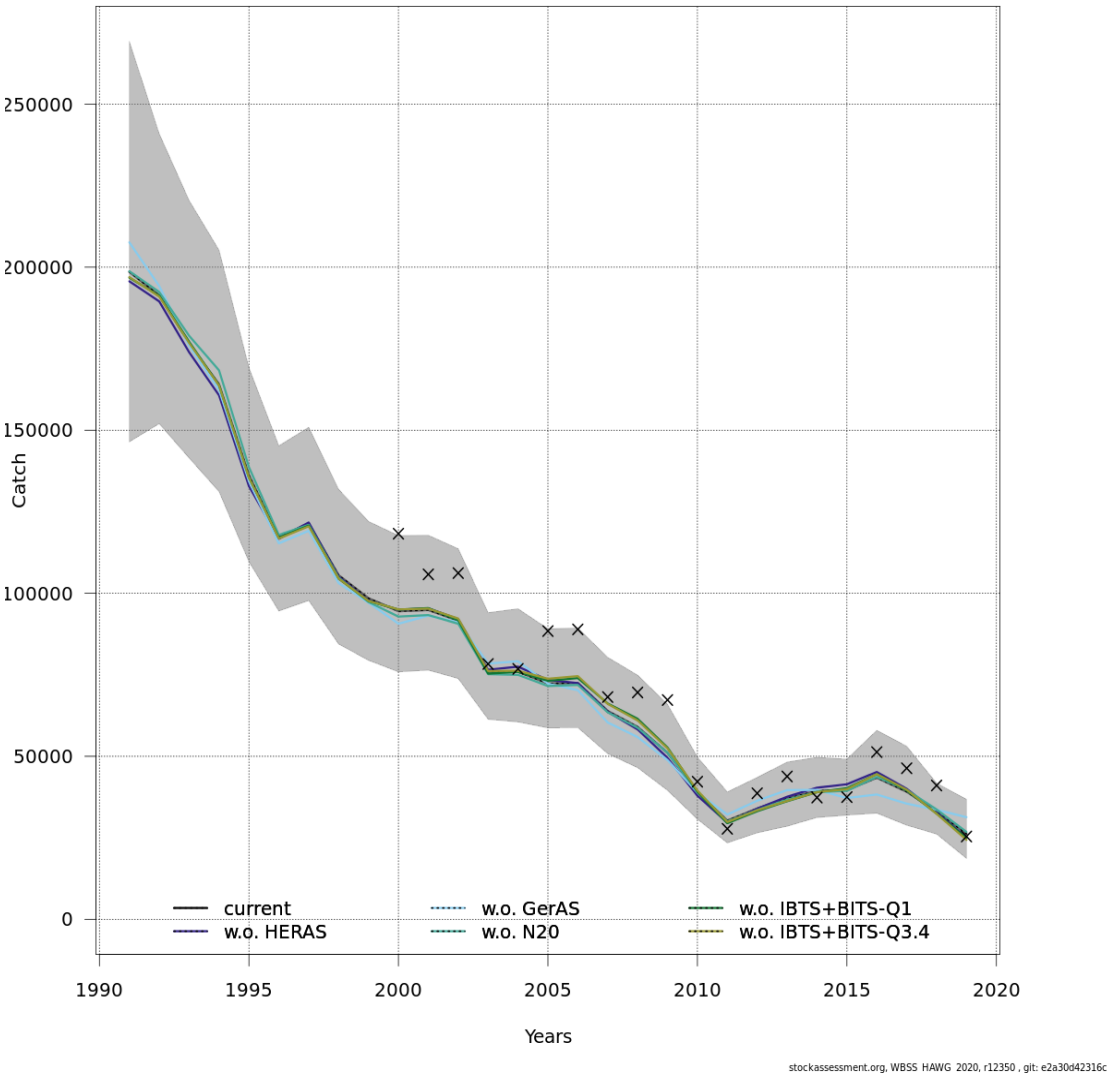

Figure 3.6.4.35. Western Baltic Spring-spawning Herring. Leave-one out from multi fleet run. Catch.