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 2021 and 2022

ICES advised in 2020 on the basis of the MSY approach. This corresponds to zero catch in 2021 (ICES 2020).

The EU and Norway agreement on a herring TAC for 2020 was 24 528 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 2021, the EU and Norway agreement on herring TACs in Division 3.a was 21 604 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 2020, a TAC of 3150 t was set on the Western Baltic stock component. The TAC for 2021 was set at 1575 t.

3.1.2 Landings in 2020

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 2020 are given in Table 3.1.1 and Figure 3.1.1. In 2020, the total landings in Division 3.a and subdivisions 22–24 have decreased to 21 745 t. Landings in 2020 increased by 24% in the Skagerrak, by 1% in the Kattegat and decreased by 60% in subdivisions 22–24. As in previous years the 2020 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 2004 to 2020 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
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 fleet-F	3150	442	1738	0	410	560	3150	
% of 3.a fleet-C can be taken in 4 EU waters							-50%	
% of 3.a fleet-C can be taken in 4 Norwegian waters								-50%
	TAC	**DK**	**GER**	**FI**	**PL**	**SWE**	**EC**	**NOR**
2021								
Div. 3.a fleet-C	21 604	9800*	145*			9498*	18 723*	2881
Div. 3.a fleet-D	6659	5692	51			916	6659	
SD 22–24 fleet-F	1575	221	869	0	205	280	1575	
% of 3.a fleet-C can be taken in 4 EU waters							-50%	
% of 3.a fleet-C can be taken in 4 Norwegian waters								-50%

*** preliminary**

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 Subarea 4. These catches have been allocated to the North Sea stock and accounted for under the A-fleet at earlier HAWG meetings. 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 occur. Therefore, no catches were moved out of Division 3.a to the North Sea for catches taken in 2020.

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 2021, the Pelagic AC informed HAWG that the transfer of EU quotas from Division 3.a to Subarea 4 in 2021 is uncertain depending on the final outcome of still ongoing bilateral negotiations between EU, UK and Norway, but a likely transfer would be the EU-Norway bilateral agreed 3000 t to Norwegian waters of the North Sea. The Norwegian fishing industry informed HAWG that 50% of the predicted catches in the C-fleet probably will be taken in Division 3.a and 50% will be transferred to the North Sea.

HAWG decided to use these values for intermediate year catch predictions leading to an estimated transfer of 21% from the C-fleet in Kattegat-Skagerrak to the A-fleet in the North Sea.

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 considered 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 taken as bycatch in the sprat fishery in the D-fleet has been varying between years depending on the utilization of the bycatch TAC and the proportion of WBSS in the catches. In 2020 the amount of WBSS taken was 481 t, an increase in relation to the recent 3 years but still lower than the 10 years average. However, the TAC utilization was 68.8% and higher than the 10 years average. Prediction of TAC utilization is further complicated by the merging of the sprat stocks in 3.a and the North Sea (ICES, 2028) with a common management and the optional transfer of 50% of the herring bycatch quota from the D-fleet in 3.a to the B-fleet in 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 21 745 t of landed herring were submitted stratified by area, fleet and quarter, resulting in 55 strata with landings. 26 of these strata were sampled - accounting for 85% of the landings. Some strata with relatively large amount of landings were unsampled, but the main problem being that fleet C only was sampled in the first quarter in Skagerrak (Table 3.2.4). Unsampled strata accounted in total for 3 349 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 the sum of the two (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 2020 was estimated to be 18 163 t, which represents an increase of 17% compared to 2019 (Table 3.2.13).

Total catches of WBSS from the North Sea, Division 3.a, and subdivisions 22–24 respectively, by quarter, were estimated to be 22 130 for 2020 (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 1993–2020, are presented in tables 3.2.15 and 3.2.16.

The total catch of NSAS in Division 3.a amounted to 6 388 t in 2020, which represents the fourth lowest value in the 28 year time-series (Table 3.2.17).

The catches of WBSS from Subdivision 4.aE and the catches of NSAS from Division 3.a in 2020 were reallocated to the appropriate stocks as shown in the text table below:

Stock	Catch reallocation	Tonnes
WBSS	4.aE (A-fleet)	6802
NSAS	3.a (C+D-fleet)	6388

3.2.1 Quality of Catch Data and Biological Sampling Data

No quantitative estimates of discards were available to the Working Group from all countries. During the 2021 meeting one country checked their estimated discard of herring in the demersal, *nephrops* and shrimp fisheries in SD 20-24, and for 2020 the estimated discard constituted 1% of the landings, so an insignificant amount. Therefore, the overall amount of discards for 2020 is assumed to be insignificant, as in previous years.

Table 3.2.4 shows the number of fishes aged by country, area, fishery and quarter. The overall sampling in 2020 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). Only a single country reported lack of sampling due to covid-19. Fortunately, occasional lack of national sampling of catches by quarter and area has been covered by similar fisheries in other countries, but as mentioned in the section before, only a single quarter and area combination was sampled in the D fleet.

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.

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 1113 with 76% of the samples in Subdivision 20 (Skagerrak) and 24% in Subdivision 21 (Kattegat). Sampling from the Danish fishery had a lower coverage of quarters and subdivisions than sampling of the Swedish fishery. Proportions of WBSS in sampled age classes were weighted by the national catches in the respective quarters and subdivisions. The sampling did not cover all age classes and thus proportions were estimated by relevant adjacent age classes, or from cruises in the same quarter and subdivision or from 2019 data. There were no samples available in the 2nd quarter therefore data from 2019 were used combined with samples of 1-2 wr from HERAS. Further, there were no samples from Kattegat in the 3rd quarter so 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 4.aE 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 12 649 tonnes of herring was caught in the transfer area in 2020, with catches constituting 59% in quarter 2 and 34% in quarter 3, however with only one sample (46 fish) from a single ICES stat. rect. from these two quarters being available for calculating stock proportions. No samples from the commercial fishery in other quarters in the transfer area were available.

For quarter 2 and 3, the same split was applied based on the combined samples from HERAS and the fishery in the transfer area (446 fish). This was done under the assumption that the fishery is restricted to the same period as HERAS in June and July and would catch similar proportions of the two stocks in this period.

Due to lack of sampling data in 2020 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 342 herring (from Q4 in 2008, 2012 and 2014) available for the analysis.

Based on vs mean counts 6802 tonnes of WBSS herring were caught in the transfer area in 2020, with 95% 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 R/V "SOLEA" between 1–21 October 2020 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, 2021). 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 and 2020 support the applicability of the SF (Oeberst et al., 2013; WD/WGIPS Oeberst et al., 2014, 2015; WD/WGBIFS Oeberst et al., 2016, 2017; WD/WGBIFS Gröhsler and Schaber, 2018, 2019; WD/WGIPS Gröhsler and Schaber 2021). The applicability of the SF could not be tested in 2019 due some higher degree of mixing of CBH/WBSSH in the baseline area of WBSSH in SDs 21 and 23.

The age-length distribution of herring in SDs 21 and in SD 23 in 2020 indicated also some contribution of fish of CBH origin. Besides the standard procedure to use the SF in SD 24 and in SD 23/39G2 (since biological samples of that rectangle were also used to raise the corresponding mean NASC values in the SD 24 area of the rectangle), the SF was accordingly also applied in SD 21 in 2020.

Individual mean weight, total numbers and biomass by age as estimated from the GERAS-Index (covering the standard survey area, which generally excludes 43G1/43G2 in SD 21 and 37G3/37G4 in SD 24) are presented in Table 3.3.1. The Western Baltic spring spawning herring GERAS-Index in 2020 was estimated to be 1.4×10^9 fish or about 37.0×10^3 tonnes in subdivisions 21–24. The biomass index in 2020 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 and the North Sea

The Herring acoustic survey (HERAS) was conducted from 25 June to 9 July 2020 and covered the Skagerrak and the Kattegat and the North Sea. The 2020 estimate of Western Baltic spring-spawning herring was 161 tonnes and 1,764 million herring. Compared to the values in 2019, the 2020 estimates represent an increase of 11% in numbers and of 17% in biomass. The stock biomass is dominated by 1–4 winter ring (70%). The present numbers of older herring (3+ group) in the stock only represent 52% of the average of the whole times series (2020: 666 million; mean 1991–2019: 1274 million). The results from the HERAS index are summarised 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 2020 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 239 million larvae, the 2020 N20 recruitment index is the lowest of the time series and about 50% of the former record low of 2016 (for further details see WD Polte and Gröhsler, HAWG 2021).

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 Figures 3.3.1-3.3.2). 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:

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

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) from the surveys in Q1 and Q3-4 are included in the assessment

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 2020 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 ($R^2 = 0.74$, 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 (1992–2020: 5 480 million). The 2020 N20 recruitment index is the lowest in the 29-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 multi-fleet 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 2020 were available for Subdivision 27.4.aEast (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–d). 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–d; 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 multi-fleet 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 multi-fleet 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 multi-fleet 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 multi-fleet model. The single fleet model output is represented as an overlay in the SSB, F, recruitment and total catch plots in the multi-fleet output. Both the multi-fleet (WBSS_HAWG_2021) and the single fleet (WBSS_HAWG_2021_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.

During the 2020 assessment, problems of convergence occurred with the multifleet model when adding the 2019 data due to difficulties estimating the variance parameter of the F process for the C-fleet (logSdLogFsta). Coupling the variance parameters for all fleets so only one logSdLogFsta parameter is estimated as a first run and then running the model with the original configuration removed the problem of convergence in 2020. However, this year, this was not enough to solve convergence problems.

During the 2018 benchmark it was chosen to replace missing data in catches at age for all fleets by a small value (1 tonne). In addition to the method described in the previous paragraph, removing this constraint for the C-fleet and letting the model handling the zeros as missing data enabled the convergence of the 2021 assessment model.

3.6.4 Final run

The results of the assessment are given in Tables 3.6.11–3.6.14. The estimated SSB for 2020 is 58 434 [41 725, 81 834 (95% CI)] t. The mean fishing mortality (ages 3–6) is estimated as 0.193 [0.123, 0.301 (95% CI)] yr-1. This means that the F3-6 is now estimated to be below F_{MSY} and F_{pa}, and below F_{lim}.

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 69.5 kt. SSB has only slightly increased in the following period up to 84.7 kt in 2015 and then has declined to 57.8 kt in 2019, which is the lowest SSB of the time-series. A slight increase in SSB was then estimated for 2020 around 58.4 kt.

Fishing mortality on this stock was high in the mid-1990s, reaching a maximum of 0.66 yr-1 in 1996. In 1999–2009, $F_{3–6}$ stabilized between 0.45 and 0.60. In 2010 and 2011, $F_{3–6}$ decreased significantly to a value of 0.41 and 0.32 yr-1, respectively. It stabilized between 0.32 and 0.43 yr-1 for few years until it increased again above 0.48 yr-1 from 2016 to 2018. $F_{3–6}$ then decreased to 0.29 yr-1 in 2019 and then to 0.19 yr-1 in 2020, which is the lowest estimated F_{3-6} of the entire time series (Table 3.6.11, Figure 3.6.4.2).

Recruitment was the highest (~4-5 billion) at the beginning of the time-series (1991-1999) and has been decreasing overall since 2000. The 2020 estimate of 582 158 thousand 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 2020 recruitment has varied from about 1.5 billion to less than 1 billion at SSB between 58 kt and 103 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. This year the model starts to accommodate the large catches of the A-fleet in the last two years, as the upper limit of the confidence interval on the catches has increased compared to the 2020 assessment.

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 up to 2020.

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, and 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 C-fleet (ages 2-8+) is lower than the IBTS Q3.4 surveys variance, 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 2018-2020 showing that the model underestimates the catches-at-age in 2018–2020. The inverse is observed for the C-fleet with large negative residuals in 2019 for ages 3-8+, 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 2018–2020 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 3.6.4.19–23). 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 decreased compared to last year assessment (Figure 3.6.4.24–27). While in the 2020 assessment, the SSB had a Mohn's rho of 25%, the Mohn's rho in this year assessment has decreased to 20% and the retrospective estimates for the 1- to 3-year peels are inside the confidence interval of the 2021 SSB estimates. Average fishing mortality retrospective estimates are also outside the confidence bounds for F for the 3 to 4-year peels (Mohn's rho = -13% compared to -18% in the 2020 assessment, Figure 3.6.4.25). The retrospective for recruitment is acceptable having a Mohn's rho = 7% (Figure 3.6.4.26). Retrospective is very small for total catch (Figure 3.6.4.27).

During the 2020 assessment, different exploratory runs were conducted to investigate why the retrospective patterns had 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 was the main only responsible for the retrospective pattern in the model. The retrospective patterns seemed to be due to the catch-at-age data which was 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. These sensitivity analyses were not re-run during the 2021 assessment.

Since the 2019 assessment, a decrease in stock perception was observed every year due to the model trusting the decrease in the GERAS survey indices. While the GERAS indices are still decreasing in 2020 and leaving out the GERAS survey from the dataset still induces an increase in the perception of the stock with increasing SSB in recent years (Figures 3.6.4.32–35), this year,

the 2020 SSB estimates is slightly larger than the 2019 SSB estimates. The effect of GERAS on the stock perception 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 0.32 (Tables 3.6.11, Figure 3.6.4.2). $F_{3–6}$ has then remained stable above F_{MSY} until 2018 (0.35-0.5), but showed an increase in 2016-2018 with an estimated $F_{3–6}$ between 0.48 and 0.50. $F_{3–6}$ then decreased in 2019 below F_{MSY} (0.29) and further in 2020 (0.19).

Recruitment has been declining since 2014 with a historical low value in 2020 of 582 158 thousand (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 70 kt in 2011 to 85 kt in 2015) 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. Contrarily to the 2020 assessment, the addition of the 2020 data resulted in a positive change in the perception of the stock compared to last year assessment, but the increase is limited to less than 2.6%. The recent estimates of recruitment have increased by 3.3% in the current assessment and F appears to be larger than previously estimated in 2018 (+1.6%) but significantly smaller in 2019 (-32.5%) and SSB has increased for both 2018 and 2019 (2.6% and 2.1% respectively).

In this year assessment, recruitment for the 2013 year-class (most recent large year class) was estimated to be 1 685 120 thousand compared to 1 581 113 thousand in the 2020 assessment. This increase in recruitment induced an increase in the SSB estimates in the following years compared to the 2020 assessment.

Parameter	Assessment in 2020	Assessment in 2021	Difference (2021-2020)/2021
SSB (t) 2018	60 944	62 561	2.58%
$F_{(3–6)}$ 2018	0.473	0.480	1.59%
Recr. (‘000) 2018	783 319	810 280	3.33%
SSB (t) 2019	56 621	57 841	2.11%
$F_{(3–6)}$ 2019	0.382	0.288	-32.48%

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 multi-fleet 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 multi-fleet 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 mean of the last five years prior the last year model estimate (i.e. for the 2021 assessment, recruitment for the forecasts was calculated on the period 2015–2019). 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 (2016–2020). Based on earlier considerations in HAWG, the different periods were chosen to reflect recent levels in recruitment and weights.

3.9.2 Intermediate year 2021

A catch constraint was assumed for the intermediate year (2021). Predicted 2021 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 Division 3.a (C and D-fleets) and Subdivision 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 2021 NSAS+WBSS (t)	TAC WBSS (t)	TAC WBSS given utilization or transfer (t)
A	356 357	5241	100% = 5241
C	21 604	70.36% = 15 201	15 201 - (70.36% (2811*0.5+3 000)) = 12 076
D	6659	35.83% = 2386	8.20% = 196
F	1575	1575	100% = 1575
Total	386 195	24 402	19 088

The amount of WBSS taken in Subdivision 4.aE by the A-fleet in 2021 is assumed equal to the average over the last 3 years (2018–2020) corresponding to 5241 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 2021 as the average of 2018–2020 in Division 3.a. This resulted in 70.36% 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 Subarea 4 in the North Sea (A-fleet). Based on information from the Norwegian fishing industry, 50% transfer is assumed for the Norwegian quotas (50% of 2881). Based on information from the Danish fishing industry, 3000 t of EU catch will be transferred to the North Sea (max allowed EU catches in Norwegian waters), which differs significantly from the assumption taken last year (50% transfer of EU quotas to the North Sea). This is discussed further in part 3.12. These assumptions result in a predicted catch for the C-fleet in Division 3.a of 12 076 tonnes.

Around 36% of the D-fleet 2021 TAC is assumed to be WBSS herring (average NSAS/WBSS split 2018–2020). 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 for 2017-2019 due to choke species effects of restricting whiting quotas. In 2020, utilization for the D-fleet is estimated to have increased to 13.7%. The problems with bycatches under the landings obligation may persist and 8.2% utilization of the TAC in 2021 for the D-fleet is assumed as the average utilization over the last 3 years (2018–2020), resulting in a predicted catch for 2021 of 196 t.

The catch by the F-fleet fishing for human consumption in subdivisions 22–24 is usually very close to the TAC and a utilization of 100% is assumed for the intermediate year, hence 1575 t.

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 19 088 t of WBSS herring in 2020.

3.9.3 Catch scenarios for 2022–2024

The inputs and outputs of the short-term predictions based on a catch constraint in the intermediate year 2021 of 19 088 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 2021 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 2022 (advice year) to 2024

ICES gives advice according to the F_{MSY} approach for the WBSS stock. Because the forecasted SSB in 2023 is below B_{lim} even when F = 0, the MSY framework gives zero catch in 2022.

None of the catch scenarios for 2022, including zero catch, is expected to bring SSB above B_{lim} in 2023. Similarly, to last year, besides requested standard scenarios HAWG also calculated the potential development of the stock projections until 2024 with different low F scenarios, where F2023 = F2022. None of these scenarios, even when F = 0, can bring the SSB above B_{lim} in 2024.

The TAC for 2021 was set according to the agreed management rule between EU-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 should be developed for the WBSS stock, taking advantage of the fleet-wise analysis and projection for this stock.

In 2020, two new scenarios were requested by ACOM for zero catch advice stocks: (1) the "Catch for bycatch fleets only" scenario, and (2) a scenario where the biomass is constant between the advice year and the year after that. The first scenario is given in the Table below. Similarly, to last year the latter scenario was not run for the following reasons. For a stock with SSB calculated in the 1st of January (and the final year of assessment being 2020), this can be easily done because SSB in 2022 only depends on F in 2021 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 2022 and the F in 2022 can be estimated to obtain a SSB in 2023 equal to 2022. 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

2022 is in fact the result of catches assumed (agreed TACs) for the intermediate year (2021) and some catches in the first months of 2022. In other words, the SSB in 2022 depends on F in 2021 but also on a fraction of the F in 2022, which is the advice year. What to assume for the first months of 2022 is the real issue here. For instance, if a zero catch is assumed in 2022 according to the advice, it will be uninformative because the table of advice would still only show the average F in 2022 (so F = 0). If an F that makes SSB 2022 = SSB 2021 is assumed for 2022, it will be an unrealistic high F needed to compensate for the low catches assumed in 2021. Given the reasons described above, the constant SSB between 2022 and 2023 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 (2022)	$F_{3–6}$	SSB* (2022)	SSB* (2023)	% SSB change **	% advice change ***
ICES advice basis							
3.9.2	MSY approach: zero catch	0	0	68 903	83 794	22	0
Other scenarios							
3.9.3	MAP^: F = F_{MSY} × SSB_{y-1}/MSY $B_{trigger}$	12 499	0.134	67 797	71 788	6	
3.9.4	MAP^: F = $F_{MSY\ lower}$ × SSB_{y-1}/MSY $B_{trigger}$	8922	0.094	68 130	75 182	10	
3.9.5	MAP^: F = $F_{MSY\ upper}$ × SSB_{y-1}/MSY $B_{trigger}$	15 017	0.164	67 554	69 420	3	
3.9.6	F= F_{MSY}	26 098	0.31	66 384	59 264	-11	
3.9.7	F = F_{pa}	32 716	0.41	65 595	53 327	-19	
3.9.8	F = F_{lim}	35 167	0.45	65 283	51 161	-22	
	SSB (2022) = B_{lim} ^^						
	SSB (2022) = B_{pa} ^^						
	SSB (2022) = MSY $B_{trigger}$ ^^						
3.9.9	F = F_{2021}	15 811	0.174	67 476	68 733	2	
3.9.15	Catch for bycatch fleets only ^^^	5437	0.036	68 464	79 423	16	

*** 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 (2023) relative to SSB (2022).**

***** The advised catch in 2021 was 0 tonnes.**

^ As SSB2021 is below MSY $B_{trigger}$, the F_{MSY}, F_{MSY} lower and F_{MSY} upper values in the MAP are adjusted by the SSB_{y-1}/MSY $B_{trigger}$ ratio.

^^ The B_{lim} and B_{pa} cannot be achieved in 2023 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 2021 (C and F fleets have 0 catch).

Table	Basis	Total catch (2022)	Total catch (2023)	$F_{3–6}$ (2022)	SSB* (2022)	SSB* (2023)	SSB* (2024)	% SSB change (2022–2023)	% SSB change (2023–2024)
Medium-term catch scenarios									
3.9.10	F = 0	0	0	0	68 903	83 794	102 194	22	22
3.9.11	F = 0.05	4889	5952	0.050	68 489	79 076	92 308	15	17
3.9.12	F = 0.1	9489	10 945	0.100	68 078	74 685	83 653	10	12
3.9.13	F = 0.15	13 821	15 131	0.150	67 670	70 596	76 048	4	8
3.9.14	Constant catch 2021–2023 **	19 088	19 088	0.169	67 529	68 201	71 588	1	5

*** 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 2021 catches kept constant for 2022–2023.**

3.10 Reference points

The WBSS stock was benchmarked in 2018 (ICES WKPELA, 2018) with subsequent changes of reference points. B_{lim} 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. B_{pa} and MSY $B_{trigger}$ were subsequently set to 150 000 t. Using the EqSim software FMSY was estimated to 0.31, F_{lim} 0.45 (5% risk to B_{lim}) and F_{pa} 0.41 (since 2020, $F_{pa}=F_{p05}$; ICES, 2021). 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. Contrarily to what was observed in the 2019 and 2020 assessments, the 2021 assessment is very consistent with the 2020 assessment and shows only a slight upward revision in the SSB estimates in recent years (see part 3.8).

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 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 2022 advice

This year assessment shows an SSB consistent with last year's assessment, if not slightly upward. Recruitment continues decreasing and it is estimated at its historical minimum in 2020 (582 158 thousands). Under these conditions, the stock is not expected to increase above B_{lim} in the short-term (2023) nor in the medium-term (2024) for any level of fishing mortality (SSB_{2024} = 102 194 t assuming F = 0).

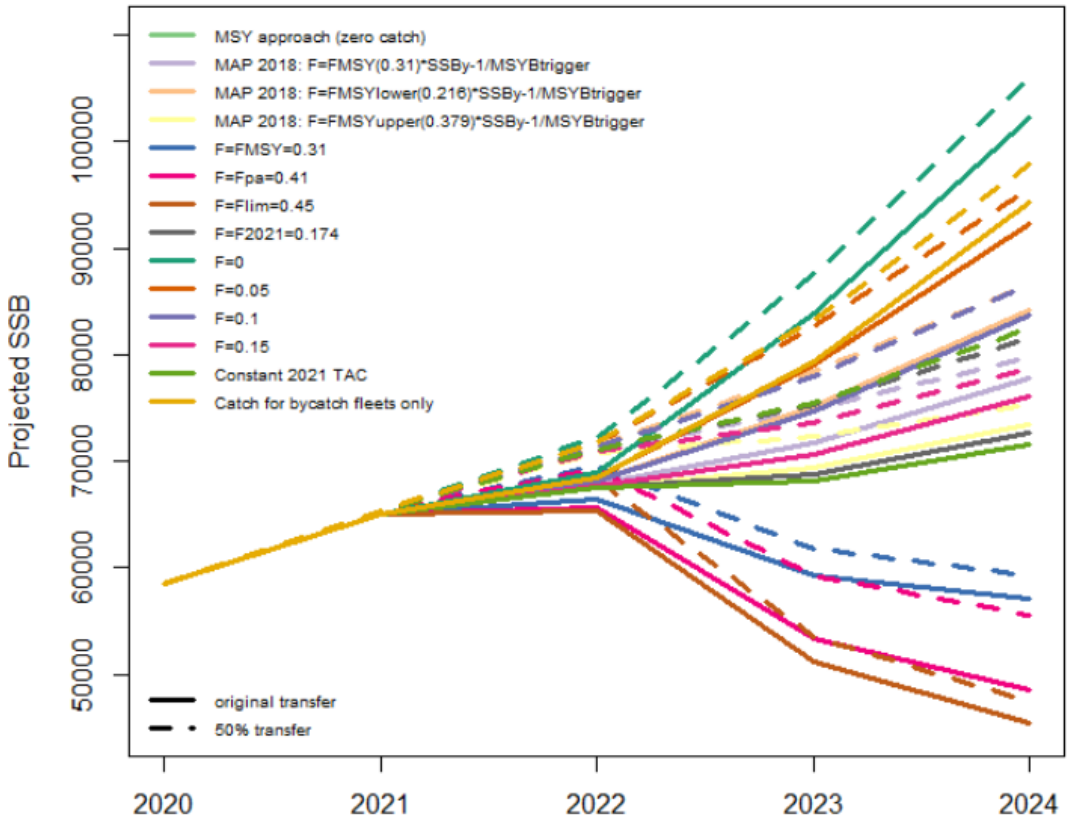
To explore the potential development of the stock, projections until 2024 with different low F scenarios (F = 0.05, 0.1, 0.15) are provided in the Table in section 3.9.4. The development of a rebuilding plan for this stock remains a high priority and it is recommended by HAWG.

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"). Estimation of the stock composition in the transfer area is highly uncertain which has implications for the quality of the input data for the assessment, but most importantly the amount and stock composition of herring catches in the transfer area remain unpredictable and represent an inevitable source of fishing mortality on the WBSS stock without area and/or time restrictions on the herring fishery in the North Sea.

As part of the Brexit process, access to important fishing grounds in the North Sea are likely to change. Consequently, changes in the exploitation pattern in the North Sea herring fisheries are foreseen for 2021–2022. Given the mixing of the WBSS and NSAS throughout parts of the North Sea, and the large differences in the size and quotas of the two stocks, changes in the distribution of the fisheries may result in unexpected catches of WBSS for which a zero catch advice is issued. Large uncertainties in the developments of the agreements and possible responses of the fisheries prevent reliable predictions in support of the forecasts. The forecasts and current advice should be interpreted in the light of such uncertainties.

For a number of years, the Pelagic Advisory Council has provided an estimate on the expected transfer of herring catches from Division 3.a to the North Sea to be assumed during the intermediate year. This information is highly uncertain for 2021. The transfer of the EU part of the human consumption quota from 3.a to the North Sea is assumed to be 3000 t (16% of EU quotas compared to approx. 50% used in recent years) which is equal to the reciprocal access in the EU-Norway agreement but high uncertainty remains on the remaining potentially transferable 34%. Sensitivity analysis assuming the usual 50% transfer showed marginal differences on the recovery in SSB (see figure and table below) and no effect on the catch advice for 2022. Because changes in fishing areas cannot be predicted, the results of the forecast need therefore to be considered with these limitations.



Relative difference (%) in forecasted SSB between the forecast with 50% transfer in the intermediate year and the forecast for advice:

	2021	2022	2023	2024
MSY approach: zero catch	0.44	4.82	4.47	3.65
MAP^: F = F_{MSY} × SSB_{y-1}/MSY $B_{trigger}$	0.44	4.78	4.18	2.59
MAP^: F = $F_{MSY\ lower}$ × SSB_{y-1}/MSY $B_{trigger}$	0.44	4.79	4.25	2.83
MAP^: F = $F_{MSY\ upper}$ × SSB_{y-1}/MSY $B_{trigger}$	0.44	4.77	4.14	2.45
F= F_{MSY}	0.44	4.74	4.36	3.68
F = F_{pa}	0.44	5.48	11.18	14.43
F = F_{lim}	0.44	4.71	4.50	4.11
F = F_{2021}	0.44	5.33	9.47	12.10
F=0	0.44	4.82	4.47	3.65
F=0.05	0.44	4.81	4.40	3.51
F=0.1	0.44	4.79	4.35	3.44
F=0.15	0.44	4.78	4.32	3.43
Constant 2021 TAC	0.44	5.35	10.60	15.17
Catch for bycatch fleets only ^^^	0.44	4.85	4.71	3.95

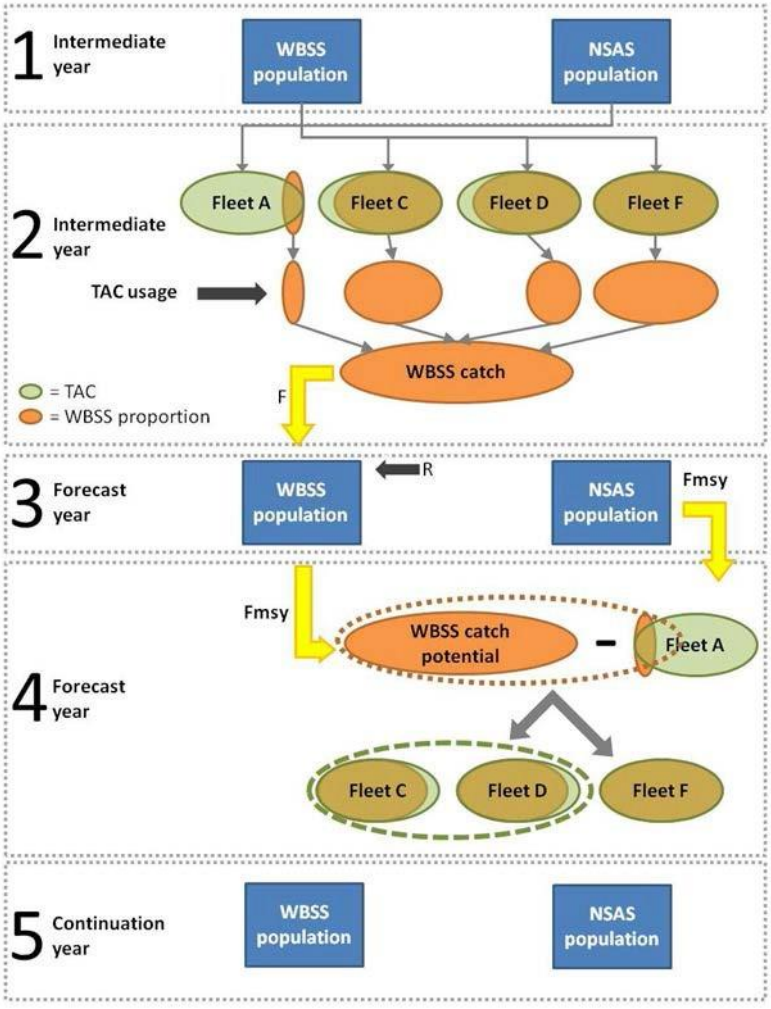
3.13 Management Considerations

3.13.1 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 Subarea 4. ICES assumes that the transfer of 50% will not be applied in 2021 for the EU quotas but will instead be 3000 t (~ 16% cf. part 3.12).

3.13.2 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 fleet's 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 transfer 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 SDs 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 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.

3.13.3 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 TAC for the A-fleet.

However, given the new B_{lim}, the stock has been below SSB for 2017 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

3.14.1 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 the 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 is 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 declining trend continues. 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 link 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.

3.14.2 Predation

Predation on larval herring by gelatinous 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* became 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*) have 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 the herring spawning period (Wiegleb *et al*., 2018).

3.14.3 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.*, 2020)

3.15 Changes in the Environment

3.15.1 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., 2021). 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 in 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 suite 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. (2020) could recently show that WBSS larvae develop cardiac arrhythmia beyond an 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 spring spawning herring. Total catch (both WBSS and NSAS) in 1989–2020 (1000 tonnes). (Data provided by Working Group members in HAWG 2021).

Year	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
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	11.8
Faroe Islands																
Germany															0.7	0.5
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	21.8
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	34.1
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	7.6
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	9.6
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	17.2
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	7.3
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	18.5
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	5.5
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	9.9
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	41.2
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	0.1
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	0.3
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	0.4
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**	**92.8**

Year	2005	2006**	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Skagerrak																
Denmark	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	3.2
Faroe Islands	0.4			0.0	0.6	0.4					0.5	0.3	0.4	0.1		
Germany	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	0.2

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	2.1
Sweden	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	9.1
Total	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	14.5
Kattegat																
Denmark	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	0.7
Sweden	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	2.6
Germany					0.6	0.0										
Total	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	3.2
Subdivisions 22+24																
Denmark	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	0.6
Finland														0.001		
Germany	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	2.1
Poland	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	0.6
Sweden	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	0.2
Total	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	3.5
Subdivision 23																
Denmark	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	0.001
Sweden	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	0.5
Total	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	0.5
Grand Total	**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**	**21.7**

Table 3.1.2 Western Baltic spring spawning herring. Catch (SOP) in 2004–2020 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	2013	1	8.5	0.8	11.7	20.9
	2	2.8	3.3	10.4	16.5		2	1.7	0.6	8.5	10.8
	3	8.2	10.8	2.4	21.4		3	8.4	1.0	1.1	10.4
	4	5.9	5.0	8.6	19.4		4	9.8	0.5	4.3	14.7
	Total	30.3	22.0	41.7	93.9		Total	28.4	2.9	25.5	56.7
2005	1	16.6	6.1	20.4	43.1	2014	1	6.2	0.2	10.8	17.3
	2	3.4	1.9	15.6	20.9		2	2.3	0.5	2.3	5.1
	3	23.4	3.4	1.9	28.7		3	10.7	2.4	0.8	14.0
	4	12.0	2.6	5.8	20.5		4	5.7	0.8	4.4	10.9
	Total	55.4	14.1	43.7	113.3		Total	24.9	4.0	18.3	47.2
2006	1	15.3	5.9	15.1	36.2	2015	1	9.0	1.9	14.2	25.1
	2	2.6	0.1	17.2	19.9		2	1.0	0.1	2.8	3.9
	3	15.7	0.8	3.0	19.5		3	7.5	1.5	0.9	9.9
	4	8.3	2.4	6.5	17.3		4	4.1	2.8	4.3	11.1
	Total	41.9	9.3	41.9	93.0		Total	21.6	6.3	22.1	50.0
2007	1	7.7	3.0	18.8	29.5	2016	1	7.9	0.7	15.5	24.0
	2	3.8	0.1	10.5	14.4		2	0.4	0.3	3.5	4.1
	3	22.4	0.8	1.7	24.9		3	15.7	1.3	1.4	18.5
	4	7.7	1.8	9.5	18.9		4	3.4	0.3	4.7	8.3
	Total	41.6	5.7	40.5	87.7		Total	27.4	2.5	25.1	55.0
2008	1	8.2	3.9	18.4	30.5	2017	1	7.5	0.0	16.8	24.3
	2	2.7	0.3	11.3	14.3		2	0.2	0.1	3.4	3.6
	3	14.9	0.6	6.0	21.5		3	12.1	0.1	1.0	13.2
	4	6.5	1.0	8.4	16.0		4	6.6	0.3	5.3	12.2
	Total	32.3	5.9	44.1	82.3		Total	26.4	0.4	26.5	53.3
2009	1	11.1	2.7	19.5	33.2	2018	1	10.0	0.0	12.0	21.9
	2	3.1	0.1	6.8	10.1		2	0.2	0.1	3.4	3.8
	3	14.3	0.9	1.4	16.6		3	10.2	0.1	0.2	10.6
	4	6.0	0.7	3.3	10.0		4	2.5	0.1	3.4	6.0
	Total	34.5	4.3	31.0	69.9		Total	22.9	0.4	19.0	42.2
2010	1	8.4	1.1	10.2	19.8	2019	1	4.4	0.1	6.0	10.5
	2	3.9	0.7	5.4	10.1		2	0.5	0.0	0.4	1.0

Year	Quarter	Div. IIIa		SD 22-24	Div. IIIa + SD 22-24
		Fleet C	Fleet D	Fleet F	Total
	3	13.4	0.4	0.4	14.3
	4	9.2	0.1	1.8	11.1
	Total	35.0	2.3	17.9	55.2
2011	1	7.0	0.5	7.8	15.3
	2	0.5	0.2	4.1	4.8
	3	6.5	1.0	0.8	8.3
	4	3.4	0.9	3.2	7.4
	Total	17.4	2.6	15.8	35.9
2012	1	4.5	1.8	14.0	20.3
	2	0.3	0.7	2.5	3.5
	3	12.3	1.7	1.1	15.0
	4	5.2	1.1	3.5	9.9
	Total	22.3	5.4	21.1	48.8

Year	Quarter	Div. IIIa		SD 22-24	Div. IIIa + SD 22-24
		Fleet C	Fleet D	Fleet F	Total
	3	6.5	0.2	0.3	7.0
	4	3.1	0.0	3.1	6.3
	Total	14.6	0.4	9.8	24.7
2020	1	4.3	0.0	2.0	6.3
	2	0.3	0.1	0.2	0.6
	3	9.5	0.6	0.4	10.5
	4	2.7	0.2	1.4	4.4
	Total	16.9	0.9	4.0	21.7

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: 2020 Country: ALL

		Fleet C		Fleet D		Total	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
1	1	6.55	25.4			6.55	25.4
	2	46.03	48.2			46.03	48.2
	3	3.46	73.4			3.46	73.4
	4	0.78	92.4			0.78	92.4
	5	0.36	121.6			0.36	121.6
	6	0.11	130.1			0.11	130.1
	7	0.23	148.8			0.23	148.8
	8+						
	Total	57.51		0.00		57.51	
	SOP		2,803		0		2,803
		Fleet C		**Fleet D**		**Total**	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
2	0			0.60	9.5	0.60	9.5
	1	0.81	25.4	0.30	53.1	1.11	32.9
	2	5.69	48.2	0.15	97.9	5.84	49.5
	3	0.43	73.4	0.06	114.7	0.48	78.3
	4	0.10	92.4	0.02	116.4	0.12	97.2
	5	0.04	121.6	0.01	116.8	0.06	120.7
	6	0.01	130.1	0.002	115.8	0.02	127.9
	7	0.03	148.8			0.03	148.8
	8+			0.0004	130.0	0.0004	130.0
	Total	7.10		1.15		8.25	
	SOP		346		47		394
		Fleet C		**Fleet D**		**Total**	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
3	0			5.52	9.5	5.52	9.5
	1	2.02	86.3	2.77	53.1	4.78	67.1
	2	16.81	131.1	1.37	97.9	18.18	128.6
	3	15.16	156.0	0.52	114.7	15.69	154.6
	4	10.22	172.8	0.22	116.4	10.44	171.6
	5	6.25	188.6	0.10	116.8	6.35	187.5

	6	3.34	202.1	0.02	115.8	3.37	201.5
	7	3.46	220.5			3.46	220.5
	8+	1.07	194.9	0.003	130.0	1.07	194.7
	Total	58.34		10.53		68.86	
	SOP		9,337		434		9,770
		Fleet C		**Fleet D**		**Total**	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
4	0	71.73	13.6	0.31	9.5	72.04	13.6
	1	12.93	44.1	0.15	53.1	13.09	44.2
	2			0.08	97.9	0.08	97.9
	3			0.03	114.7	0.03	114.7
	4			0.01	116.4	0.01	116.4
	5			0.01	116.8	0.01	116.8
	6			0.001	115.8	0.001	115.8
	7						
	8+			0.0002	130.0	0.00	130.0
	Total	84.67		0.59		85.25	
	SOP		1,546		24		1,570
		Fleet C		**Fleet D**		**Total**	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
Total	0	71.73	13.6	6.43	9.5	78.16	13.3
	1	22.31	41.8	3.22	53.1	25.53	43.2
	2	68.53	68.5	1.60	97.9	70.12	69.2
	3	19.05	139.1	0.61	114.7	19.66	138.4
	4	11.10	166.5	0.26	116.4	11.35	165.3
	5	6.65	184.5	0.11	116.8	6.77	183.4
	6	3.47	199.6	0.03	115.8	3.49	198.9
	7	3.72	215.5			3.72	215.5
	8+	1.07	194.9	0.004	130.0	1.08	194.7
	Total	207.62		12.26		219.88	
	SOP		14,032		505		14,537

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: 2020 Country: ALL

		Fleet C		Fleet D		Total	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
1	1	10.29	24.2			10.29	24.2
	2	22.35	47.4			22.35	47.4
	3	2.41	74.8			2.41	74.8
	4	0.21	74.8			0.21	74.8
	5						
	6						
	7	0.10	58.6			0.10	58.6
	8+						
	Total	35.37		0.00		35.37	
	SOP		1,510.719		0		1,510.719
		Fleet C		**Fleet D**		**Total**	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
2	0			0.23	9.5	0.23	9.5
	1	0.0005	24.2	0.12	53.1	0.1170	53.0
	2	0.0010	47.4	0.06	97.9	0.0588	97.0
	3	0.0001	74.8	0.02	114.7	0.0222	114.5
	4	0.00001	74.8	0.01	116.4	0.0093	116.4
	5			0.004	116.8	0.0042	116.8
	6			0.001	115.8	0.0010	115.8
	7	0.000005	58.6			0.0000	58.6
	8+			0.0001	130.0	0.0001	130.0
	Total	0.0016		0.44		0.4451	
	SOP		0.1		18		18
		Fleet C		**Fleet D**		**Total**	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
3	0	0.95	19.7	2.17	9.5	3.11	12.6
	1	3.18	44.7	1.09	53.1	4.26	46.8
	2	0.29	69.6	0.54	97.9	0.83	88.0
	3	0.03	80.9	0.21	114.7	0.23	110.6
	4			0.09	116.4	0.09	116.4
	5			0.04	116.8	0.04	116.8

	6			0.01	115.8	0.01	115.8
	7						
	8+			0.001	130.0	0.001	130.0
	Total	4.44		4.13		8.58	
	SOP		183		170		353
		Fleet C		**Fleet D**		**Total**	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
4	0	5.90	19.7	2.80	9.5	8.70	16.4
	1	19.77	44.7	1.40	53.1	21.18	45.3
	2	1.80	69.6	0.70	97.9	2.49	77.5
	3	0.18	80.9	0.27	114.7	0.44	101.2
	4			0.11	116.4	0.11	116.4
	5			0.05	116.8	0.05	116.8
	6			0.01	115.8	0.01	115.8
	7						
	8+			0.002	130.0	0.002	130.0
	Total	27.64		5.35		32.99	
	SOP		1,139		220		1,360
		Fleet C		**Fleet D**		**Total**	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
Total	0	6.84	19.7	5.20	9.5	12.05	15.3
	1	33.24	38.4	2.61	53.1	35.85	39.4
	2	24.44	49.3	1.29	97.9	25.73	51.7
	3	2.61	75.3	0.49	114.7	3.11	81.5
	4	0.21	74.8	0.21	116.4	0.42	95.4
	5	0.00		0.09	116.8	0.09	116.8
	6	0.00		0.02	115.8	0.02	115.8
	7	0.10	58.6	0.00		0.10	58.6
	8+	0.00		0.003	130.0	0.003	130.0
	Total	67.46		9.92		77.38	
	SOP		2,833		409		3,242

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: 2020** **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	0.000001	17.1			0.36	17.8	0.36	17.8
	2	0.000	57.5			0.34	52.0	0.34	52.0
	3	0.001	118.6	0.01	151.7	1.75	84.8	1.76	85.2
	4	0.002	144.6	0.02	172.8	1.71	107.9	1.73	108.6
	5	0.01	155.7	0.04	179.3	3.53	147.5	3.58	147.9
	6	0.01	167.8	0.04	199.0	1.75	163.6	1.80	164.5
	7	0.02	174.1	0.07	192.3	3.26	172.8	3.35	173.2
	8+	0.01	184.6	0.01	199.1	1.05	177.1	1.07	177.4
	Total	0.04		0.19		13.74		13.97	
	SOP		7		36		1,912		1,955

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	0.000004	17.1			0.020	27.5	0.020	27.5
	2	0.0001	57.1			0.06	42.2	0.06	42.2
	3	0.001	84.8	0.00003	151.7	0.49	54.8	0.50	54.9
	4	0.001	134.2	0.00004	172.8	0.26	73.0	0.26	73.2
	5	0.00	152.7	0.0001	179.3	0.39	83.3	0.40	83.9
	6	0.00	167.4	0.0001	199.0	0.39	109.7	0.39	110.4
	7	0.01	167.8	0.0002	192.3	0.29	149.3	0.31	150.0
	8+	0.003	174.6	0.00003	199.1	0.17	123.5	0.17	124.5
	Total	0.02		0.0005		2.08		2.10	
	SOP		4		0.1		189		193

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					0.01	15.8	0.01	15.8
	1	0.00001	64.2			0.19	38.2	0.19	38.2
	2	0.00002	86.1			0.26	47.7	0.26	47.7
	3	0.00004	79.1	0.07	151.7	0.51	56.1	0.57	67.0
	4	0.0001	138.0	0.11	172.8	0.52	58.1	0.63	78.0
	5	0.0003	162.9	0.28	179.3	0.37	63.5	0.65	113.9

	6	0.0005	170.1	0.28	199.0	0.36	54.8	0.64	118.5
	7	0.0009	169.9	0.50	192.3	0.06	69.8	0.56	179.5
	8+	0.0003	175.9	0.07	199.1	0.04	70.9	0.11	147.8
	Total	0.0022		1.31		2.32		3.63	
	SOP		0.4		246		129		375

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	0.000001	19.9			0.02	19.9	0.02	19.9
	1	0.00004	55.6			1.12	45.1	1.12	45.1
	2	0.0001	81.9			1.83	76.2	1.83	76.2
	3	0.0003	87.0	0.10	179.8	1.66	100.7	1.75	105.1
	4	0.001	151.3	0.29	179.6	1.77	120.1	2.06	128.5
	5	0.004	159.4	0.12	188.6	1.96	161.5	2.08	163.0
	6	0.01	168.8	0.31	206.4	0.99	166.9	1.31	176.3
	7	0.02	168.3	0.13	205.0	0.96	166.4	1.11	171.0
	8+	0.01	175.1	0.08	198.6	0.14	182.4	0.23	188.0
	Total	0.03		1.03		10.45		11.52	
	SOP		6		200		1,238		1,443

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	0.000001	19.9			0.03	18.5	0.03	18.5
	1	0.0001	52.1			1.69	38.3	1.69	38.3
	2	0.0003	72.0	0.00003	151.7	2.49	69.1	2.49	69.1
	3	0.001	98.1	0.17	167.6	4.41	84.1	4.58	87.3
	4	0.004	143.7	0.42	177.5	4.25	104.8	4.67	111.3
	5	0.01	156.4	0.45	181.8	6.25	142.9	6.71	145.5
	6	0.02	168.1	0.64	202.6	3.49	147.4	4.15	155.9
	7	0.04	170.3	0.71	194.7	4.57	168.6	5.33	172.1
	8+	0.02	180.0	0.16	198.2	1.40	167.8	1.58	171.0
	Total	0.10		2.54		28.58		31.22	
	SOP		17		482		3,467		3,966

Table 3.2.4 Western Baltic spring spawning herring. Samples of commercial catch by quarter and area for 2020 available to the Working Group.
1/2

	Country	Fleet	Quarter	Landings	Numbers of	Numbers of	Numbers of
				('000 tons)	samples	fish meas.	fish aged
Skagerrak	**Denmark**	**C**	**1**	0.26678	No data available		
		C	**2**	0.000003	No data available		
		C	**3**	1.54885	10	651	651
		C	**4**	0.86841	No data available		
	Total	**Total**		2.68404	10	651	651
	Denmark	**D**	**1**	0.000	-		
		D	**2**	0.047	No data available		
		D	**3**	0.434	8	82	36
		D	**4**	0.024	No data available		
	Total	**Total**		0.505	8	82	36
	Germany	**C**	**1**	0.000	-		
		C	**2**	0.000	-		
		C	**3**	0.000	-		
		C	**4**	0.155	No data available		
	Total	**Total**		0.155			
	Norway	**C**	**1**	0.058	No data available		
		C	**2**	0.197	No data available		
		C	**3**	1.764	2	130	99
		C	**4**	0.100	No data available		
	Total	**Total**		2.119	2	130	99
	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**	2.478	10	1,000	996
		C	**2**	0.149	No data available		

	Country	Fleet	Quarter	Landings ('000 tons)	Numbers of samples	Numbers of fish meas.	Numbers of fish aged
		C	3	6.024	5	260	260
		C	4	0.422	9	81	81
	Total	Total		9.073	24	1,341	1,337
Kattegat	Denmark	C	1	0.159	No data available		
		C	2	0.0001	No data available		
		C	3	0.027	No data available		
		C	4	0.077	No data available		
	Total	Total		0.263	0	0	0
	Denmark	D	1	0.000	-		
		D	2	0.018	No data available		
		D	3	0.170	No data available		
		D	4	0.220	No data available		
	Total	Total		0.409	0	0	0
	Sweden	C	1	1.352	6	660	660
		C	2	0.000	-		
		C	3	0.156	No data available		
		C	4	1.063	3	317	317
	Total	Total		2.570	9	977	977

Table 3.2.4 (continued) Western Baltic spring spawning herring. Samples of commercial catch by quarter and area for 2020 available to the Working Group.
2/2

	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**	0.001		No data available	
		F	**3**	0.000		No data available	
		F	**4**	0.001		No data available	
	Total	**Total**		0.003	0	0	0
	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**	0.0065	3	1,135	186
		F	**2**	0.0027	1	864	84
		F	**3**	0.0002		No data available	
		F	**4**	0.0047		No data available	
	Total	**Total**		0.0141	4	1,999	270
Subdivision 23	**Denmark**	**F**	**1**	0.000		-	
		F	**2**	0.000		-	
		F	**3**	0.000		-	
		F	**4**	0.001	1	130	53
	Total	**Total**		0.001	1	130	53
	Sweden	**F**	**1**	0.036		No data available	
		F	**2**	0.000		-	
		F	**3**	0.246	1	60	60
		F	**4**	0.199		No data available	
	Total	**Total**		0.481	1	60	60
Subdivision 24	**Denmark**	**F**	**1**	0.342	4	687	215
		F	**2**	0.010		No data available	
		F	**3**	0.002	2	281	96
		F	**4**	0.229	2	258	106
	Total	**Total**		0.583	8	1226	417
	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**	1.521	17	6,488	1,327
		F	**2**	0.044	2	741	92
		F	**3**	0.0004	2	389	123
		F	**4**	0.490	3	1,132	353
	Total	**Total**		2.0546	24	8,750	1,895
	Poland	**F**	**1**	0.048	6	1,058	388
		F	**2**	0.100	7	1,222	319
		F	**3**	0.041	1	282	84
		F	**4**	0.407		-	
	Total	**Total**		0.596	14	2562	791
	Sweden	**F**	**1**	0.000		-	
		F	**2**	0.036	1	150	150
		F	**3**	0.085	2	300	298
		F	**4**	0.112	1	108	107
	Total	**Total**		0.233	4	558	555
Total	**Skagerrak**	**C**	**1-4**	**14.032**	**36**	**2,122**	**2,087**
		D	**1-4**	**0.505**	**8**	**82**	**36**
	Kattegat	**C**	**1-4**	**2.833**	**9**	**977**	**977**
		D	**1-4**	**0.409**	**0**	**0**	**0**
	Subdivision 22	**F**	**1-4**	**0.017**	**4**	**1,999**	**270**
	Subdivision 23	**F**	**1-4**	**0.482**	**2**	**190**	**113**
	Subdivision 24	**F**	**1-4**	**3.467**	**50**	**13,096**	**3,658**
	Total	**Total**	**1-4**	**21.745**	**109**	**18,466**	**7,141**

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 2020.
1/2

	Country	Quarter	Fleet	Sampling
Skagerrak	**Denmark**	**1**	**C**	Sweden Q1 27.3.a.20 fleet-C
		2	**C**	Sweden Q1 27.3.a.20 fleet-C
		3	**C**	Denmark 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**	No landings
		4	**C**	Sweden Q4 27.3.a.20 fleet-C
	Sweden	**1**	**C**	Sweden Q1 27.3.a.20 fleet-C
		2	**C**	Sweden Q1 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 Q3 27.3.a.20 fleet-D
		3	**D**	Denmark Q3 27.3.a.20 fleet-D
		4	**D**	Denmark Q3 27.3.a.20 fleet-D
	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 Q1 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 Q1 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

	Sweden	**1**	**C**	Sweden Q1 27.3.a.21 fleet-C
		2	**C**	No landings
		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**	No landings
		2	**D**	Denmark Q3 27.3.a.20 fleet-D
		3	**D**	Denmark Q3 27.3.a.20 fleet-D
		4	**D**	Denmark Q3 27.3.a.20 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**	Germany Q2 27.3.c.22 fleet-F
		4	**F**	Germany Q2 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 (see WD)
		4	**F**	National imputation (see WD)

Fleet C = Human consumption, Fleet D= Industrial catch,

Fleet F= All catch from Subdivisions 22–24. **Continued on next page**

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 2020.
2/2

	Country	Quarter	Fleet	Sampling
Subdivision 23	**Denmark**	**1**	**F**	No landings
		2	**F**	No landings
		3	**F**	Sweden Q3 27.3.b.23 fleet-F
		4	**F**	Denmark Q4 27.3.b.23 fleet-F
	Sweden	**1**	**F**	Sweden Q3 27.3.b.23 fleet-F
		2	**F**	Sweden Q3 27.3.b.23 fleet-F
		3	**F**	Sweden Q3 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**	Germany Q2 27.3.d.24 fleet-F
		3	**F**	Denmark 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**	Germany Q3 27.3.d.24 fleet-F
		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**	Sweden Q4 27.3.d.24 fleet-F
	Sweden	**1**	**F**	No landings
		2	**F**	Sweden Q2 27.3.d.24 fleet-F
		3	**F**	Sweden 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: 2020

		Skagerrak			Kattegat		
Quarter	W-rings	NSAS	WBSS	n	NSAS	WBSS	n
1	1	89.13%	10.87%	46	88.00%	12.00%	50
	2	54.00%	46.00%	50	34.00%	66.00%	50
	3	16.00%	84.00%	50	17.78%	82.22%	45
	4	7.14%	92.86%	14	0.00%	100.00%	4
	5	12.50%	87.50%	6	0.00%	100.00%	0
	6	12.50%	87.50%	1	0.00%	100.00%	0
	7	12.50%	87.50%	3	0.00%	100.00%	1
	8+	12.50%	87.50%	0	0.00%	100.00%	0
		Skagerrak			Kattegat		
Quarter	W-rings	NSAS	WBSS	n	NSAS	WBSS	n
2	1	85.82%	14.18%	141	93.75%	6.25%	64
	2	26.92%	73.08%	26	19.61%	80.39%	51
	3	6.25%	93.75%	16	14.29%	85.71%	21
	4	0.00%	100.00%	2	0.00%	100.00%	13
	5	0.00%	100.00%	1	0.00%	100.00%	17
	6	5.26%	94.74%	0	0.00%	100.00%	11
	7	5.26%	94.74%	0	0.00%	100.00%	7
	8+	5.26%	94.74%	0	0.00%	100.00%	1
		Skagerrak			Kattegat		
Quarter	W-rings	NSAS	WBSS	n	NSAS	WBSS	n
3	0	95.45%	4.55%	22	97.74%	2.26%	265
	1	89.85%	10.15%	32	63.29%	36.71%	286
	2	52.56%	47.44%	168	25.24%	74.76%	103
	3	27.02%	72.98%	148	5.26%	94.74%	38
	4	19.99%	80.01%	97	12.50%	87.50%	16
	5	3.85%	96.15%	49	5.26%	94.74%	19
	6	17.61%	82.39%	42	8.33%	91.67%	12
	7	22.17%	77.83%	39	42.86%	57.14%	7
	8	0.00%	100.00%	14	0.00%	100.00%	4
		Skagerrak			Kattegat		
Quarter	W-rings	NSAS	WBSS	n	NSAS	WBSS	n
4	0	86.00%	14.00%	50	95.74%	4.26%	47

	1	8.33%	91.67%	12	12.00%	88.00%	50
	2	0.00%	100.00%	0	14.29%	85.71%	21
	3	0.00%	100.00%	0	0.00%	100.00%	2
	4	0.00%	100.00%	0	23.40%	76.60%	0
	5	0.00%	100.00%	0	23.40%	76.60%	0
	6	0.00%	100.00%	0	23.40%	76.60%	0
	7	0.00%	100.00%	0	23.40%	76.60%	0
	8	0.00%	100.00%	0	23.40%	76.60%	0

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	5-8+	mean(5-8+)	4-8+	mean(4-8+)
2	1-2; 3-8+	HERAS; 2019 mean(3-8+)	1-8+	2019
3			0-8+	Q3 IBTS Kat
4	3-8+	2019 mean(3-8+)	4-8+	2019 mean(4-8+)

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: 2020** **Country: All**

		Fleet C		Fleet D		Total	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
1	1	9.06	24			9.06	24
	2	7.60	47			7.60	47
	3	0.43	75			0.43	75
	4					0.00	
	5					0.00	
	6					0.00	
	7					0.00	
	8+					0.00	
	Total	17.08		0.00		17.08	
	SOP		611.4		0.0		611.4

		Fleet C		Fleet D		Total	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
2	0			0.23	9.5	0.23	9
	1	0.0004	24	0.11	53	0.11	53
	2	0.0002	47	0.01	98	0.01	97
	3	0.00002	75	0.003	115	0.00	115
	4					0.00	
	5					0.00	
	6					0.00	
	7					0.00	
	8+					0.00	
	Total	0.001		0.36		0.36	
	SOP		0.02		9.5		7.3

		Fleet C		Fleet D		Total	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
3	0	0.93	20	2.12	9	3.04	13
	1	2.01	45	0.69	53	2.70	47
	2	0.07	70	0.14	98	0.21	88
	3	0.00	81	0.01	115	0.01	111
	4			0.01	116	0.011	116
	5			0.00	117	0.002	117

	6			0.00	116	0.0007	116
	7					0.00	
	8+					0.00	
	Total	3.01		2.97		5.98	
	SOP		113.3		72.6		186.0
		Fleet C		**Fleet D**		**Total**	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
4	0	5.65	20	2.68	9	8.33	16
	1	2.37	45	0.17	53	2.54	45
	2	0.26	70	0.10	98	0.36	77
	3					0.00	
	4			0.03	116	0.03	116
	5			0.01	117	0.01	117
	6			0.00	116	0.003	116
	7					0.00	
	8+			0.00	130	0.000	130
	Total	8.28		2.99		11.27	
	SOP		235.2		48.9		284.0
		Fleet C		**Fleet D**		**Total**	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
Total	0	6.57	20	5.03	9	11.61	15
	1	13.44	31	0.97	53	14.40	32
	2	7.93	48	0.25	98	8.18	50
	3	0.43	75	0.01	115	0.44	76
	4	0.00		0.04	116	0.04	116
	5	0.00		0.01	117	0.01	117
	6	0.00		0.00	116	0.003	116
	7	0.00		0.00		0.00	
	8+	0.00		0.00	130	0.000	130
	Total	28.37		6.31		34.69	
	SOP		960		131		1,091

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: 2020** **Country: All**

		Fleet C		Fleet D		Total	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
1	1	5.84	25			5.84	25
	2	24.86	48			24.86	48
	3	0.55	73			0.55	73
	4	0.06	92			0.06	92
	5	0.05	122			0.05	122
	6	0.01	130			0.01	130
	7	0.03	149			0.03	149
	8+					0.00	
	Total	31.39		0.00		31.39	
	SOP		1,403.5		0.0		1,403.5
		Fleet C		**Fleet D**		**Total**	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
2	0			0.60	9.5	0.60	9.5
	1	0.69	25.4	0.26	53.1	0.95	32.9
	2	1.53	48.2	0.04	97.9	1.57	49.5
	3	0.03	73.4	0.004	114.7	0.03	78.3
	4					0.000	
	5					0.000	
	6	0.001	130.1	0.0001	115.8	0.001	127.9
	7	0.001	148.8			0.00	148.8
	8+			0.00002	130.0	0.00002	130.0
	Total	2.25		0.90		3.16	
	SOP		93.7		23.8		111.8
		Fleet C		**Fleet D**		**Total**	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
3	0			5.27	9.5	5.27	9.5
	1	1.81	86.3	2.48	53.1	4.30	67.1
	2	8.84	131.1	0.72	97.9	9.56	128.6
	3	4.10	156.0	0.14	114.7	4.24	154.6
	4	2.04	172.8	0.04	116.4	2.09	171.6
	5	0.24	188.6	0.00	116.8	0.24	187.5

	6	0.59	202.1	0.00	115.8	0.59	201.5
	7	0.77	220.5			0.77	220.5
	8+					0.00	
	Total	18.39		8.67		27.05	
	SOP		2,641.1		274.5		2,915.6
		Fleet C		**Fleet D**		**Total**	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
4	0	61.69	13.6	0.27	9.5	61.96	13.6
	1	1.08	44.1	0.01	53.1	1.09	44.2
	2					0.00	
	3					0.00	
	4					0.00	
	5					0.00	
	6					0.00	
	7					0.00	
	8+					0.00	
	Total	62.77		0.28		63.05	
	SOP		886.5		3.2		889.7
		Fleet C		**Fleet D**		**Total**	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
Total	0	61.69	13.6	6.14	9.5	67.83	13.2
	1	9.42	39.3	2.76	53.1	12.18	42.4
	2	35.22	69.0	0.76	97.9	35.98	69.6
	3	4.68	145.7	0.15	114.7	4.82	144.8
	4	2.10	170.7	0.04	116.4	2.14	169.5
	5	0.29	178.0	0.004	116.8	0.29	177.2
	6	0.60	200.4	0.004	115.8	0.61	199.8
	7	0.80	217.8	0.00		0.80	217.8
	8+	0.00		0.00002	130.0	0.00002	130.0
	Total	114.80		9.85		124.65	
	SOP		5,024.8		301.5		5,326.3

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.
Western Baltic Spring spawners
Division: Kattegat **Year: 2020** **Country: All**

		Fleet C		Fleet D		Total	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
1	1	1.23	24.2			1.23	24.2
	2	14.75	47.4			14.75	47.4
	3	1.98	74.8			1.98	74.8
	4	0.21	74.8			0.21	74.8
	5					0.00	
	6					0.00	
	7	0.10	58.6			0.10	58.6
	8+					0.00	
	Total	18.28		0.00		18.28	
	SOP		899.3		0.0		899.3
		Fleet C		**Fleet D**		**Total**	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
2	1	0.00003	24.2	0.01	53	0.01	53
	2	0.001	47.4	0.05	98	0.05	97
	3	0.0001	74.8	0.02	115	0.02	115
	4	0.00001	74.8	0.01	116	0.01	116
	5			0.004	117	0.004	117
	6			0.001	116	0.001	116
	7	0.000005	58.6			0.000005	59
	8+			0.0001	130	0.0001	130
	Total	0.001		0.09		0.09	
	SOP		0.05		8.8		8.8
		Fleet C		**Fleet D**		**Total**	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
3	0	0.02	19.7	0.05	9.5	0.07	12.6
	1	1.17	44.7	0.40	53.1	1.57	46.8
	2	0.22	69.6	0.40	97.9	0.62	88.0
	3	0.03	80.9	0.19	114.7	0.22	110.6
	4			0.08	116.4	0.08	116.4
	5			0.04	116.8	0.04	116.8
	6			0.01	115.8	0.01	115.8

	7					0.00	
	8+			0.001	130.0	0.00	130.0
	Total	1.43		1.17		2.60	
	SOP		69.8		97.6		167.4
		Fleet C		**Fleet D**		**Total**	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
4	0	0.25	19.7	0.12	9.5	0.37	16
	1	17.40	44.7	1.24	53.1	18.63	45
	2	1.54	69.6	0.60	97.9	2.14	77
	3	0.18	80.9	0.27	114.7	0.44	101
	4			0.09	116.4	0.09	116
	5			0.04	116.8	0.04	117
	6			0.01	115.8	0.01	116
	7					0.00	
	8+			0.001	130.0	0.00	130
	Total	19.37		2.35		21.72	
	SOP		904		171		1,075.5
		Fleet C		**Fleet D**		**Total**	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
Total	0	0.27	19.7	0.17	9.5	0.44	15.8
	1	19.80	43.4	1.64	53.1	21.44	44.2
	2	16.51	49.8	1.05	97.9	17.55	52.6
	3	2.18	75.4	0.48	114.7	2.66	82.5
	4	0.21	74.8	0.17	116.4	0.38	93.4
	5	0.00		0.08	116.8	0.08	116.8
	6	0.00		0.02	115.8	0.02	115.8
	7	0.10	58.6	0.00		0.10	58.6
	8+	0.00		0.003	130.0	0.00	130.0
	Total	39.08378		3.61		42.69	
	SOP		1,873.3		277.7		2,151.1

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.
Western Baltic Spring spawners
Division: Skagerrak **Year: 2020** **Country: All**

		Fleet C		Fleet D		Total	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
1	1	0.71	25.4			0.71	25.4
	2	21.17	48.2			21.17	48.2
	3	2.91	73.4			2.91	73.4
	4	0.72	92.4			0.72	92.4
	5	0.32	121.6			0.32	121.6
	6	0.10	130.1			0.10	130.1
	7	0.20	148.8			0.20	148.8
	8+					0.00	
	Total	26.12		0.00		26.12	
	SOP		1,399.3		0		1,399.3
		Fleet C		**Fleet D**		**Total**	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
2	1	0.11	25.4	0.04	53.1	0.16	32.9
	2	4.16	48.2	0.11	97.9	4.26	49.5
	3	0.40	73.4	0.05	114.7	0.45	78.3
	4	0.10	92.4	0.02	116.4	0.12	97.2
	5	0.04	121.6	0.01	116.8	0.06	120.7
	6	0.01	130.1	0.002	115.8	0.02	127.9
	7	0.03	148.8			0.03	148.8
	8+			0.0004	130.0	0.0004	130.0
	Total	4.85		0.24		5.09	
	SOP		252.6		23.5		276.0
		Fleet C		**Fleet D**		**Total**	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
3	0			0.25	9.5	0.25	
	1	0.20	86.3	0.28	53.1	0.49	67.1
	2	7.98	131.1	0.65	97.9	8.63	128.6
	3	11.07	156.0	0.38	114.7	11.45	154.6
	4	8.18	172.8	0.18	116.4	8.36	171.6
	5	6.01	188.6	0.09	116.8	6.10	187.5
	6	2.76	202.1	0.02	115.8	2.77	201.5

	7	2.69	220.5			2.69	220.5
	8+	1.07	194.9	0.003	130.0	1.07	194.7
	Total	39.95		1.86		41.81	
	SOP		6,695.4		159.1		6,852.1
		Fleet C		**Fleet D**		**Total**	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
4	0	10.04	13.6	0.04	9.5	10.09	13.6
	1	11.86	44.1	0.14	53.1	12.00	44.2
	2			0.08	97.9	0.08	97.9
	3			0.03	114.7	0.03	114.7
	4			0.01	116.4	0.01	116.4
	5			0.01	116.8	0.01	116.8
	6			0.001	115.8	0.00	115.8
	7					0.00	
	8+			0.0002	130.0	0.00	130.0
	Total	21.90		0.31		22.21	
	SOP		659.5		21.0		680.5
		Fleet C		**Fleet D**		**Total**	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
Total	0	10.04	13.6	0.29	9.5	10.34	13.5
	1	12.89	43.6	0.47	53.1	13.35	43.9
	2	33.30	68.1	0.84	97.9	34.14	68.8
	3	14.37	137.0	0.46	114.7	14.84	136.3
	4	9.00	165.5	0.21	116.4	9.21	164.3
	5	6.37	184.8	0.11	116.8	6.48	183.7
	6	2.86	199.4	0.02	115.8	2.89	198.7
	7	2.92	214.9	0.00		2.92	214.9
	8+	1.07	194.9	0.004	130.0	1.08	194.7
	Total	92.83		2.41		95.24	
	SOP		9,006.8		203.6		9,210.4

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: 2020 Country: All

		Fleet C		Fleet D		Total	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
1	1	14.89	24.67			14.89	24.67
	2	32.45	48.01			32.45	48.01
	3	0.98	74.01			0.98	74.01
	4	0.06	92.40			0.06	92.40
	5	0.05	121.60			0.05	121.60
	6	0.01	130.10			0.01	130.10
	7	0.03	148.80			0.03	148.80
	8+					0.00	
	Total	48.47		0.00		48.47	
	SOP		2,014.9		0.0		2,014.9
		Fleet C		**Fleet D**		**Total**	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
2	0			0.834419977	9.5	0.83	9.5
	1	0.69	25.4	0.37	53.1	1.06	35.0
	2	1.53	48.2	0.05	97.9	1.58	49.8
	3	0.03	73.4	0.01	114.7	0.03	81.7
	4					0.00	
	5					0.00	
	6	0.001	130.1	0.0001	115.8	0.001	127.9
	7	0.001	148.8			0.001	148.8
	8+			0.00002	130.0	0.00002	130.0
	Total	2.25		1.26		3.52	
	SOP		93.7		33.3		119.1
		Fleet C		**Fleet D**		**Total**	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
3	0	0.93	19.7	7.39	9.5	8.31	10.6
	1	3.83	64.5	3.17	53.1	7.00	59.3
	2	8.91	130.6	0.86	97.9	9.77	127.8
	3	4.10	156.0	0.15	114.7	4.25	154.5
	4	2.044	172.8	0.06	116.4	2.10	171.3
	5	0.24	188.6	0.01	116.8	0.25	186.9

	6	0.59	202.1	0.005	115.8	0.59	201.4
	7	0.77	220.5			0.77	220.5
	8+					0.00	
	Total	21.40		11.63		33.03	
	SOP		2,754.4		347.2		3,101.6
		Fleet C		**Fleet D**		**Total**	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
4	0	67.34	14.1	2.95	9.5	70.28	13.9
	1	3.45	44.5	0.18	53.1	3.63	44.9
	2	0.26	69.6	0.10	97.9	0.36	77.5
	3					0.00	
	4			0.03	116.4	0.03	116.4
	5			0.01	116.8	0.01	116.8
	6			0.003	115.8	0.003	115.8
	7					0.00	
	8+			0.0004	130.0	0.0004	130.0
	Total	71.04		3.27		74.31	
	SOP		1,121.7		52.1		1,173.7
		Fleet C		**Fleet D**		**Total**	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
Total	0	68.26	14.2	11.17	9.5	79.43	13.5
	1	22.86	34.3	3.72	53.1	26.58	37.0
	2	43.15	65.2	1.01	97.9	44.16	66.0
	3	5.11	139.8	0.16	114.7	5.27	139.0
	4	2.10	170.7	0.08	116.4	2.18	168.6
	5	0.29	178.0	0.02	116.8	0.30	174.5
	6	0.60	200.4	0.01	115.8	0.61	199.4
	7	0.80	217.8	0.00		0.80	217.8
	8+	0.00		0.0004	130.0	0.0004	130.0
	Total	143.17		16.16		159.33	
	SOP		5,984.7		432.5		6,417.3

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.
Western Baltic Spring spawners
Division: 3.a Year: 2020 Country: All

		Fleet C		Fleet D		Total	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
1	1	1.95	24.6			1.95	24.6
	2	35.93	47.9			35.93	47.9
	3	4.89	74.0			4.89	74.0
	4	0.93	88.4			0.93	88.4
	5	0.32	121.6			0.32	121.6
	6	0.10	130.1			0.10	130.1
	7	0.31	118.1			0.31	118.1
	8+					0.00	
	Total	44.41		0.00		44.41	
	SOP		2,298.6		0.0		2,298.6
		Fleet C		**Fleet D**		**Total**	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
2	1	0.11	25.4	0.05	53.1	0.16	33.8
	2	4.16	48.2	0.16	97.9	4.31	50.0
	3	0.40	73.4	0.07	114.7	0.47	79.7
	4	0.10	92.4	0.03	116.4	0.13	98.6
	5	0.04	121.6	0.01	116.8	0.06	120.4
	6	0.01	130.1	0.003	115.8	0.02	127.1
	7	0.03	148.8			0.03	148.8
	8+			0.0005	130.0	0.0005	130.0
	Total	4.85		0.33		5.18	
	SOP		252.6		32.3		284.9
		Fleet C		**Fleet D**		**Total**	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
3	0	0.02	19.7	0.30	9.5	0.32	10.1
	1	1.37	50.9	0.68	53.1	2.05	51.6
	2	8.19	129.5	1.05	97.9	9.24	125.9
	3	11.09	155.8	0.58	114.7	11.67	153.8
	4	8.18	172.8	0.25	116.4	8.43	171.1
	5	6.01	188.6	0.13	116.8	6.14	187.1
	6	2.76	202.1	0.03	115.8	2.78	201.3

	7	2.69	220.5			2.69	220.5
	8+	1.071	194.9	0.005	130.0	1.076	194.7
	Total	41.38		3.03		44.41	
	SOP		6,765		256.7		7,021.9
		Fleet C		**Fleet D**		**Total**	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
4	0	10.29	13.7	0.16	9.5	10.46	13.7
	1	29.26	44.5	1.38	53.1	30.63	44.8
	2	1.54	69.6	0.67	97.9	2.21	78.2
	3	0.18	80.9	0.30	114.7	0.47	102.1
	4			0.10	116.4	0.10	116.4
	5			0.04	116.8	0.04	116.8
	6			0.01	115.8	0.01	115.8
	7					0.00	
	8+			0.002	130.0	0.002	130.0
	Total	41.27		2.66		43.93	
	SOP		1,563.7		192.3		1,756.0
		Fleet C		**Fleet D**		**Total**	
Quarter	W-rings	**Numbers**	**Mean W.**	**Numbers**	**Mean W.**	Numbers	Mean W.
Total	0	**10.32**	**13.8**	**0.46**	**9.5**	10.78	13.6
	1	**32.69**	**43.5**	**2.11**	**53.1**	34.80	44.1
	2	**49.81**	**62.0**	**1.88**	**97.9**	51.69	63.3
	3	**16.56**	**128.9**	**0.94**	**114.7**	17.50	128.1
	4	**9.21**	**163.4**	**0.38**	**116.4**	9.59	161.5
	5	**6.37**	**184.8**	**0.19**	**116.8**	6.56	182.9
	6	**2.86**	**199.4**	**0.04**	**115.8**	2.90	198.2
	7	**3.02**	**209.5**	**0.00**		3.02	209.5
	8+	**1.07**	**194.9**	**0.01**	**130.0**	1.08	194.5
	Total	131.91		6.02		137.93	
	SOP		**10,880.1**		**481.3**		11,361.4

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 1993–2020.

Year/	W-rings	0	1	2	3	4	5	6	7	8+	Total
1993	Num-bers	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	Num-bers	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	Num-bers	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	Num-bers	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	Num-bers	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	Num-bers	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	Num-bers	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	

Year/	W-rings	0	1	2	3	4	5	6	7	8+	Total
	SOP	477	9,698	13,012	14,048	5,232	3,225	749	373	366	47,179
2000	**Num-bers**	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	**Num-bers**	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	**Num-bers**	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	**Num-bers**	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	**Num-bers**	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	**Num-bers**	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	**Num-bers**	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	

Year/	W-rings	0	1	2	3	4	5	6	7	8+	Total
	SOP	121	3,847	9,584	12,907	6,972	9,765	2,199	2,159	1,134	48,688
2007	Num-bers	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	Num-bers	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	Num-bers	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	Num-bers	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	Num-bers	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	Num-bers	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	Num-bers		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

Year/	W-rings	0	1	2	3	4	5	6	7	8+	Total
	SOP		716	4,872	9,409	1,830	848	290	118	242	18,325
2014	**Num-bers**	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	**Num-bers**	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	**Num-bers**	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	**Num-bers**	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	**Num-bers**	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	**Num-bers**	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
2020	**Num-bers**	10.8	36.6	54.9	23.3	17.1	7.8	13.6	8.3	5.7	178.18

Year/	W-rings	0	1	2	3	4	5	6	7	8+	Total
	Mean W.	13.6	47.1	67.1	132.5	160.7	180.8	186.1	199.3	204.8	101.94
	SOP	146	1,723	3,681	3,094	2,753	1,406	2,536	1,663	1,160	18,163

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) North Sea + Div. 3.a + SD 22–24 Year: 2020 Country: All

		North Sea		Division 3.a		Subdivision 22-24		Total	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
1	0							0.00	
	1	0.0053	104.00	1.95	24.64	0.36	17.80	2.31	23.76
	2	0.224	124.90	35.93	47.87	0.34	51.97	36.49	48.38
	3	0.123	141.80	4.89	73.97	1.76	85.20	6.77	78.12
	4	0.126	155.30	0.93	88.39	1.73	108.57	2.79	103.93
	5	0.158	165.20	0.32	121.60	3.58	147.90	4.05	146.52
	6	0.262	176.70	0.10	130.10	1.80	164.47	2.16	164.43
	7			0.31	118.11	3.35	173.20	3.65	168.59
	8+	0.193	200.33			1.07	177.37	1.26	180.89
	Total	1.092		44.41		13.97		59.47	
	SOP		176.7		2,298.6		1,955.2		4,430.5
		North Sea		**Division 3.a**		**Subdivision 22-24**		**Total**	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
2	1	1.632	104.00	0.16	33.81	0.02	27.46	1.82	96.81
	2	2.169	125.00	4.31	49.99	0.06	42.19	6.54	74.80
	3	3.729	142.00	0.47	79.73	0.50	54.88	4.70	126.54
	4	4.899	156.00	0.13	98.60	0.26	73.23	5.29	150.52
	5	0.725	167.00	0.06	120.39	0.40	83.87	1.18	136.80
	6	6.149	178.00	0.02	127.15	0.39	110.36	6.56	173.81
	7	2.934	188.00	0.03	148.78	0.31	149.99	3.27	184.12
	8+	2.704	202.59	0.00	130.00	0.17	124.50	2.88	197.85
	Total	24.942		5.18		2.10		32.23	
	SOP		4,049.7		284.9		193.4		4,528.0
		North Sea		**Division 3.a**		**Subdivision 22-24**		**Total**	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
3	0			0.32	10.15	0.01	15.80	0.33	10.33
	1	0.17	113.90	2.05	51.64	0.19	38.23	2.41	55.08
	2	0.81	135.00	9.24	125.91	0.26	47.71	10.31	124.65
	3	1.99	153.00	11.67	153.78	0.57	66.97	14.24	150.17
	4	2.50	167.10	8.43	171.09	0.63	77.97	11.57	165.17
	5	0.34	178.00	6.14	187.07	0.65	113.93	7.13	179.96

	6	4.26	190.20	2.78	201.29	0.64	118.51	7.68	188.22
	7	2.39	200.10	2.69	220.50	0.56	179.52	5.64	207.77
	8+	1.64	215.50	1.08	194.66	0.11	147.83	2.82	204.93
	Total	14.10		44.41		3.63		62.14	
	SOP		2,553.5		7,021.9		374.7		9,950.2
		North Sea		**Division 3.a**		**Subdivision 22-24**		**Total**	
Quarter	W-rings	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.	Numbers	Mean W.
4	0			10.46	13.68	0.02	19.89	10.48	13.69
	1			30.63	44.84	1.12	45.14	31.76	44.85
	2			2.21	78.20	1.83	76.18	4.04	77.28
	3			0.47	102.05	1.75	105.11	2.23	104.46
	4	0.006	166.20	0.10	116.40	2.06	128.53	2.16	128.09
	5			0.04	116.79	2.08	163.04	2.13	162.09
	6	0.050	189.30	0.01	115.80	1.31	176.26	1.37	176.28
	7					1.11	171.03	1.11	171.03
	8+	0.054	215.01	0.00	130.00	0.23	188.03	0.28	192.81
	Total	0.110		43.93		11.52		55.56	
	SOP		22.0		1,756.0		1,443.0		3,221.0
		North Sea		**Division 3.a**		**Subdivision 22-24**		**Total**	
Quarter	W-rings	**Numbers**	**Mean W.**	Numbers	Mean W.	**Numbers**	**Mean W.**	Numbers	Mean W.
Total	0	**0.00**		10.78	13.58	**0.03**	**18.46**	10.809	13.59
	1	**1.81**	**104.95**	34.80	44.06	**1.69**	**38.34**	38.297	46.69
	2	**3.20**	**127.52**	51.69	63.30	**2.49**	**69.11**	57.385	67.14
	3	**5.84**	**145.75**	17.50	128.10	**4.58**	**87.25**	27.927	125.09
	4	**7.54**	**159.69**	9.59	161.51	**4.67**	**111.28**	21.804	150.11
	5	**1.22**	**169.80**	6.56	182.85	**6.71**	**145.53**	14.484	164.47
	6	**10.72**	**182.87**	2.90	198.23	**4.15**	**155.94**	17.773	179.09
	7	**5.32**	**193.43**	3.02	209.52	**5.33**	**172.08**	13.673	188.67
	8+	**4.59**	**207.25**	1.08	194.53	**1.58**	**171.04**	7.244	197.46
	Total	40.25		137.93		31.22		209.40	
	SOP		**6,801.9**		11,361.4		**3,966.3**		22,129.7

Single fleet assessment input
Multi fleet assessment input

Table 3.2.15 Western Baltic spring spawning herring. Total catch in numbers (mill) of Western Baltic Spring Spawners in North Sea + Div. 3.a + SD 22–24 in the years 1993–2020.

	W-rings	0	1	2	3	4	5	6	7	8+	Total
Year	Area										
1993	North Sea+Div. 3.a	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	North Sea+Div. 3.a	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	North Sea+Div. 3.a	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	North Sea+Div. 3.a	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	North Sea+Div. 3.a	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	North Sea+Div. 3.a	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	North Sea+Div. 3.a	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	North Sea+Div. 3.a	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	North Sea+Div. 3.a	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	North Sea+Div. 3.a	69.6	577.7	168.3	134.6	53.1	12.0	7.5	2.4	2.0	1027.3

Year	W-rings / Area	0	1	2	3	4	5	6	7	8+	Total
	Subdiv. 22-24	80.6	81.4	113.6	186.7	119.2	45.1	31.1	11.4	6.3	675.4
2003	**North Sea+Div. 3.a**	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	**North Sea+Div. 3.a**	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	**North Sea+Div. 3.a**	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	**North Sea+Div. 3.a**	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	**North Sea+Div. 3.a**	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	**North Sea+Div. 3.a**	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	**North Sea+Div. 3.a**	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	**North Sea+Div. 3.a**	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	**North Sea+Div. 3.a**	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	**North Sea+Div. 3.a**	1.5	30.5	94.3	20.7	9.5	7.1	4.2	2.2	8.6	178.7

Year	W-rings / Area	0	1	2	3	4	5	6	7	8+	Total
	Subdiv. 22-24	0.5	46.3	36.5	43.8	37.8	28.4	14.0	9.0	8.4	224.6
2013	**North Sea+Div. 3.a**		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	**North Sea+Div. 3.a**	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	**North Sea+Div. 3.a**	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	**North Sea+Div. 3.a**	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	**North Sea+Div. 3.a**	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	**North Sea+Div. 3.a**	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	**North Sea+Div. 3.a**	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
2020	**North Sea+Div. 3.a**	10.8	36.6	54.9	23.3	17.1	7.8	13.6	8.3	5.7	178.2
	Subdiv. 22-24	0.0	1.7	2.5	4.6	4.7	6.7	4.1	5.3	1.6	31.2

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 North Sea + Div. 3.a + SD22–24 in the years 1993–2020.

	W-rings	0	1	2	3	4	5	6	7	8+	SOP
Year	Area										
1993	North Sea+Div. 3.a	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	North Sea+Div. 3.a	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	North Sea+Div. 3.a	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	North Sea+Div. 3.a	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	North Sea+Div. 3.a	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	North Sea+Div. 3.a	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	North Sea+Div. 3.a	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	North Sea+Div. 3.a	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	North Sea+Div. 3.a	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	North Sea+Div. 3.a	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	North Sea+Div. 3.a	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	North Sea+Div. 3.a	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	North Sea+Div. 3.a	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	North Sea+Div. 3.a	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	North Sea+Div. 3.a	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	North Sea+Div. 3.a	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

Year	W-rings / Area	0	1	2	3	4	5	6	7	8+	SOP
2009	**North Sea+Div. 3.a**	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	**North Sea+Div. 3.a**	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	**North Sea+Div. 3.a**	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	**North Sea+Div. 3.a**	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	**North Sea+Div. 3.a**		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	**North Sea+Div. 3.a**	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	**North Sea+Div. 3.a**	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	**North Sea+Div. 3.a**	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	**North Sea+Div. 3.a**	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	**North Sea+Div. 3.a**	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	**North Sea+Div. 3.a**	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
2020	**North Sea+Div. 3.a**	13.6	47.1	67.1	132.5	160.7	180.8	186.1	199.3	204.8	18,163
	Subdiv. 22-24	18.5	38.3	69.1	87.3	111.3	145.5	155.9	172.1	171.0	3,966

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 1993–2020.

Year	W-Rings / Ages	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	

Year	W-Rings / Ages	0	1	2	3	4	5	6	7	8+	Total
	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

Year	W-Rings / Ages	0	1	2	3	4	5	6	7	8+	Total
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
2020	**Number**	79.43	26.58	44.16	5.27	2.18	0.30	0.61	0.80	0.001	159.3
	Mean W.	13.49	36.49	65.71	138.58	168.38	174.62	199.24	216.74	137.84	
	SOP	1,072	970	2,902	730	367	53	122	173	0.1	6,388

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 1993–2020 (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

									*	**			***	***
Year	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
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

	***	***	***	***	***	***	***	***	****	*****	***	***	5*	6*
Year	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
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	1,028.745
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	185.814
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	82.236
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	66.046
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	21.600
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	15.890
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	7.590
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	3.210
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	1.370
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	1,412.500
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	115.706
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	12.550
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	7.617
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	5.313
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	5.413
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	2.207
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	2.009
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	1.134
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	0.497
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	0.230
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	36.969

									*	**			***	***
Year	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
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	11.490
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	12.2
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	41.0
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	64.6
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	82.0
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	102.2
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	126.4
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	149.4
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	154.9
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	167.9
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	26.2

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

6* excl. Central Baltic Herring in SDs 21 and SD 24 (SD 23) 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 1991–2020 (July).

		*	*	*	*	*			**						
Year	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
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	2,687
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	1,342
3	1,927	1,799	1,274	935	1,022	247	787	901	523	674	452	1,393	395	726	464
4	866	1,593	598	501	1,270	141	166	282	135	364	153	524	323	307	201
5	350	556	434	239	255	119	67	111	28	186	96	88	103	184	103
6	88	197	154	186	174	37	69	51	3	56	38	40	25	72	84
7	72	122	63	62	39	20	80	31	2	7	23	18	12	22	37
8+	10	20	13	34	21	13	77	53	1	10	12	17	5	18	21
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	4,939
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	910
W-rings/Biomass ('000 tonnes)															
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	105.9
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	100.1
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	46.6
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	28.9
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	16.5
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	14.9
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	7.5
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	4.9
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	325.3
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	119.3
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	39.4
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	74.6
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	100.5
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	143.7
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	160.9
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	177.7
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	202.3

		*	*	*	*	*			**						
Year	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
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	229.2
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	65.9

Year	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
W-rings/Numbers in millions															
0			112				1		314	2	203	1		2	9
1	2,081	3,918	5,852	565	999	2,980	1,018	49	513	1,949	425	696	106	418	815
2	2,217	3,621	1,160	398	511	473	1,081	627	415	1,244	255	424	224	591	274
3	1,780	933	843	205	254	259	236	525	176	446	381	661	271	315	225
4	490	499	333	161	115	163	87	53	248	224	99	401	175	109	180
5	180	154	274	82	65	70	76	30	28	171	40	94	169	67	74
6	27	34	176	86	24	53	33	12	37	82	40	53	50	52	77
7	10	26	45	39	28	22	14	8	26	89	12	52	35	19	64
8+	0.1	14	44	65	34	46	60	15	42	115	28	92	44	13	46
Total	**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**	**1,764**
3+ group	**2,487**	**1,660**	**1,715**	**638**	**520**	**613**	**506**	**643**	**557**	**1,127**	**600**	**1,353**	**744**	**575**	**666**
W-rings/Biomass ('000 tonnnes)															
0							0.0		1.0	0.03	1.00	0.00		0.00	0.00
1	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	35.0
2	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	23.0
3	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	29.0
4	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	26.0
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	13.0
6	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	13.0
7	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	13.0
8+	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	9.0
Total	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	161.0
3+ group	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	103.0
W-rings/Mean weight (g)															
0			6.3				3.0		4.3	14.2	4.0	23.0		4.0	4.6
1	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	43.2
2	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	85.2
3	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	127.0
4	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	145.2

		*	*	*	*	*			**						
Year	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
5	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	178.5
6	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	171.9
7	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	201.0
8+	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	198.7
Total	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	91.7

* 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.
N20 Larval Abundance Index.
Estimation of 0-Group herring reaching 20 mm in length
in Greifswalder Bodden and adjacent waters (March/April to June).

Year	N20 (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
2020	239

* 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
2020	0	1812	3204	5845	7536	1219	10720	5325	4587

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
2020	10315	32689	49813	16558	9210	6368	2864	3022	1071

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
2020	462.8	2107	1881	944.4	384.9	190.1	40.66	0	6.787

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
2020	30.67	1690	2487	4580	4673	6707	4148	5326	1579

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	0.1037	0.1478	0.1595	0.1666	0.1957	0.1997	0.2116	0.2215
2015	0.0000	0.1147	0.1367	0.1436	0.1625	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
2020	0.0000	0.1050	0.1275	0.1457	0.1597	0.1698	0.1829	0.1934	0.2072

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	0.0663	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
2020	0.0138	0.0435	0.0620	0.1289	0.1634	0.1848	0.1994	0.2095	0.1949

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	0.1101	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	0.1101	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
2020	0.0095	0.0531	0.0979	0.1147	0.1164	0.1168	0.1158	0.0000	0.1300

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	0.0257	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	0.1747
2009	0.0105	0.0283	0.0481	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
2020	0.0185	0.0383	0.0691	0.0873	0.1113	0.1455	0.1559	0.1721	0.1710

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	0.0131	0.0459	0.0708	0.1327	0.1674	0.1892	0.2097	0.2338
1996	0.0001	0.0181	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	0.0871	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
2020	0.0001	0.0238	0.0484	0.0781	0.1039	0.1465	0.1644	0.1686	0.1809

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
2020	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
2020	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
2020	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
2020	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 in thousands)**

	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
2020	225000	180000	74000	77000

TABLE 3.6.8.b WESTERN BALTIC SPRING SPAWNING HERRING
***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
2020	185814	82236	66046	21600

TABLE 3.6.8.c WESTERN BALTIC SPRING SPAWNING HERRING
***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
2020	239

TABLE 3.6.8.d WESTERN BALTIC SPRING SPAWNING HERRING
***Multi fleet*/Survey indices: IBTS+BITS-Q1 (number per hour)**

	1	2	3
2002	1166345	53774	11703
2003	634554	115414	3207
2004	300694	62762	12182
2005	211643	109896	6337
2006	147220	28012	5867
2007	215066	32362	2947
2008	166945	31225	3786
2009	616668	35237	1103
2010	283447	70603	8757
2011	151203	63594	11692
2012	334504	72913	3546
2013	182103	68799	12056
2014	136922	17344	2917
2015	258998	58671	1899
2016	205037	93324	5638
2017	452975	65639	10504
2018	99906	57667	2710
2019	425325	36118	5299
2020	367697	80994	4912

TABLE 3.6.8.e WESTERN BALTIC SPRING SPAWNING HERRING
***Multi fleet*/Survey indices: IBTS+BITS-Q3.4 (number per hour)**

	2	3
2002	3106	1306
2003	6290	1446
2004	3339	1216
2005	3382	600.5
2006	2638	1175
2007	3587	653.7
2008	2266	1169
2009	3022	555.1
2010	3727	1125
2011	2685	660.7
2012	5520	801.4
2013	4925	1424
2014	1228	1242
2015	9481	1392
2016	7624	2105
2017	4990	1507
2018	5241	1038
2019	9404	3168
2020	8325	2058

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 **1/3**
***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

# 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	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
2/3

```
$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

continued

TABLE 3.6.10 WESTERN BALTIC SPRING SPAWNING HERRING
3/3

$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

$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) (tons), average fishing mortality and total stock biomass (TSB) (tons).**

Year	R(age 0)	Low	High	SSB	Low	High	Fbar (3-6)	Low	High	TSB	Low	High
1991	5022943	3862967	6531238	294077	238967	361896	0.436	0.319	0.597	591241	496634	703870
1992	3630255	2880796	4574690	300530	245962	367206	0.506	0.393	0.652	518501	437446	614575
1993	3060821	2369000	3954675	284750	233802	346799	0.574	0.445	0.739	452238	379982	538234
1994	4514044	3526940	5777413	225900	185793	274666	0.598	0.468	0.766	372079	313585	441485
1995	4196456	3323087	5299361	193972	158677	237118	0.604	0.464	0.785	314615	264888	373678
1996	4185013	3327521	5263477	133192	110267	160884	0.656	0.513	0.840	277979	237488	325373
1997	3489204	2725647	4466663	147001	121995	177132	0.635	0.496	0.811	278869	237384	327603
1998	4590581	3631603	5802791	118707	99253	141973	0.618	0.480	0.794	263239	225753	306949
1999	4901369	3901140	6158050	119183	99572	142657	0.528	0.411	0.679	267183	229986	310396
2000	2993894	2385673	3757179	123386	103364	147287	0.573	0.457	0.718	256795	220967	298431
2001	2757400	2222439	3421131	136051	114973	160994	0.602	0.479	0.756	276821	238691	321043
2002	2740576	2202127	3410681	159982	135316	189145	0.493	0.392	0.621	285553	246200	331195
2003	2956361	2370559	3686924	129160	108886	153209	0.453	0.359	0.572	221619	191147	256947
2004	2064667	1654831	2576004	133609	112816	158235	0.497	0.393	0.628	227433	196301	263504
2005	1769476	1420549	2204110	121380	102745	143394	0.528	0.422	0.660	213085	183495	247446
2006	1361515	1086272	1706499	133027	112128	157821	0.478	0.383	0.596	225861	193571	263538
2007	1421277	1135240	1779384	109135	91526	130132	0.534	0.428	0.666	177349	151211	208006
2008	1169516	936407	1460655	89005	75015	105604	0.575	0.461	0.716	155360	133252	181136
2009	1148604	922140	1430684	79609	67504	93885	0.524	0.413	0.665	139032	120200	160815
2010	1487230	1193680	1852970	74031	62977	87026	0.406	0.318	0.517	123334	106753	142491
2011	1359643	1095129	1688048	69532	58786	82242	0.319	0.247	0.411	114133	98150	132719
2012	1179901	946166	1471377	72538	61555	85482	0.379	0.293	0.489	124511	107489	144230
2013	1685120	1275657	2226013	80985	68786	95348	0.401	0.309	0.521	137015	118257	158748
2014	1156414	909546	1470288	83868	70353	99980	0.347	0.267	0.450	141249	121553	164137
2015	940624	737352	1199933	84718	70660	101573	0.425	0.334	0.542	143826	122570	168770
2016	900718	688624	1178135	80484	66987	96701	0.482	0.375	0.619	124974	105335	148274
2017	969757	718431	1309003	73684	61120	88832	0.504	0.378	0.673	116270	97673	138407
2018	810280	561813	1168633	62561	49773	78634	0.480	0.348	0.664	98793	80122	121816
2019	676518	423391	1080977	57841	43056	77703	0.288	0.202	0.411	102047	78062	133402
2020	582158	295053	1148633	58434	41725	81834	0.193	0.123	0.301	94523	68953	129574

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	0.209	0.324	0.362	0.412	0.458	0.513	0.561	0.561
1992	0.027	0.224	0.351	0.403	0.473	0.535	0.615	0.684	0.684
1993	0.035	0.261	0.387	0.449	0.534	0.606	0.706	0.789	0.789
1994	0.043	0.291	0.408	0.467	0.558	0.630	0.739	0.823	0.823
1995	0.067	0.364	0.439	0.481	0.562	0.632	0.741	0.821	0.821
1996	0.047	0.318	0.439	0.505	0.607	0.694	0.819	0.915	0.915
1997	0.049	0.310	0.426	0.486	0.582	0.669	0.801	0.922	0.922
1998	0.052	0.316	0.430	0.479	0.568	0.651	0.772	0.914	0.914
1999	0.036	0.249	0.384	0.421	0.487	0.555	0.650	0.777	0.777
2000	0.030	0.242	0.397	0.444	0.526	0.606	0.717	0.861	0.861
2001	0.032	0.251	0.400	0.452	0.551	0.637	0.767	0.908	0.908
2002	0.027	0.208	0.344	0.377	0.450	0.521	0.624	0.742	0.742
2003	0.024	0.191	0.318	0.347	0.414	0.477	0.574	0.684	0.684
2004	0.025	0.205	0.331	0.373	0.455	0.523	0.636	0.756	0.756
2005	0.018	0.184	0.337	0.391	0.489	0.555	0.676	0.806	0.806
2006	0.016	0.179	0.344	0.375	0.447	0.498	0.593	0.700	0.700
2007	0.013	0.175	0.364	0.412	0.502	0.560	0.661	0.764	0.764
2008	0.013	0.183	0.386	0.436	0.539	0.607	0.716	0.813	0.813
2009	0.014	0.191	0.384	0.403	0.488	0.551	0.654	0.740	0.740
2010	0.008	0.126	0.294	0.314	0.379	0.424	0.506	0.575	0.575
2011	0.005	0.094	0.228	0.245	0.298	0.333	0.400	0.457	0.457
2012	0.006	0.100	0.232	0.270	0.352	0.402	0.490	0.555	0.555
2013	0.006	0.104	0.237	0.279	0.371	0.430	0.525	0.600	0.600
2014	0.005	0.092	0.220	0.249	0.319	0.370	0.449	0.525	0.525
2015	0.007	0.120	0.266	0.296	0.385	0.461	0.560	0.679	0.679
2016	0.006	0.119	0.295	0.333	0.426	0.525	0.643	0.811	0.811
2017	0.005	0.107	0.297	0.345	0.434	0.552	0.686	0.901	0.901
2018	0.004	0.101	0.280	0.325	0.407	0.528	0.662	0.921	0.921
2019	0.002	0.068	0.204	0.215	0.246	0.304	0.388	0.583	0.583
2020	0.002	0.064	0.193	0.172	0.171	0.186	0.241	0.381	0.381

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	0.004	0.018	0.016	0.018	0.017	0.017	0.017
1992	0.000	0.000	0.004	0.018	0.016	0.018	0.018	0.019	0.019
1993	0.000	0.000	0.004	0.018	0.016	0.018	0.019	0.020	0.020
1994	0.000	0.000	0.004	0.018	0.017	0.018	0.020	0.021	0.021
1995	0.000	0.000	0.004	0.018	0.017	0.018	0.022	0.023	0.023
1996	0.000	0.000	0.004	0.018	0.018	0.020	0.023	0.026	0.026
1997	0.000	0.000	0.004	0.018	0.018	0.020	0.023	0.031	0.031
1998	0.000	0.000	0.004	0.017	0.018	0.022	0.023	0.038	0.038
1999	0.000	0.000	0.004	0.018	0.019	0.024	0.025	0.043	0.043
2000	0.000	0.000	0.004	0.017	0.021	0.026	0.028	0.046	0.046
2001	0.000	0.000	0.003	0.016	0.021	0.027	0.030	0.047	0.047
2002	0.000	0.000	0.003	0.016	0.020	0.025	0.029	0.046	0.046
2003	0.000	0.000	0.002	0.015	0.019	0.022	0.026	0.043	0.043
2004	0.000	0.000	0.002	0.015	0.018	0.020	0.024	0.037	0.037
2005	0.000	0.000	0.002	0.013	0.017	0.017	0.024	0.039	0.039
2006	0.000	0.000	0.001	0.010	0.014	0.015	0.022	0.041	0.041
2007	0.000	0.000	0.001	0.007	0.010	0.009	0.018	0.029	0.029
2008	0.000	0.000	0.001	0.005	0.008	0.007	0.014	0.024	0.024
2009	0.000	0.000	0.001	0.004	0.008	0.006	0.015	0.030	0.030
2010	0.000	0.000	0.000	0.004	0.007	0.005	0.014	0.025	0.025
2011	0.000	0.000	0.000	0.004	0.006	0.004	0.013	0.019	0.019
2012	0.000	0.000	0.000	0.003	0.006	0.003	0.017	0.017	0.017
2013	0.000	0.000	0.000	0.004	0.007	0.005	0.019	0.022	0.022
2014	0.000	0.000	0.001	0.005	0.008	0.007	0.023	0.033	0.033
2015	0.000	0.000	0.001	0.006	0.009	0.009	0.025	0.043	0.043
2016	0.000	0.000	0.001	0.007	0.010	0.011	0.027	0.051	0.051
2017	0.000	0.000	0.001	0.009	0.011	0.012	0.026	0.061	0.061
2018	0.000	0.000	0.002	0.010	0.015	0.015	0.035	0.101	0.101
2019	0.000	0.000	0.002	0.012	0.018	0.019	0.046	0.138	0.138
2020	0.000	0.000	0.003	0.013	0.021	0.018	0.055	0.150	0.150

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	0.001	0.042	0.142	0.111	0.089	0.079	0.074	0.075	0.075
1992	0.001	0.042	0.143	0.112	0.089	0.080	0.074	0.076	0.076
1993	0.001	0.042	0.144	0.113	0.090	0.080	0.075	0.077	0.077
1994	0.001	0.044	0.149	0.117	0.093	0.083	0.078	0.079	0.079
1995	0.001	0.046	0.155	0.122	0.097	0.086	0.081	0.082	0.082
1996	0.001	0.046	0.155	0.122	0.097	0.086	0.081	0.082	0.082
1997	0.001	0.046	0.157	0.123	0.098	0.087	0.081	0.083	0.083
1998	0.001	0.049	0.166	0.130	0.104	0.092	0.086	0.088	0.088
1999	0.001	0.051	0.175	0.137	0.109	0.097	0.091	0.093	0.093
2000	0.001	0.053	0.181	0.142	0.113	0.101	0.094	0.096	0.096
2001	0.001	0.050	0.171	0.134	0.107	0.095	0.089	0.091	0.091
2002	0.001	0.050	0.171	0.134	0.107	0.095	0.089	0.091	0.091
2003	0.001	0.046	0.156	0.122	0.097	0.087	0.081	0.083	0.083
2004	0.001	0.041	0.139	0.109	0.087	0.077	0.072	0.074	0.074
2005	0.001	0.044	0.151	0.118	0.094	0.084	0.078	0.080	0.080
2006	0.001	0.049	0.168	0.132	0.105	0.094	0.087	0.089	0.089
2007	0.001	0.053	0.180	0.141	0.112	0.100	0.093	0.095	0.095
2008	0.001	0.055	0.189	0.148	0.118	0.105	0.098	0.100	0.100
2009	0.001	0.058	0.198	0.155	0.123	0.110	0.103	0.105	0.105
2010	0.001	0.054	0.184	0.145	0.115	0.103	0.096	0.098	0.098
2011	0.001	0.044	0.151	0.118	0.094	0.084	0.078	0.080	0.080
2012	0.001	0.039	0.132	0.103	0.082	0.073	0.068	0.070	0.070
2013	0.001	0.036	0.121	0.095	0.076	0.067	0.063	0.064	0.064
2014	0.001	0.037	0.127	0.099	0.079	0.071	0.066	0.067	0.067
2015	0.001	0.041	0.140	0.110	0.087	0.078	0.073	0.074	0.074
2016	0.001	0.051	0.175	0.137	0.109	0.098	0.091	0.093	0.093
2017	0.001	0.058	0.196	0.154	0.122	0.109	0.102	0.104	0.104
2018	0.001	0.055	0.188	0.148	0.117	0.105	0.098	0.100	0.100
2019	0.001	0.047	0.159	0.124	0.099	0.088	0.082	0.084	0.084
2020	0.001	0.047	0.161	0.126	0.100	0.090	0.084	0.086	0.086

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	0.015	0.041	0.017	0.008	0.004	0.003	0.004	0.004	0.004
1992	0.013	0.034	0.014	0.007	0.004	0.003	0.004	0.003	0.003
1993	0.019	0.048	0.019	0.009	0.005	0.003	0.005	0.004	0.004
1994	0.026	0.070	0.027	0.012	0.006	0.004	0.006	0.005	0.005
1995	0.050	0.140	0.051	0.021	0.009	0.006	0.009	0.007	0.007
1996	0.029	0.076	0.027	0.012	0.005	0.004	0.006	0.005	0.005
1997	0.032	0.077	0.026	0.011	0.005	0.004	0.005	0.004	0.004
1998	0.035	0.088	0.030	0.012	0.005	0.004	0.005	0.004	0.004
1999	0.023	0.054	0.020	0.008	0.004	0.003	0.004	0.003	0.003
2000	0.016	0.037	0.014	0.005	0.003	0.002	0.003	0.003	0.003
2001	0.019	0.049	0.020	0.009	0.005	0.005	0.009	0.009	0.009
2002	0.018	0.052	0.021	0.007	0.004	0.003	0.004	0.003	0.003
2003	0.016	0.057	0.032	0.014	0.009	0.008	0.009	0.007	0.007
2004	0.016	0.065	0.043	0.022	0.014	0.012	0.012	0.009	0.009
2005	0.008	0.037	0.025	0.012	0.006	0.005	0.004	0.003	0.003
2006	0.009	0.048	0.042	0.022	0.013	0.013	0.011	0.009	0.009
2007	0.005	0.031	0.030	0.015	0.007	0.008	0.008	0.007	0.007
2008	0.005	0.034	0.033	0.014	0.005	0.006	0.005	0.005	0.005
2009	0.008	0.058	0.050	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	0.012	0.008	0.001	0.000	0.000	0.000	0.000	0.000
2012	0.001	0.011	0.009	0.001	0.000	0.000	0.000	0.000	0.000
2013	0.001	0.015	0.015	0.002	0.000	0.000	0.000	0.000	0.000
2014	0.001	0.013	0.012	0.001	0.000	0.000	0.000	0.000	0.000
2015	0.002	0.029	0.028	0.003	0.000	0.000	0.000	0.000	0.000
2016	0.001	0.018	0.019	0.002	0.000	0.000	0.000	0.000	0.000
2017	0.000	0.003	0.004	0.000	0.000	0.000	0.000	0.000	0.000
2018	0.000	0.003	0.003	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
2020	0.001	0.009	0.014	0.003	0.000	0.001	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	0.011	0.126	0.161	0.224	0.304	0.357	0.417	0.465	0.465
1992	0.013	0.148	0.190	0.266	0.364	0.434	0.519	0.586	0.586
1993	0.015	0.170	0.219	0.308	0.423	0.505	0.608	0.688	0.688
1994	0.016	0.177	0.228	0.320	0.442	0.525	0.635	0.718	0.718
1995	0.016	0.178	0.229	0.320	0.439	0.521	0.630	0.709	0.709
1996	0.017	0.197	0.252	0.353	0.487	0.584	0.710	0.802	0.802
1997	0.016	0.187	0.239	0.334	0.462	0.558	0.691	0.803	0.803
1998	0.016	0.179	0.230	0.319	0.440	0.533	0.658	0.784	0.784
1999	0.013	0.143	0.186	0.258	0.355	0.431	0.531	0.638	0.638
2000	0.013	0.151	0.199	0.279	0.390	0.477	0.592	0.716	0.716
2001	0.013	0.152	0.205	0.293	0.417	0.510	0.639	0.761	0.761
2002	0.009	0.105	0.149	0.220	0.320	0.398	0.503	0.602	0.602
2003	0.007	0.088	0.129	0.196	0.290	0.361	0.457	0.551	0.551
2004	0.008	0.099	0.148	0.227	0.338	0.415	0.528	0.637	0.637
2005	0.009	0.104	0.159	0.249	0.371	0.449	0.570	0.684	0.684
2006	0.007	0.082	0.132	0.211	0.315	0.376	0.473	0.561	0.561
2007	0.007	0.091	0.153	0.249	0.372	0.441	0.543	0.632	0.632
2008	0.008	0.093	0.163	0.270	0.408	0.490	0.599	0.683	0.683
2009	0.006	0.075	0.136	0.229	0.353	0.431	0.534	0.602	0.602
2010	0.004	0.051	0.094	0.163	0.257	0.316	0.396	0.452	0.452
2011	0.003	0.037	0.069	0.122	0.197	0.245	0.308	0.357	0.357
2012	0.004	0.050	0.092	0.163	0.263	0.326	0.405	0.467	0.467
2013	0.004	0.054	0.100	0.178	0.289	0.358	0.444	0.514	0.514
2014	0.003	0.042	0.080	0.143	0.231	0.293	0.360	0.425	0.425
2015	0.004	0.050	0.097	0.177	0.288	0.373	0.461	0.561	0.561
2016	0.004	0.050	0.100	0.187	0.307	0.417	0.525	0.667	0.667
2017	0.004	0.047	0.096	0.182	0.301	0.431	0.558	0.737	0.737
2018	0.003	0.043	0.087	0.167	0.275	0.407	0.529	0.720	0.720
2019	0.002	0.020	0.040	0.078	0.129	0.196	0.259	0.361	0.361
2020	0.001	0.007	0.015	0.029	0.049	0.077	0.102	0.145	0.145

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	5022943	4152570	2234165	1865106	912334	551552	162991	48728	17450
1992	3630255	3664762	2031597	1326664	1062780	491264	283982	80561	31300
1993	3060821	2619490	1810037	1159149	732820	540773	234094	125693	46312
1994	4514044	2149891	1222277	1028223	596889	357288	239879	94336	63870
1995	4196456	3248778	980058	654342	545136	271261	158360	93064	56645
1996	4185013	2897531	1376282	519838	328110	253247	117781	61899	53973
1997	3489204	2962747	1272778	738092	257265	144882	101716	42416	38486
1998	4590581	2421862	1315605	681338	375272	117773	61326	36548	26394
1999	4901369	3240278	1057901	694730	347096	176022	49916	23518	20280
2000	2993894	3555608	1536881	583867	369918	176353	82834	21425	16481
2001	2757400	2124105	1700921	858468	301753	178733	78197	33527	13093
2002	2740576	1966506	981372	938531	458828	139904	78023	29090	15570
2003	2956361	1959900	970767	562380	526293	241963	67356	34289	17401
2004	2064667	2170704	986406	581835	325296	282538	123276	31131	21256
2005	1769476	1475182	1085830	590538	326347	169126	136688	53711	20106
2006	1361515	1290691	728552	638464	337045	161936	81031	56290	27107
2007	1421277	981767	659708	419942	355561	180304	77970	38073	33449
2008	1169516	1050873	491319	376163	226479	175315	86126	32793	27508
2009	1148604	851006	538476	272732	196091	109412	77084	34886	21966
2010	1487230	826643	425736	298234	150470	99515	51991	31823	22510
2011	1359643	1103191	436711	257221	177098	84140	53924	25852	24749
2012	1179901	1000824	620659	283480	162985	107300	49466	29633	26228
2013	1685120	857532	543225	411781	176723	93929	58122	25025	26306
2014	1156414	1280360	457103	347514	258746	98132	50272	28122	23464
2015	940624	850890	736866	300604	220232	148898	56254	26113	25499
2016	900718	686374	455163	475833	184023	121850	74489	26413	21775
2017	969757	661829	368408	269154	288210	99424	59208	31266	17627
2018	810280	725604	362438	223014	149031	158374	47823	24140	15946
2019	676518	600134	396893	222502	132423	80618	77067	20594	12708
2020	582158	499048	341652	261726	143557	86485	48738	43227	15148

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	115644.93	655619.77	612525.11	563331.02	304193.61	199847.69	64442.81	20664.07	7400.12
1992	84390.94	613309.74	598567.12	439651.95	396662.03	201216.92	129128.85	39633.64	15398.54
1993	91145.61	508051.29	582526.49	421248.45	301591.19	243999.87	117961.04	68430.18	25213.51
1994	164828.60	463877.92	414633.21	387585.29	255161.37	166302.07	125178.77	53050.35	35917.34
1995	237673.26	871034.30	357823.85	254301.82	235510.10	127094.99	83198.58	52483.36	31944.94
1996	169423.01	679544.75	497376.42	208997.31	149949.32	126941.89	66194.30	37494.07	32692.71
1997	145501.04	678322.78	448681.18	287652.95	113909.88	70788.10	56344.89	25930.28	23527.54
1998	202855.25	566243.42	468883.76	263079.34	163532.42	56672.08	33248.77	22399.38	16176.55
1999	150989.19	605080.88	339746.11	240766.67	134150.13	75349.81	24002.06	13010.61	11219.31
2000	75937.00	642528.59	507237.58	211684.81	152616.81	80895.62	42889.02	12751.22	9808.87
2001	76740.04	399193.76	566401.86	315938.61	128874.57	85097.39	42607.71	20702.67	8084.56
2002	64070.57	309951.36	284541.12	295146.15	166444.88	56936.31	36485.44	15600.65	8350.01
2003	61872.73	285474.91	263182.99	164389.87	177694.34	91484.77	29486.14	17287.02	8772.72
2004	44006.06	337917.44	278547.37	181234.28	118586.34	114560.82	57974.68	16709.83	11409.15
2005	26702.82	206765.38	309377.01	190944.82	125750.18	71593.56	67092.22	30130.55	11279.00
2006	18780.56	177025.44	212867.89	200394.98	121627.66	63566.51	36399.19	28957.48	13944.49
2007	16228.22	131393.06	201963.33	142561.26	140781.88	77266.98	37943.96	20718.05	18201.72
2008	13430.98	146200.01	158780.60	134229.43	94826.04	79883.17	44292.19	18588.72	15592.84
2009	14256.14	124397.07	173851.19	91123.66	75968.22	46290.39	37198.31	18629.12	11729.56
2010	9731.58	80380.46	105881.96	78966.39	46895.69	33861.50	20487.83	13982.68	9890.37
2011	5935.46	80076.79	85312.93	53940.97	44266.64	23092.72	17386.36	9333.96	8935.82
2012	5681.47	76997.15	124000.18	65075.75	46927.88	34387.84	18724.10	12381.91	10959.18
2013	8491.64	68792.66	111010.62	97137.95	53082.70	31742.69	23204.33	11100.12	11668.26
2014	4910.51	91209.63	86624.36	73946.71	68371.96	29361.21	17806.17	11364.10	9481.71
2015	5386.47	78605.16	168534.68	75140.20	68751.62	53752.74	23849.88	12958.99	12654.42
2016	4624.98	63192.00	114010.70	133084.04	63260.93	49379.97	35482.43	15101.80	12449.86
2017	3885.64	54696.88	91876.53	77834.39	101253.88	42170.59	29765.23	19427.96	10953.05
2018	2981.88	56265.66	85653.93	61036.44	49619.26	64866.27	23489.92	15557.16	10276.56
2019	1364.66	31666.86	68894.81	41241.77	28051.34	20619.05	24699.44	9609.51	5929.63
2020	939.00	24566.38	55923.79	38853.92	21483.65	14040.23	10236.54	14009.67	4909.42

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	11.17	7576.77	30060.89	12939.17	9112.96	2542.39	756.10	270.77
1992	0.00	9.86	6902.56	21105.01	15082.34	7897.34	4631.88	1352.63	525.53
1993	0.00	7.05	6098.20	18728.15	10661.13	8630.42	4023.18	2259.98	832.70
1994	0.00	5.78	4122.09	16229.62	9195.49	5704.19	4382.04	1812.03	1226.82
1995	0.00	8.74	3295.35	10473.48	8520.12	4491.35	3078.39	1914.86	1165.51
1996	0.00	7.80	4587.40	8279.49	5203.78	4445.93	2407.24	1430.63	1247.43
1997	0.00	7.97	4227.87	11695.71	4124.40	2622.65	2137.95	1182.57	1072.99
1998	0.00	6.52	4400.15	10634.63	6219.69	2324.12	1280.86	1224.92	884.62
1999	0.00	8.72	3543.79	11125.63	5910.43	3843.25	1103.70	890.81	768.16
2000	0.00	9.57	5115.75	9165.97	6955.76	4165.15	2063.53	872.10	670.86
2001	0.00	6.26	5220.93	12554.86	5757.11	4289.93	2115.33	1381.80	539.60
2002	0.00	5.27	2482.29	13247.05	8225.31	3156.28	2034.77	1191.86	637.93
2003	0.00	5.10	1729.58	7419.14	8792.79	4766.77	1595.56	1301.70	660.58
2004	0.00	5.86	1969.03	7747.81	5156.37	4983.91	2641.21	1022.73	698.30
2005	0.00	4.44	1876.52	6690.62	5011.20	2627.49	2901.19	1853.03	693.66
2006	0.00	4.59	923.54	5552.97	4290.57	2205.78	1564.34	2027.97	976.57
2007	0.00	3.57	512.04	2593.25	3323.38	1538.57	1228.00	996.48	875.45
2008	0.00	4.11	288.27	1600.45	1677.47	1039.69	1083.90	705.56	591.85
2009	0.00	3.79	276.42	1101.21	1473.55	590.08	1042.39	936.04	589.37
2010	0.00	4.41	160.31	1039.63	1005.27	429.06	662.72	706.92	500.02
2011	0.00	6.53	143.72	823.34	1035.86	288.38	655.46	444.29	425.34
2012	0.00	7.11	194.35	880.54	915.12	294.05	739.65	460.26	407.38
2013	0.00	7.92	215.22	1445.05	1040.30	394.79	972.66	486.53	511.43
2014	0.00	16.76	267.03	1585.39	1926.45	602.77	1032.13	816.07	680.89
2015	0.00	15.29	480.93	1601.01	1800.05	1260.82	1274.96	1007.06	983.39
2016	0.00	16.70	397.73	3143.41	1649.49	1174.89	1780.05	1185.85	977.61
2017	0.00	21.60	370.62	2152.92	2945.43	1061.21	1400.20	1665.32	938.87
2018	0.00	34.51	527.91	2018.63	2006.96	2204.39	1472.16	2105.54	1390.85
2019	0.00	41.85	871.05	2461.90	2158.39	1361.33	3153.60	2406.24	1484.79
2020	0.00	40.90	882.70	3163.04	2756.26	1424.75	2374.39	5486.16	1922.52

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	2567.31	133649.23	268813.75	178397.88	70188.97	38059.50	10514.28	3209.82	1149.49
1992	1865.65	118583.06	245690.64	127554.36	82192.52	34078.27	18416.28	5334.84	2072.70
1993	1589.84	85650.29	221079.82	112577.47	57255.00	37898.76	15337.78	8409.38	3098.49
1994	2426.83	72711.19	154156.87	103168.64	48197.11	25882.44	16247.26	6524.32	4417.24
1995	2344.03	114072.21	128075.79	68066.88	45654.85	20384.79	11127.72	6677.26	4064.23
1996	2338.14	101760.41	179890.22	54085.84	27484.34	19034.68	8277.92	4442.08	3873.24
1997	1968.14	105031.03	167844.27	77489.01	21747.28	10989.83	7214.74	3072.01	2787.35
1998	2742.29	90816.02	182943.75	75496.09	33503.92	9437.76	4596.13	2796.65	2019.71
1999	3086.07	127916.87	154406.07	80870.09	32575.64	14832.08	3934.27	1892.49	1631.93
2000	1950.13	145096.18	231408.25	70155.65	35852.46	15348.51	6744.08	1780.89	1369.95
2001	1698.79	82090.03	243346.93	97915.25	27741.45	14750.98	6036.32	2642.47	1031.91
2002	1687.37	75953.50	140322.35	106982.95	42155.89	11539.30	6019.07	2291.37	1226.42
2003	1659.49	69150.85	127445.79	58769.75	44279.62	18266.92	4754.86	2471.85	1254.40
2004	1032.60	68390.99	116302.07	54512.64	24506.11	19089.28	7785.78	2008.06	1371.06
2005	959.97	50339.83	138112.22	59757.04	26576.65	12357.09	9337.71	3747.31	1402.76
2006	825.14	49088.63	102669.86	71705.29	30503.72	13156.91	6157.39	4368.18	2103.50
2007	920.09	39825.96	98777.85	50167.28	34258.39	15601.49	6311.28	3147.19	2764.95
2008	795.22	44722.92	76945.04	47043.97	22859.61	15896.54	7306.64	2841.01	2383.13
2009	816.19	37806.76	87783.54	35535.31	20633.56	10345.38	6820.41	3151.99	1984.61
2010	986.83	34351.61	65206.31	36460.84	14842.28	8817.30	4309.74	2693.93	1905.50
2011	739.39	37736.12	55678.61	26090.76	14458.10	6164.00	3693.74	1808.76	1731.61
2012	559.03	29903.21	69577.61	25233.72	11660.11	6884.45	2966.54	1815.46	1606.85
2013	734.28	23596.82	56286.73	33843.28	11664.31	5558.38	3214.31	1413.90	1486.27
2014	526.93	36815.24	49399.65	29805.91	17830.16	6064.08	2903.64	1659.44	1384.56
2015	474.41	27033.26	87587.40	28395.72	16731.45	10149.04	3584.82	1699.96	1660.01
2016	567.78	27129.71	66521.45	55457.18	17294.11	10285.41	5882.42	2130.52	1756.39
2017	684.68	29219.39	59717.91	34864.28	30149.29	9347.84	5209.89	2809.79	1584.10
2018	549.24	30787.25	56610.01	27812.83	15001.04	14324.32	4047.43	2086.75	1378.44
2019	385.67	21499.36	52868.44	23594.20	11308.10	6180.10	5525.08	1508.23	930.67
2020	337.36	18167.17	46205.11	28184.53	12451.71	6734.68	3549.57	3215.88	1126.94

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	64214.50	132623.17	34160.55	14220.25	3444.85	1533.36	634.48	157.13	56.27
1992	41302.57	96166.65	26167.23	8598.62	3474.12	1207.57	1004.93	240.96	93.62
1993	49623.51	97102.87	31241.28	9746.02	3025.21	1641.04	1010.19	451.99	166.54
1994	101512.11	115036.22	29770.74	11523.55	3190.66	1361.75	1276.45	410.40	277.86
1995	178398.74	336326.40	44033.59	12531.73	4640.90	1561.57	1217.97	562.73	342.52
1996	104744.99	166916.17	33491.72	5522.89	1625.87	900.21	588.61	256.28	223.46
1997	94385.25	173050.57	30149.24	7305.12	1170.56	475.02	472.88	167.14	151.65
1998	138374.66	160602.88	35407.34	7177.63	1767.64	395.44	287.78	147.05	106.20
1999	95228.91	134666.04	18744.69	4866.17	1106.94	414.34	168.90	70.94	61.17
2000	40311.20	102504.07	19023.13	2849.39	844.31	306.70	213.45	50.93	39.18
2001	44075.21	80166.25	31029.53	6711.47	1417.30	813.53	637.05	283.58	110.74
2002	41149.28	79223.40	18504.85	6169.19	1562.72	366.71	258.97	76.26	40.82
2003	41151.63	85979.29	27375.28	7250.88	4135.26	1674.76	564.73	231.56	117.51
2004	28177.79	108140.97	37352.19	11649.97	3969.08	2989.77	1314.58	252.26	172.24
2005	12606.99	41703.52	23991.76	6173.76	1823.59	744.49	515.67	143.61	53.76
2006	10036.03	48040.50	27449.26	12801.52	3814.40	1873.26	799.61	441.98	212.83
2007	6150.95	23871.48	17422.59	5515.23	2402.64	1379.59	541.44	243.28	213.73
2008	4994.60	27451.97	14390.31	4620.32	1072.43	926.21	379.20	161.54	135.51
2009	7417.50	37899.90	23663.16	3703.79	694.28	387.36	186.15	105.83	66.63
2010	3422.77	13329.26	5736.95	766.74	53.89	26.89	6.84	5.45	3.86
2011	1680.95	10513.21	3026.12	238.04	11.51	4.01	1.44	1.16	1.11
2012	1126.17	8961.16	4796.41	253.21	7.59	3.69	0.95	1.05	0.93
2013	1609.89	9785.25	7360.38	762.42	16.15	6.12	1.70	1.29	1.35
2014	1104.56	13066.90	5067.43	447.74	13.48	5.24	1.11	1.11	0.93
2015	1761.05	19001.40	18488.38	824.82	28.85	28.49	3.26	2.28	2.22
2016	1051.52	9716.53	7669.06	707.11	12.45	17.61	3.65	2.12	1.75
2017	204.83	1732.71	1283.87	81.28	4.23	3.48	1.10	1.23	0.70
2018	151.78	1601.40	1090.55	70.27	2.46	5.88	1.09	1.16	0.77
2019	96.95	975.64	903.00	72.41	2.91	4.02	2.28	1.11	0.69
2020	314.13	3494.39	4202.95	669.21	34.32	44.88	11.59	11.90	4.17

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	48863.12	389336.20	301974.04	340652.00	217620.62	151141.87	50751.66	16541.02	5923.59
1992	41222.72	398550.17	319806.69	282393.96	295913.05	158033.74	105075.76	32705.21	12706.69
1993	39932.26	325291.08	324107.19	280196.81	230649.85	195829.65	97589.89	57308.83	21115.78
1994	60889.66	276124.73	226583.51	256663.48	194578.11	133353.69	103273.02	44303.60	29995.42
1995	56930.49	420626.95	182419.12	163229.73	176694.23	100657.28	67774.50	43328.51	26372.68
1996	62339.88	410860.37	279407.08	141109.09	115635.33	102561.07	54920.53	31365.08	27348.58
1997	49147.65	400233.21	246459.80	191163.11	86867.64	56700.60	46519.32	21508.56	19515.55
1998	61738.30	314818.00	246132.52	169770.99	122041.17	44514.76	27084.00	18230.76	13166.02
1999	52674.21	342489.25	163051.56	143904.78	94557.12	56260.14	18795.19	10156.37	8758.05
2000	33675.67	394918.77	251690.45	129513.80	108964.28	61075.26	33867.96	10047.30	7728.88
2001	30966.04	236931.22	286804.47	198757.03	93958.71	65242.95	33819.01	16394.82	6402.31
2002	21233.92	154769.19	123231.63	168746.96	114500.96	41874.02	28172.63	12041.16	6444.84
2003	19061.61	130339.67	106632.34	90950.10	120486.67	66776.32	22570.99	13281.91	6740.23
2004	14795.67	161379.62	122924.08	107323.86	84954.78	87497.86	46233.11	13426.78	9167.55
2005	13135.86	114717.59	145396.51	118323.40	92338.74	55864.49	54337.65	24386.60	9128.82
2006	7919.39	79891.72	81825.23	110335.20	83018.97	46330.56	27877.85	22119.35	10651.59
2007	9157.18	67692.05	85250.85	84285.50	100797.47	58747.33	29863.24	16331.10	14347.59
2008	7641.16	74021.01	67156.98	80964.69	69216.53	62020.73	35522.45	14880.61	12482.35
2009	6022.45	48686.62	62128.07	50783.35	53166.83	34967.57	29149.36	14435.26	9088.95
2010	5321.98	32695.18	34778.39	40699.18	30994.25	24588.25	15508.53	10576.38	7480.99
2011	3515.12	31820.93	26464.48	26788.83	28761.17	16636.33	13035.72	7079.75	6777.76
2012	3996.27	38125.67	49431.81	38708.28	34345.06	27205.65	15016.96	10105.14	8944.02
2013	6147.47	35402.67	47148.29	61087.20	40361.94	25783.40	19015.66	9198.40	9669.21
2014	3279.02	41310.73	31890.25	42107.67	48601.87	22689.12	13869.29	8887.48	7415.33
2015	3151.01	32555.21	61977.97	44318.65	50191.27	42314.39	18986.84	10249.69	10008.80
2016	3005.68	26329.06	39422.46	73776.34	44304.88	37902.06	27816.31	11783.31	9714.11
2017	2996.13	23723.18	30504.13	40735.91	68154.93	31758.06	23154.04	14951.62	8429.38
2018	2280.86	23842.50	27425.46	31134.71	32608.80	48331.68	17969.24	11363.71	7506.50
2019	882.04	9150.01	14252.32	15113.26	14581.94	13073.60	16018.48	5693.93	3513.48
2020	287.51	2863.92	4633.03	6837.14	6241.36	5835.92	4300.99	5295.73	1855.79

TABLE 3.9.1 WESTERN BALTIC SPRING SPAWNING HERRING. Input table for short term predictions.

2020

wr	N	M	Mat	PM	PF	SWt
0	582158	0.3	0.00	0.25	0.1	0.0001
1	499048	0.5	0.00	0.25	0.1	0.0238
2	341652	0.2	0.20	0.25	0.1	0.0484
3	261726	0.2	0.75	0.25	0.1	0.0781
4	143557	0.2	0.90	0.25	0.1	0.1039
5	86485	0.2	1.00	0.25	0.1	0.1465
6	48739	0.2	1.00	0.25	0.1	0.1644
7	43227	0.2	1.00	0.25	0.1	0.1686
8+	15148	0.2	1.00	0.25	0.1	0.1809

2021

wr	N	M	Mat	PM	PF	SWt
0	859579	0.3	0.00	0.25	0.1	0.0001
1		0.5	0.00	0.25	0.1	0.0187
2		0.2	0.20	0.25	0.1	0.0487
3		0.2	0.75	0.25	0.1	0.0801
4		0.2	0.90	0.25	0.1	0.1111
5		0.2	1.00	0.25	0.1	0.1414
6		0.2	1.00	0.25	0.1	0.1637
7		0.2	1.00	0.25	0.1	0.1743
8+		0.2	1.00	0.25	0.1	0.1845

2022

wr	N	M	Mat	PM	PF	SWt
0	859579	0.3	0.00	0.25	0.1	0.0001
1		0.5	0.00	0.25	0.1	0.0187
2		0.2	0.20	0.25	0.1	0.0487
3		0.2	0.75	0.25	0.1	0.0801
4		0.2	0.90	0.25	0.1	0.1111
5		0.2	1.00	0.25	0.1	0.1414
6		0.2	1.00	0.25	0.1	0.1637
7		0.2	1.00	0.25	0.1	0.1743
8+		0.2	1.00	0.25	0.1	0.1845

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_{2020} wr 0-8+:	Populations numbers from the assessment
$N_{2021/2022}$ wr 0:	Average of wr 0 for the years 2015-2019
Natural Mortality (M):	Constant
Weight in the Stock 2021-2022 (SWt):	Average for 2016-2020

TABLE 3.9.2 WESTERN BALTIC SPRING SPAWNING HERRING
***Multi fleet*/Forecast table. MSY approach (zero catch)**

Year	2020	2021	2022	2023	2024
fbar:Estimate	0.193	0.174	0.000	0.000	0.000
fbar:low	0.193	0.174	0.000	0.000	0.000
fbar:high	0.193	0.174	0.000	0.000	0.000
rec:Estimate	582158	859579	859579	859579	859579
rec:low	582158	859579	859579	859579	859579
rec:high	582158	859579	859579	859579	859579
ssb:Estimate	58434	65046	68903	83794	102194
ssb:low	58434	65046	68903	83794	102194
ssb:high	58434	65046	68903	83794	102194
catch:Estimate	19436	19088	0	0	0
catch:low	19436	19088	0	0	0
catch:high	19436	19088	0	0	0

Per fleet

Year	2020	2021	2022	2023	2024
Fleet A : Estimate	2878	5241	0	0	0
Fleet C : Estimate	11759	12076	0	0	0
Fleet D : Estimate	643	196	0	0	0
Fleet F : Estimate	4156	1575	0	0	0

TABLE 3.9.3 WESTERN BALTIC SPRING SPAWNING HERRING
***Multi fleet*/Forecast table. MAP 2018: F=FMSY(0.31)*SSBy-1/MSYBtrigger**

Year	2020	2021	2022	2023	2024
fbar:Estimate	0.193	0.174	0.134	0.140	0.148
fbar:low	0.193	0.174	0.134	0.140	0.148
fbar:high	0.193	0.174	0.134	0.140	0.148
rec:Estimate	582158	859579	859579	859579	859579
rec:low	582158	859579	859579	859579	859579
rec:high	582158	859579	859579	859579	859579
ssb:Estimate	58434	65046	67797	71788	77726
ssb:low	58434	65046	67797	71788	77726
ssb:high	58434	65046	67797	71788	77726
catch:Esti-mate	19436	19088	12499	14444	16553
catch:low	19436	19088	12499	14444	16553
catch:high	19436	19088	12499	14444	16553

Per fleet

Year	2020	2021	2022	2023	2024
Fleet A : Estimate	2878	5241	1989	2349	2770
Fleet C : Estimate	11759	12076	4188	4781	5408
Fleet D : Estimate	643	196	73	92	99
Fleet F : Estimate	4156	1575	6250	7222	8277

TABLE 3.9.4 WESTERN BALTIC SPRING SPAWNING HERRING
***Multi fleet*/Forecast table. MAP 2018: F=FMSYlower(0.216)*SSBy-1/MSYBtrigger**

Year	2020	2021	2022	2023	2024
fbar:Estimate	0.193	0.174	0.094	0.098	0.108
fbar:low	0.193	0.174	0.094	0.098	0.108
fbar:high	0.193	0.174	0.094	0.098	0.108
rec:Estimate	582158	859579	859579	859579	859579
rec:low	582158	859579	859579	859579	859579
rec:high	582158	859579	859579	859579	859579
ssb:Estimate	58434	65046	68130	75182	84139
ssb:low	58434	65046	68130	75182	84139
ssb:high	58434	65046	68130	75182	84139
catch:Esti-mate	19436	19088	8922	10821	13389
catch:low	19436	19088	8922	10821	13389
catch:high	19436	19088	8922	10821	13389

Per fleet

Year	2020	2021	2022	2023	2024
Fleet A : Estimate	2878	5241	1433	1814	2351
Fleet C : Estimate	11759	12076	2977	3531	4268
Fleet D : Estimate	643	196	51	66	75
Fleet F : Estimate	4156	1575	4461	5411	6694

TABLE 3.9.5 WESTERN BALTIC SPRING SPAWNING HERRING
***Multi fleet*/Forecast table. MAP 2018: F=FMSYupper(0.379)*SSBy-1/MSYBtrigger**

Year	2020	2021	2022	2023	2024
fbar:Estimate	0.193	0.174	0.164	0.171	0.175
fbar:low	0.193	0.174	0.164	0.171	0.175
fbar:high	0.193	0.174	0.164	0.171	0.175
rec:Estimate	582158	859579	859579	859579	859579
rec:low	582158	859579	859579	859579	859579
rec:high	582158	859579	859579	859579	859579
ssb:Estimate	58434	65046	67554	69420	73471
ssb:low	58434	65046	67554	69420	73471
ssb:high	58434	65046	67554	69420	73471
catch:Esti-mate	19436	19088	15017	16762	18221
catch:low	19436	19088	15017	16762	18221
catch:high	19436	19088	15017	16762	18221

Per fleet

Year	2020	2021	2022	2023	2024
Fleet A : Estimate	2878	5241	2373	2667	2943
Fleet C : Estimate	11759	12076	5047	5605	6054
Fleet D : Estimate	643	196	88	109	114
Fleet F : Estimate	4156	1575	7509	8381	9111

TABLE 3.9.6 WESTERN BALTIC SPRING SPAWNING HERRING
***Multi fleet*/Forecast table. F=FMSY=0.31**

Year	2020	2021	2022	2023	2024
fbar:Estimate	0.193	0.174	0.310	0.310	0.310
fbar:low	0.193	0.174	0.310	0.310	0.310
fbar:high	0.193	0.174	0.310	0.310	0.310
rec:Estimate	582158	859579	859579	859579	859579
rec:low	582158	859579	859579	859579	859579
rec:high	582158	859579	859579	859579	859579
ssb:Estimate	58434	65046	66384	59264	57166
ssb:low	58434	65046	66384	59264	57166
ssb:high	58434	65046	66384	59264	57166
catch:Estimate	19436	19088	26098	24439	23508
catch:low	19436	19088	26098	24439	23508
catch:high	19436	19088	26098	24439	23508

Per fleet

Year	2020	2021	2022	2023	2024
Fleet A : Estimate	2878	5241	3995	3500	3206
Fleet C : Estimate	11759	12076	8894	8538	8369
Fleet D : Estimate	643	196	160	182	179
Fleet F : Estimate	4156	1575	13049	12220	11754

TABLE 3.9.7 WESTERN BALTIC SPRING SPAWNING HERRING
***Multi fleet*/Forecast table. F=Fpa=0.41**

Year	2020	2021	2022	2023	2024
fbar:Estimate	0.193	0.174	0.410	0.410	0.410
fbar:low	0.193	0.174	0.410	0.410	0.410
fbar:high	0.193	0.174	0.410	0.410	0.410
rec:Estimate	582158	859579	859579	859579	859579
rec:low	582158	859579	859579	859579	859579
rec:high	582158	859579	859579	859579	859579
ssb:Estimate	58434	65046	65595	53327	48490
ssb:low	58434	65046	65595	53327	48490
ssb:high	58434	65046	65595	53327	48490
catch:Esti-mate	19436	19088	32716	28002	25412
catch:low	19436	19088	32716	28002	25412
catch:high	19436	19088	32716	28002	25412

Per fleet

Year	2020	2021	2022	2023	2024
Fleet A : Estimate	2878	5241	4906	3728	3075
Fleet C : Estimate	11759	12076	11246	10047	9413
Fleet D : Estimate	643	196	206	226	218
Fleet F : Estimate	4156	1575	16358	14001	12706

TABLE 3.9.8 WESTERN BALTIC SPRING SPAWNING HERRING
***Multi fleet*/Forecast table. F=Flim=0.45**

Year	2020	2021	2022	2023	2024
fbar:Estimate	0.193	0.174	0.450	0.450	0.450
fbar:low	0.193	0.174	0.450	0.450	0.450
fbar:high	0.193	0.174	0.450	0.450	0.450
rec:Estimate	582158	859579	859579	859579	859579
rec:low	582158	859579	859579	859579	859579
rec:high	582158	859579	859579	859579	859579
ssb:Estimate	58434	65046	65283	51161	45523
ssb:low	58434	65046	65283	51161	45523
ssb:high	58434	65046	65283	51161	45523
catch:Esti-mate	19436	19088	35167	29079	25854
catch:low	19436	19088	35167	29079	25854
catch:high	19436	19088	35167	29079	25854

Per fleet

Year	2020	2021	2022	2023	2024
Fleet A : Estimate	2878	5241	5232	3761	2985
Fleet C : Estimate	11759	12076	12128	10537	9711
Fleet D : Estimate	643	196	223	242	231
Fleet F : Estimate	4156	1575	17584	14540	12927

TABLE 3.9.9 WESTERN BALTIC SPRING SPAWNING HERRING
***Multi fleet/*Forecast table. F=F2021=0.174**

Year	2020	2021	2022	2023	2024
fbar:Estimate	0.193	0.174	0.174	0.174	0.174
fbar:low	0.193	0.174	0.174	0.174	0.174
fbar:high	0.193	0.174	0.174	0.174	0.174
rec:Estimate	582158	859579	859579	859579	859579
rec:low	582158	859579	859579	859579	859579
rec:high	582158	859579	859579	859579	859579
ssb:Estimate	58434	65046	67476	68733	72726
ssb:low	58434	65046	67476	68733	72726
ssb:high	58434	65046	67476	68733	72726
catch:Estimate	19436	19088	15811	16891	17898
catch:low	19436	19088	15811	16891	17898
catch:high	19436	19088	15811	16891	17898

Per fleet

Year	2020	2021	2022	2023	2024
Fleet A : Estimate	2878	5241	2493	2673	2875
Fleet C : Estimate	11759	12076	5319	5662	5962
Fleet D : Estimate	643	196	93	111	113
Fleet F : Estimate	4156	1575	7905	8445	8949

TABLE 3.9.10 WESTERN BALTIC SPRING SPAWNING HERRING
***Multi fleet/*Forecast table. F=0**

Year	2020	2021	2022	2023	2024
fbar:Estimate	0.193	0.174	0.000	0.000	0.000
fbar:low	0.193	0.174	0.000	0.000	0.000
fbar:high	0.193	0.174	0.000	0.000	0.000
rec:Estimate	582158	859579	859579	859579	859579
rec:low	582158	859579	859579	859579	859579
rec:high	582158	859579	859579	859579	859579
ssb:Estimate	58434	65046	68903	83794	102194
ssb:low	58434	65046	68903	83794	102194
ssb:high	58434	65046	68903	83794	102194
catch:Esti-mate	19436	19088	0	0	0
catch:low	19436	19088	0	0	0
catch:high	19436	19088	0	0	0

Per fleet

Year	2020	2021	2022	2023	2024
Fleet A : Estimate	2878	5241	0	0	0
Fleet C : Estimate	11759	12076	0	0	0
Fleet D : Estimate	643	196	0	0	0
Fleet F : Estimate	4156	1575	0	0	0

TABLE 3.9.11 WESTERN BALTIC SPRING SPAWNING HERRING
***Multi fleet/*Forecast table. F=0.05**

Year	2020	2021	2022	2023	2024
fbar:Estimate	0.193	0.174	0.050	0.050	0.050
fbar:low	0.193	0.174	0.050	0.050	0.050
fbar:high	0.193	0.174	0.050	0.050	0.050
rec:Estimate	582158	859579	859579	859579	859579
rec:low	582158	859579	859579	859579	859579
rec:high	582158	859579	859579	859579	859579
ssb:Estimate	58434	65046	68489	79076	92308
ssb:low	58434	65046	68489	79076	92308
ssb:high	58434	65046	68489	79076	92308
catch:Esti-mate	19436	19088	4889	5952	7031
catch:low	19436	19088	4889	5952	7031
catch:high	19436	19088	4889	5952	7031

Per fleet

Year	2020	2021	2022	2023	2024
Fleet A : Estimate	2878	5241	793	1031	1306
Fleet C : Estimate	11759	12076	1624	1910	2173
Fleet D : Estimate	643	196	28	35	36
Fleet F : Estimate	4156	1575	2445	2976	3515

TABLE 3.9.12 WESTERN BALTIC SPRING SPAWNING HERRING
***Multi fleet*/Forecast table. F=0.1**

Year	2020	2021	2022	2023	2024
fbar:Estimate	0.193	0.174	0.100	0.100	0.100
fbar:low	0.193	0.174	0.100	0.100	0.100
fbar:high	0.193	0.174	0.100	0.100	0.100
rec:Estimate	582158	859579	859579	859579	859579
rec:low	582158	859579	859579	859579	859579
rec:high	582158	859579	859579	859579	859579
ssb:Estimate	58434	65046	68078	74685	83653
ssb:low	58434	65046	68078	74685	83653
ssb:high	58434	65046	68078	74685	83653
catch:Estimate	19436	19088	9489	10945	12343
catch:low	19436	19088	9489	10945	12343
catch:high	19436	19088	9489	10945	12343

Per fleet

Year	2020	2021	2022	2023	2024
Fleet A : Estimate	2878	5241	1522	1828	2164
Fleet C : Estimate	11759	12076	3168	3577	3938
Fleet D : Estimate	643	196	55	67	69
Fleet F : Estimate	4156	1575	4745	5472	6172

TABLE 3.9.13 WESTERN BALTIC SPRING SPAWNING HERRING
***Multi fleet/*Forecast table. F=0.15**

Year	2020	2021	2022	2023	2024
fbar:Estimate	0.193	0.174	0.150	0.150	0.150
fbar:low	0.193	0.174	0.150	0.150	0.150
fbar:high	0.193	0.174	0.150	0.150	0.150
rec:Estimate	582158	859579	859579	859579	859579
rec:low	582158	859579	859579	859579	859579
rec:high	582158	859579	859579	859579	859579
ssb:Estimate	58434	65046	67670	70596	76048
ssb:low	58434	65046	67670	70596	76048
ssb:high	58434	65046	67670	70596	76048
catch:Esti-mate	19436	19088	13821	15131	16347
catch:low	19436	19088	13821	15131	16347
catch:high	19436	19088	13821	15131	16347

Per fleet

Year	2020	2021	2022	2023	2024
Fleet A : Estimate	2878	5241	2191	2437	2702
Fleet C : Estimate	11759	12076	4638	5032	5372
Fleet D : Estimate	643	196	81	97	99
Fleet F : Estimate	4156	1575	6910	7565	8174

TABLE 3.9.14 WESTERN BALTIC SPRING SPAWNING HERRING
***Multi fleet*/Forecast table. Constant 2021 TAC**

Year	2020	2021	2022	2023	2024
fbar:Estimate	0.193	0.174	0.169	0.157	0.145
fbar:low	0.193	0.174	0.169	0.157	0.145
fbar:high	0.193	0.174	0.169	0.157	0.145
rec:Estimate	582158	859579	859579	859579	859579
rec:low	582158	859579	859579	859579	859579
rec:high	582158	859579	859579	859579	859579
ssb:Estimate	58434	65046	67529	68201	71588
ssb:low	58434	65046	67529	68201	71588
ssb:high	58434	65046	67529	68201	71588
catch:Esti-mate	19436	19088	19088	19088	19088
catch:low	19436	19088	19088	19088	19088
catch:high	19436	19088	19088	19088	19088

Per fleet

Year	2020	2021	2022	2023	2024
Fleet A : Estimate	2878	5241	5241	5241	5241
Fleet C : Estimate	11759	12076	12076	12076	12076
Fleet D : Estimate	643	196	196	196	196
Fleet F : Estimate	4156	1575	1575	1575	1575

TABLE 3.9.15 WESTERN BALTIC SPRING SPAWNING HERRING
***Multi fleet/*Forecast table. Catch for bycatch fleets only**

Year	2020	2021	2022	2023	2024
fbar:Estimate	0.193	0.174	0.036	0.028	0.022
fbar:low	0.193	0.174	0.036	0.028	0.022
fbar:high	0.193	0.174	0.036	0.028	0.022
rec:Estimate	582158	859579	859579	859579	859579
rec:low	582158	859579	859579	859579	859579
rec:high	582158	859579	859579	859579	859579
ssb:Estimate	58434	65046	68464	79423	94210
ssb:low	58434	65046	68464	79423	94210
ssb:high	58434	65046	68464	79423	94210
catch:Esti-mate	19436	19088	5437	5437	5437
catch:low	19436	19088	5437	5437	5437
catch:high	19436	19088	5437	5437	5437

Per fleet

Year	2020	2021	2022	2023	2024
Fleet A : Estimate	2878	5241	5241	5241	5241
Fleet C : Estimate	11759	12076	0	0	0
Fleet D : Estimate	643	196	196	196	196
Fleet F : Estimate	4156	1575	0	0	0

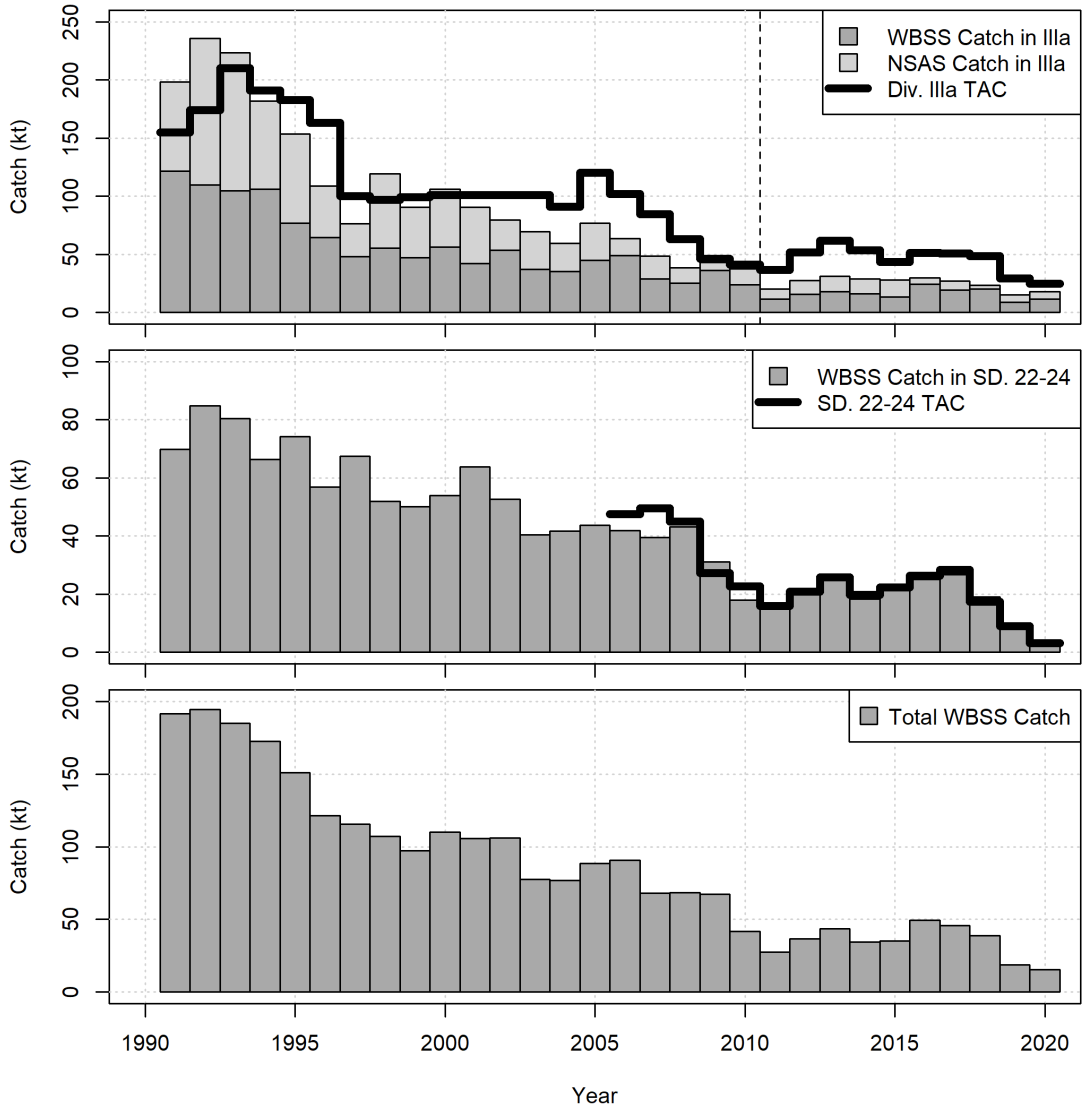


Figure 3.1.1 Western Baltic Spring Spawning Herring. CATCH and TACs (1000 t) by area. Note, the TAC for Division 3.a excludes the by-catch TAC, while the CATCH includes the by-catch.

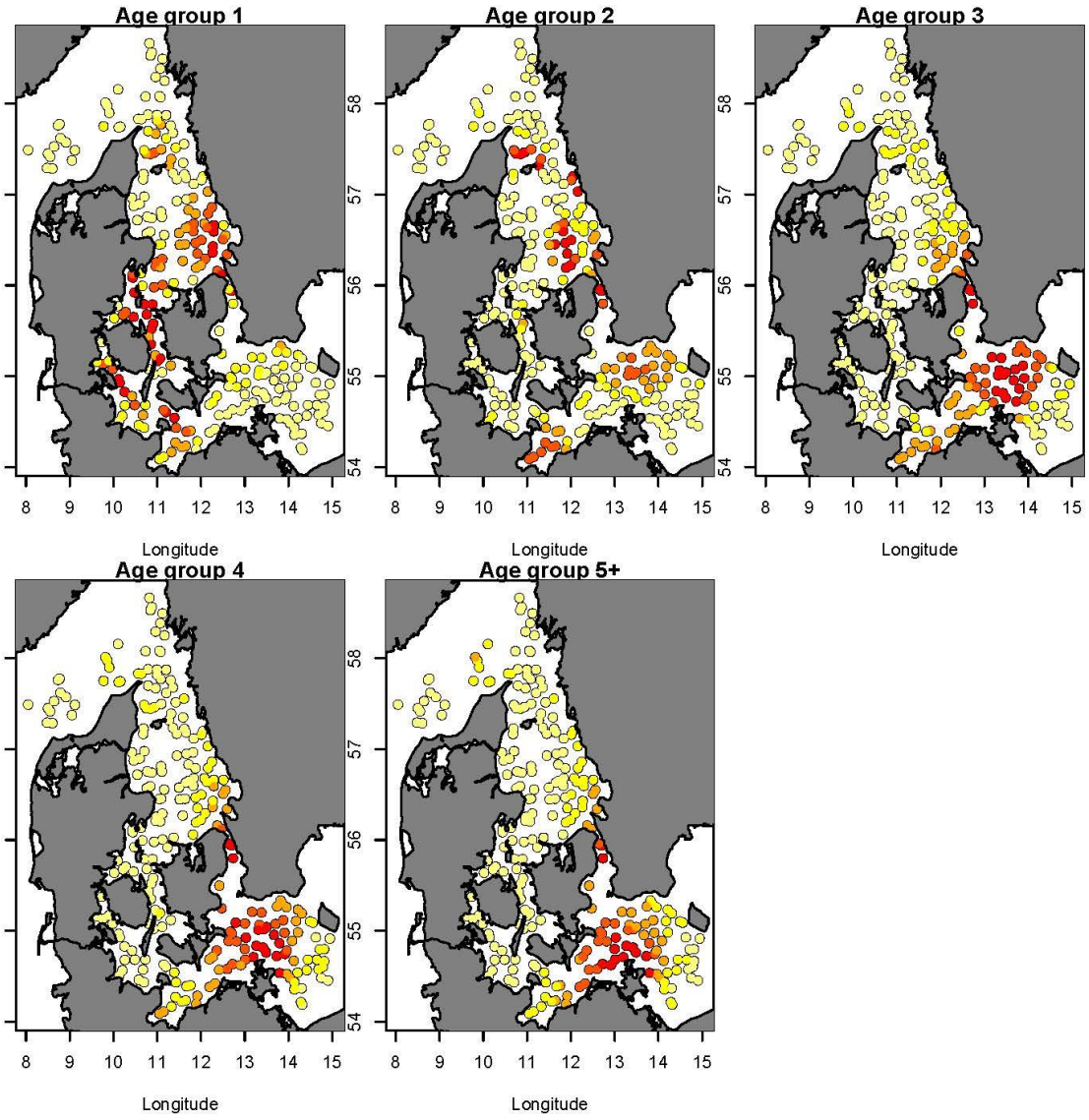


Figure 3.3.1 WESTERN BALTIC SPRING SPAWNING HERRING. Map showing distribution of hauls and the density of fish per age in the IBTS+BITS-Q1 survey.

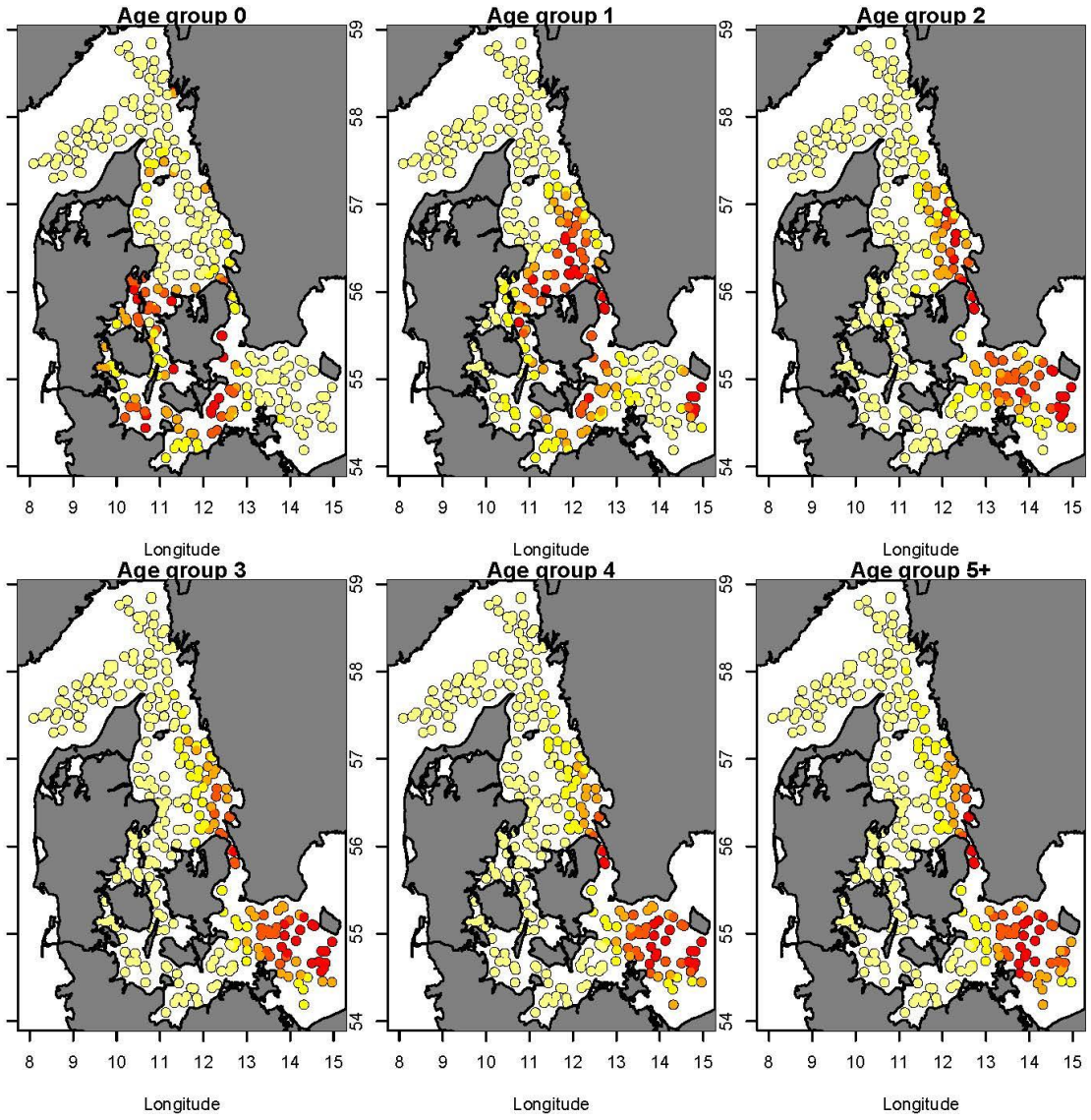


Figure 3.3.2 WESTERN BALTIC SPRING SPAWNING HERRING. Map showing distribution of hauls and the density of fish per age in the IBTS+BITS-Q3.4 survey.

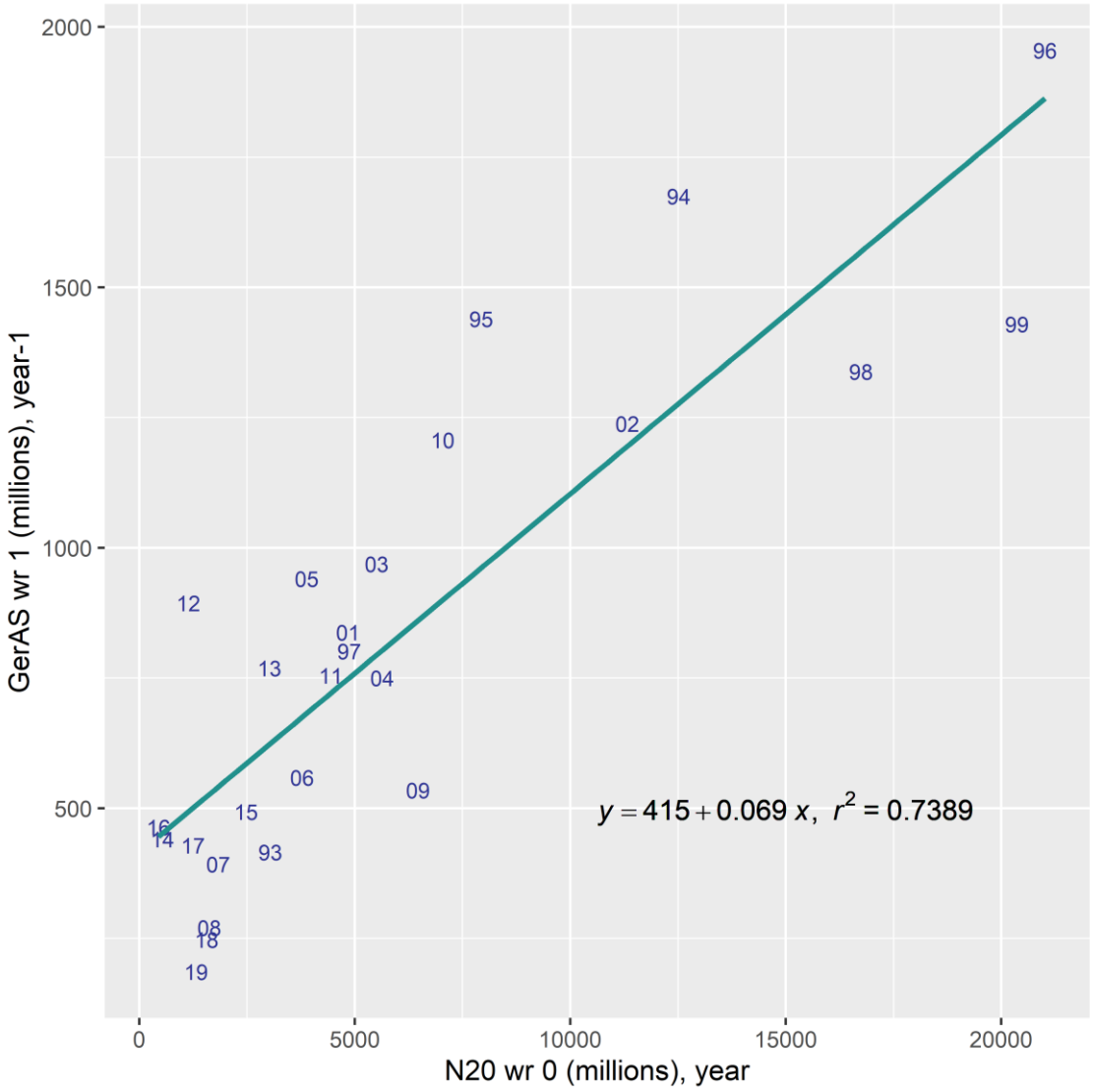


Figure 3.5.1 WESTERN BALTIC SPRING SPAWNING HERRING. Correlation of 1 wr herring from GERAS with the N20 larvae index. Note the year lag between surveys. Labels show the year of the N20.

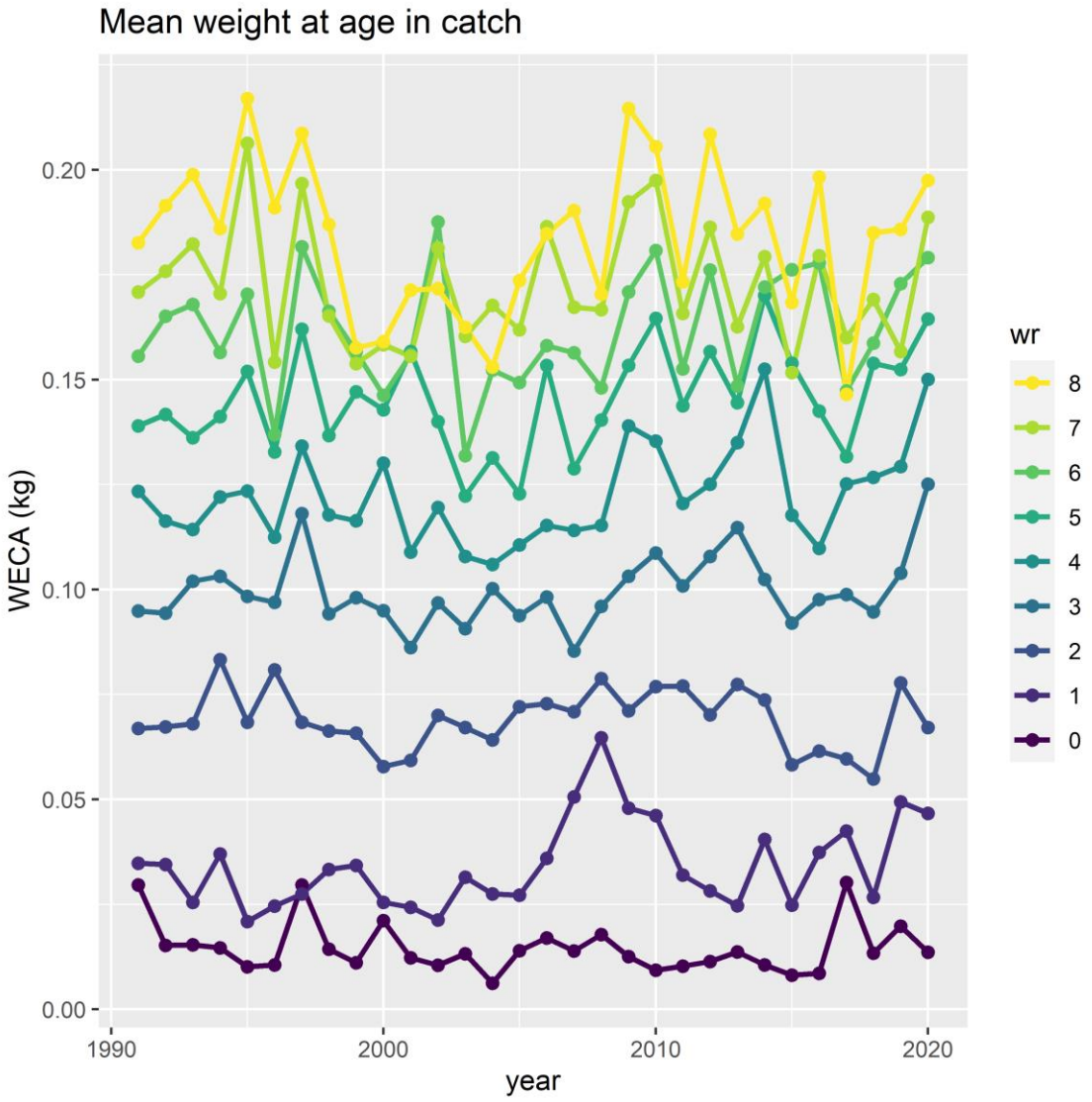


Figure 3.6.1.1 WESTERN BALTIC SPRING SPAWNING HERRING. Weight (kg) at age as W-ringers (wr) in the catch (WECA).

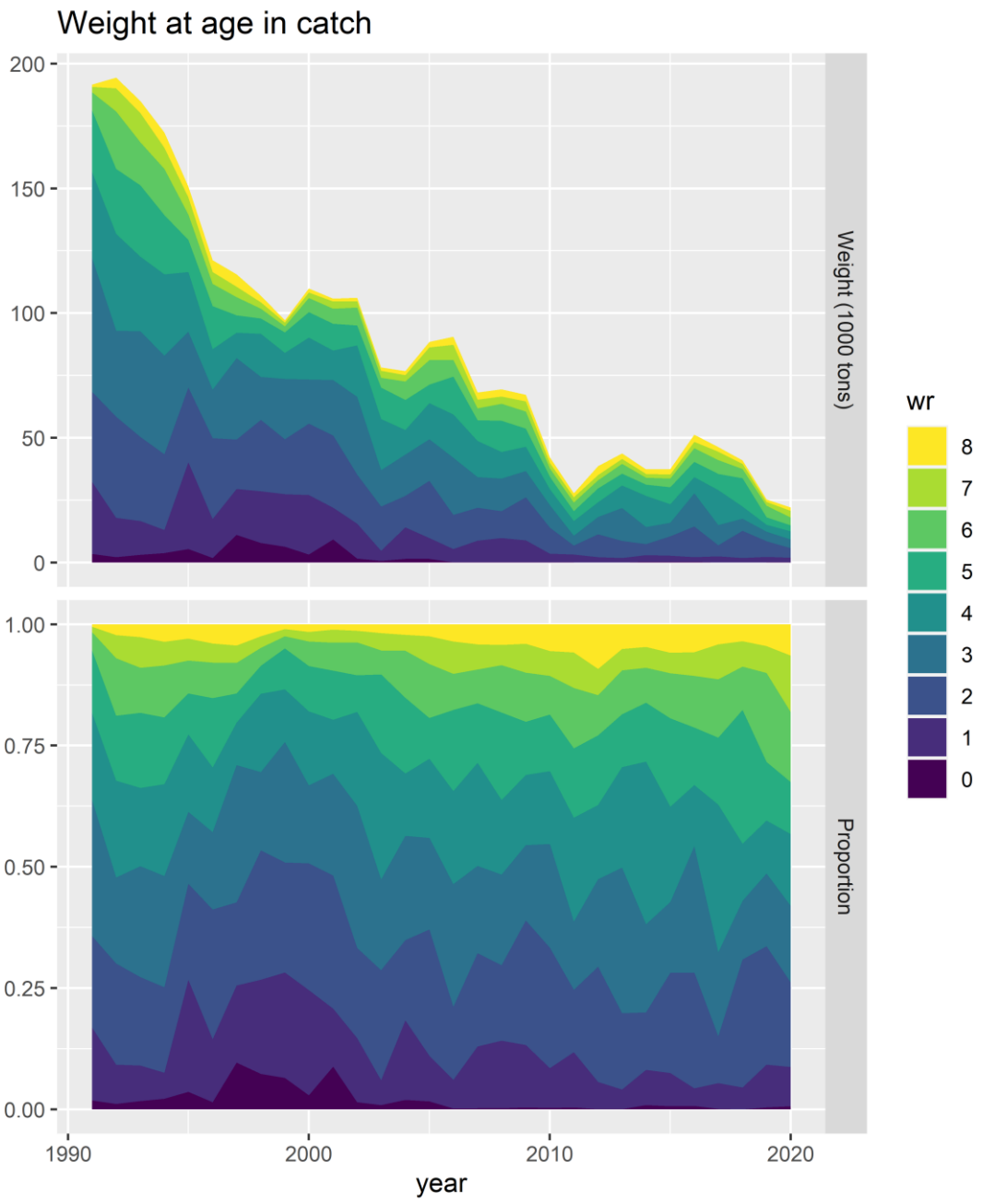


Figure 3.6.1.2 WESTERN BALTIC SPRING SPAWNING HERRING. Catch in weight. Upper panel: Catch in weight (1000 tons) at age as W-ringers (wr). Lower panel: Proportion (by weight) of a given age as W-ringers (wr) in the catch.

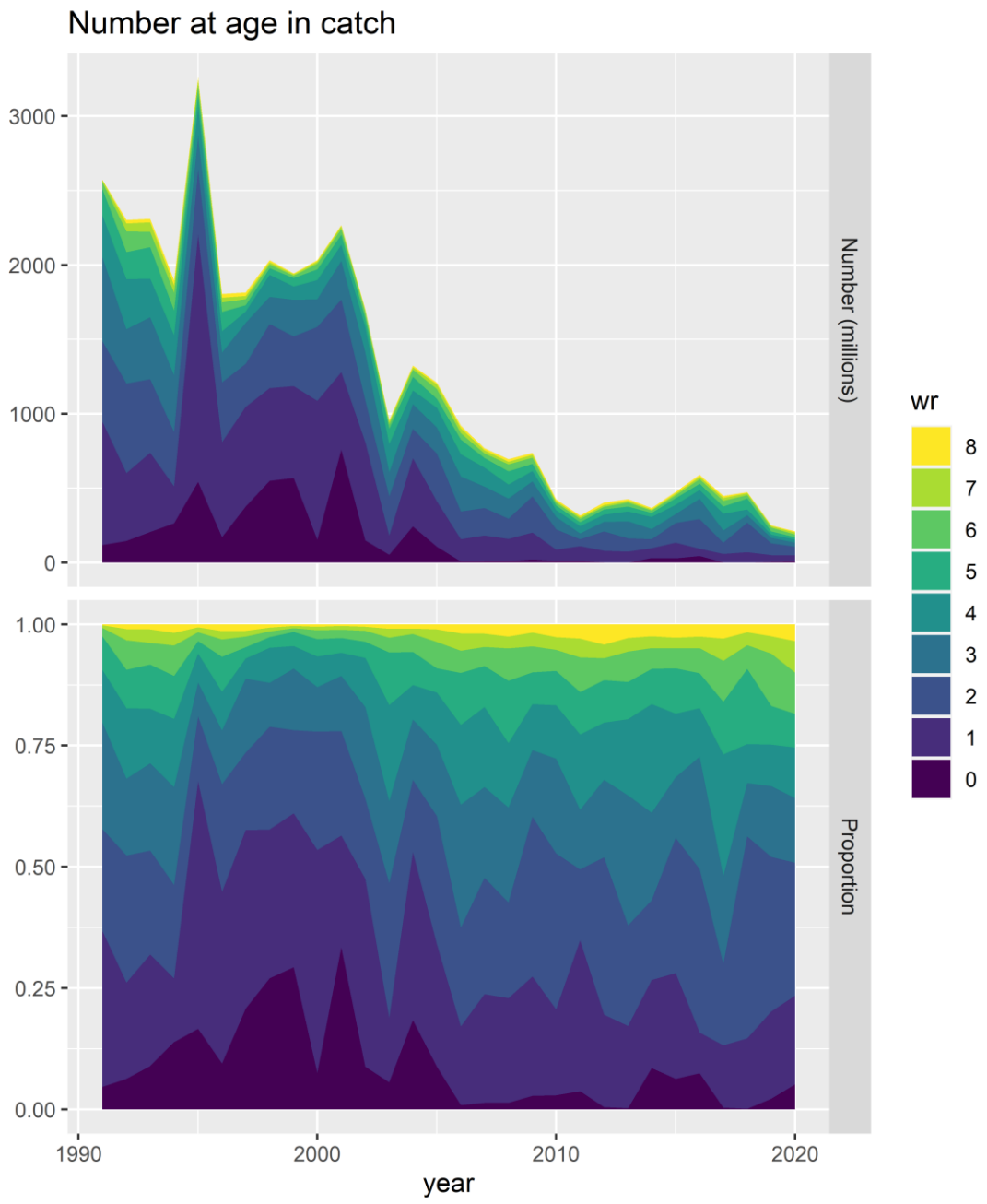


Figure 3.6.1.3 WESTERN BALTIC SPRING SPAWNING HERRING. Catch in Numbers. Upper panel: Catch in numbers (millions) at age as W-ringers (wr). Lower panel: Proportion (by number) of a given age as W-ringers (wr) in the catch.

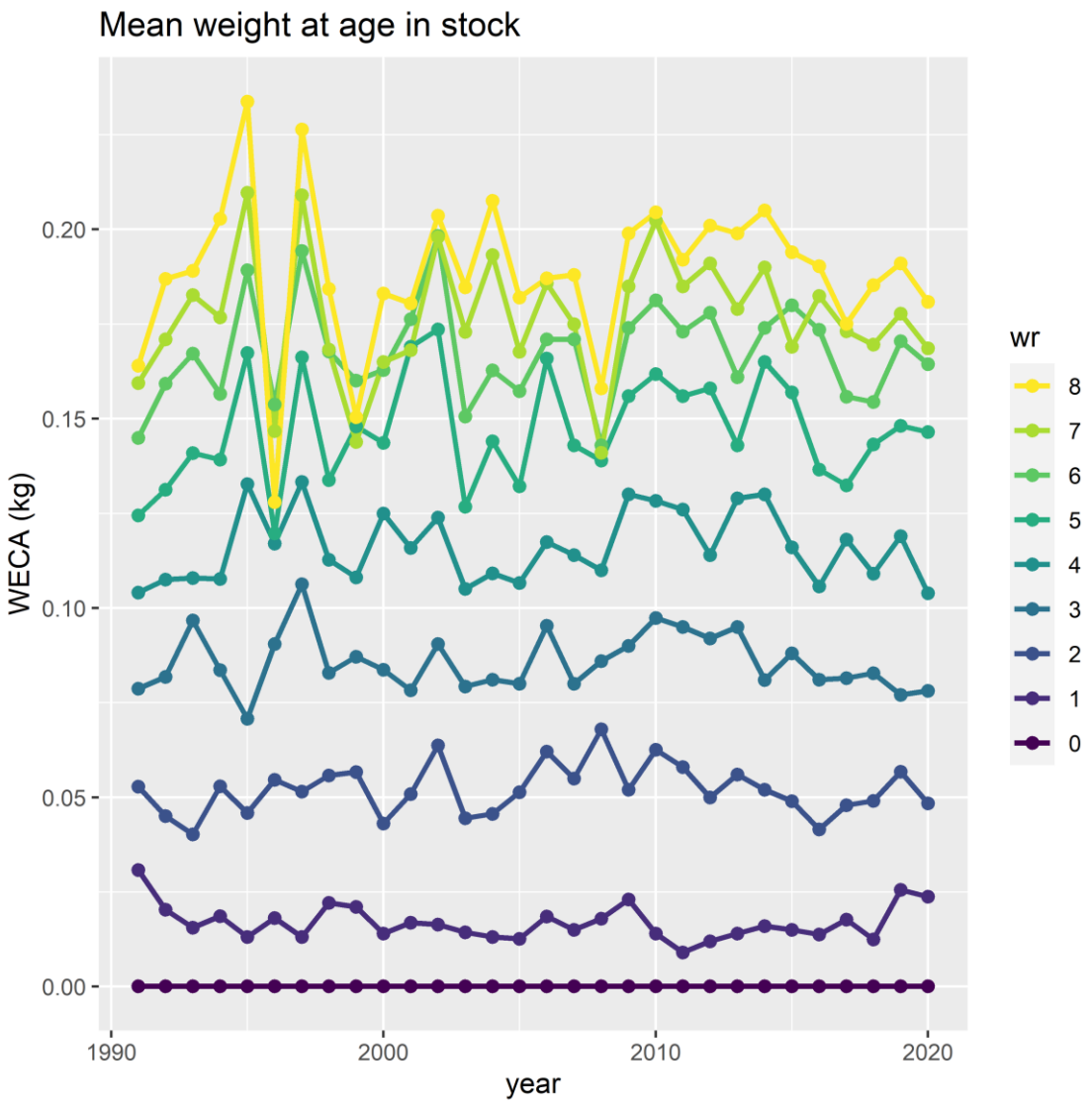


Figure 3.6.1.4 WESTERN BALTIC SPRING SPAWNING HERRING. Weight (kg) at age as W-ringers (wr) in the catch (WEST).

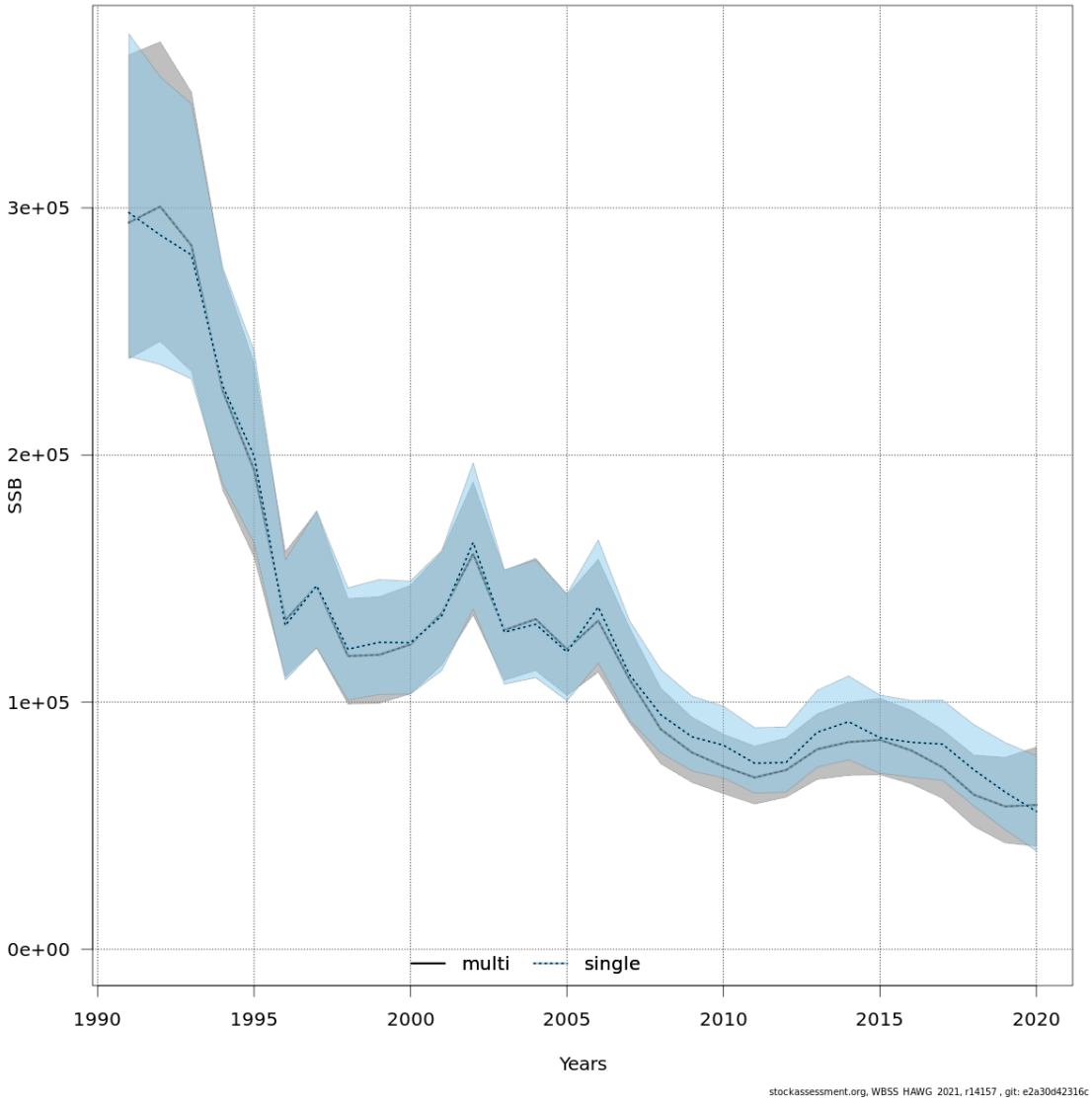


Figure 3.6.4.1 WESTERN BALTIC SPRING SPAWNING HERRING. Stock summary plot. Spawning stock biomass (SSB). Estimates from the WBSS multi fleet (multi) and the WBSS single fleet (single) assessment runs and point wise 95% confidence intervals are shown by line and shaded area.

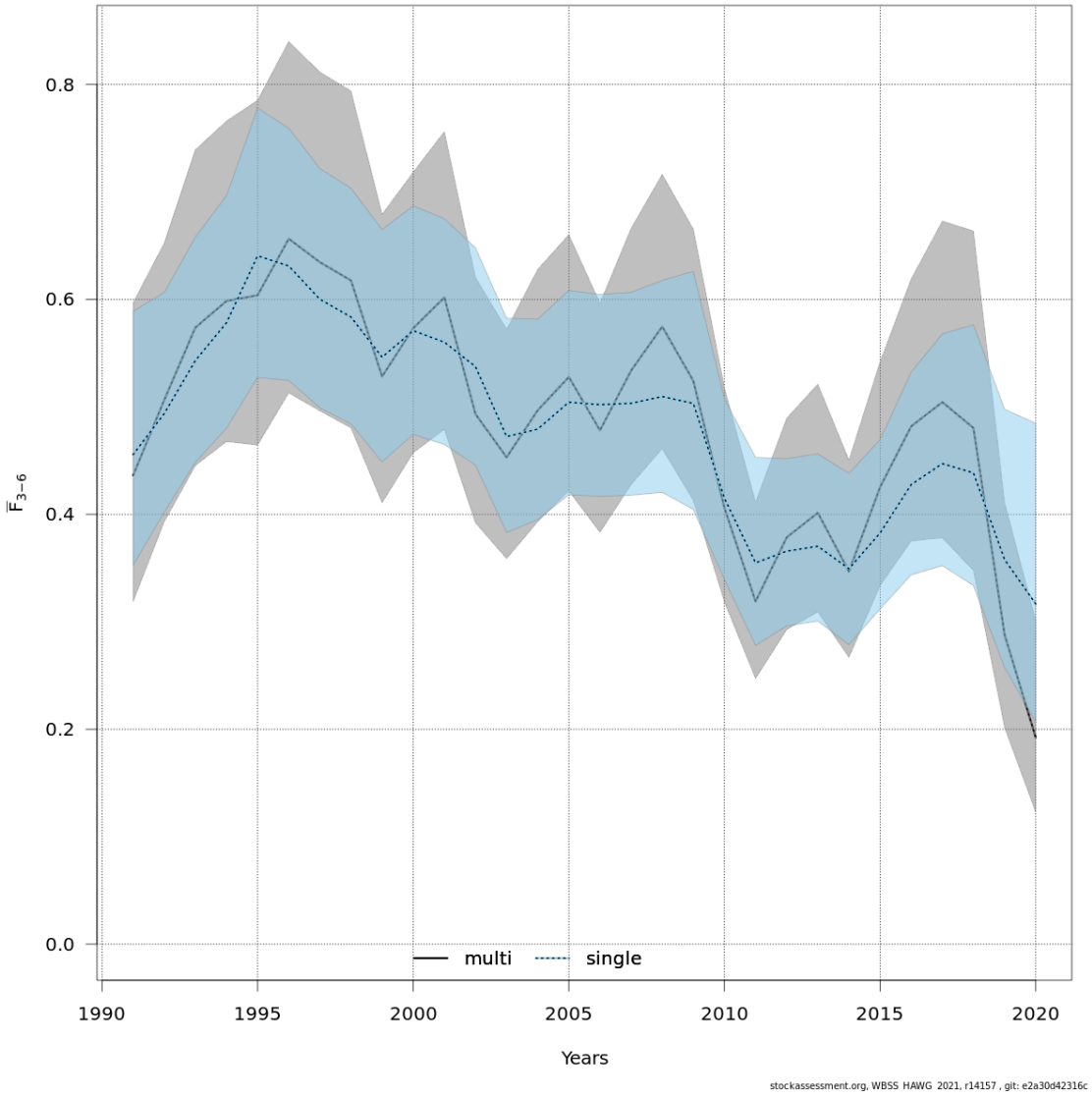


Figure 3.6.4.2 WESTERN BALTIC SPRING SPAWNING HERRING. Stock summary plot. Average fishing mortality (F) for the shown age range. Estimates from the WBSS multi fleet (multi) and the WBSS single fleet (single) assessment runs and point wise 95% confidence intervals are shown by line and shaded area.

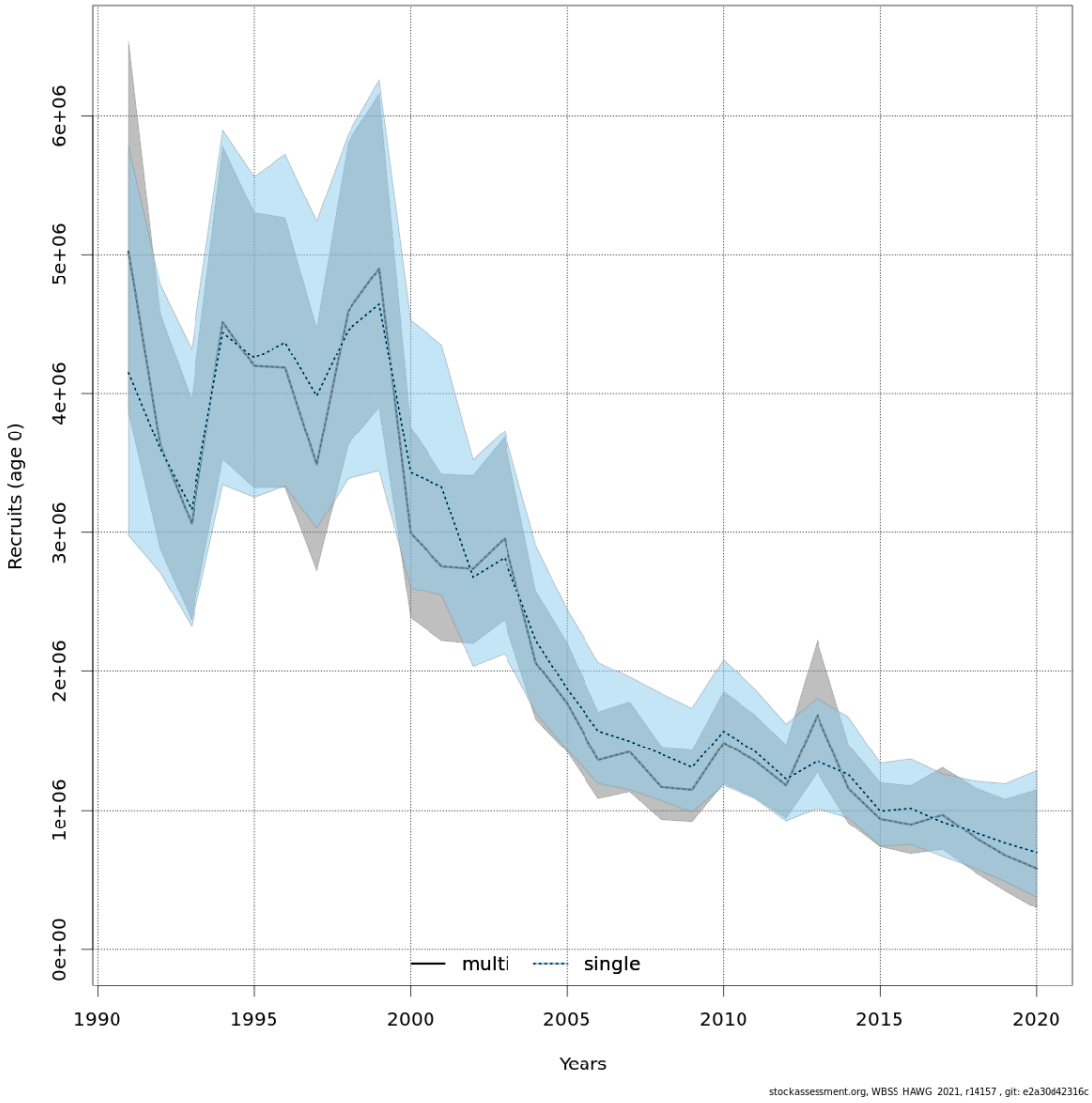


Figure 3.6.4.3 WESTERN BALTIC SPRING SPAWNING HERRING. Stock summary plot. Yearly recruitment (age 0 equal 0 W-ringers). Estimates from the WBSS multi fleet (multi) and the WBSS single fleet (single) assessment runs and point wise 95% confidence intervals are shown by line and shaded area.

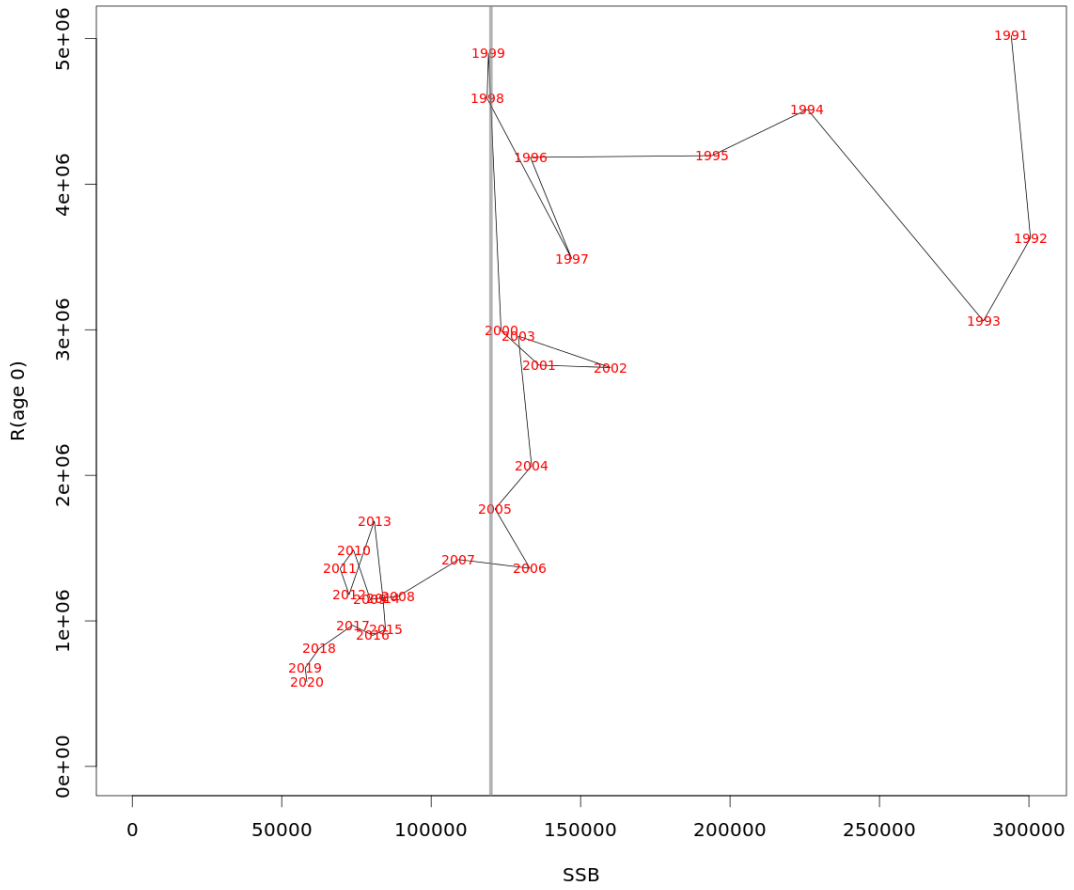


Figure 3.6.4.4 WESTERN BALTIC SPRING SPAWNING HERRING. Recruitment at age 0-wr (in thousands) is plotted against spawning stock biomass (tonnes) as estimated by the assessment.

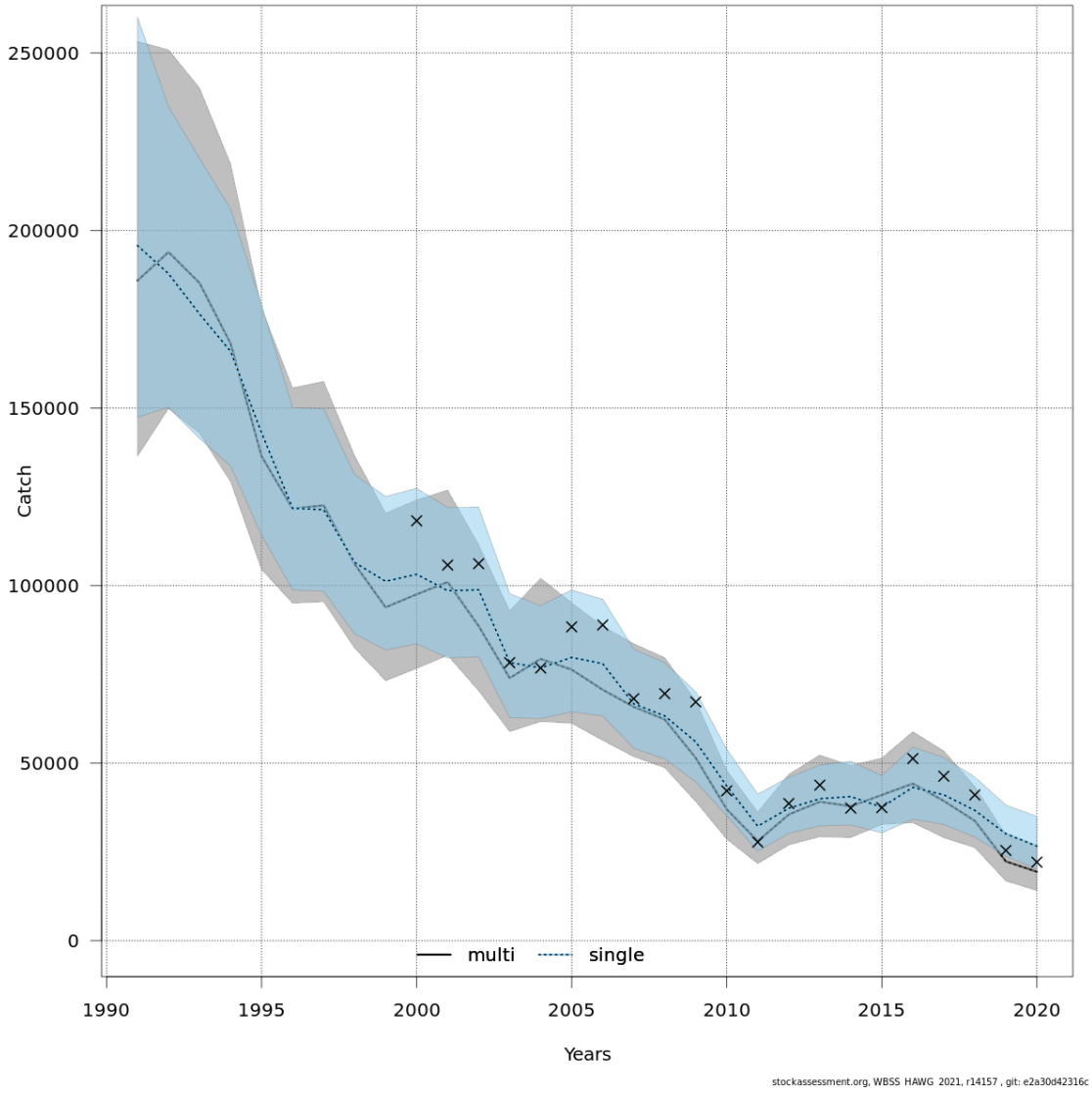


Figure 3.6.4.5 WESTERN BALTIC SPRING SPAWNING HERRING. Total catch in weight (tonnes). Prediction from the WBSS multi fleet (multi) and the WBSS single fleet (single) assessment runs and point wise 95% confidence intervals are shown by line and shaded area. The yearly observed total catch weight (crosses)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

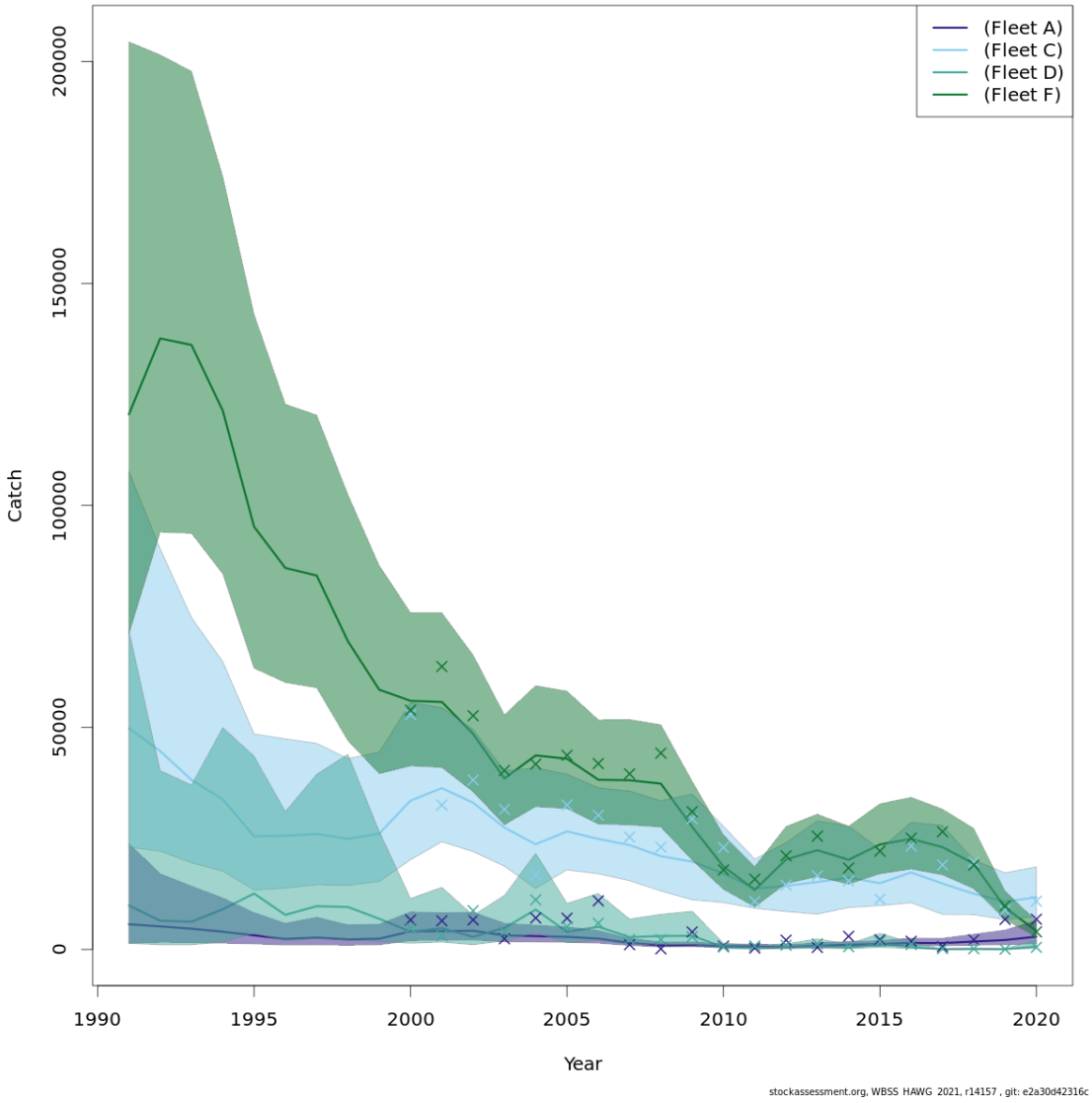


Figure 3.6.4.6 WESTERN BALTIC SPRING SPAWNING HERRING. Total catch in weight (tonnes) by fleet. Prediction from the WBSS multi fleet assessment run and point wise 95% confidence intervals are shown by line and shaded area. The plot also shows the observed total catch weight per fleet (crosses)

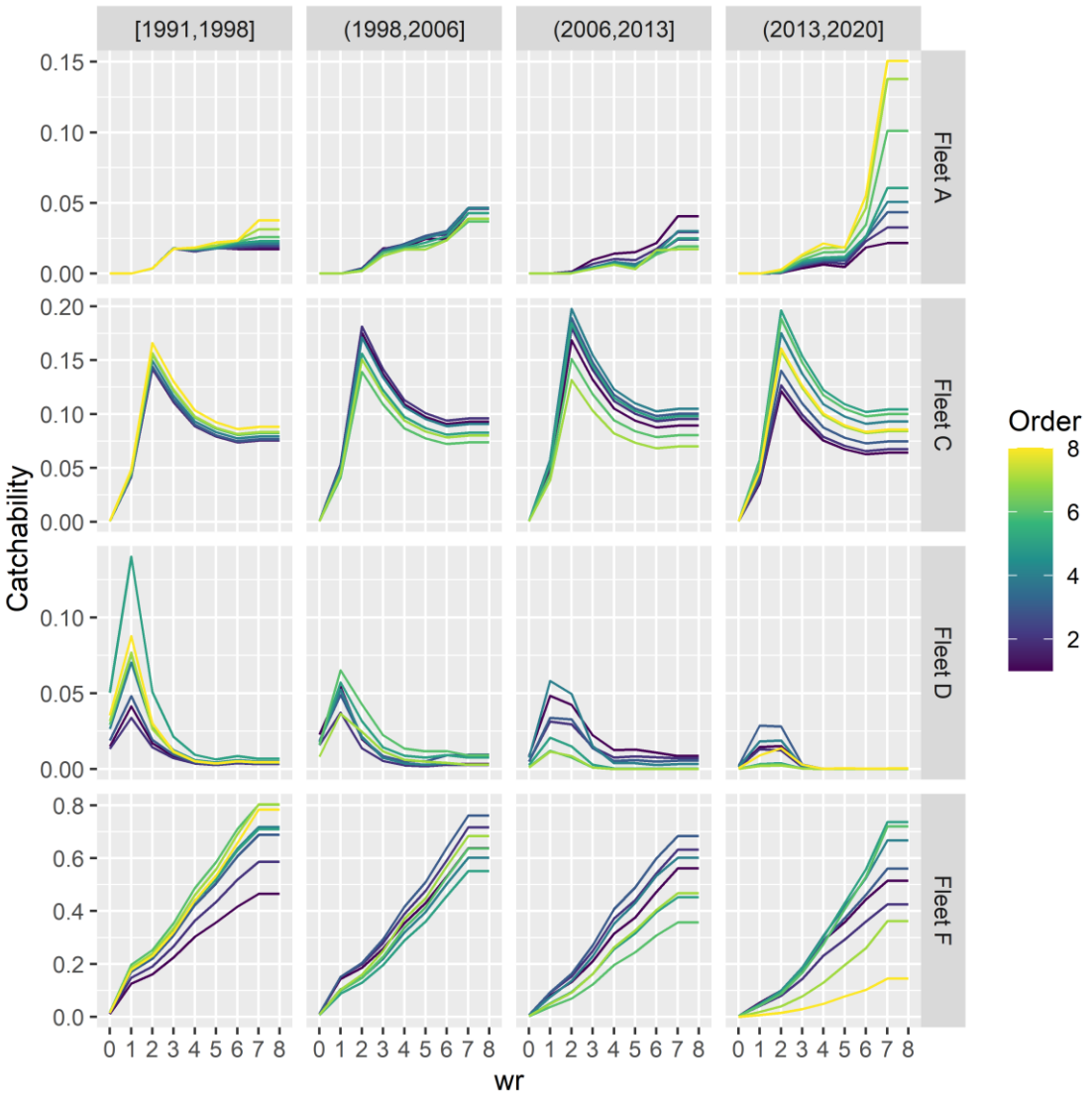


Figure 3.6.4.7 WESTERN BALTIC SPRING SPAWNING HERRING. Estimated selection pattern at age as W-ringers (wr) per fleet and year. Order: 1 equal 1st year in the respective time span.

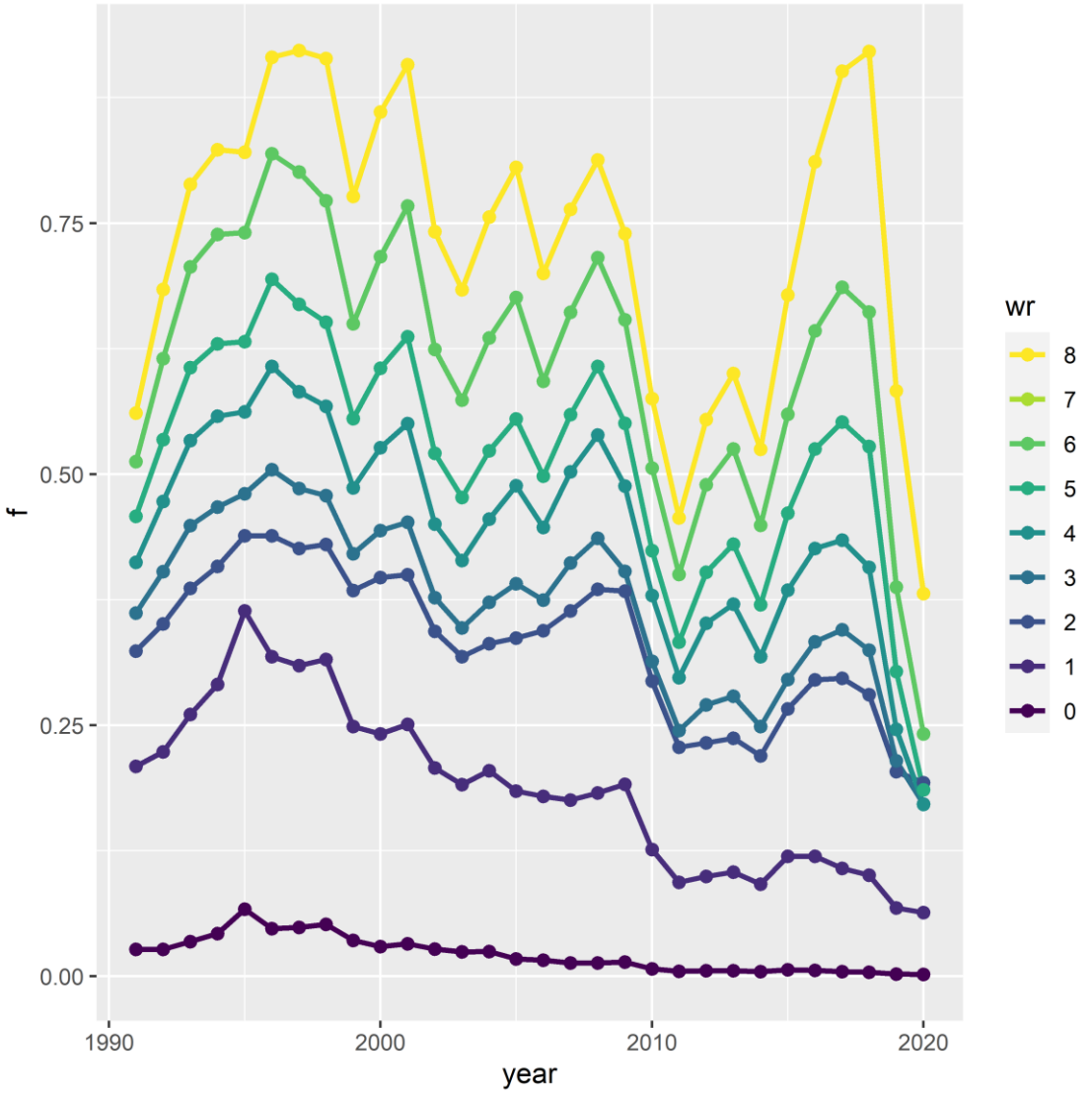


Figure 3.6.4.8 Western Baltic Spring Spawning Herring. Time-series of estimated fishing mortality-at-age as W-ringers (wr).

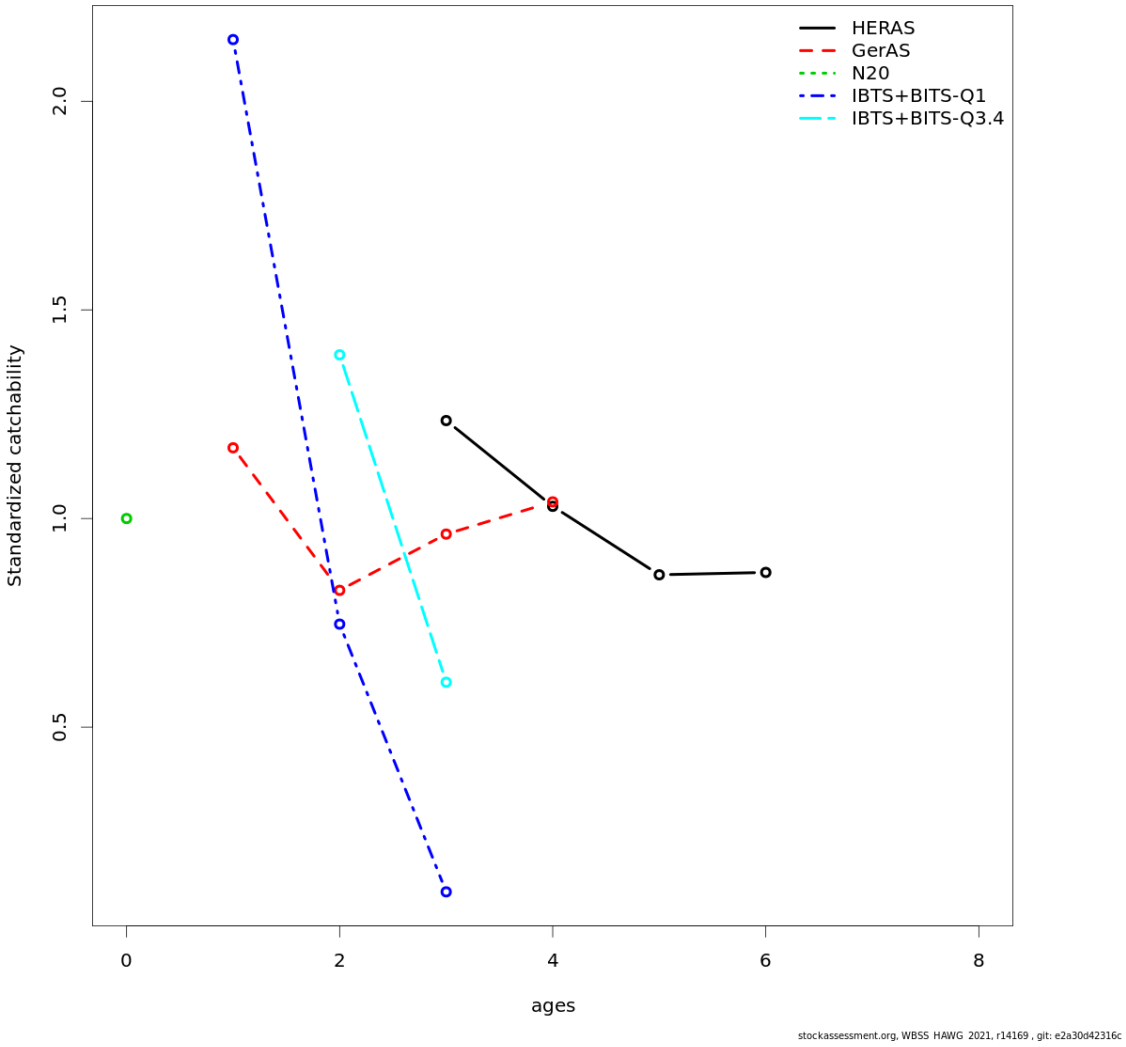


Figure 3.6.4.9 Western Baltic Spring Spawning Herring. Estimated survey catchabilities. N20 only covers age 0 and therefore only shows one point.

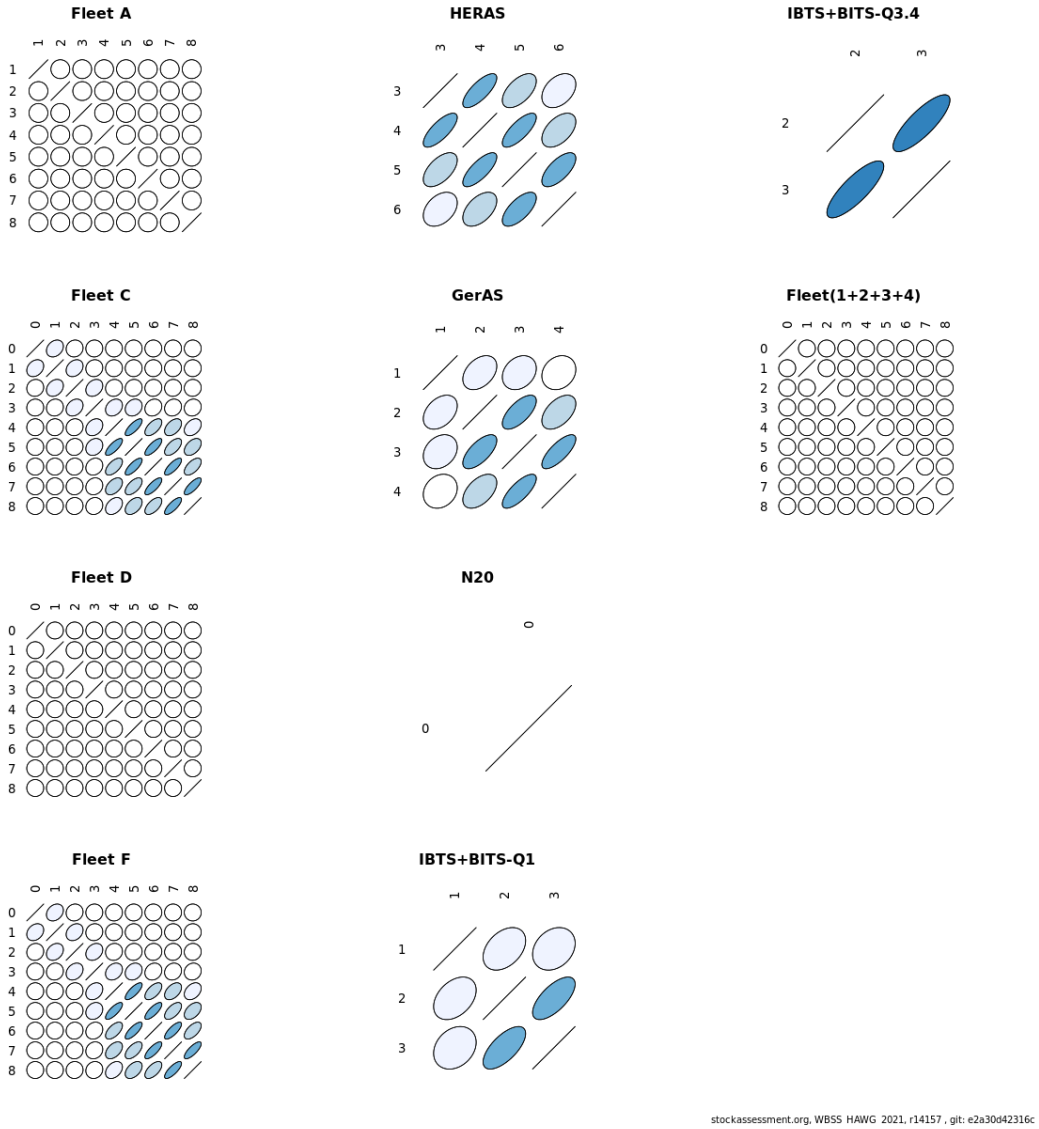


Figure 3.6.4.10 WESTERN BALTIC SPRING SPAWNING HERRING. Estimates correlations between age groups for each fleet.

Figure 3.6.4.11 WESTERN BALTIC SPRING SPAWNING HERRING. Estimated age distribution in the stock. Colours represent a cohort.

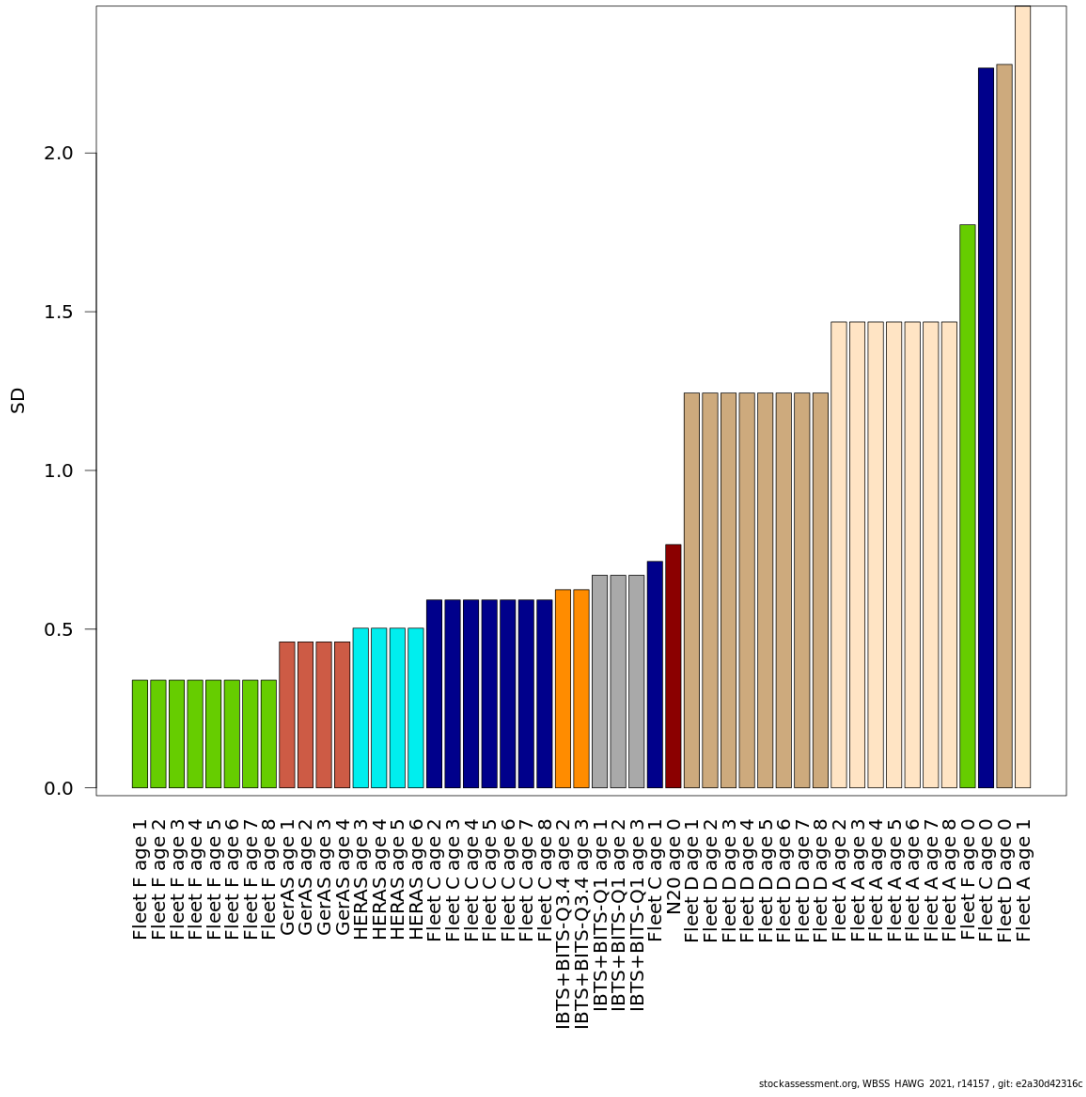


Figure 3.6.4.12 WESTERN BALTIC SPRING SPAWNING HERRING. Estimated observation variance in the WBSS multi fleet assessment run.

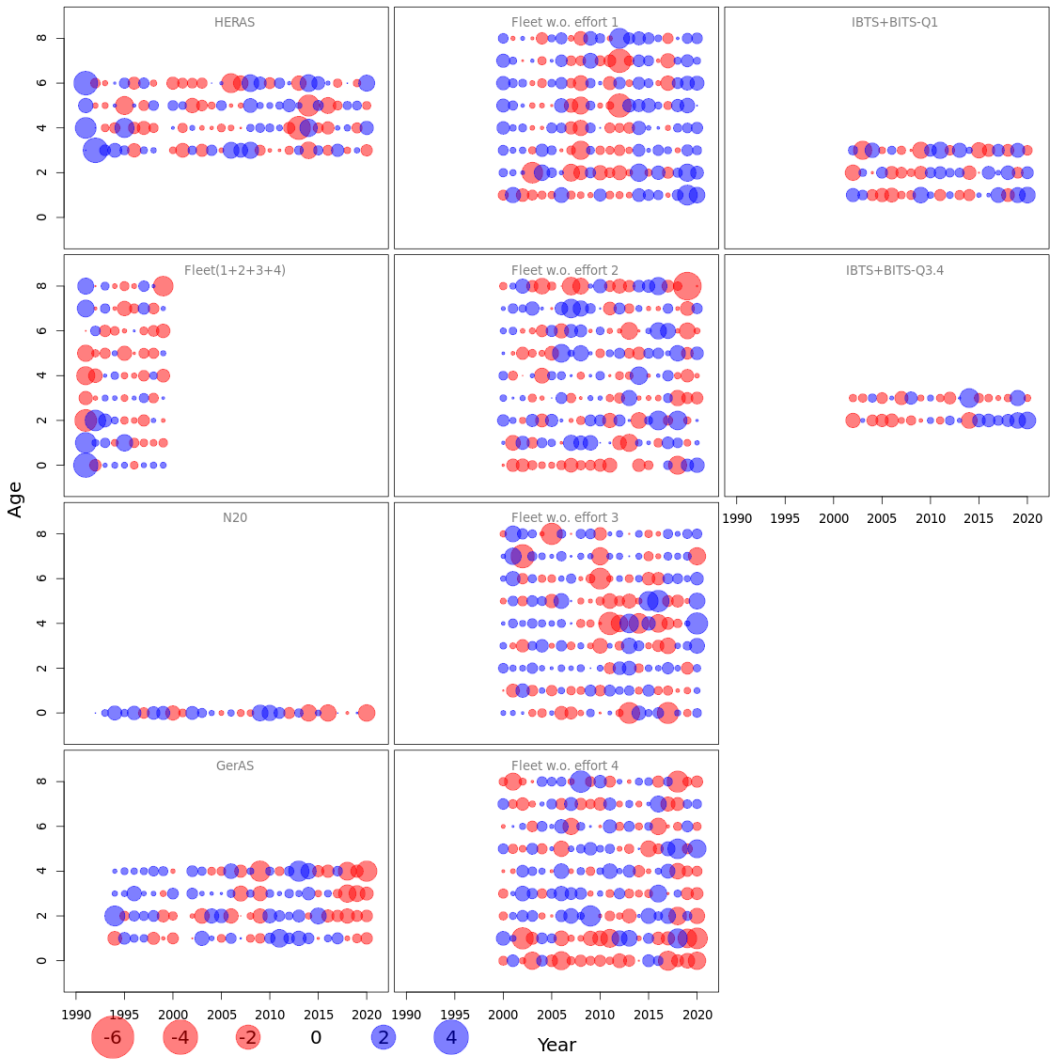


Figure 3.6.4.13 WESTERN BALTIC SPRING SPAWNING HERRING. BUBBLE PLOT. Standardized one-observation-ahead residuals from multi fleet run.

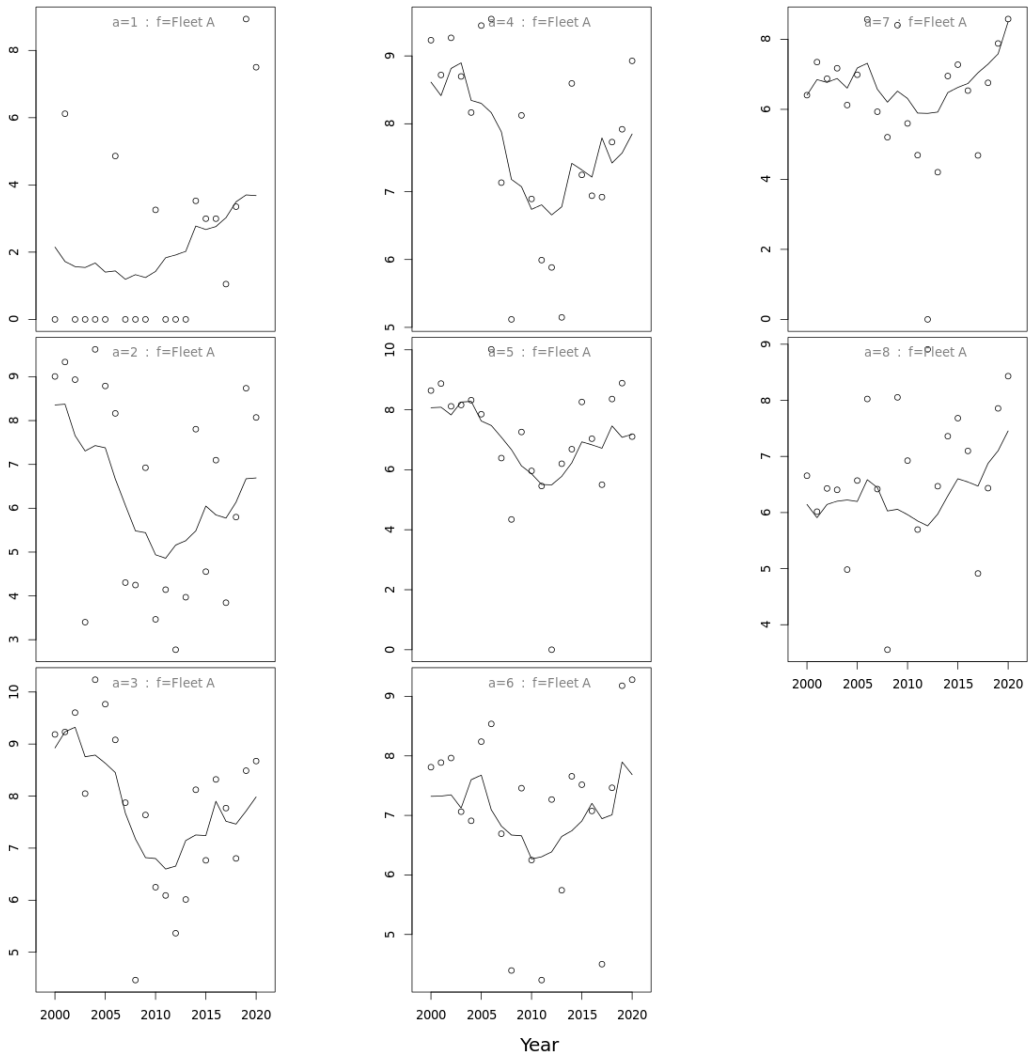


Figure 3.6.4.14 WESTERN BALTIC SPRING SPAWNING HERRING. Diagnostics of commercial catches fit per fleet. Fleet A. Plot of predicted (line) and observed (points) catches (log scale) per W-ringers (a) and year.

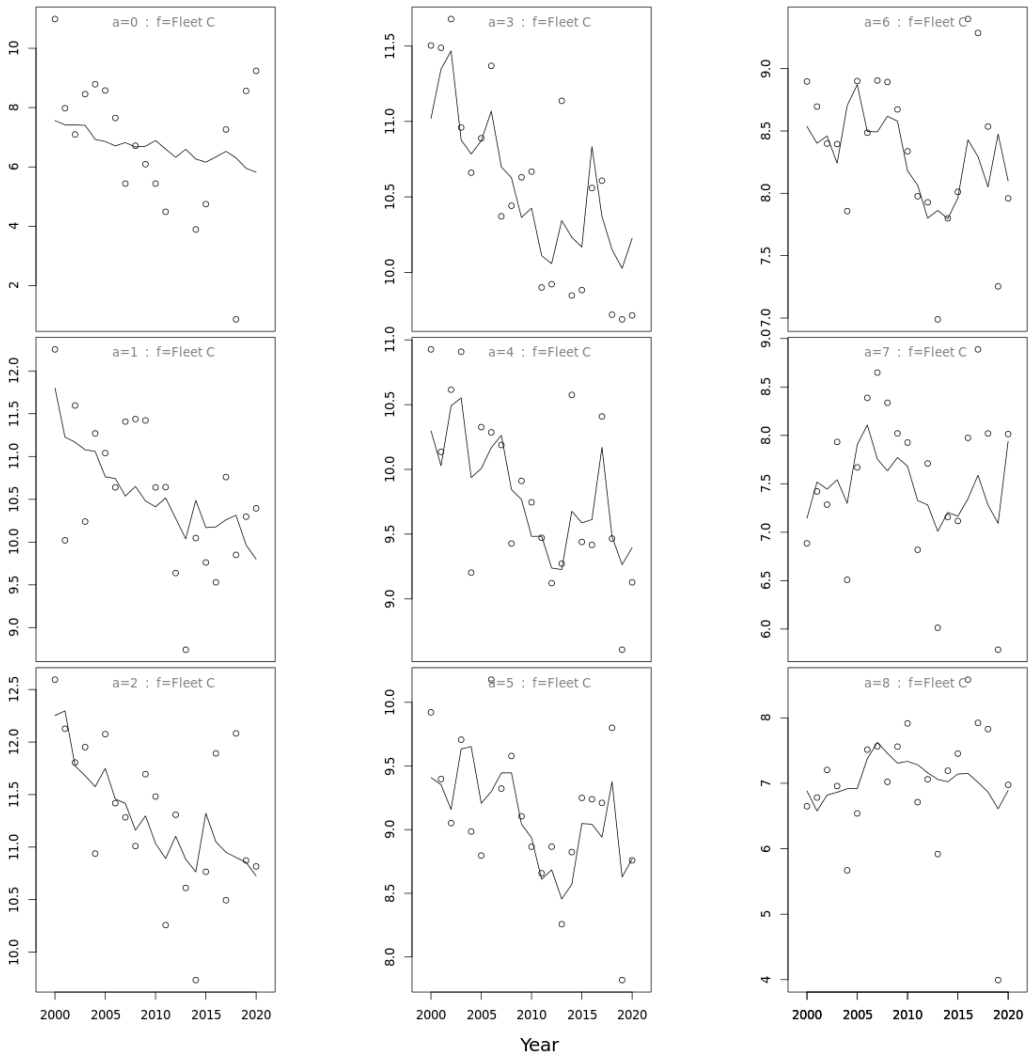


Figure 3.6.4.15 WESTERN BALTIC SPRING SPAWNING HERRING. Diagnostics of commercial catches fit per fleet. Fleet C. Plot of predicted (line) and observed (points) catches (log scale) per W-ringers (a) and year.

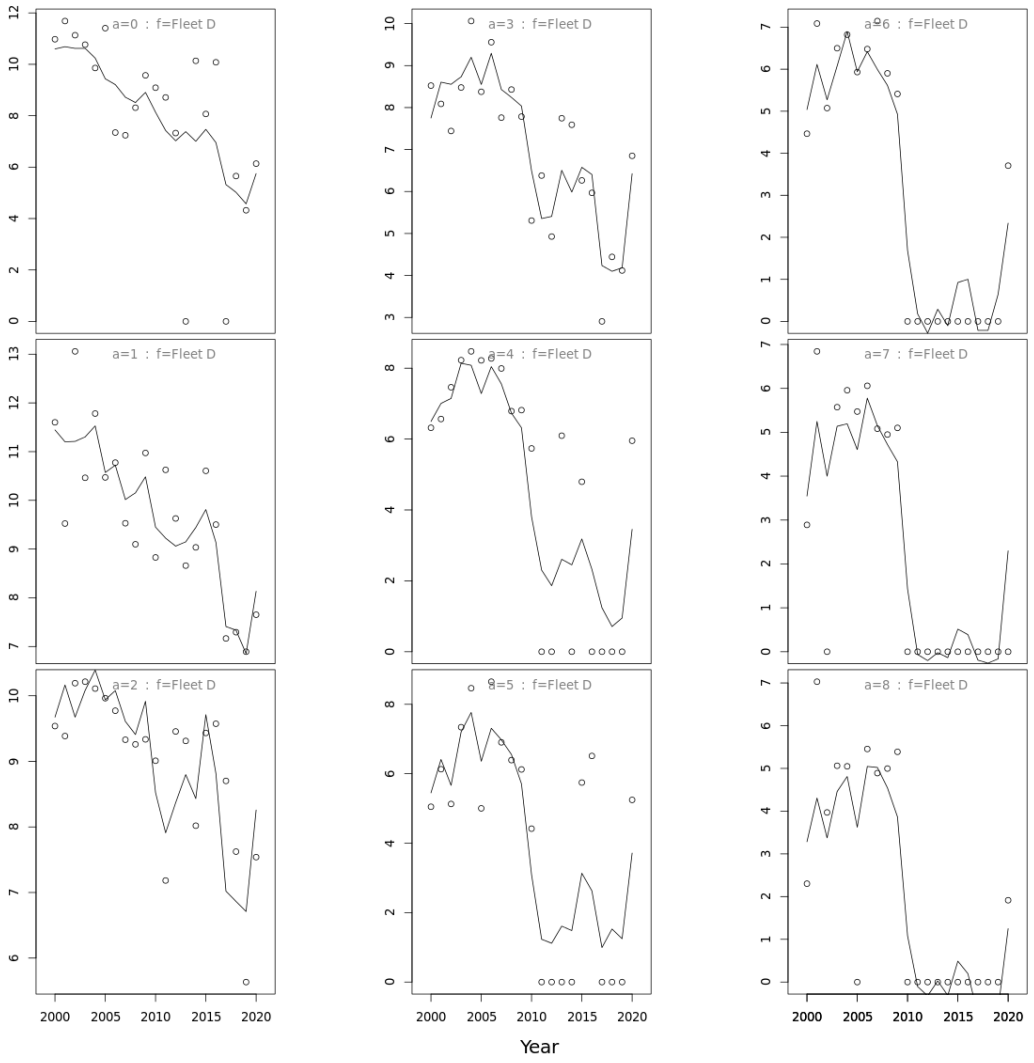


Figure 3.6.4.16 WESTERN BALTIC SPRING SPAWNING HERRING. Diagnostics of commercial catches fit per fleet. Fleet D. Plot of predicted (line) and observed (points) catches (log scale) per W-ringers (a) and year.

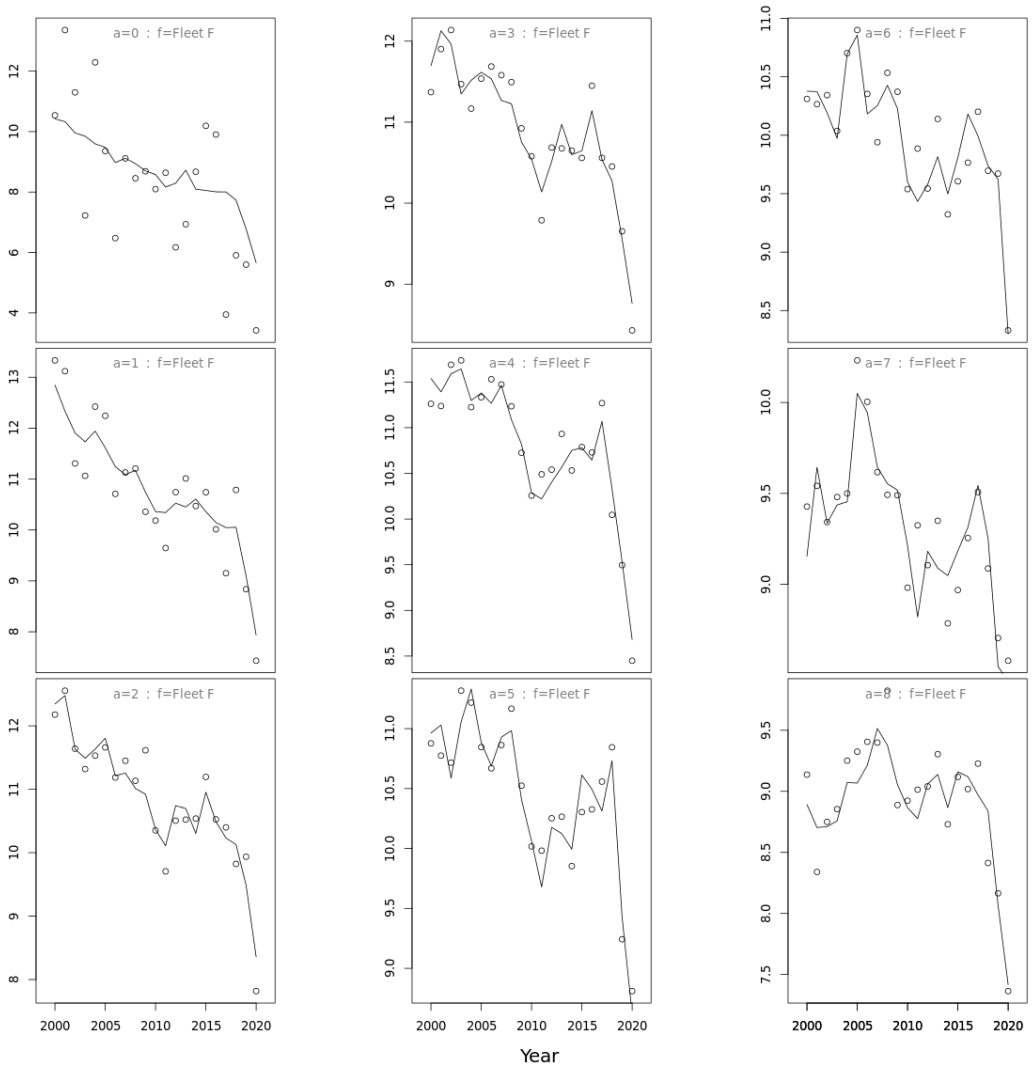


Figure 3.6.4.17 WESTERN BALTIC SPRING SPAWNING HERRING. Diagnostics of commercial catches fit per fleet. Fleet F. Plot of predicted (line) and observed (points) catches (log scale) per W-ringers (a) and year.

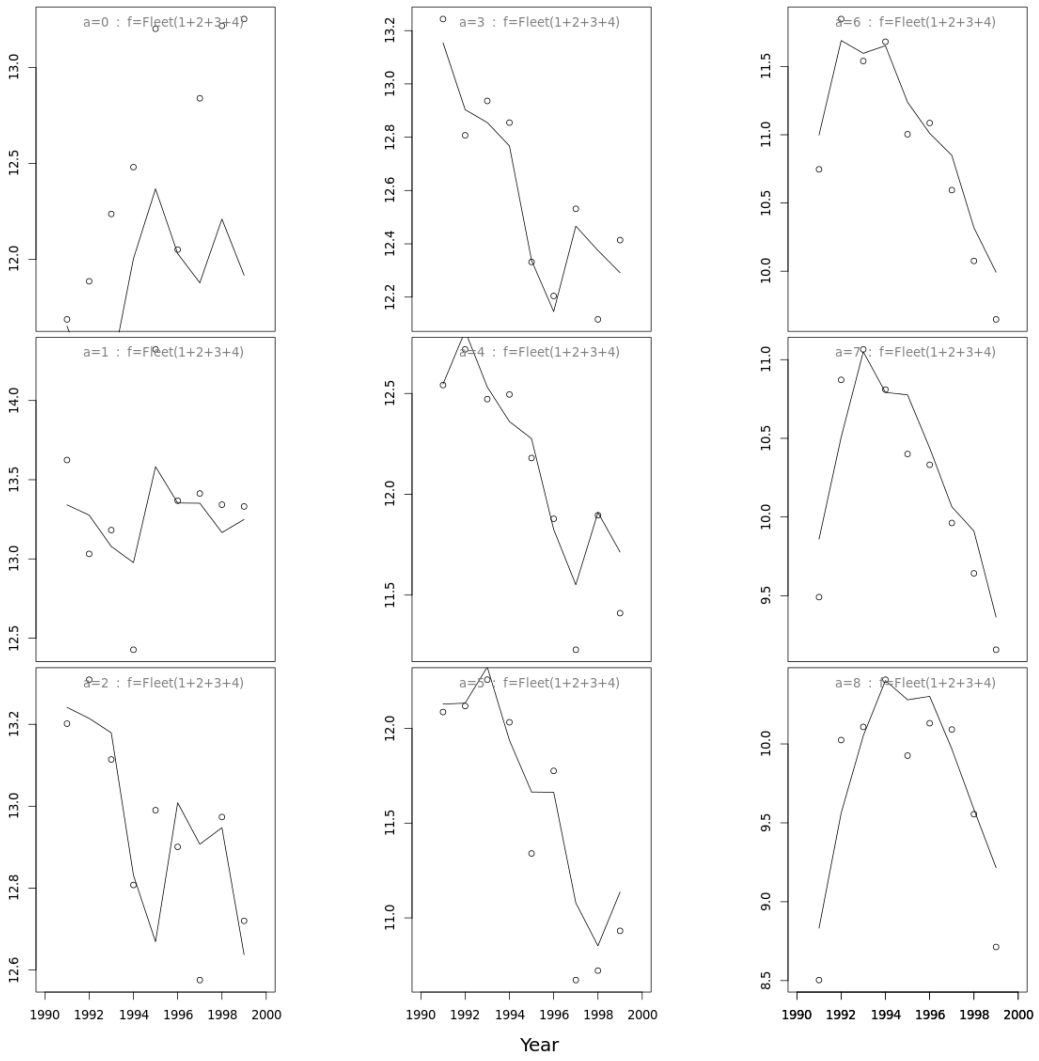


Figure 3.6.4.18 WESTERN BALTIC SPRING SPAWNING HERRING. Diagnostics of commercial catches fit per fleet. sum of fleets Plot of predicted (line) and observed (points) catches (log scale) per W-ringers (a) and year.

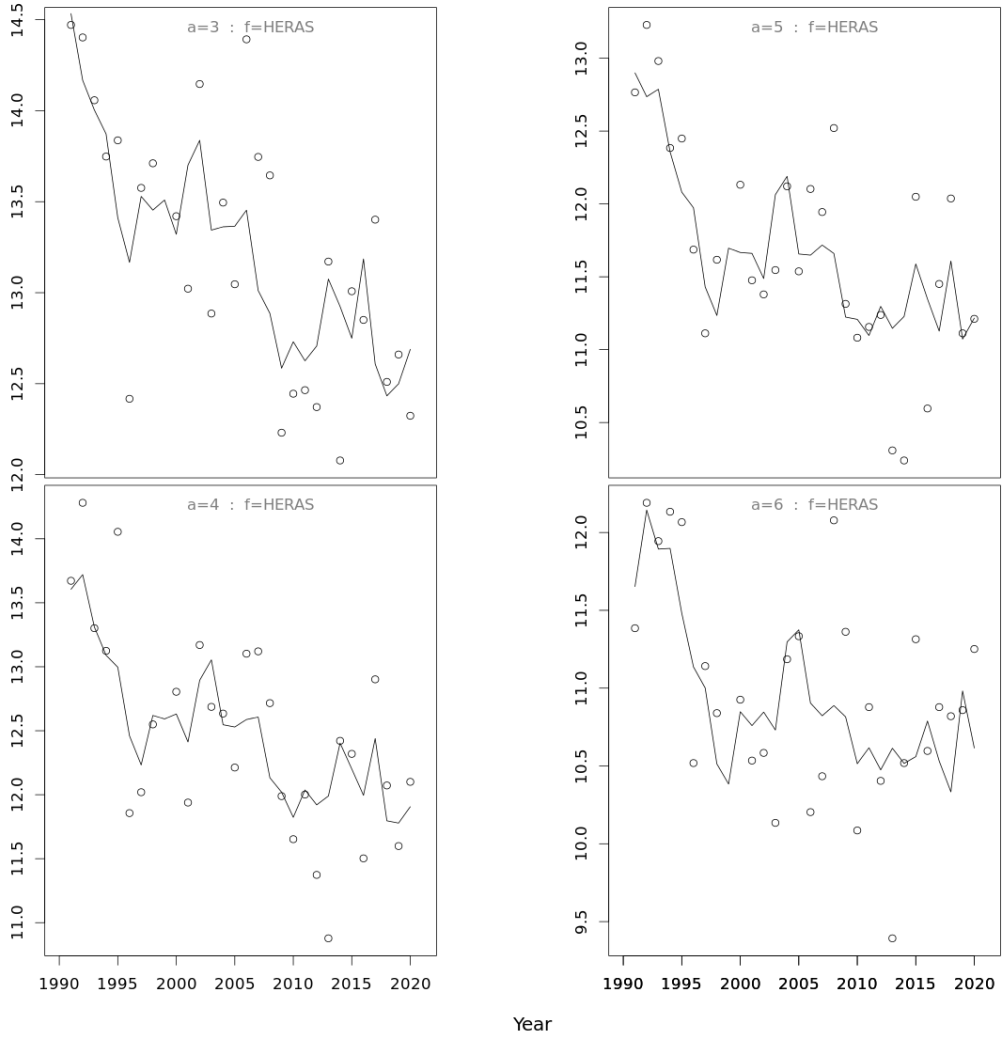


Figure 3.6.4.19 WESTERN BALTIC SPRING SPAWNING HERRING. Diagnostics of the HERAS index. Plot of predicted (line) and observed (points) index (log scale) per W-ringers (a) and year.

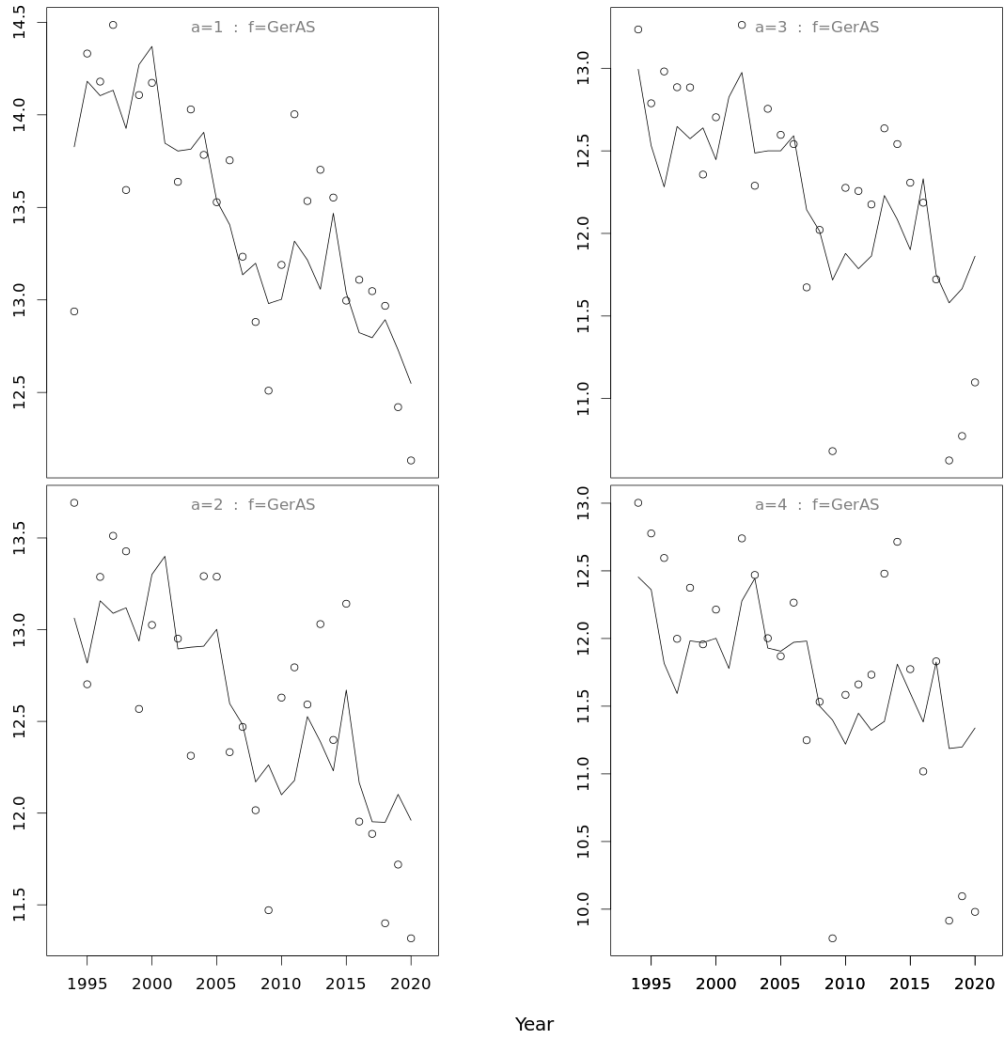


Figure 3.6.4.20 WESTERN BALTIC SPRING SPAWNING HERRING. Diagnostics of the GERAS-index. Plot of predicted (line) and observed (points) index (log scale) per W-ringers (a) and year.

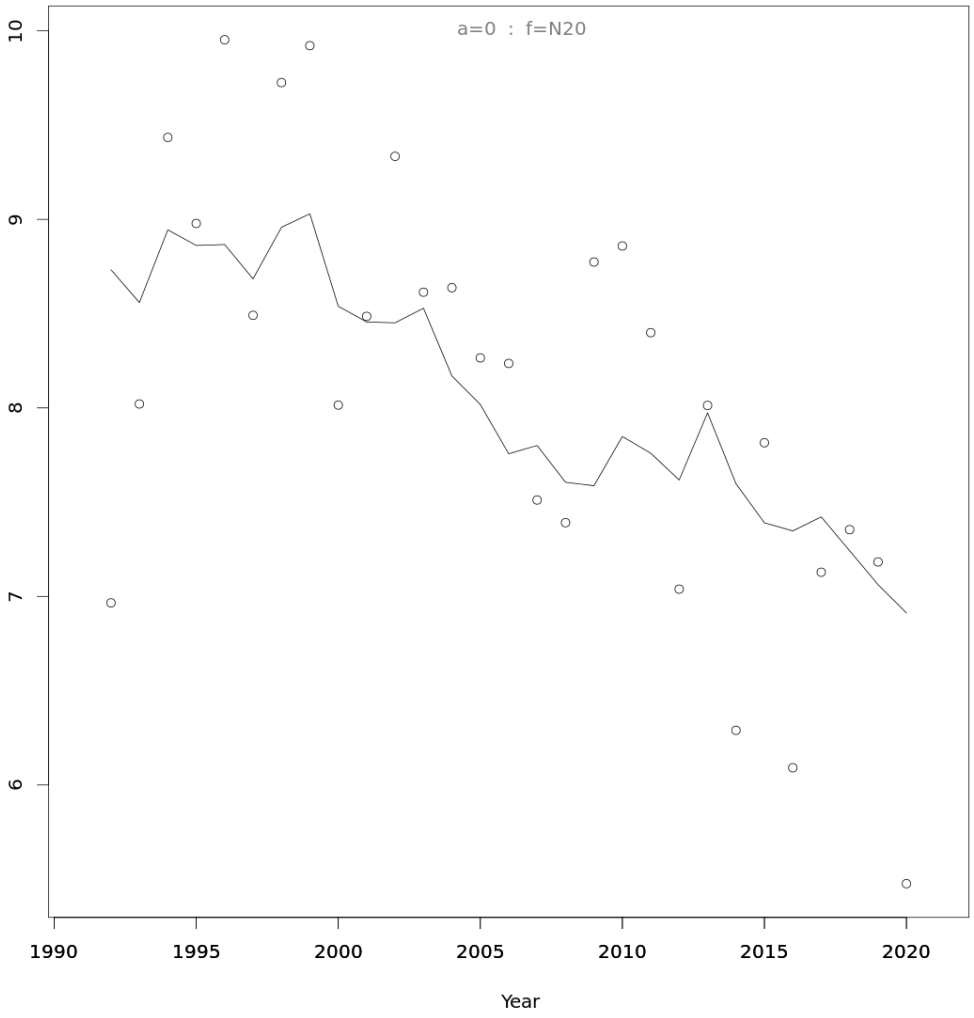


Figure 3.6.4.21 WESTERN BALTIC SPRING SPAWNING HERRING. Diagnostics of the N20 index. Plot of predicted (line) and observed (points) index (log scale) per W-ringers (a) and year.

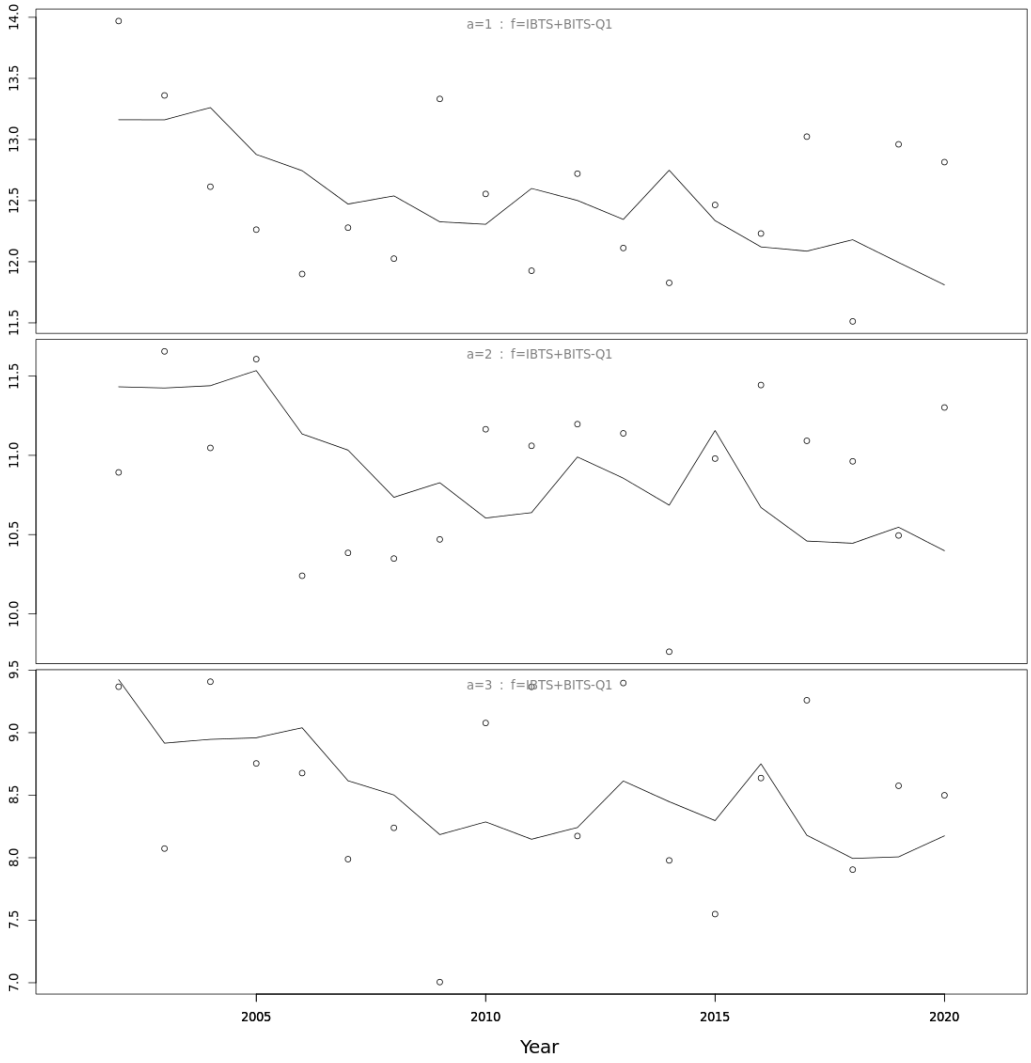


Figure 3.6.4.22 WESTERN BALTIC SPRING SPAWNING HERRING. Diagnostics of the IBTS+BITS-Q1 index. Plot of predicted (line) and observed (points) index (log scale) per W-ringers (a) and year.

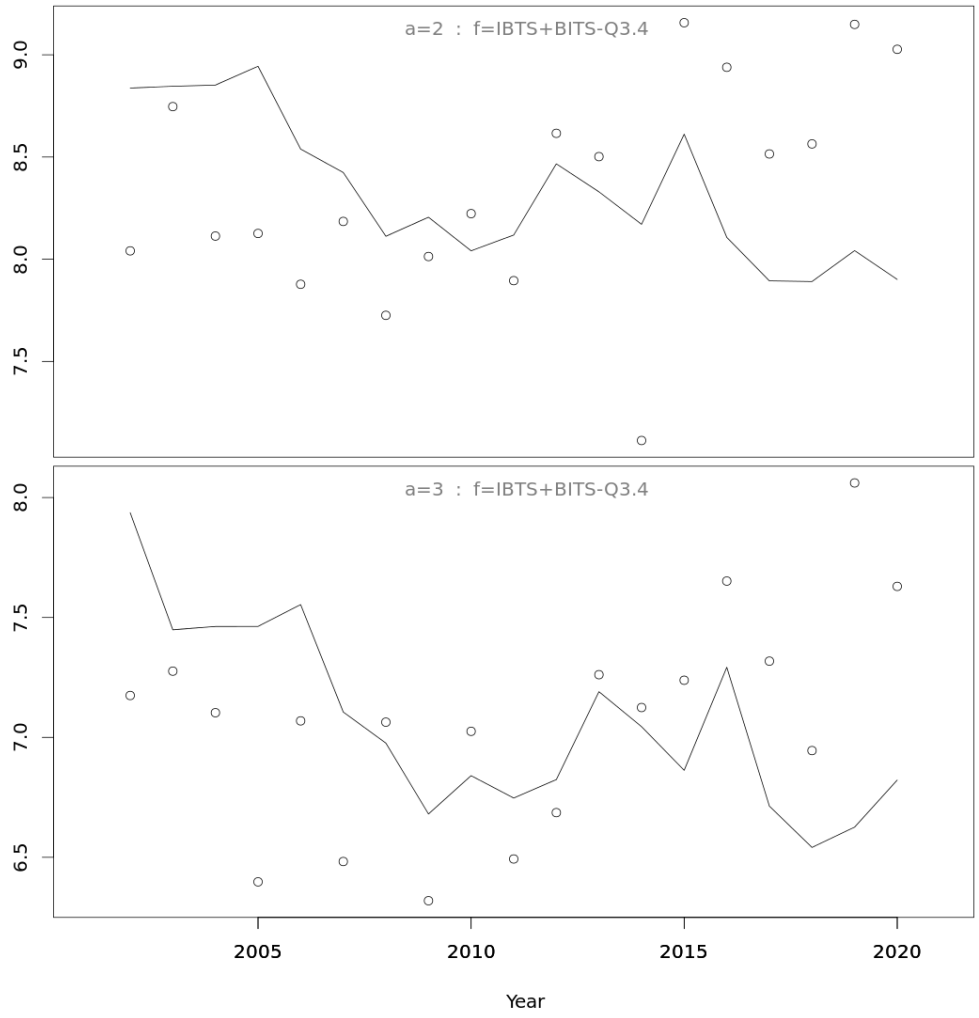


Figure 3.6.4.23 WESTERN BALTIC SPRING SPAWNING HERRING. Diagnostics of the IBTS+BITS-Q3.4 index. Plot of predicted (line) and observed (points) index (log scale) per W-ringers (a) and year.

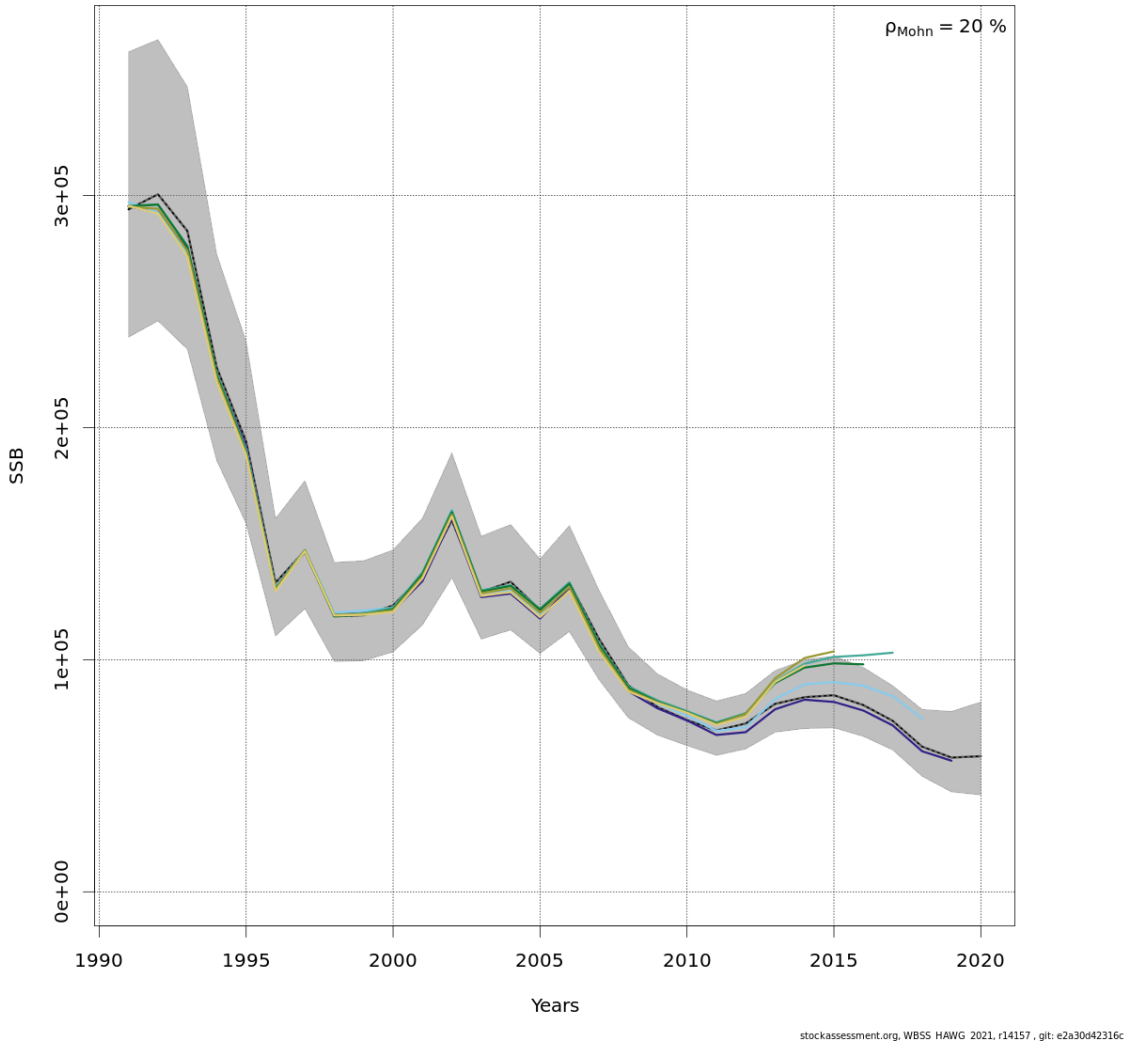


Figure 3.6.4.24 WESTERN BALTIC SPRING SPAWNING HERRING. Analytical retrospective pattern over 5 years from multi fleet run. Spawning stock biomass.

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.

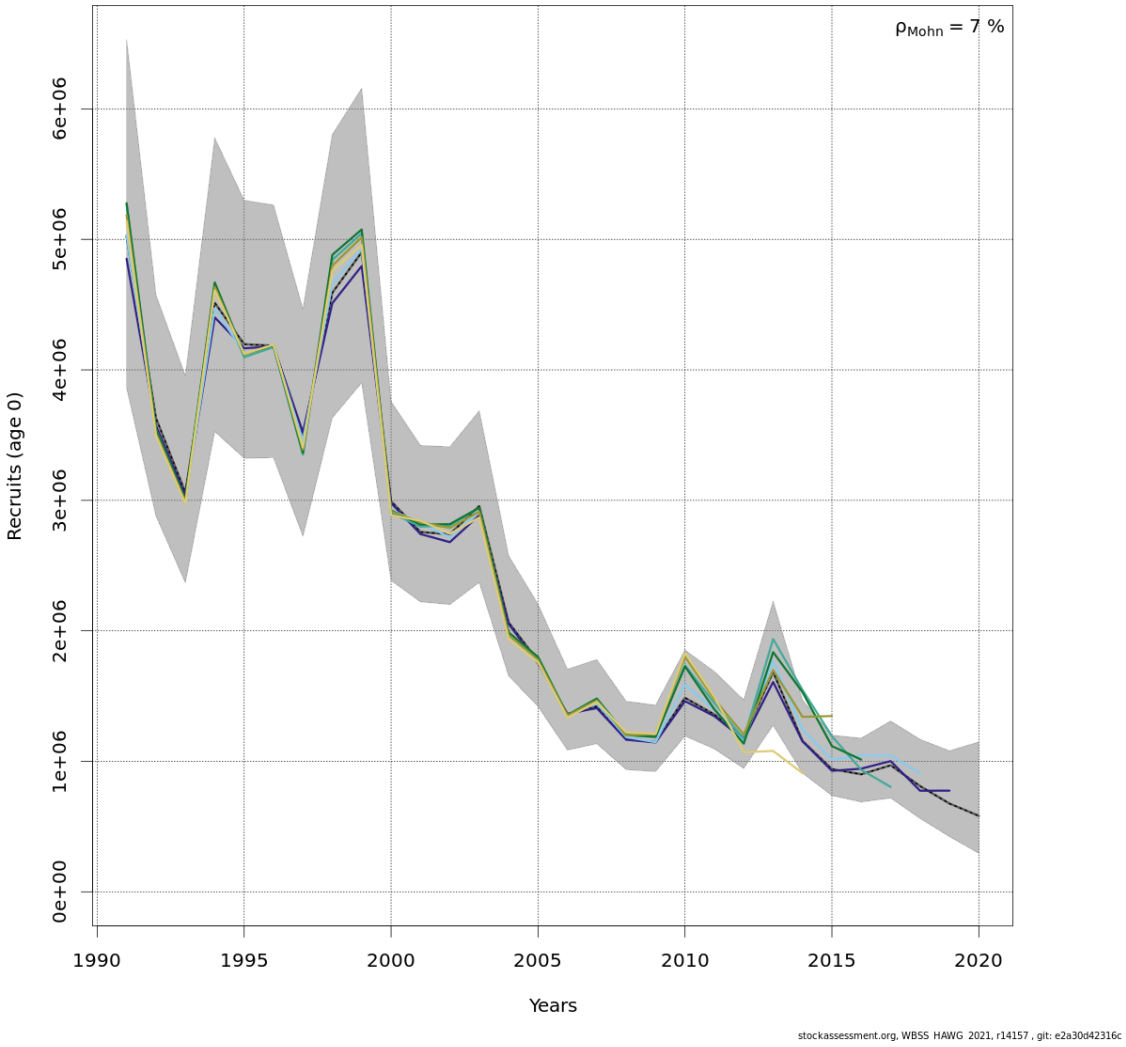


Figure 3.6.4.26 WESTERN BALTIC SPRING SPAWNING HERRING. Analytical retrospective pattern over 5 years from multi fleet run. Recruitment.

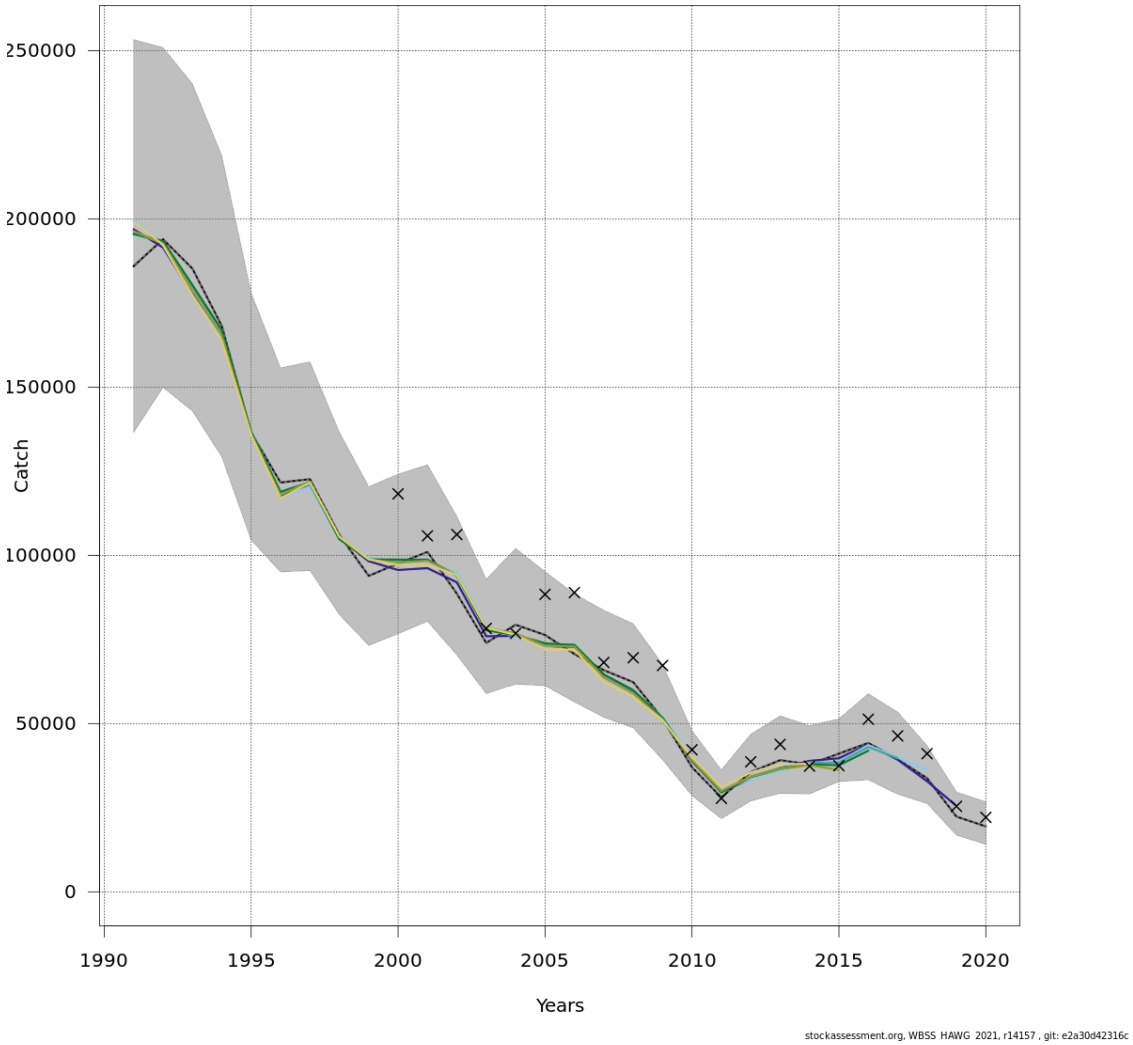


Figure 3.6.4.27 WESTERN BALTIC SPRING SPAWNING HERRING. Analytical retrospective pattern over 5 years from multi fleet run. Catch.

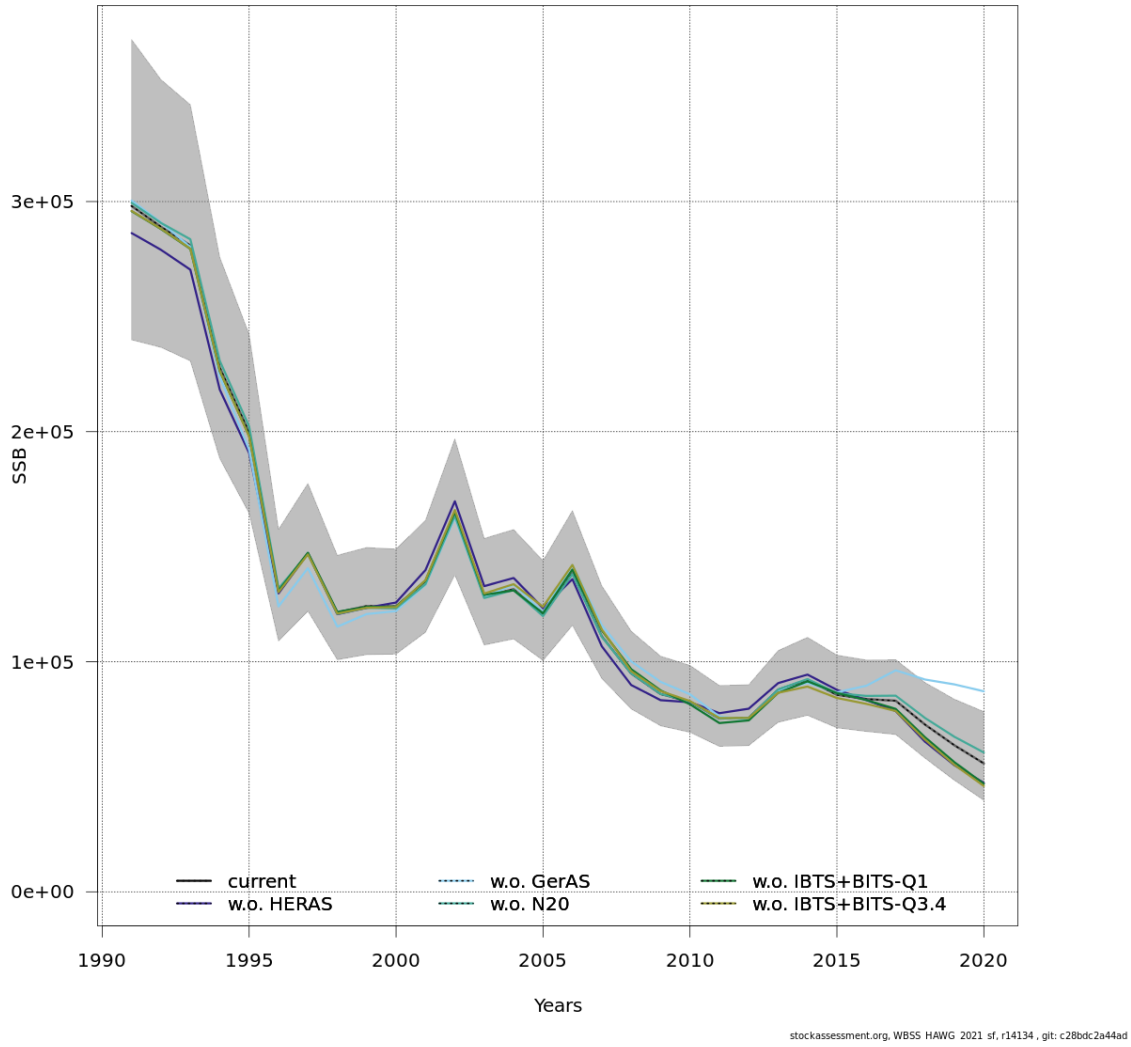


Figure 3.6.4.28 WESTERN BALTIC SPRING SPAWNING HERRING. Leave-one out from single fleet run. Spawning stock biomass.

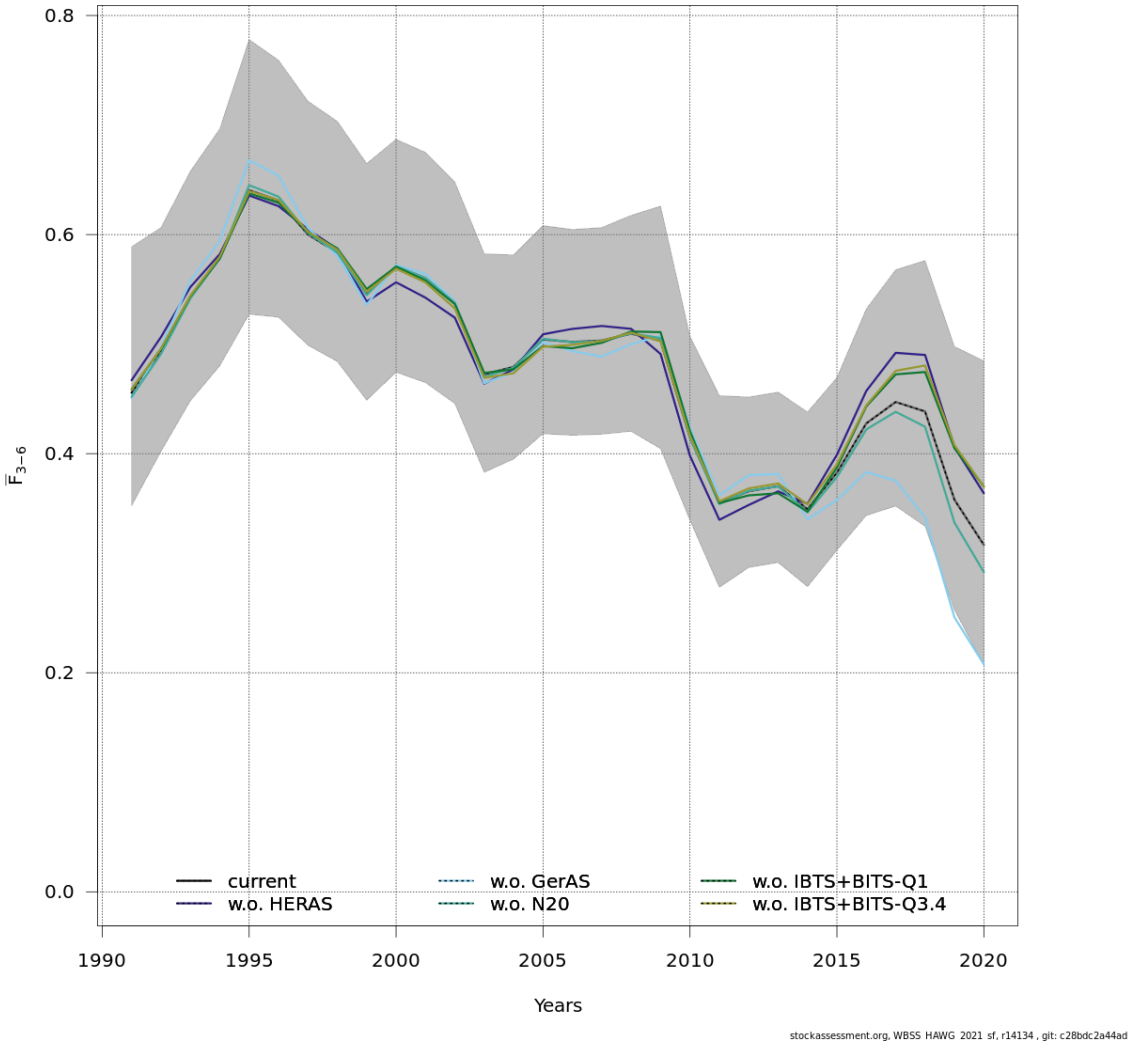


Figure 3.6.4.29 WESTERN BALTIC SPRING SPAWNING HERRING. Leave-one out from single fleet run. Average fishing mortality for the shown age range.

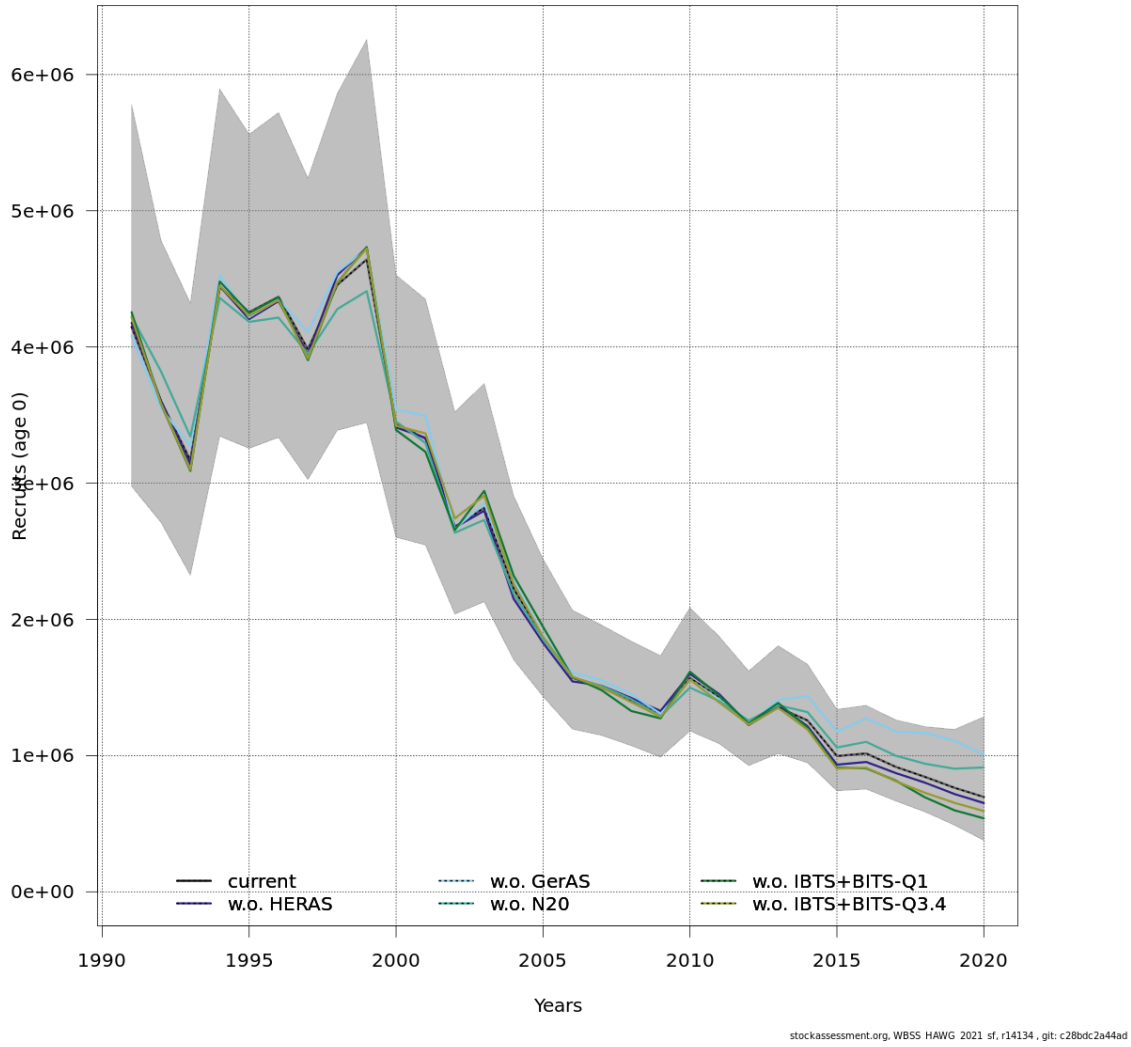


Figure 3.6.4.30 WESTERN BALTIC SPRING SPAWNING HERRING. Leave-one out from single fleet run. Recruitment.

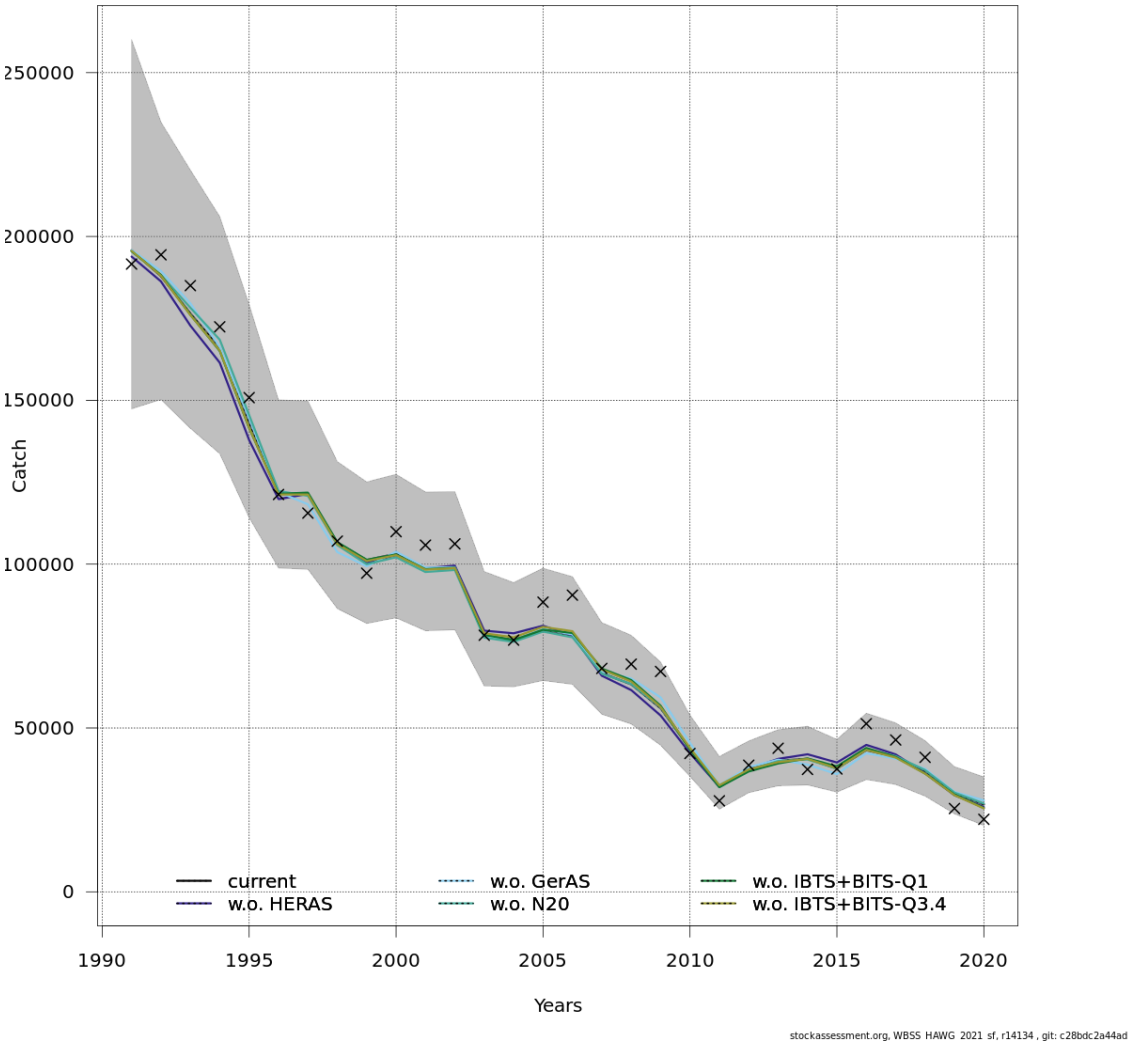


Figure 3.6.4.31 WESTERN BALTIC SPRING SPAWNING HERRING. Leave-one out from single fleet run. Catch.

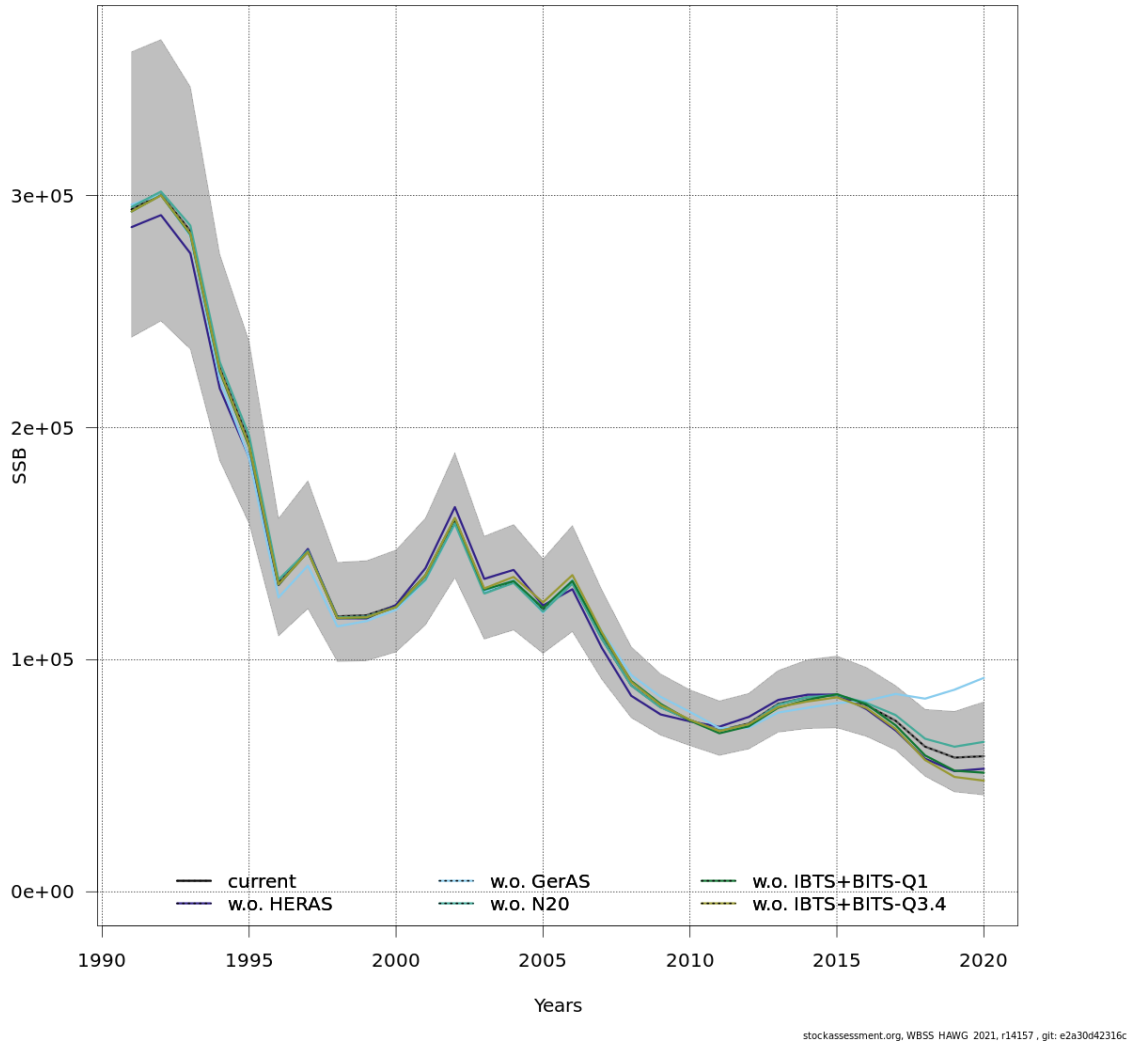


Figure 3.6.4.32 WESTERN BALTIC SPRING SPAWNING HERRING. Leave-one out from multi fleet run. Spawning stock biomass.

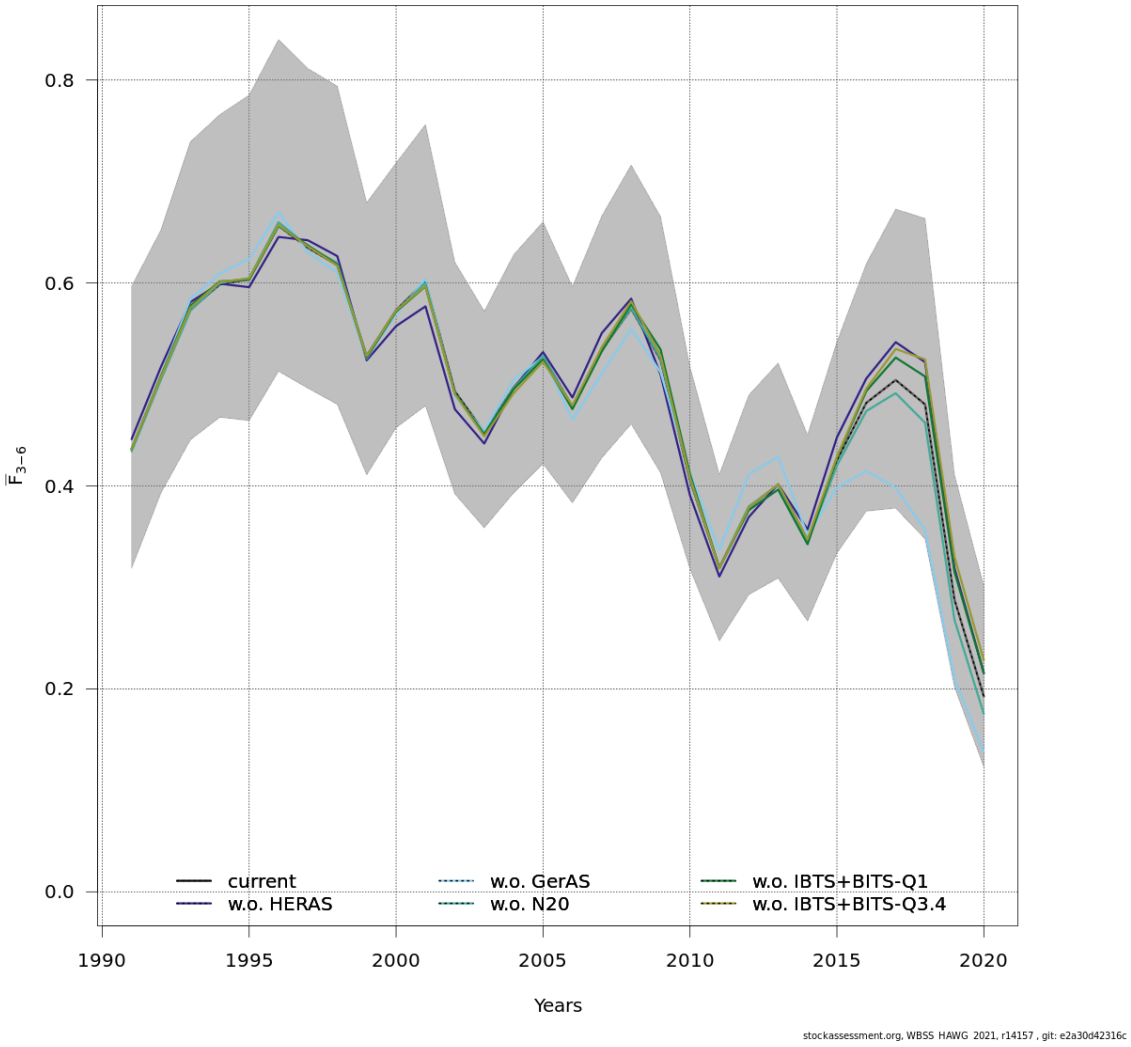


Figure 3.6.4.33 WESTERN BALTIC SPRING SPAWNING HERRING. Leave-one out from multi fleet run. Average fishing mortality for the shown age range.

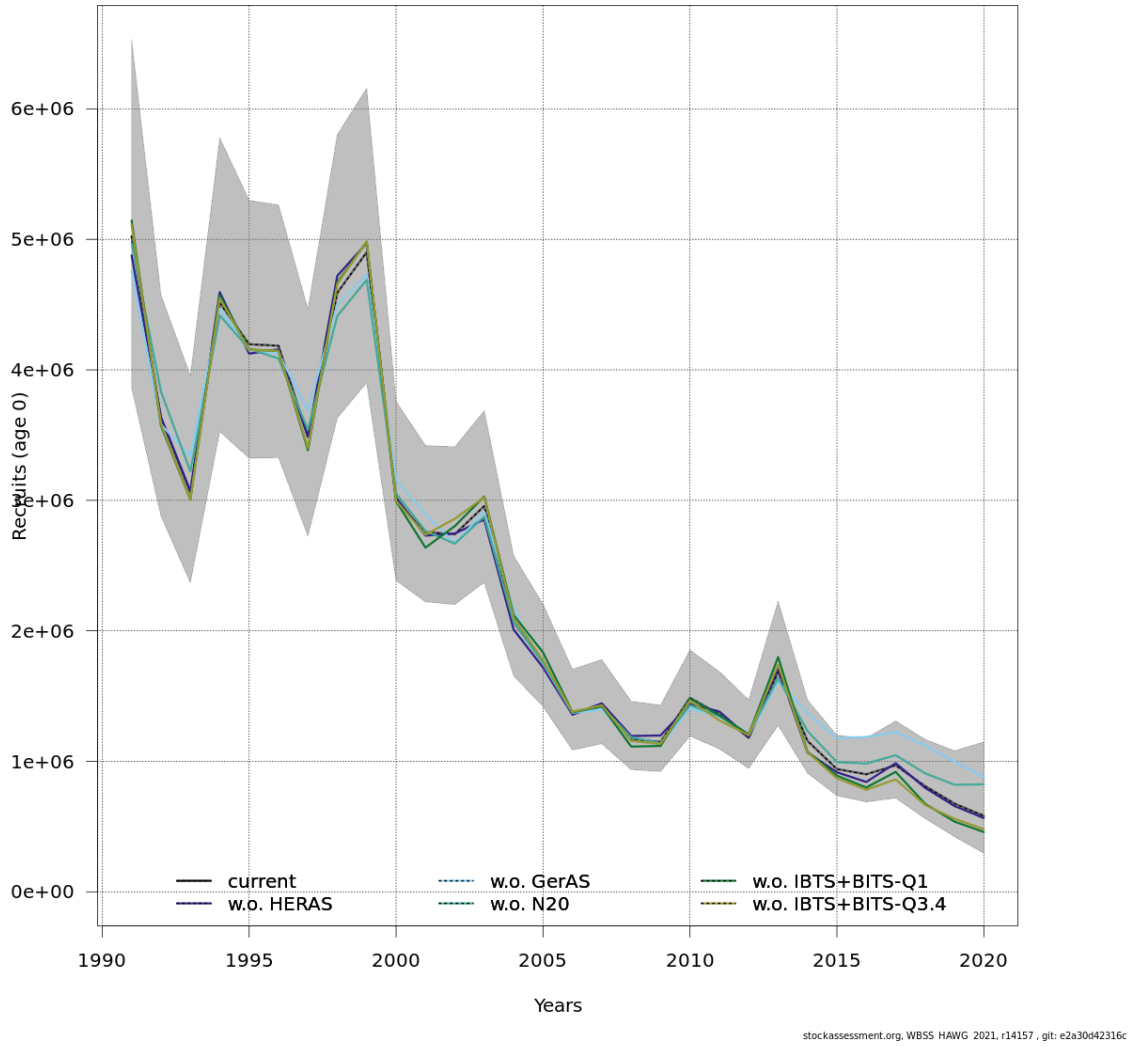


Figure 3.6.4.34 WESTERN BALTIC SPRING SPAWNING HERRING. Leave-one out from multi fleet run. Recruitment.

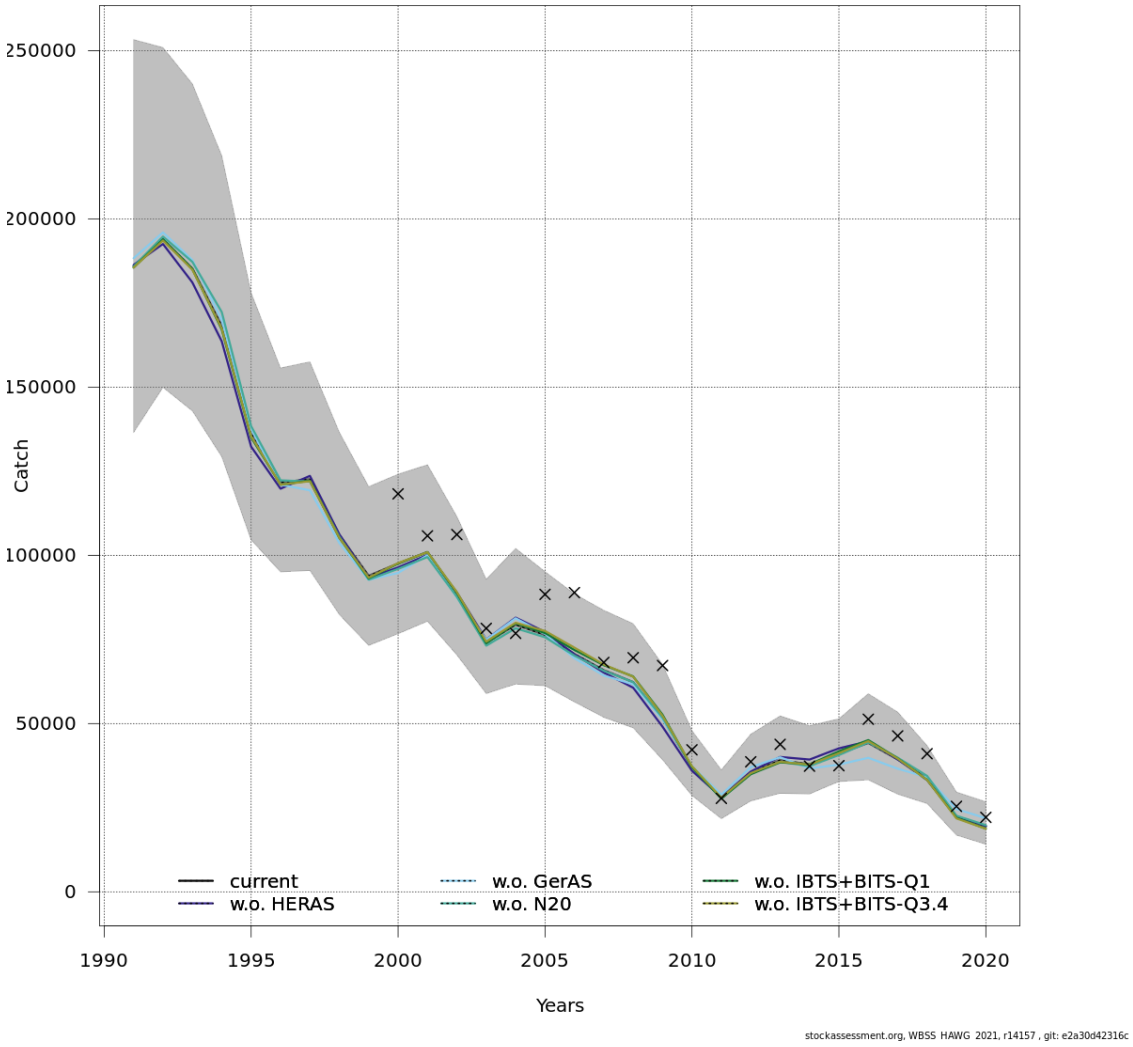


Figure 3.6.4.35 WESTERN BALTIC SPRING SPAWNING HERRING. Leave-one out from multi fleet run. Catch.