2 Herring (*Clupea harengus*) in Subarea 4 and divisions 3.a and 7.d, autumn spawners

This section was added to the report in November 2021

2.1 Introduction

The WG noted that the use of "age", "winter rings", "rings" and "ringers" still causes confusion outside the group (and sometimes even among WG members). The WG tries to avoid this by consequently using "rings", "ringers", "winter ringers" or "wr" instead of "age" throughout this section. However, if the word "age" is used it is qualified in brackets with one of the ring designations. It should be observed that, for autumn and winter spawning stocks, there is a difference of one year between "age" and "rings", which is not the case for spring spawners. Further elaboration on the rationale behind this, specific to the North Sea autumn spawners, Western Baltic spring spawners and the mixed stock catches, can be found in the Stock Annexes. It is the responsibility of any user of age-based data for any of these herring stocks to consult the relevant annex and if in doubt consult a relevant member of the Working Group.

2.1.1 ICES advice and management applicable to 2020 and 2021

Norway and the European Union had submitted a joint request to ICES in 2018 to evaluate possible elements for long-term management strategies for several fish stocks, including North Sea autumn spawning herring (Anon, 2017). The management strategy evaluations were finalized in April 2019 and resulted in an ICES advice of 17 April 2019 (ICES, 2019). On North Sea autumn spawning herring, ICES concluded that *"Optimum values of F_{target} were found to be between 0.22 and 0.23 and $B_{trigger}$ at 1 400 000 t across management strategies. Not all management strategies are considered precautionary in the long term. The median long-term yield differs by less than 2% across the management strategies. The ICES MSY advice rule with current FMSY and MSY $B_{trigger}$ was found not to be precautionary (probability of SSB < B_{lim} higher than 5%) under the assumptions of the present simulations."*

There is currently no agreed EU-Norway management plan (Anon, 2019) although a Working Group has been set up by Norway, UK and the European Union to recommend a way of optimally and sustainably utilizing the North Sea autumn spawning herring stock. Until new agreed management strategies will become available, the MSY approach is used as the basis of ICES advice.

The final TAC adopted by the management bodies for 2020 was 393 962 tonnes for Area 4 and Division 7.d, where no more than 42 351 t should be caught in Division 4.c and 7.d. For 2021, the total TAC is 364 107 t (356 357 t for the A-Fleet), including a TAC of 34 793 t for Division 4.c and 7.d.

The bycatch TAC for the B-Fleet in the North Sea (and Division 2.a) was 8954 t in 2020 and has decreased by 13% to 7750 t in 2021. As North Sea autumn spawners are also caught in Division 3.a, regulations for the fleets operating in this area have to be taken into account for the management of the WBSS stock (see Section 3). Catches of spring-spawning herring in the Thames estuary are in general low and not included in the TAC. For a definition of the different fleets harvesting North Sea herring see the Stock Annex and Section 2.7.2.

2.1.2 Catches in 2020

Total landings and estimated catches are given in the Table 2.1.1 for the North Sea and for each Division in tables 2.1.2 to 2.1.5. Total Working Group (WG) catches per statistical rectangle and quarter are shown in figures 2.1.1 (a–d), the total for the year in Figure 2.1.1(e). Each nation provided most of their catch data (either official landings or Working Group catch) by statistical rectangle. The catch figures in tables 2.1.1–2.1.5 are mostly provided by WG members and may or may not reflect national catch statistics. These figures can therefore **not** be used for legal purposes.

The total WG catch of all herring caught in the North Sea amounted to 427 321 t in 2020. Official catches by the human consumption fishery were 414 935 t, corresponding to an overshoot of 8% of the TAC for the human consumption fishery (385 008 t). The effect of quota banking and borrowing is unknown by the WG.

As in previous years, the vast majority of catches are taken in the 3rd quarter in Division 4.a (W).

In the southern North Sea and the eastern Channel, the total catch sums to 37 689 t. The separate TAC for this area was 42 351 t, so 11% of the TAC remains in Division 4.c and 7.d (but due to catch regulations, 50% of the TAC could have been taken in Division 4.b).

Information on bycatches in the industrial fishery is provided by Denmark and Sweden. While the Norwegian bycatches are included in the A-fleet figure for Norway, catches taken in the small-meshed fishery by Denmark and Sweden are accounted to a separate EU quota (B-fleet).

Landings of herring taken as bycatch in the small-meshed fishery were 9864 tonnes in 2020. The bycatch ceiling for the B-Fleet was 8954 t. Since the introduction of yearly bycatch ceilings in 1996, these ceilings have fully been taken in 2014, 2016 and 2020.

The total North Sea TAC and catch estimates for the years 2015 to 2020 are shown in the table below (adapted from Table 2.1.6).

Year	2015	2016	2017	2018	2019	2020
TAC HC ('000 t)	445	518	482	601	385	385
"Official" landings HC ('000 t) *	472	545	485	594	439	415
Working Group catch HC ('000 t)	474	545	485	594	440	417
Excess of landings over TAC HC ('000 t)	28	27	3	-7	55	32
Bycatch ceiling ('000 t) **	16	13	11	10	13	9
Reported bycatches ('000 t) ***	8	15	7	8	5	10
Working Group catch North Sea ('000 t)	482	560	492	602	446	427

HC = human consumption fishery

*** Landings might be provided by WG members to HAWG before the official landings become available; they may then differ from the official catches and cannot be used for management purposes. Norwegian bycatches included in this figure.**

**** bycatch ceiling for EU industrial fleets only, Norwegian bycatches included in the HC figure.**

***** prior to 2019 provided by Denmark only. Since 2019 by Denmark and Sweden.**

2.1.3 Regulations and their effects

In 2021, half of the EU quota for Division 3a (HER/03A.) can be taken in the North Sea (HER/*04C.). Based on correspondence with the Pelagic AC, the expected transfer of this quota in 2021 is uncertain, depending on the outcome of ongoing trilateral EU, UK and Norway negotiations. Norway can take up to 50% of its quota for Division 3.a in the North Sea (Subarea 4).

In the North Sea, Norway can take up to 3000 tonnes of its quota in UK and EU waters in divisions 4.a and 4.b (HER/*4AB-C). 3000 tonnes of the EU quota can be taken within Norwegian waters south of 62°N (HER/*04N-S62).

Half of the EU quota for divisions 4.c and 7.d can be taken in Division 4.b (HER/*04B.).

Also 50% of the EU bycatch quota in the small-meshed fishery in 3.a can be fished in UK and EU waters in 4 (HER/*04-C-BC).

In 2014, an agreed record between EU and Norway was applied, enabling an interannual quota flexibility of 10% of the TAC. Each party could transfer non-utilized quota of up to 10% of its quota into the next year, where it is added to the quota allocated to the party concerned in the following year (or borrow 10% of the TAC, to be subtracted the following year). This interannual flexibility was changed in 2015 due to the Russian embargo on EU fishing products, so that 25% of the TAC could be transferred into the next year, while up to 10% could be borrowed. Subsequent year, the quota flexibility has been set to 10% again.

At HAWG 2020, the effect of quota swaps and banking and borrowing could not be assessed by the WG. Unfortunately, there is still no complete coverage of whether countries have applied the annual quota flexibility.

Since 2015, a landing obligation is in place for the European pelagic fleets operating in the North Sea and the Baltic. All catches of (quota) regulated species have to be landed into port. Since 2020, the landing obligation also applies to all demersal fisheries although some exemptions have been agreed in the regional discard plans.

2.1.4 Changes in fishing technology and fishing patterns.

There have been no major changes to fishing technology of the fleets that target North Sea herring.

As usual, the herring fishery concentrated in the Northwestern part of the North Sea, around the Fladen Ground area (figures 2.1.1 a–e). The majority of catches are taken in Subdivision 4.aW, in the order of 55% of the total. Subdivision 4.aE provided 14% of the catches in 2020 and catches in Division 4.b contributed 22%.

The utilization of catches in divisions 4.c and 7.d has decreased since 2010. Since 2014, catches in the southern North Sea contributed less than 10% to the total catch, while they were in the range of 15% for the period before 2010. The TAC in this Division is not fully taken since 2012. Catches in Division 4.c were only 4920 t in 2020 (1.2%).

The bycatch ceiling for the small-meshed fishery (B-Fleet) has fully been taken in 2020. Amount of catches have almost doubled compared to 2019, and catches were more equally distributed in 4.aW (45%) and 4.b (55%). In former years, most of the catches in the B-Fleet were taken in Division 4.b (70% in 2019).

After a substantial decline in misreporting since 2009, misreporting is regarded as a minor problem in the herring fishery.

2.2 Biological composition of the catch

Biological information (numbers, weight, catch (SOP) at age and relative age composition) on the catch as obtained by sampling of commercial catches is given in tables 2.2.1–2.2.5. Data are given for the whole year and by quarter. Except in cases where the necessary data are missing, data are displayed separately by area for herring caught in the North Sea, for Western Baltic spring spawners (only in 4.aE), and for the total NSAS stock, including catches in Division 3.a.

Biological information on the NSAS caught in Division 3.a was obtained using splitting procedures described in Section 3.2 and in the Stock Annex.

The tables are laid out as follows:

- Table 2.2.6: Total catches of NSAS (SOP figures), mean weights- and numbers-at-age by fleet
- Table 2.2.7: Data on catch numbers-at-age and SOP catches for the period 2005–2020 (herring caught in the North Sea)
- Table 2.2.8: WBSS taken in the North Sea (see below)
- Table 2.2.9: NSAS caught in Division 3.a
- Table 2.2.10: Total numbers of NSAS
- Table 2.2.11: Mean weights-at-age, separately for the different Divisions where NSAS are caught, for the period 2010–2020.

Note that SOP catch estimates may deviate in some instances slightly from the WG catch used for the assessment.

2.2.1 Catch in numbers-at-age

The total number of herring taken in the North Sea is 4.36 billion fish and NSAS amounts to 4.48 billion fish in 2020. The proportion of 0- and 1-ringers of herring taken in the North Sea has increased considerably. It is 49% of the total catch in numbers in 2020 (Table 2.2.5), compared to 21% in 2019. Most of these young herring are still taken in the B-Fleet in Division 4.b. Here, 0-ringers amount to 78% of the total catch in numbers.

The proportion of 3+ winter ring herring is down to 39% of the total catch in numbers taken in the North Sea (compared to 76% in 2019).

In terms of biomass, the 6 and 7 winter ring herring contributed most to the catches in 2020.

Western Baltic (WBSS) and local Division 3.a spring spawners are taken in the eastern North Sea during summer feeding migration (see Stock Annex and Section 3.2.2). These catches are included in Table 2.1.1 and listed as WBSS. Table 2.2.8 specifies the estimated catch numbers of WBSS caught in the North Sea, which are transferred from the North Sea assessment to the assessment of Division 3.a/Western Baltic in 2005–2020. After splitting the herring caught in the North Sea and 3.a between stocks, the total catch of North Sea Autumn spawners amounts to 426 928 tonnes.

Area	Allocated	Unallocated	BMS/Discard	Total
4.a West	235 330		284	235 613
4.a East	58 597			58 597
4.b	95 422			95 422
4.c/7.d	35 451		2238	37 689
	Total catch in the North Sea			427 321
	Autumn spawners caught in Division 3.a (SOP)			6409
	Baltic spring spawners caught in the North Sea (SOP)			-6802
	Total catch NSAS used for the assessment			426 928

2.2.2 Other Spring-spawning herring in the North Sea

Norwegian spring spawners and local fjord-type spring-spawning herring are taken in Division 4.a (East) close to the Norwegian coast under a separate TAC. These catches are not included in the Norwegian North Sea catch figures given in tables 2.1.1–2.1.6, but are listed separately in the respective catch tables. Along with the reduction in biomass of these spring-spawning herring in recent years, the catches have decreased in recent years and amount to only 88 t in 2020.

Blackwater herring are caught in the Thames estuary under a separate quota and included in the catch figure for England and Wales. In recent years, these catches have been relatively small. At the time of HAWG, no catch figure for 2020 was available.

In recent years, no larger quantities of spring spawners were reported from routine sampling of commercial catch taken in the west.

2.2.3 Data revisions

No data revisions were applied in this year's assessment.

2.2.4 Quality of catch and biological data

Annual misreporting and unallocation of catches are regarded as a minor issue in the North Sea herring fishery. In 2020, no unallocated catches were reported.

Since 2015, a landing obligation is in place for pelagic fleets operating in the North Sea and the Baltic. All catches have to be landed into port. Reported catches in the BMS category (below minimum landing size, including any fish lost or damaged during processing procedures) were 284 tonnes in 2020. Some countries stated these to be zero, and other countries have not reported any catches in this category. In accordance with the landing obligation, no discards were reported in the 2020 North Sea herring fishery. However, discards occurred in demersal fisheries not targeting on herring. These discards sum to 2283 tonnes in 2020.

The sampling of commercial landings covers 82% of the total catch.

More important than a sufficient overall sampling level is an appropriate spread of sampling effort over the different métiers (here defined as each combination of fleet/nation/area and quarter). Of 115 different reported métiers, 28 were sampled in 2020. The sampling level of more than 1 sample per 1000 t catch has been met for only 17 métiers. With regards to age readings, 15 métiers appear to be sampled sufficiently (>25 fish aged per 1000 t catch).

However, some of the métiers yielded very little catch. In 71 métiers, the catch is below 1000 t. The total catch in these métiers sums to 10 582 t, so the remaining 45 métiers represent 416 739 t of the working group catch (98%). Of these 45 métiers, 24 were sampled. 11 métiers have more than 1 sample per 1000 t catch and also 11 métiers more than 25 age readings per 1000 t catch.

According to the DCF regulations, some catches of UK (England and Wales) were landed into and sampled by other nations.

The WG recommends that all métiers with substantial catch should be sampled (including by-catches in the industrial fisheries), and that catches landed abroad should be sampled and their biological data be made available to the national laboratories (see Section 1.5).

2.3 Fishery independent information

2.3.1 Acoustic Surveys in the North Sea (HERAS), West of Scotland 6.a (N) and the Malin Shelf area (MSHAS) in June–July 2020

Six national surveys were carried out during late June and July covering most of the continental shelf in the North Sea, West of Scotland and the Malin Shelf. The survey methods and full results are given in the report of the Working Group for International Pelagic Surveys (WGIPS; ICES 2021a). The vessels, areas and dates of cruises are given in Table 2.3.1.1 and in Figure 2.3.1.1.

The global survey results provide spatial distributions of herring, abundance by number and biomass-at-age by strata and distributions of mean weight- and proportion mature-at-age for the assessment (Table 2.3.1.2).

The time-series of abundance of North Sea autumn spawning herring is given in Table 2.3.1.3. The 2020 estimate of North Sea autumn spawning herring SSB (spawning-stock biomass) is lower than previous year at 1.7 million tonnes (2019: 1.9 million tonnes) due to a decrease in the number of fish (2019: 10 295 million fish, 2020: 8 915 million fish). The mean weight of mature fish is similar to last year at 192.6g and the decrease in biomass follows directly from a decrease in numbers. The spawning stock is dominated by fish of age 2, 5 and 6 wr. In the 2019 survey 3 and 5 wr dominated.

Distribution of herring in the North Sea area (Figure 2.3.1.2) is similar to that seen since 2017 and does not extend as far south as was the norm in the years prior to 2017. Abundance of NSAS herring was slightly lower compared to recent surveys in the North Sea area.

The abundance of immature fish in the stock has decreased by 3% since last year from 15 265 million in 2019 to 14 851 million this year. This is influenced by the small number of immature 2 wr fish.

Maturity of 2 winter ringers was at an all-time low at 37% in 2018. This year the maturity level was high for this age group (75% mature in 2020; 59% mature in 2019) and although the abundance of 2 winter ringers was twice the abundance in 2019, the high maturity level meant this age group contribute mainly to the mature fish abundance this year. Maturities for ages 3 and above were comparable to the long-term average, with 98% of 3 winter ringers and 99% or higher maturity for all ages 4 and above. Since 2015, observed maturities are reported for all age groups, previously maturity was fixed at 100% for ages above 4 wr.

2.3.2 International Herring Larvae Surveys in the North Sea (IHLS)

Six survey areas were covered within the framework of the International Herring Larval Surveys in the North Sea during the sampling period 2020–2021. They monitored the abundance and distribution of newly hatched herring larvae in the Orkney/Shetlands area, in the Buchan area and the central North Sea (CNS) in September and in the southern North Sea (SNS) in December 2020 and January 2021 (Figures 2.3.2.1–2.3.2.4).

The survey around the Orkneys revealed relatively low numbers of newly hatched larvae, in line with the estimate last year. In the Buchan and the central North Sea, larvae hatched in larger quantities, but concentrated in only two dense areas, while the remaining stations contributed only low numbers of larvae (Figure 2.3.2.2).

The two surveys in the southern North Sea showed a peak in abundance in January. In recent years, this peak was most often observed in December. However, the overall distribution of larvae and thus the main spawning area used by herring is not obviously different from preceding years. The

abundance of young larvae is high when hatching started in December, but their spatial distribution is limited. With progressing spawning season also the spatial distribution gets broader.

No survey was planned for the second half of January 2021. Instead, an additional MIK sampling is scheduled for March–April 2021 in the German Bight and Skagerrak/Kattegat area. This sampling should shade light on the foraging and recruitment of herring larvae originating in the Downs stock component. This survey is described in section 2.11.

During the most recent benchmark of the North Sea herring assessment (ICES, WKPELA 2018), it was decided to use the Larvae Abundance Index (LAI) as direct input into the assessment model and to resolve spatial stock dynamics inside the model.

2.3.3 International Bottom Trawl Survey (IBTS-Q1)

The International Bottom Trawl Survey (IBTS) provides the time series for 1-ringer herring abundance index in the North Sea from GOV catches carried out during day-time. In addition, night time catches with the fine meshed (1600 μm) 2-m-midwater ring net (MIK, ICES 2017) provide abundance estimates for large herring larvae (0-ringers) of the autumn spawning stock components. For more details on the times series, the reader is referred to the previous reports of the working group.

2.3.3.1 The 0-ringer abundance (IBTS0 survey)

The total abundance of 0-ringers in the survey area is used as a recruitment index for the stock. This year, 683 depth-integrated hauls were completed with the MIK-net, which is 117 MIK hauls more than in 2020. For the index, all hauls north of 51° N were used, in total 663 hauls, 111 more than in 2020. Due to bad weather during the second week of February, some participants could not take their stations, but these gaps could be successfully filled by other participants. Coverage of the survey area was good, mostly achieving the desired 4 hauls per ICES rectangle. Index values are calculated as described in detail in the Stock Annex.

Larvae measured between 7 and 41 mm standard length (SL, Figure 2.3.3.1.1). Again, and as in most years, the smallest larvae <10 mm were the most numerous. Larger larvae >18 mm SL were rarer and were caught in higher densities than last year (Figure 2.3.3.1.2). The smallest larvae were chiefly caught in 7.d and in the Southern Bight. The large larvae appeared in moderate to high quantities in both, the central western and southern parts of the North Sea. In the south-eastern and eastern part of the North Sea, the potential nurseries, abundance of large herring larvae was lower than last year.

The newly proposed rule was applied to the MIK herring larvae data time series from 1992 onwards, where because of data quality issues all French data before 2008 are excluded. The results of the calculation can be found in Table 2.3.3.1.1. The 2021 index is 95.2.

2.3.3.2 The 1-ringer herring abundances (IBTS-1)

The 1-ringer recruitment estimate (IBTS-1 index) is based on GOV catches in the entire survey area. The time series for year classes 1991 to 2019 is shown in Table 2.3.3.2.1 The index from the 2021 survey is 3128 which is well above the long-term average of the time series. Figure 2.3.3.2.1 illustrates the spatial distribution of 1-ringers as estimated by trawling in January/February 2019, 2020 and 2021. For the 2019 year class, the vast majority of the 1-ringers were found in the Kattegat/Skagerrak area, while in the North Sea, the 1-ringer abundance was low. Just 4 rectangles in the Kattegat/Skagerrak area contributed to more than 75 % of the index for this year. After 6 years in a row, where the trajectories for six recent 1-ringer abundances (year classes 2013–2018) correspond very well to the trajectories of their 6 respective 0-ringer indices (Figure 2.3.3.2.2), this correspondence has weakened again for the 2019 year class. While the index for the 0-ringers

only showed a slight increase in the 2020 MIK survey, the 2021 IBTS revealed a much stronger increase for the same year class.

2.4 Mean weights-at-age, maturity-at-age and natural mortality

2.4.1 Mean weights-at-age

Table 2.4.1.1 shows the historic mean weights-at-age (winter ringers, wr) in the North Sea stock during the 3rd quarter in divisions 4 and 3.a from the North Sea acoustic survey (HERAS) as well as the mean weights-at-age in the catch from 1996 to 2020 for comparison. The data for 2020 were sourced from tables 2.3.1.2. and 2.2.2. In the third quarter most fish are approaching their peak weights just prior to spawning.

The mean weights in the acoustic survey in 2020 were lighter for groups 1 to 3-wr and 9+ wr compared to those in the catch (Table 2.4.1.1).

However, the general trend towards smaller mean weight at age observed in recent years in the acoustic survey and, but less pronounced, in the catch in the 3rd quarter (Figure 2.4.1.1), seems to be turned in 2020. Almost all ages, in both the acoustic survey and the catch, had higher mean weight at age compared to 2019, with the only exception of 5-wr fish in the catch and 8-wr in the catch and the survey.

The signal of the 2007-year class (part of the plus group) is meanwhile blurred and not to be seen any longer. This year class have been growing slower throughout the years and was also the year class exhibiting greatly reduced maturity as 2-wr in 2010 and 3-wr in 2011.

2.4.2 Maturity ogive

The percentages at age of North Sea autumn spawning herring that were considered mature in 2020 were estimated from the North Sea acoustic survey (Table 2.4.2.1). The method and justification for the use of values derived from a single year's data were described fully in ICES (1996/ACFM:10). While 5+ group herring were considered fully mature in the period prior to 2015, WGIPS reported maturity stage for all groups up to 7+ separately in the most recent years.

Maturity of 2 winter ringers was at an all-time low in 2018 at 37%. In 2019, the proportion mature at 2 winter rings was at 59%, still low when compared to the long term. In 2020, 2 winter ringers were to 75% mature, much more in line with previous years. Maturities for winter ringers 3 (98%) and 4 (100%) are also comparable to the long-term average. 100% maturity was achieved by age 4.

2.4.3 Natural mortality

One of the improvements of the 2012 benchmark of the North Sea herring stock (ICES WKPELA, 2012) was the integration of fundamental links between the North Sea ecosystem and the NSAS stock dynamics.

From 2012 onwards, the assessment of NSAS includes variable estimates of natural mortality (M) at age derived directly from a multispecies stock assessment model, the SMS model, used in WGSAM (Lewy and Vinther, 2004; ICES, 2011). The input data to the assessment are the smoothed values of the raw SMS model annual *M* values, which are variable both at-age and over the time. Natural mortality in years outside the time-period covered by the model are filled and estimated for each age as a five-year running mean in the forward direction and in the

reverse direction for years prior. The M estimates are variable along the time period covered by the assessment and are the result of predator–prey overlap and diet composition. The trends in total M of NSAS are a result of the contribution of each of the predators to the predation mortality of the NSAS stock. The time-series of M adopted at the benchmark in 2012 was from the 2011 key run of the SMS model covering the period 1963–2010 (ICES WGSAM, 2011). Since 2012, the M time-series were updated following the latest key runs of the SMS model (ICES WGSAM, 2014; 2016, 2021).

During the 2018 benchmark (ICES WKPELA, 2018), it was decided to use the new M time-series from the 2017 SMS model key run (ICES WGSAM, 2018). However, because of the substantial impact the absolute level of M has on the assessment, an age and year independent offset is applied. This offset is calculated using a likelihood profiling of the assessment model which allows one to find the M that best fits the input data to the assessment. However, for the profiling performed during WKPELA 2018, a benchmark interim model specification was used. In practice, the assessment profiling should have been performed using the WKPELA 2018 final model configuration to ensure consistency in the derivation of additive rescaling. This discrepancy was only discovered at HAWG 2021 and has consequence in the scaling of the assessment. In order to correct this discrepancy but also update the natural mortality for the NSAS assessment with the latest SMS model key run (ICES WGSAM, 2021), a dedicated inter-benchmark was held (IBPNSherring2021: ICES, 2021b).

The latest natural mortality vector from WGSAM (ICES WGSAM, 2021) spans the 1974–2019 period. Values outside this year range is computed using a three-year moving average.

2.5 Recruitment

Information on the development in North Sea herring recruitment comes from the International Bottom Trawl Surveys, from which IBTS0 and IBTS-1 indices are derived. Further, the SAM assessment provides estimates of the recruitment of herring in which information from the catch and from all fishery independent indices is incorporated. Of importance is the fact that IBTS0 allows the assessment model to estimate recruitment levels in the assessment year. This is subsequently used in the short-term forecast for the intermediate year. The recruitment trends from the assessment are dealt with in Section 2.6.

2.5.1 Relationship between 0-ringer and 1-ringer recruitment indices

The estimation of 0-ringer abundance (IBTS0 index) predicts the year class strength one year before the strength is estimated from abundance of 1-ringers (IBTS-1 index). The relationship between year class estimates from the two indices is illustrated in Figure 2.5.1.1 and is described by the fitted linear regression.

The time series of 0- and 1-ringer abundance from the Q1 IBTS survey exists since the 1977 year class. For more than a decade until the mid-1990s, there has been very good agreement between the indices in their description of temporal trends in recruitment, with the 0-ringer index explaining more than 70 % of the variability of the respective 1-ringer abundance. It has to be borne in mind that the IBTS 0-ringer (or MIK) index only reflects recruitment in the autumn spawning components. Hence, once the contribution of the winter spawning Downs component to the total North Sea stock increased and of the autumn spawning components decreased, the relationship between the two indices started to erode. This was particularly true during the first decade of the 21st century (for the year classes 2002–2012), but also already for the 1995 year class, when the predicted trends in recruitment deviated between the two indices.

Since 2017, the MIK index time series is calculated with the new algorithm, which only dates back to 1992 and excludes larvae of Downs origin more rigorously. The correlation between 0- and 1-ringer indices utilizing the newly calculated MIK index time series is much weaker, explaining only 27 % recruitment variability (Figure 2.5.1.1). However, starting with the 2013 year class, there was once again good agreement between the trends of the two indices. In 2014 it was recorded as the largest 0-ringer abundance since 2002, and the strength of this year class was confirmed in 2015 with one of the largest 1-ringer abundances. This was the first strong year class observed since 2002. Since then, the IBTS 1-ringer index followed the ups and downs of the MIK 0-ringer index for the respective year class until the 2019 year class (Figure 2.3.3.2.2). For the 2020 year class, the relationship between the MIK 0-ringer and the IBTS 1-ringer index decreased again.

2.6 Assessment of North Sea herring

2.6.1 Data exploration and preliminary results

The tool for the assessment of North Sea herring is FLSAM, an implementation of the State-space assessment model (www.stockassessment.org, Nielsen and Berg 2014), embedded inside the FLR library (Kell *et al.*, 2007).

Acoustic (HERAS ages 1–8+), bottom trawl (IBTS-Q1 age 1, IBTS-Q3 age 2–5), IBTS0 and larval index (LAI) indices are available for the assessment of North Sea autumn spawning herring. The surveys and the years for which they are available are given in Table 2.6.1.1. The input data and the performance of the assessment have been scrutinised to check for potential problems.

The proportion mature of 2, 3 and 4-wr individuals are 75%, 98%, and 100% respectively. The historical proportion mature at age are given in Table 2.6.1.2 and plotted in Figure 2.6.1.1. The maturity for age 2 has substantially increased compared to the lowest point in 2018. This is following a consistent decrease of proportion mature at this age since 2015. Other biological inputs to the assessment are presented in Figures 2.6.1.2–2.6.1.4 and Tables 2.6.1.3–2.6.1.5. Catch at age are given in Table 2.6.1.6 and the proportions plotted in Figure 2.6.1.5. One strong feature in 2020 is the large proportion of young fish caught (age 0) which is due to the large update of the B fleet.

The numbers-at-age over all ages in the HERAS acoustic survey are given in Table 2.6.1.7 and the proportions are plotted in Figure 2.6.1.6. Overall, the age composition of the stock sampled by the HERAS acoustic survey in 2020 is similar to previous years. For this survey, the internal consistency of the index remains high, as it has been for a long period (Figure 2.6.1.7). However, as explored at HAWG 2020 (ICES, 2020), the index consistency has decreased in recent years. Other survey indices are presented in Tables 2.6.1.8–2.6.1.14. The internal consistency of the IBTSQ3 (the other multi-age index) is shown in Figure 2.6.1.8 and presents good cohort tracking.

2.6.2 NS herring assessment

In accordance with the settings described in the Stock Annex, the final assessment of North Sea herring was carried out by fitting the state space model (SAM, in the FLR environment). The input data are presented in Table 2.6.1.2–2.6.1.14 and model settings are given in Table 2.6.2.7. Estimated parameters and model outputs are given in Table 2.6.2.1–2.6.2.6.

A summary of assessment outputs is shown in Figure 2.6.2.1 (SSB, F averaged over age 2–6 and recruitment). The spawning stock at spawning time in 2020 is estimated at approximately 1.5 million tonnes, similar to 2019 (1.55 million tonnes), suggesting a stall in the decrease of the stock

observed since 2012. As for recruitment, the 2021 estimates are the highest since 2013, in line with survey observations. Mean F_{2-6} in 2019 is estimated at approximately 0.20.

The SAM model fits the catch and the surveys well and residuals are random and small for all ages (figures 2.6.2.2–2.6.2.5). Only a small block of positive residuals can be observed for age 7 catch data over the years 2000–2006, while at age 8 for catch data, a similar block of negative residuals can be observed (figures 2.6.1.13 and 2.6.1.14). This likely indicates a trade-off in model fit to either the age 7 or age 8+ catch information. There is a methodological need however to link age 7 and age 8+ together in the stock assessment model. The residuals are very small and are not considered an issue for the performance of the assessment. The fitting of the LAI index is poor due to the intrinsic noise to the larvae survey. However, this survey is the only one able to provide information on the strength of the different spawning components. Given the low impact of this survey on the overall assessment, this is not considered an issue.

The estimated observation variances and survey catchabilities are given in Tables 2.6.2.1–2.6.2.2 and plotted in Figures 2.6.2.6–2.6.2.8. Overall, the assessment is informed best by catch data and HERAS over the core ages of the stock (ages 2-6). With the new assessment model from the latest inter-benchmark (ICES, 2021b), the catchability of the HERAS survey is 1.11, in line with the expectation for this survey that covers the stock in its entirety.

A feature of the assessment model is the estimation of an observation variance parameter for each dataset (Table 2.6.2.1, Figure 2.6.2.6). Overall, all data sources are associated with low observation variances. The catch-at-ages 1–5 stands out as the most precise data source while the LAI indices, IBTSQ3 age 0 and HERAS age 1 to be the noisiest data. The uncertainty associated with the parameter estimated is low for most data sources where only the CV of the catch-at-age 0 is some- what high (Figure 2.6.2.7). However, the CV quantities do not indicate a lack of convergence of the assessment model. Overall, the assessment is informed best by catch data and HERAS over the core ages of the stock (ages 2–6).

Estimated survey catchabilities for the HERAS and IBTSQ surveys are given in Table 2.6.2.2 and plotted in Figures 2.6.2.8. With the new assessment model from the latest inter-benchmark (ICES, 2021b), the catchability of the HERAS survey is 1.11, in line with the expectation for this survey that covers the stock in its entirety.

The analytical retrospective pattern is lower than for the 2020 assessment, partly due to the change in model settings as a result of the latest inter benchmark (ICES, 2021b). With the current model, the analytical retrospective is limited until 2018 (Table 2.6.2.5, Figure 2.6.2.9). The mean mohn's rho with a 5-year period for the peel is of: -5.1% (F_{bar}), -9.5% (rec), and 8% (SSB).

Figure 2.6.1.49 shows the model uncertainty plot, representing the parametric uncertainty of the fit of the assessment model in terminal F and SSB.

Further data screening of the input data on mature – immature biomass ratios, survey CPUEs, proportion of catch numbers- and weights-at-age and proportion of IBTS and acoustic survey ages have been executed, as well as correlation coefficient analyses for the acoustic and IBTS survey and assessment parameters (Figure 2.6.2.10–2.6.2.12).

2.6.3 Exploratory Assessment for NS herring

An exploratory assessment using fleet disaggregated data for (1) catches-at-age (2) weight in the catch-at-age was carried out (Figure 2.6.3.1). It is important to note that fleet B and D are combined because of their similarity. More details on the model configuration exploration is provided in the 2018 benchmark report (ICES WKPELA, 2018). Tables for the multifleet assessment and results (including fleet wise fishing mortalities) are given in Table 2.6.3.1–2.6.3.7. Figure

2.6.3.2 shows a comparison between the single fleet and multi-fleet stock trajectory results and these are very consistent.

Of particular relevance when running the SAM model using a multifleet configuration is the fishing mortality-at-age that is outputted for each fleet. The subsequent catch residuals for each fleet is shown in Figure 2.6.2.3 to Figure 2.6.2.5. The observation variance is shown in Figure 2.6.2.6, with high levels for fleet B and D. Expectedly, the model is driven by catch data from the fleet A which represents most of the overall catches. The model uncertainty and the correlation coefficients between the estimated parameters are shown in Figure 2.6.2.7 and 2.6.2.8, respectively.

The analytical retrospective for the multi-fleet model is shown in in Figure 2.6.2.9 and is slightly higher than for the single fleet model. The fishing selectivity for the A fleet are shown in Figure 2.6.3.10 and present similar patterns to the single fleet model. This is expected as fleet A is the main fleet harvesting the stock. The development of selectivity patterns for the other fleets (C and B and D combined) are presented in Figure 2.6.3.11 and 2.6.3.12.

2.6.4 State of the Stock

Based on the most recent estimates of SSB and fishing mortality, ICES classifies the stock as is being harvested sustainably. Fishing mortality is below the estimated F_{MSY} (0.31).

The SSB in autumn 2020 was estimated at 1.51 million tonnes, which is above B_{pa} (0.96 million t) and MSY $B_{trigger}$(1.23 million t).

Since 2013, stock recruitment has been low but a large recruitment was observed in 2021 (highest level since 2013). In 2021, recruitment is estimated at 30 billion, 28% higher than the 10-years weighted mean. This is expected to benefit the stock in the coming years.

Similarl to recent years' assessments, fishing mortality on older ages remains high in recent years. As for the 2020 assessment, the fishing mortality-at-age 7 and 8 is estimated at 0.51 in 2020, which is substantially higher than F_{bar2-6} (0.20). In the 2017 assessment (ICES HAWG, 2017), comparison of the only acoustic survey and catch data gave the same impression that the catches at the older ages are relatively high compared to the estimated number of fish in those ages.

2.7 Short-term predictions

Short-term predictions for the years 2020, 2021, and 2022 were done with code developed in the R programming language. During HAWG 2019, a modification to the code was made because the 2015 EU-Norway management rule is no longer in force and because the ICES advice for WBSS herring resulted in a zero catch advice. During HAWG 2020, a further modification to the code was made to allow for a combined scaling of the A and B fleets (see below).

The various assumptions for the short-term predictions for both the stock and the four different fleets are given in tables 2.7.1 and 2.7.2 respectively. The reference points are presented in Table 2.7.3.

In the short-term predictions, recruitment is assumed constant at 23 billion for the years 2023 and 2023 following the same recruitment regime since 2002 (weighted mean of the past 10 year classes, weighted by the uncertainty in the estimate). The recruitment estimate of the 2020 year class, obtained from the assessment (informed by the 2021 IBTS0 survey) served as the estimate for 2021.

For the intermediate year (2021), no overshoot for the A fleet was assumed. Previous negotiations between the EU and Norway resulted in the allowance of 50% of the C-fleet TAC in the Kattegat-

Skagerrak area to be taken in the North Sea. Because a TAC for the C-fleet had been agreed for 2021 despite the zero advice for WBSS herring, the pelagic AC was requested to estimate the percentage of the 3.a herring TAC that would be taken in the North Sea. The pelagic AC estimated it at 48% in 2021. The same proportion has been used in this projection for the scenarios where the C-fleet catch was not set to zero.

The expected catches of Western Baltic Spring-spawning herring caught under the North Sea TAC are deducted from the expected A fleet catches in the intermediate year. In the projected year 2022, for most of the scenarios, the C and D fleet outtake was set to 0 in agreement with the 0-catch advice for WBSS for 2022. The catch scenarios with a 0 catch advice for WBSS are presented in Table 2.7.4.

For the catch options with a TAC status quo for the C and D fleets, the fraction of North Sea Autumn Spawning (NSAS) herring caught in 3.a by the C and D fleet was used to derive C and D fleet NSAS catches, based on projected TACs in 3.a for these fleets. The catch scenarios assuming a status quo in C-D fleet catches are presented in Table 2.7.5.

In the absence of an agreed management plan for NSAS herring, it has not been possible to derive fleet-based fishing mortalities for the prediction year. Therefore, the ICES MSY Advice Rule (MSY AR) has been used as the basis for the advice. With the reference points derived at IBPNSherring2021 (ICES, 2021b) The MSY AR stipulates a fishing mortality of $F_{MSY} = 0.31$ when the stock is above MSY $B_{trigger}$ (1 232 828 tonnes) and a linear decline in F when the stock is below MSY $B_{trigger}$. With the forecasted values in 2022, the SSB is calculated above MSY $B_{trigger}$ which results in a target $F_{(WR)\,2\text{–}6} = F_{MSY}$ (Figure 2.7.1.1).

There is no specific allowance in the ICES MSY AR for multiple fishing mortality targets, such as the F for 0 and 1 WR herring, which were previously integral part of the management plans for NSAS herring. In the forecast, the combined selection pattern for the A and B fleets are scaled together to achieve the different targets of the forecast scenarios. Therefore, the fishing mortalities of the A and B fleets are both variable across the scenarios. In addition, three scenarios are presented in which 1) a fixed target fishing mortality for the B-fleet is used and 2) and 3) the TACs of the C and D fleet are the same as in 2020 (with and without transfer of the C fleet to the North Sea).

All predictions are for North Sea autumn spawning herring only.

2.7.1 Comments on the short-term projections

The new assessment model from IBPNSherring2021 (ICES, 2021b) resulted in a lower estimated stock size and higher fishing mortality than in the previous assessment. The interbenchmark process also led to an update of the reference points for the stock. The new biomass limit reference point B_{lim} has increased to 874 198 tonnes. MSY reference points have been updated with a lower MSY $B_{trigger}$ (1 232 828 tonnes) and a higher F_{MSY} (0.31). The increase in F_{MSY} in particular is mainly the result of changing selection patterns in the fishery and the stock–recruitment model used in the estimation process. The 2021 data suggest that the steep decline of the stock observed since 2016 has stalled, and the spawning stock biomass is now above MSY $B_{trigger}$. The decrease in the rate of stock decline and the higher F_{MSY} lead to higher catch advice for 2022 compared to 2021, more specifically an increase of 45%.

2.7.2 Exploratory short-term projections

The 2021 assessment predicted a stall in the decline of the stock. This contrasts with the projections made in 2020, based on the sharp decline of the stock observed since 2017 (Figure 2.7.2.1).

As a result, the SSB in the intermediate year is calculated as much higher which contributes to an increase in catch opportunity, alongside the use of newly derived reference points.

A direct comparison of the forecast results with the last two assessments (2020 and 2019) is given in Figure 2.7.2.2 for the catches at age and Figure 2.7.2.3 as proportions. Overall, it is predicted that the contribution of old ages will be lessened in 2022 relative to 2021 where the proportion of age 7–8 is substantial.

To explore the sensitivity of the short-term projection to the particular situation for North Sea herring (stock mainly consisting of older fish that are highly selected for), HAWG 2021 again carried out and extended short-term projection using the MSY AR projection, using the same recruitment and the same fishing patterns by fleet for the years 2023–2027 (Figure 2.7.2.4). This is using the new model and reference points derived during IBPNSherring 2021 (ICES, 2021b). This projection resulted catch of ~420 tonnes by 2026. SSB would decline steadily from 1.6 million tonnes to 1.1 million tonnes. It should be noted that this does not constitute a real evaluation of the MSY AR rule because the fishing mortality was not adapted according to the rule, but simply kept constant during the years of the projection.

2.8 Medium term predictions and HCR simulations

No medium-term prediction or HCR simulations were carried out during the Working Group. A new management strategy evaluation was carried out in 2019 (ICES WKNSMSE, 2019), following an EU-Norway request (EU–Norway, 2018[2]). However, to date there is no agreement of management plan.

2.9 Precautionary and Limit Reference Points and F_{MSY} targets

The precautionary reference points for this stock were originally adopted in 1998 and updated in 2012, 2016 and 2018.

New reference points were calculated during the 2021 interbenchmark meeting (ICES WKNSHERRING, 2021) which resulted in a downward estimate of B_{lim} and MSY $B_{trigger}$ and an upward estimate of F_{MSY}. Sensitivity testing revealed that the derivation of reference points for herring in the North Sea is very sensitive to the choice of time periods and stock–recruitment models used. Reference points out of the 2018 benchmark and the 2021 interbenchmark are presented in Table 2.9.1. The derivation of reference points and the history of the reference points for North Sea herring are further described in the Stock Annex.

Overall, in light of the 2021 assessment, the fishing pressure remains below F_{MSY} while the SSB is above MSY $B_{trigger}$.

2.10 Quality of the assessment

The data used within the assessment, the assessment methods and settings were carefully scrutinized during the 2018 benchmark (ICES WKPELA, 2018) and 2021 inter-benchmark (ICES, 2021b). These are described in the North Sea Herring Stock Annex (a list of links to the Stock Annexes can be found in Annex 4). The changes made during the 2021 inter-benchmark overall improved the assessment model. Sensitivity testing revealed that the derivation of reference points for herring in the North Sea is very sensitive to the choice of time periods and stock–recruitment models used.

2.11 North Sea herring spawning components

The North Sea autumn-spawning herring stock is generally understood as representing a complex of multiple spawning components (Cushing, 1955; Harden Jones, 1968; Iles and Sinclair, 1982; Heath *et al.*, 1997). Monitoring and maintaining the diversity of local populations is widely viewed as critical to the successful management of marine fish stocks.

2.11.1 International Herring Larval Survey

The spawning component abundance index (SCAI: Payne, 2010) was developed to characterize the relative dynamics of the individual North Sea spawning components.

The dynamics of the components are documented in Table 2.3.2.1 and can be observed in Figure 2.11.1.

Prior to 2002 there were large differences in the contributions of each of the components to the total SSB with northern components (Orkney/Shetland and Buchan) being the major contributors. Since 2002 there has been a more even contribution from each of the four components with some interannual variability. However, the Downs component may be underrepresented in some years due late spawning and Orkney-Shetland due to a lack of sampling due to vessel constraints in 2016–2019.

2.11.2 IBTS0 Larval Index

The ringnet hauls for 0-ringers during the IBTS in the North Sea and eastern English Channel also include Downs herring larvae. These larvae are, however, too small to have passed their critical period of high and highly variable mortality. Their abundance cannot be used for recruitment prediction. These small larvae (separated as <19 mm) have been excluded from the standard estimation of 0-ringer recruitment (IBTS0 index).

2.11.3 Component considerations

The Downs TAC was set up to conserve the spawning aggregation of Downs herring. Uncertainties concerning the status of, and recruitment to, this component of the North Sea herring stock are high, and HAWG is not aware of any evidence to suggest that this measure is inappropriate. HAWG therefore recommends that the 4.c–7.d TAC be maintained at 11% of the total North Sea TAC (as recommended by ICES). Any new management approach should provide an appropriate balance of F across stock components and be similarly conservative until the uncertainty about contribution of the Downs and other components to the catch in all fisheries in the North Sea is reduced.

2.12 Ecosystem considerations

The status as of 2015 can be found in ICES HAWG (2015) and the stock annex.

2.13 Changes in the environment

For several herring stocks in the working group, the mean weight-at-age in the catch and in the stock has been decreasing since the early 1980s. This applies to the Celtic Sea herring, Irish Sea herring and North Sea Autumn Spawning herring. No real pattern is observed for Western Baltic

Spring-spawning herring and an increase in mean weight is seen in the combined Malin Shelf herring.

Decreases in mean weight in the catch could drive the recent increase in selectivity of the fisheries for older ages. The fisheries often target certain weight classes of herring which could be of an older age in the recent years.

The North Sea Autumn Spawning herring stock has, since 2002, produced a series of below average year classes, a situation which has not been observed previously (Payne *et al.*, 2009): the most recent year class also appears to represent a continuation of this trend. This low recruitment has occurred despite a spawning-stock biomass that is well above the B_{lim} of 800 000 tonnes (where impaired recruitment is expected to set in) (Figure 2.13.1).

Stock productivity, as represented by the number of recruits-per-spawner from the assessment, has been low for the last decade (Figure 2.13.2). Although there have been changes during this low productivity regime, at no point has this metric approached the levels seen during the 1990s. The most recent recruits-per-spawner is amongst the lowest observed during the recent period.

Year-class strength in this stock is determined during the larvae phase (Dickey-Collas and Nash, 2005; Payne *et al.*, 2009). Updating these analyses with the most recent datasets suggests that the trend of reduced larval survival between the early (as indicated by the SSB/LAI index) and the late (as indicated by the IBTS0 index) larval stages has continued in the most recent years (Figure 2.13.3). (It should be noted that the switch from the SCAI calculation to the LAI calculation inside the assessment model, has caused a higher variability of the larvae survival relationship between SSB/LAI and IBTS0 indices). The most recent observation continues the trend of relatively poor survival.

The IBTS0 index is regarded by the working group as not being representative of recruitment to the Downs spawning component, as observations of small larvae in this region are removed from the index calculation. A more appropriate metric is therefore to base the metric of larval survival on the abundance of larvae from the three northern components (i.e. excluding the Downs). However, this refined metric shows a very similar trend (Figure 2.13.4) with continued poor survival.

All indicators therefore suggest that the stock remains in the low productivity regime observed in previous years.

2.14 References

A. Nielsen and C. W. Berg, "Estimation of time-varying selectivity in stock assessments using state-space models," *Fish. Res.*, vol. 158, pp. 96–101, Oct. 2014.

ICES. 2019. EU and Norway request concerning the long-term management strategy of cod, saithe, and whiting, and of North Sea autumn-spawning herring. *In* Report of the ICES Advisory Committee, 2019. ICES Advice 2019, sr.2019.06, https://doi.org/10.17895/ices.advice.4895

ICES. 2020. Herring Assessment Working Group for the Area South of 62° N (HAWG). ICES Scientific Reports. 2:60. 1151 pp. http://doi.org/10.17895/ices.pub.6105

ICES. 2021a. Working Group of International Pelagic Surveys (WGIPS). ICES Scientific Reports. 3:40. 481pp. https://doi.org/10.17895/ices.pub.8055

ICES. 2021b. Inter-Benchmark Protocol on North Sea Herring (IBPNSHerring 2021). ICES Scientific Reports. 3:98. 168 pp. https://doi.org/10.17895/ices.pub.8398

Table 2.1.1. Herring caught in the North Sea. Total catch (tonnes) by country, 2016–2020. These figures do not in all cases correspond to the official statistics and cannot be used for legal purposes.

Country	2016	2017	2018	2019	2020
Belgium	26	13	32	60	119
Denmark *	133 962	110 318	132 231	91 680	95 615
Faroe Islands	833	442	497	614	804
France	35 177	28 801	31 505	25 288	19 768
Germany	44 231	43 707	51 636	37 699	29 439
Netherlands	98 859	84 914	111 302	79 465	75 036
Norway	150 183	134 132	162 594	128 614	115 879
Sweden *	16 625	18 518	19 408	13 184	13 149
Ireland	127	868	515	3	235
UK (England)	20 485	16 997	19 591	12 685	16 241
UK (Scotland)	59 240	49 514	66 005	50 771	49 692
UK (N.Ireland)	-	3 469	6 916	3 938	2 681
Unallocated landings	8	0	0	0	0
Total landings	559 756	491 693	602 232	444 001	424 800
Discards/BMS	170	-	96	1 630	2 522
Total catch	559 926	491 693	602 328	445 631	427 321
Estimates of the parts of the catches which have been allocated to spring-spawning stocks					
WBSS	1 839	632	2 164	8 832	6 802
Thames estuary **	1	0	0	-	-
Norw. Spring Spawners ***	216	83	310	5	88

*** Including any bycatches in the industrial fishery**

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

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

Table 2.1.2. Herring caught in the North Sea. Catch in tonnes in Division 4.a (West). These figures do not in all cases correspond to the official statistics and cannot be used for legal purposes.

Country	2016	2017	2018	2019	2020
Denmark *	81080	76277	90763	54820	56676
Faroe Islands	811	405	496	611	794
France	15073	11064	14745	13344	7688
Germany	27926	32736	35884	19851	16694
Lithuania	-	-	-	-	2789
Netherlands	66740	55832	56990	44071	50363
Norway	57056	57744	78647	53254	35674
Sweden	9933	12447	14132	8557	7718
Ireland	127	868	515	3	235
UK (England)	13010	12072	12313	5640	11439
UK (Scotland)	58557	49012	64424	50771	42581
UK (N. Ireland)	-	3469	5582	3938	2681
Total Landings	330313	311926	374491	254860	235330
Discards/BMS	100	-	-	-	284
Total catch	330413	311926	374491	254860	235613

*** Including any bycatches in the industrial fishery.**

Table 2.1.3. Herring caught in the North Sea. Catch in tonnes in Division 4.a (East). These figures do not in all cases correspond to the official statistics and cannot be used for legal purposes.

Country	2016	2017	2018	2019	2020
Denmark *	16305	3928	751	-	62
Netherlands	-	-	-	100	-
Norway	78125	74216	73452	64592	58535
Sweden	3985	705	377	-	-
Total landings	98415	78849	74580	64692	58597
Discards/BMS	-	-	-	-	-
Total catch	98415	78849	74580	64692	58597
Norw. Spring Spawners **	216	85	310	5	88

*** Including any bycatches in the industrial fishery.**

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

Table 2.1.4. Herring caught in the North Sea. Catch in tonnes in Division 4.b. These figures do not in all cases correspond to the official statistics and cannot be used for legal purposes.

Country	2016	2017	2018	2019	2020
Belgium	-	-	-	-	11
Denmark*	36149	30045	4067	36750	38842
Faroe Islands	22	37	1	3	10
France	6225	7423	6090	1359	5092
Germany	3419	2048	4964	8568	4197
Netherlands	17233	15739	34491	20700	8814
UK (N. Ireland)	-	-	1334	-	-
Norway	15002	2172	10495	10768	21671
Sweden*	2705	5366	4899	4627	5431
UK (England)	3820	2435	3262	2750	919
UK (Scotland)	683	502	1581	-	7082
Unallocated landings	0	0	0	0	0
Total landings	85258	65767	107794	85525	95422
Discards	-	-	1	800	-
Total catch	85258	65767	107795	86325	95422

*** Including any bycatches in the industrial fishery**

Table 2.1.5. Herring caught in the North Sea. Catch in tonnes in Division 4.c and 7.d. These figures do not in all cases correspond to the official statistics and cannot be used for legal purposes.

Country	2016	2017	2018	2019	2020
Belgium	26	13	32	60	108
Denmark*	428	68	40	110	36
France	13879	10314	10670	10585	6988
Germany	12886	8923	10788	9280	8548
Netherlands	14886	13343	19821	14594	15859
Sweden	2	-	-	-	
UK (England)	3655	2490	4016	4295	3883
UK (Scotland)	-	-	-	-	30
Unallocated landings	8	0	0	0	0
Total landings	45770	35151	45367	38924	35451
Discards/BMS	70	-	95	830	2238
Total catch	45840	35151	45462	39754	37689
Coastal spring spawners included above**	1	-	10	-	-

*** Including any bycatches in the industrial fishery**

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

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

Table 2.1.6 ("The Wonderful Table"): Herring caught in the North Sea. Catch in thousand tonnes in Subarea 4, Division 7.d and Division 3.a.

Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Subarea 4 and Division 7.d: TAC (4 and 7.d)													
Agreed Divisions 4.a,b	147.4	149.0	173.5	360.4	427.7	418.3	396.3	461.2	428.7	534.5	342.7	342.7	317.2
Agreed Div. 4.c, 7.d	23.6	15.3	26.5	44.6	50.3	51.7	49.0	57.0	53.0	66.0	42.4	42.4	34.8
Bycatch ceiling in the small mesh fishery *	16.0	13.6	16.5	17.9	14.4	13.1	15.7	13.4	11.4	9.7	13.2	9.0	7.8
CATCH (4 and 7.d)													
National catch Divisions 4.a,b **	145.0	148.1	191.7	387.2	453.8	465.9	439	514.0	456.5	556.9	405.1	389.3	
Unallocated catch Divisions 4.a,b	-1.1	0.0	0.0	-3.0	0.0	3.3	1.5	0.0	0.0	0.0	0.0	0.0	
Discard/slipping Divisions 4.a,b ***	0.1	0.0	-	-	-	0.0	-	0.1	-	0.0	0.8	0.3	
Total catch Divisions 4.a,b #	143.9	148.1	191.7	384.2	453.9	469.2	440.5	514.1	456.5	556.9	405.9	389.6	
National catch Divisions 4.c, 7.d **	21.5	26.5	26.7	37.1	44.7	38.2	41.1	45.8	35.2	45.4	38.9	35.5	
Unallocated catch Divisions 4.c,7.d	0.4	0.0	0.0	3.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Discard/slipping Divisions 4.c, 7.d ***	-	-	-	-	-	-	-	0.1	-	0.1	0.8	2.2	
Total catch Divisions 4.c, 7.d	21.9	26.5	26.7	40.4	44.7	38.2	41.1	45.8	35.2	45.5	39.8	37.7	
Total catch 4 and 7.d as used by ICES #	165.8	174.6	218.4	424.6	498.5	507.5	481.6	559.9	491.7	602.3	445.6	427.3	
CATCH BY FLEET/STOCK (4 and 7.d) ##													
North Sea autumn spawners directed fisheries (Fleet A)	152.1	164.8	209.2	411.8	489.9	490.5	471.5	543.6	484.1	591.7	440.5	417.5	
North Sea autumn spawners industrial (Fleet B)	9.8	9.1	8.9	10.6	8.1	14.0	7.9	14.5	7.0	8.5	5.2	9.9	
North Sea autumn spawners in 4 and 7.d total	161.9	173.9	218.1	422.5	498.1	504.5	479.4	558.1	491.1	600.2	436.8	420.5	
Baltic-3.a-type spring spawners in 4	3.9	0.8	0.3	2.1	0.5	3.0	2.2	1.8	0.6	2.2	8.8	6.8	
Coastal-type spring spawners	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Norw. Spring Spawners caught under a separate quota in 4 ###	44.6	56.9	12.2	9.6	3.2	2.3	2.2	0.2	0.1	0.3	0.0	0.1	
Division 3.a: TAC (3.a)													
Agreed herring TAC	37.7	33.9	30.0	45.0	55.0	46.8	43.6	51.1	50.7	48.4	29.3	24.5	21.6
Bycatch ceiling in the small mesh fishery	8.4	7.5	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7

Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
CATCH (3.a)													
National catch	38.8	37.3	20.0	27.7	31.2	28.9	27.8	29.9	26.8	23.3	14.9	17.8	
Catch as used by ICES	38.8	37.3	20.0	27.7	31.2	28.9	27.8	29.9	26.8	23.3	14.9	17.8	
CATCH BY FLEET/STOCK (3.a) ##													
Autumn spawners human consumption (Fleet C)	5.1	12.0	6.6	7.8	11.8	9.5	10.2	4.1	7.4	3.2	5.8	6.0	
Autumn spawners mixed clupeoid (Fleet D)	1.5	1.8	1.8	4.4	1.6	3.3	4.4	1.4	0.2	0.2	0.3	0.4	
Autumn spawners in 3.a total	6.5	13.8	8.4	12.2	13.4	12.8	14.7	5.5	7.6	3.4	6.1	6.4	
Spring spawners human consumption (Fleet C)	29.4	23.0	10.8	14.5	16.6	15.4	11.3	23.3	19.0	19.7	8.8	10.9	
Spring spawners mixed clupeoid (Fleet D)	2.9	0.5	0.8	1.0	1.3	0.6	1.8	1.1	0.2	0.2	0.0	0.5	
Spring spawners in 3.a total	32.3	23.5	11.6	15.5	17.9	16.1	13.1	24.4	19.2	19.9	8.8	11.4	
North Sea autumn spawners Total as used by ICES	168.4	187.6	226.5	434.6	511.4	517.3	494.1	563.6	498.7	603.5	442.9	426.9	

Table 2.2.1. North Sea autumn spawning herring (NSAS), and western Baltic spring spawners (WBSS) caught in the North Sea and Division 3.a in 2020. Catch in numbers (millions) at age (CANUM), by quarter and division.

WR	3.a NSAS	4.aE all	4.aE WBSS	4.aE NSAS only	4.aW	4.b	4.c	7.d	4.a & 4.b NSAS	4.c & 7.d	Total NSAS	Herring caught in the North Sea
Quarters: 1-4												
0	**79.4**	**0.0**	**0.0**	**0.0**	**562.2**	**1476.1**	**9.6**	**0.0**	**2038.3**	**9.6**	**2127.4**	**2047.9**
1	**26.6**	**21.7**	**1.8**	**19.9**	**54.9**	**10.7**	**0.1**	**0.0**	**85.5**	**0.1**	**112.1**	**87.3**
2	**44.2**	**147.1**	**3.2**	**143.**	**271.0**	**77.8**	**1.6**	**10.**	**492.7**	**12.**	**549.**	**508.3**
3	**5.3**	**44.4**	**5.8**	**38.5**	**108.3**	**39.9**	**4.1**	**19.2**	**186.7**	**23.3**	**215.2**	**215.8**
4	**2.2**	**38.8**	**7.5**	**31.3**	**186.4**	**33.6**	**4.5**	**33.9**	**251.3**	**38.4**	**291.9**	**297.2**
5	**0.3**	**18.1**	**1.2**	**16.9**	**85.6**	**7.8**	**1.2**	**34.0**	**110.3**	**35.2**	**145.8**	**146.7**
6	**0.6**	**57.4**	**10.7**	**46.7**	**313.2**	**105.4**	**5.5**	**44.1**	**465.2**	**49.6**	**515.4**	**525.5**
7	**0.8**	**39.5**	**5.3**	**34.2**	**186.4**	**88.9**	**6.9**	**32.**	**309.5**	**39.**	**349.4**	**354.0**
8	**0.0**	**8.8**	**1.8**	**7.0**	**31.2**	**23.8**	**1.8**	**5.1**	**61.9**	**6.9**	**68.8**	**70.6**
9+	**0.0**	**12.7**	**2.8**	**10.0**	**45.9**	**41.4**	**2.2**	**8.4**	**97.3**	**10.6**	**107.8**	**110.6**
Sum	**159.3**	**388.5**	**40.2**	**348.2**	**1845.2**	**1905.3**	**37.4**	**187.7**	**4098.7**	**225.1**	**4483.2**	**4364.1**
Quarter: 1												
0	0.0	0.0	0.0	0.0	11.7	1.9	2.3	0.0	13.6	2.3	**15.9**	**15.9**
1	14.9	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0	**15.0**	**0.1**
2	32.5	0.1	0.2	0.0	2.6	0.8	1.5	0.1	3.4	1.6	**37.4**	**5.1**
3	1.0	0.0	0.1	0.0	1.5	0.5	2.8	0.8	2.0	3.6	**6.6**	**5.6**
4	0.1	0.0	0.1	0.0	3.6	1.0	1.1	0.9	4.6	2.1	**6.7**	**6.7**
5	0.0	0.0	0.2	0.0	3.0	0.3	0.5	1.5	3.3	2.0	**5.4**	**5.3**
6	0.0	0.0	0.3	0.0	11.0	0.9	3.6	1.6	11.9	5.1	**17.0**	**17.1**
7	0.0	0.0	0.0	0.0	14.7	0.8	3.6	1.2	15.5	4.8	**20.3**	**20.3**
8	0.0	0.0	0.1	0.0	1.2	0.1	0.6	0.3	1.2	0.8	**2.0**	**2.0**
9+	0.0	0.0	0.1	0.0	10.7	0.3	2.0	0.3	11.0	2.2	**13.2**	**13.2**
Sum	**48.5**	**0.3**	**1.1**	**0.0**	**60.0**	**6.4**	**18.0**	**6.7**	**66.5**	**24.7**	**139.6**	**91.4**
Quarter: 2												
0	0.8	0.0	0.0	0.0	40.3	346.9	0.0	0.0	0.2	0.1	**388.0**	**387.2**
1	1.1	18.6	1.6	17.0	0.5	2.4	0.0	0.0	19.9	0.0	**21.0**	**21.5**
2	1.6	130.7	2.2	128.	63.7	0.5	0.0	0.0	192.8	0.0	**194.**	**194.9**
3	0.0	37.6	3.7	33.9	35.7	0.2	0.0	0.0	69.8	0.0	**69.9**	**73.5**
4	0.0	33.1	4.9	28.2	66.0	0.1	0.0	0.0	94.4	0.0	**94.4**	**99.3**
5	0.0	15.7	0.7	15.0	17.7	0.0	0.0	0.0	32.7	0.0	**32.7**	**33.4**
6	0.0	46.6	6.1	40.5	54.0	0.5	0.0	0.0	95.0	0.0	**95.1**	**101.2**
7	0.0	31.1	2.9	28.2	38.3	0.5	0.0	0.0	67.0	0.0	**67.0**	**70.0**
8	0.0	7.5	1.1	6.3	4.2	0.1	0.0	0.0	10.7	0.0	**10.7**	**11.8**
9+	0.0	10.5	1.6	8.9	6.3	0.3	0.0	0.0	15.5	0.0	**15.5**	**17.0**
Sum	**3.5**	**331.4**	**24.9**	**306.5**	**326.7**	**351.7**	**0.0**	**0.1**	**597.8**	**0.3**	**988.5**	**1009.9**
Quarter: 3												
0	8.3	0.0	0.0	0.0	56.8	831.3	0.0	0.0	888.0	0.0	**896.4**	**888.0**
1	7.0	3.0	0.2	2.8	10.4	6.4	0.0	0.0	19.6	0.0	**26.6**	**19.8**
2	9.8	15.9	0.8	15.1	140.3	68.4	0.0	0.0	223.8	0.0	**233.**	**224.6**
3	4.3	6.6	2.0	4.6	56.5	32.5	0.0	0.0	93.6	0.0	**97.8**	**95.6**
4	2.1	5.5	2.5	3.0	91.6	19.7	0.0	0.0	114.3	0.0	**116.4**	**116.8**
5	0.2	2.4	0.3	2.0	54.2	4.3	0.0	0.0	60.6	0.0	**60.8**	**60.9**
6	0.6	10.5	4.3	6.3	221.4	84.9	0.0	0.0	312.6	0.0	**313.2**	**316.9**
7	0.8	8.3	2.4	5.9	111.8	71.7	0.0	0.0	189.3	0.0	**190.**	**191.7**
8	0.0	1.3	0.6	0.7	23.3	18.7	0.0	0.0	42.6	0.0	**42.6**	**43.2**
9+	0.0	2.2	1.0	1.2	27.7	33.2	0.0	0.0	62.2	0.0	**62.2**	**63.2**
Sum	**33.0**	**55.7**	**14.1**	**41.6**	**794.0**	**1171.1**	**0.0**	**0.0**	**2006.7**	**0.0**	**2039.7**	**2020.8**
Quarter: 4												
0	70.3	0.0	0.0	0.0	453.5	296.0	7.3	0.0	749.5	7.3	**827.1**	**756.8**
1	3.6	0.1	0.0	0.1	43.9	1.9	0.0	0.0	45.8	0.0	**49.5**	**45.8**
2	0.4	0.3	0.0	0.3	64.4	8.1	0.0	10.	72.8	10.	**84.0**	**83.7**
3	0.0	0.1	0.0	0.1	14.6	6.7	1.2	18.4	21.5	19.6	**41.1**	**41.1**
4	0.0	0.1	0.0	0.1	25.3	12.8	3.3	33.0	38.1	36.3	**74.5**	**74.5**
5	0.0	0.0	0.0	0.0	10.7	3.2	0.7	32.5	13.9	33.2	**47.1**	**47.1**
6	0.0	0.2	0.0	0.1	26.7	19.1	1.9	42.5	45.9	44.4	**90.3**	**90.4**
7	0.0	0.1	0.0	0.1	21.6	15.9	3.4	30.	37.7	34.	**72.0**	**72.0**
8	0.0	0.0	0.0	0.0	2.6	4.9	1.2	4.8	7.5	6.0	**13.5**	**13.6**
9+	0.0	0.0	0.0	0.0	1.2	7.6	0.3	8.1	8.7	8.3	**17.1**	**17.1**
Sum	**74.3**	**1.0**	**0.1**	**0.9**	**664.5**	**376.1**	**19.4**	**180.9**	**1041.5**	**200.3**	**1316.2**	**1241.9**

Table 2.2.2. North Sea autumn spawning herring (NSAS), and western Baltic spring spawners (WBSS) caught in the North Sea and Division 3.a in 2020. Mean weight-at-age (kg) in the catch (WECA), by quarter and division.

WR	3.a NSAS	4.aE all	4.aE WBSS	4.aW	4.b	4.c	7.d	4.a & 4.b all	4.c & 7.d	Total NSAS	Herring caught in the North Sea
Quarters: 1-4											
0	**0.014**	**0.000**	**0.000**	**0.004**	**0.004**	**0.004**	**0.000**	**0.004**	**0.004**	**0.004**	**0.004**
1	**0.037**	**0.105**	**0.105**	**0.079**	**0.048**	**0.021**	**0.000**	**0.082**	**0.021**	**0.071**	**0.082**
2	**0.066**	**0.126**	**0.128**	**0.138**	**0.150**	**0.112**	**0.117**	**0.136**	**0.116**	**0.130**	**0.136**
3	**0.139**	**0.144**	**0.146**	**0.160**	**0.174**	**0.138**	**0.125**	**0.159**	**0.127**	**0.155**	**0.155**
4	**0.168**	**0.158**	**0.160**	**0.174**	**0.186**	**0.153**	**0.153**	**0.173**	**0.153**	**0.171**	**0.170**
5	**0.175**	**0.169**	**0.170**	**0.195**	**0.212**	**0.154**	**0.178**	**0.192**	**0.177**	**0.189**	**0.189**
6	**0.199**	**0.180**	**0.183**	**0.216**	**0.234**	**0.199**	**0.187**	**0.215**	**0.188**	**0.214**	**0.213**
7	**0.216**	**0.191**	**0.193**	**0.218**	**0.241**	**0.201**	**0.198**	**0.221**	**0.199**	**0.219**	**0.219**
8	**0.000**	**0.197**	**0.199**	**0.239**	**0.252**	**0.221**	**0.232**	**0.238**	**0.229**	**0.238**	**0.237**
9+	**0.000**	**0.210**	**0.000**	**0.246**	**0.265**	**0.188**	**0.223**	**0.249**	**0.216**	**0.247**	**0.246**
Quarter: 1											
0	0.000	0.000	0.000	0.002	0.002	0.002	0.000	0.000	0.000	**0.002**	**0.002**
1	0.025	0.104	0.104	0.016	0.024	0.015	0.000	0.031	0.015	**0.025**	**0.029**
2	0.048	0.125	0.125	0.080	0.138	0.112	0.131	0.095	0.000	**0.055**	**0.100**
3	0.074	0.142	0.142	0.117	0.158	0.138	0.124	0.127	0.000	**0.123**	**0.132**
4	0.089	0.155	0.155	0.116	0.171	0.154	0.140	0.128	0.148	**0.133**	**0.134**
5	0.122	0.165	0.165	0.106	0.170	0.106	0.180	0.112	0.161	**0.130**	**0.131**
6	0.130	0.177	0.177	0.142	0.186	0.204	0.192	0.145	0.200	**0.162**	**0.162**
7	0.121	0.185	0.185	0.149	0.188	0.198	0.201	0.151	0.000	**0.162**	**0.162**
8	0.000	0.194	0.194	0.160	0.201	0.228	0.235	0.162	0.000	**0.189**	**0.189**
9+	0.000	0.204	0.204	0.180	0.194	0.183	0.221	0.181	0.188	**0.182**	**0.182**
Quarter: 2											
0	0.009	0.000	0.000	0.002	0.002	0.000	0.000	0.000	0.000	**0.002**	**0.002**
1	0.035	0.104	0.104	0.044	0.016	0.000	0.000	0.093	0.000	**0.089**	**0.093**
2	0.050	0.125	0.125	0.140	0.149	0.150	0.116	0.130	0.000	**0.129**	**0.130**
3	0.080	0.142	0.142	0.151	0.174	0.170	0.121	0.146	0.138	**0.147**	**0.146**
4	0.000	0.156	0.156	0.167	0.188	0.187	0.139	0.163	0.149	**0.164**	**0.163**
5	0.000	0.167	0.167	0.176	0.209	0.221	0.180	0.172	0.181	**0.172**	**0.172**
6	0.127	0.178	0.178	0.191	0.230	0.260	0.191	0.185	0.216	**0.186**	**0.185**
7	0.148	0.188	0.188	0.206	0.242	0.259	0.200	0.198	0.000	**0.199**	**0.198**
8	0.000	0.195	0.195	0.215	0.250	0.265	0.234	0.203	0.000	**0.204**	**0.203**
9+	0.000	0.208	0.208	0.230	0.269	0.273	0.221	0.217	0.238	**0.218**	**0.217**
Quarter: 3											
0	0.011	0.000	0.000	0.004	0.004	0.000	0.000	0.004	0.000	**0.004**	**0.004**
1	0.058	0.114	0.114	0.075	0.061	0.000	0.000	0.076	0.000	**0.071**	**0.076**
2	0.127	0.135	0.135	0.145	0.150	0.150	0.000	0.146	0.000	**0.145**	**0.146**
3	0.154	0.153	0.153	0.168	0.176	0.154	0.000	0.170	0.000	**0.169**	**0.170**
4	0.171	0.167	0.167	0.184	0.190	0.173	0.000	0.184	0.000	**0.184**	**0.184**
5	0.187	0.178	0.178	0.213	0.217	0.212	0.000	0.211	0.000	**0.212**	**0.212**
6	0.201	0.190	0.190	0.229	0.237	0.226	0.000	0.230	0.000	**0.231**	**0.230**
7	0.220	0.200	0.200	0.237	0.245	0.234	0.000	0.238	0.000	**0.239**	**0.238**
8	0.000	0.207	0.207	0.251	0.255	0.243	0.000	0.251	0.000	**0.252**	**0.251**
9+	0.000	0.220	0.220	0.275	0.269	0.249	0.000	0.270	0.000	**0.271**	**0.270**
Quarter: 4											
0	0.014	0.000	0.020	0.004	0.004	0.004	0.000	0.004	0.000	**0.005**	**0.004**
1	0.045	0.108	0.108	0.080	0.042	0.024	0.000	0.079	0.000	**0.076**	**0.079**
2	0.078	0.134	0.134	0.123	0.148	0.139	0.117	0.126	0.117	**0.124**	**0.125**
3	0.000	0.153	0.153	0.154	0.163	0.137	0.125	0.157	0.126	**0.142**	**0.142**
4	0.116	0.166	0.166	0.163	0.182	0.153	0.153	0.169	0.153	**0.162**	**0.162**
5	0.117	0.177	0.177	0.167	0.209	0.189	0.178	0.176	0.178	**0.178**	**0.178**
6	0.116	0.189	0.189	0.182	0.221	0.191	0.187	0.198	0.187	**0.193**	**0.193**
7	0.000	0.199	0.199	0.188	0.227	0.204	0.198	0.204	0.199	**0.202**	**0.202**
8	0.000	0.207	0.207	0.203	0.242	0.218	0.232	0.228	0.229	**0.229**	**0.229**
9+	0.000	0.220	0.220	0.252	0.249	0.225	0.223	0.249	0.223	**0.237**	**0.236**

Table 2.2.3. North Sea autumn spawning herring (NSAS), and western Baltic spring spawners (WBSS) caught in the North Sea in 2020. Mean length-at-age (cm) in the catch, by quarter and division.

WR	3.a NSAS	4.aE all	4.aW WBSS	4.aW	4.b	4.c	7.d	4.a & 4.b all	4.c & 7.d	Herring caught in the North Sea
Quarters: 1-4										
0	**n.d.**	**0.0**	**n.d.**	**7.7**	**7.6**	**7.6**	**0.0**	**7.6**	**7.6**	**7.6**
1	**n.d.**	**21.7**	**n.d.**	**20.5**	**15.9**	**13.6**	**0.0**	**20.2**	**13.6**	**20.2**
2	**n.d.**	**23.2**	**n.d.**	**24.8**	**25.1**	**23.9**	**24.0**	**24.4**	**24.0**	**24.4**
3	**n.d.**	**24.3**	**n.d.**	**25.5**	**26.4**	**25.5**	**24.5**	**25.4**	**24.7**	**25.4**
4	**n.d.**	**25.2**	**n.d.**	**26.2**	**26.9**	**26.0**	**26.1**	**26.1**	**26.1**	**26.1**
5	**n.d.**	**25.7**	**n.d.**	**27.6**	**27.7**	**26.2**	**27.0**	**27.3**	**27.0**	**27.2**
6	**n.d.**	**26.3**	**n.d.**	**28.4**	**28.8**	**28.2**	**27.4**	**28.3**	**27.5**	**28.2**
7	**n.d.**	**26.9**	**n.d.**	**28.4**	**29.2**	**28.2**	**27.9**	**28.4**	**27.9**	**28.4**
8	**n.d.**	**27.2**	**n.d.**	**29.5**	**30.0**	**29.0**	**29.1**	**29.3**	**29.1**	**29.3**
9+	**n.d.**	**27.7**	**n.d.**	**30.1**	**30.2**	**29.3**	**29.3**	**29.8**	**29.3**	**29.8**
Quarter: 1										
0	n.d.	0.0	n.d.	6.9	6.9	6.9	0.0	6.9	6.9	**6.9**
1	n.d.	21.6	n.d.	12.0	12.4	12.0	0.0	13.6	12.0	**13.4**
2	n.d.	23.1	n.d.	21.7	23.7	23.9	24.6	22.2	23.9	**22.7**
3	n.d.	24.2	n.d.	25.0	24.8	25.7	24.4	24.9	25.4	**25.3**
4	n.d.	25.1	n.d.	25.1	25.6	26.4	25.5	25.2	26.0	**25.4**
5	n.d.	25.6	n.d.	24.9	26.0	24.9	27.1	25.0	26.5	**25.6**
6	n.d.	26.2	n.d.	27.0	26.8	28.5	27.6	27.0	28.2	**27.3**
7	n.d.	26.8	n.d.	27.4	27.3	28.5	27.9	27.4	28.3	**27.6**
8	n.d.	27.1	n.d.	28.0	27.8	29.6	29.1	28.0	29.4	**28.6**
9+	n.d.	27.8	n.d.	29.2	28.9	29.3	29.4	29.2	29.3	**29.2**
Quarter: 2										
0	n.d.	0.0	n.d.	6.9	6.9	0.0	0.0	6.9	0.0	**6.9**
1	n.d.	21.6	n.d.	14.8	12.1	0.0	0.0	20.4	0.0	**20.4**
2	n.d.	23.1	n.d.	24.2	24.9	25.6	23.3	23.5	25.4	**23.5**
3	n.d.	24.2	n.d.	24.8	26.2	26.4	24.3	24.5	25.1	**24.5**
4	n.d.	25.1	n.d.	25.6	26.9	27.5	25.5	25.4	25.9	**25.4**
5	n.d.	25.6	n.d.	26.1	27.5	27.9	27.1	25.9	27.1	**25.9**
6	n.d.	26.2	n.d.	26.9	28.6	29.7	27.5	26.6	28.3	**26.6**
7	n.d.	26.8	n.d.	27.6	29.1	30.0	27.9	27.2	0.0	**27.2**
8	n.d.	27.1	n.d.	28.0	29.6	30.9	29.1	27.5	0.0	**27.5**
9+	n.d.	27.6	n.d.	28.8	30.4	31.4	29.4	28.1	30.0	**28.1**
Quarter: 3										
0	n.d.	0.0	n.d.	7.8	7.8	0.0	0.0	7.8	0.0	**7.8**
1	n.d.	22.2	n.d.	19.9	17.4	0.0	0.0	19.4	0.0	**19.4**
2	n.d.	23.7	n.d.	25.4	25.1	25.6	0.0	25.2	25.6	**25.2**
3	n.d.	24.8	n.d.	26.0	26.5	25.7	0.0	26.1	25.7	**26.1**
4	n.d.	25.7	n.d.	26.7	27.2	26.8	0.0	26.7	26.8	**26.7**
5	n.d.	26.2	n.d.	28.4	28.0	27.7	0.0	28.3	27.7	**28.3**
6	n.d.	26.9	n.d.	29.0	29.0	28.6	0.0	28.9	28.6	**28.9**
7	n.d.	27.5	n.d.	28.8	29.4	29.0	0.0	29.0	29.0	**29.0**
8	n.d.	27.6	n.d.	29.8	30.1	29.9	0.0	29.9	29.9	**29.9**
9+	n.d.	28.1	n.d.	30.7	30.4	30.3	0.0	30.5	30.3	**30.5**
Quarter: 4										
0	n.d.	0.0	n.d.	7.8	7.8	7.8	0.0	7.8	7.8	**7.8**
1	n.d.	22.0	n.d.	20.8	15.8	14.3	0.0	20.6	14.3	**20.6**
2	n.d.	23.7	n.d.	24.3	24.9	25.5	24.0	24.3	24.0	**24.3**
3	n.d.	24.8	n.d.	25.7	25.8	24.9	24.5	25.8	24.5	**25.2**
4	n.d.	25.7	n.d.	26.1	26.6	25.9	26.1	26.3	26.1	**26.2**
5	n.d.	26.2	n.d.	26.7	27.6	27.1	27.0	26.9	27.0	**27.0**
6	n.d.	26.9	n.d.	27.7	28.1	27.5	27.4	27.8	27.4	**27.6**
7	n.d.	27.5	n.d.	28.1	28.5	27.9	27.9	28.2	27.9	**28.1**
8	n.d.	27.7	n.d.	29.7	29.4	28.8	29.1	29.5	29.0	**29.3**
9+	n.d.	28.1	n.d.	29.1	29.3	29.3	29.3	29.3	29.3	**29.3**

Table 2.2.4. North Sea autumn spawning herring (NASAS), and western Baltic spring spawners (WBSS) caught in the North Sea and Division 3.a in 2020. Catches (tonnes) at-age (SOP figures), by quarter and division.

WR	3.a NASAS	4.aE all	4.aE WBSS	4.aE NASAS only	4.aW	4.b	4.c	7.d	4.a & 4.b NASAS	4.c & 7.d	Total NASAS	Herring caught in the North Sea
Quarters: 1-4												
0	**1.1**	**0.0**	**0.0**	**0.0**	**2.1**	**5.2**	**0.0**	**0.0**	**7.3**	**0.0**	**8.4**	**7.3**
1	**1.0**	**2.3**	**0.2**	**2.1**	**4.3**	**0.5**	**0.0**	**0.0**	**6.9**	**0.0**	**7.9**	**7.1**
2	**2.9**	**18.5**	**0.4**	**18.1**	**37.4**	**11.7**	**0.2**	**1.3**	**67.2**	**1.4**	**71.6**	**69.1**
3	**0.7**	**6.4**	**0.9**	**5.5**	**17.3**	**6.9**	**0.6**	**2.4**	**29.7**	**3.0**	**33.4**	**33.5**
4	**0.4**	**6.1**	**1.2**	**4.9**	**32.4**	**6.3**	**0.7**	**5.2**	**43.6**	**5.9**	**49.8**	**50.7**
5	**0.1**	**3.1**	**0.2**	**2.8**	**16.7**	**1.7**	**0.2**	**6.1**	**21.2**	**6.2**	**27.5**	**27.7**
6	**0.1**	**10.4**	**2.0**	**8.4**	**67.6**	**24.6**	**1.1**	**8.2**	**100.6**	**9.3**	**110.0**	**111.9**
7	**0.2**	**7.5**	**1.0**	**6.5**	**40.7**	**21.4**	**1.4**	**6.4**	**68.6**	**7.8**	**76.5**	**77.4**
8	**0.0**	**1.7**	**0.4**	**1.4**	**7.5**	**6.0**	**0.4**	**1.2**	**14.8**	**1.6**	**16.4**	**16.7**
9+	**0.0**	**2.7**	**0.0**	**2.7**	**11.3**	**11.0**	**0.4**	**1.9**	**24.9**	**2.3**	**27.2**	**27.2**
Sum	**6.4**	**58.7**	**6.2**	**52.4**	**237.3**	**95.2**	**4.9**	**32.6**	**384.9**	**37.5**	**428.8**	**428.6**
Quarter: 1												
0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**	**0.0**
1	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.4**	**0.0**
2	1.6	0.0	0.0	0.0	0.2	0.1	0.2	0.0	0.3	0.2	**0.0**	**0.5**
3	0.1	0.0	0.0	0.0	0.2	0.1	0.4	0.1	0.2	0.5	**0.8**	**0.7**
4	0.0	0.0	0.0	0.0	0.4	0.2	0.2	0.1	0.6	0.3	**0.9**	**0.9**
5	0.0	0.0	0.0	0.0	0.3	0.0	0.1	0.3	0.3	0.3	**0.7**	**0.7**
6	0.0	0.0	0.0	0.0	1.6	0.2	0.7	0.3	1.7	1.0	**2.7**	**2.8**
7	0.0	0.0	0.0	0.0	2.2	0.1	0.7	0.2	2.3	1.0	**3.3**	**3.3**
8	0.0	0.0	0.0	0.0	0.2	0.0	0.1	0.1	0.2	0.2	**0.4**	**0.4**
9+	0.0	0.0	0.0	0.0	1.9	0.1	0.4	0.1	2.0	0.4	**2.4**	**2.4**
Sum	**2.0**	**0.0**	**0.2**	**-0.1**	**7.0**	**0.8**	**2.7**	**1.2**	**7.7**	**3.9**	**11.5**	**11.7**
Quarter: 2												
0	0.0	0.0	0.0	0.0	0.1	0.7	0.0	0.0	0.8	0.0	**0.8**	**0.8**
1	0.0	1.9	0.2	1.8	0.0	0.0	0.0	0.0	1.8	0.0	**1.9**	**2.0**
2	0.1	16.3	0.3	16.1	8.9	0.1	0.0	0.0	25.0	0.0	**25.1**	**25.3**
3	0.0	5.3	0.5	4.8	5.4	0.0	0.0	0.0	10.2	0.0	**10.2**	**10.8**
4	0.0	5.2	0.8	4.4	11.0	0.0	0.0	0.0	15.4	0.0	**15.4**	**16.2**
5	0.0	2.6	0.1	2.5	3.1	0.0	0.0	0.0	5.6	0.0	**5.6**	**5.7**
6	0.0	8.3	1.1	7.2	10.3	0.1	0.0	0.0	17.6	0.0	**17.7**	**18.7**
7	0.0	5.8	0.6	5.3	7.9	0.1	0.0	0.0	13.3	0.0	**13.3**	**13.9**
8	0.0	1.5	0.2	1.2	0.9	0.0	0.0	0.0	2.2	0.0	**2.2**	**2.4**
9+	0.0	2.2	0.3	1.8	1.4	0.1	0.0	0.0	3.4	0.0	**3.4**	**3.7**
Sum	**0.1**	**49.2**	**4.0**	**45.1**	**49.1**	**1.2**	**0.0**	**0.0**	**95.4**	**0.0**	**95.6**	**99.5**
Quarter: 3												
0	0.1	0.0	0.0	0.0	0.2	3.3	0.0	0.0	3.6	0.0	**3.6**	**3.6**
1	0.4	0.3	0.0	0.0	0.8	0.4	0.0	0.0	1.2	0.0	**1.9**	**1.5**
2	1.2	2.2	0.1	0.0	20.4	10.3	0.0	0.0	30.7	0.0	**33.9**	**32.8**
3	0.7	1.0	0.3	0.0	9.5	5.7	0.0	0.0	15.2	0.0	**16.6**	**16.2**
4	0.4	0.9	0.4	0.0	16.9	3.7	0.0	0.0	20.6	0.0	**21.5**	**21.5**
5	0.0	0.4	0.1	0.4	11.5	0.9	0.0	0.0	12.8	0.0	**12.9**	**12.9**
6	0.1	2.0	0.8	0.0	50.8	20.2	0.0	0.0	70.9	0.0	**72.3**	**73.0**
7	0.2	1.7	0.5	1.2	26.5	17.5	0.0	0.0	45.2	0.0	**45.4**	**45.7**
8	0.0	0.3	0.1	0.1	5.8	4.8	0.0	0.0	10.7	0.0	**10.7**	**10.9**
9+	0.0	0.5	0.2	0.3	7.6	8.9	0.0	0.0	16.8	0.0	**16.8**	**17.1**
Sum	**3.1**	**9.3**	**2.6**	**1.9**	**150.0**	**75.8**	**0.0**	**0.0**	**227.7**	**0.0**	**235.6**	**235.1**
Quarter: 4												
0	1.0	0.0	0.0	0.0	1.8	1.2	0.0	0.0	3.0	0.0	**4.0**	**3.0**
1	0.2	0.0	0.0	0.0	3.5	0.1	0.0	0.0	3.6	0.0	**3.8**	**3.6**
2	0.0	0.0	0.0	0.0	7.9	1.2	0.0	1.3	9.1	1.3	**10.4**	**10.4**
3	0.0	0.0	0.0	0.0	2.2	1.1	0.2	2.3	3.3	2.5	**5.8**	**5.8**
4	0.0	0.0	0.0	0.0	4.1	2.3	0.5	5.1	6.5	5.6	**12.0**	**12.0**
5	0.0	0.0	0.0	0.0	1.8	0.7	0.1	5.8	2.5	5.9	**8.4**	**8.4**
6	0.0	0.0	0.0	0.0	4.9	4.2	0.4	7.9	9.1	8.3	**17.4**	**17.4**
7	0.0	0.0	0.0	0.0	4.1	3.6	0.7	6.1	7.7	6.8	**14.5**	**14.5**
8	0.0	0.0	0.0	0.0	0.5	1.2	0.3	1.1	1.7	1.4	**3.1**	**3.1**
9+	0.0	0.0	0.0	0.0	0.3	1.9	0.1	1.8	2.2	1.9	**4.0**	**4.0**
Sum	**1.2**	**0.2**	**0.0**	**0.1**	**31.1**	**17.4**	**2.2**	**31.4**	**48.7**	**33.6**	**83.5**	**82.4**

Table 2.2.5. North Sea autumn spawning herring (NSAS), and western Baltic spring spawners (WBSS) caught in the North Sea in 2020. Percentage age composition (based on numbers, 3+ group summarized), by quarter and division.

WR	3.a NSAS	4.aE all	4.aE WBSS	4.aE NSAS only	4.aW	4.b	4.c	7.d	4.a & 4.b NSAS	4.c & 7.d	Total NSAS	Herring caught in the North Sea
Quarters: 1-4												
0	**49.9%**	**0.0%**	**0.0%**	**0.0%**	**30.5%**	**77.5%**	**25.7%**	**0.0%**	**49.7%**	**4.3%**	**47.5%**	**46.9%**
1	**16.7%**	**5.6%**	**4.5%**	**5.7%**	**3.0%**	**0.6%**	**0.1%**	**0.0%**	**2.1%**	**0.0%**	**2.5%**	**2.0%**
2	**27.7%**	**37.9%**	**8.0%**	**41.3%**	**14.7%**	**4.1%**	**4.2%**	**5.8%**	**12.0%**	**5.5%**	**12.3**	**11.6**
3	**3.3%**	**11.4%**	**14.5%**	**11.1%**	**5.9%**	**2.1%**	**10.9%**	**10.2%**	**4.6%**	**10.3%**	**4.8%**	**4.9%**
4	**1.4%**	**10.0%**	**18.7%**	**9.0%**	**10.1%**	**1.8%**	**12.0%**	**18.1%**	**6.1%**	**17.1%**	**6.5%**	**6.8%**
5	**0.2%**	**4.7%**	**3.0%**	**4.9%**	**4.6%**	**0.4%**	**3.3%**	**18.1%**	**2.7%**	**15.6%**	**3.3%**	**3.4%**
6	**0.4%**	**14.8%**	**26.6%**	**13.4%**	**17.0%**	**5.5%**	**14.6%**	**23.5%**	**11.4%**	**22.0%**	**11.5%**	**12.0%**
7	**0.5%**	**10.2%**	**13.2%**	**9.8%**	**10.1%**	**4.7%**	**18.5%**	**17.2**	**7.6%**	**17.4**	**7.8%**	**8.1%**
8	**0.0%**	**2.3%**	**4.5%**	**2.0%**	**1.7%**	**1.2%**	**4.8%**	**2.7%**	**1.5%**	**3.0%**	**1.5%**	**1.6%**
9+	**0.0%**	**3.3%**	**6.9%**	**2.9%**	**2.5%**	**2.2%**	**5.9%**	**4.5%**	**2.4%**	**4.7%**	**2.4%**	**2.5%**
Sum 3+	**5.7%**	**56.6%**	**87.5%**	**53.0%**	**51.9%**	**17.9%**	**70.0%**	**94.2%**	**36.2%**	**90.2%**	**37.8%**	**39.4%**
Quarter: 1												
0	0.0%	0.0%	0.0%	0.0%	19.5%	29.2%	13.0%	0.0%	20.4%	9.5%	**11.4%**	**17.4%**
1	30.7%	5.5%	0.5%	100.0	0.1%	0.2%	0.1%	0.0%	0.2%	0.1%	**10.8%**	**0.1%**
2	67.0%	38.7%	20.5%	0.0%	4.3%	12.5%	8.5%	0.8%	5.1%	6.4%	**26.8%**	**5.6%**
3	2.0%	11.2%	11.3%	0.0%	2.5%	7.5%	15.8%	12.1%	3.0%	14.8%	**4.7%**	**6.2%**
4	0.1%	9.9%	11.6%	0.0%	6.0%	15.8%	6.3%	14.0%	6.9%	8.4%	**4.8%**	**7.3%**
5	0.1%	4.8%	14.4%	0.0%	5.0%	4.1%	2.9%	22.9%	4.9%	8.3%	**3.8%**	**5.8%**
6	0.0%	14.3%	24.0%	0.0%	18.4%	13.3%	19.8%	23.5	17.9%	20.8	**12.2%**	**18.7%**
7	0.1%	9.8%	0.0%	0.0%	24.5%	11.9%	19.7%	18.6	23.3%	19.4	**14.5**	**22.2**
8	0.0%	2.3%	6.8%	0.0%	1.9%	1.1%	3.1%	3.8%	1.8%	3.3%	**1.5%**	**2.2%**
9+	0.0%	3.6%	10.8%	0.0%	17.8%	4.3%	10.9%	4.1%	16.5%	9.1%	**9.5%**	**14.5**
Sum 3+	**2.3%**	**55.8%**	**79.0%**	**0.0%**	**76.1%**	**58.0%**	**78.4%**	**99.2%**	**74.3%**	**84.0%**	**51.0%**	**76.9%**
Quarter: 2												
0	23.7%	0.0%	0.0%	0.0%	12.3%	98.7%	0.0%	0.0%	0.0%	51.3%	**39.3%**	**38.3%**
1	30.2%	5.6%	6.5%	5.5%	0.2%	0.7%	0.0%	0.0%	3.3%	0.0%	**2.1%**	**2.1%**
2	45.0%	39.4%	8.7%	41.9%	19.5%	0.2%	12.7%	0.4%	32.2%	2.0%	**19.7**	**19.3**
3	0.9%	11.4%	15.0%	11.1%	10.9%	0.0%	14.6%	11.5%	11.7%	6.1%	**7.1%**	**7.3%**
4	0.0%	10.0%	19.6%	9.2%	20.2%	0.0%	9.1%	14.2%	15.8%	6.2%	**9.5%**	**9.8%**
5	0.0%	4.7%	2.9%	4.9%	5.4%	0.0%	1.0%	23.5%	5.5%	8.1%	**3.3%**	**3.3%**
6	0.0%	14.1%	24.7%	13.2%	16.5%	0.1%	31.0%	23.6	15.9%	12.6	**9.6%**	**10.0%**
7	0.1%	9.4%	11.8%	9.2%	11.7%	0.1%	19.0%	18.7	11.2%	9.2%	**6.8%**	**6.9%**
8	0.0%	2.2%	4.5%	2.1%	1.3%	0.0%	7.9%	3.8%	1.8%	2.5%	**1.1%**	**1.2%**
9+	0.0%	3.2%	6.3%	2.9%	1.9%	0.1%	4.7%	4.2%	2.6%	2.1%	**1.6%**	**1.7%**
Sum 3+	**1.0%**	**54.9%**	**84.8%**	**52.5%**	**68.0%**	**0.5%**	**87.3%**	**99.6%**	**64.4%**	**46.7%**	**39.0%**	**40.2%**
Quarter: 3												
0	25.2%	0.0%	0.0%	0.0%	7.2%	71.0%	0.0%	0.0%	44.3%	0.0%	**43.9%**	**43.9%**
1	21.2%	5.3%	1.2%	0.0%	1.3%	0.5%	0.0%	0.0%	1.0%	0.0%	**1.3%**	**1.0%**
2	29.6%	28.6%	5.7%	0.0%	17.7%	5.8%	5.9%	0.0%	11.2	5.9%	**11.5**	**11.1**
3	12.9%	11.8%	14.1%	0.0%	7.1%	2.8%	12.1%	0.0%	4.7%	12.1%	**4.8%**	**4.7%**
4	6.4%	9.9%	17.8%	0.0%	11.5%	1.7%	19.2%	0.0%	5.7%	19.2%	**5.7%**	**5.8%**
5	0.7%	4.3%	2.4%	0.0%	6.8%	0.4%	3.6%	0.0%	3.0%	3.6%	**3.0%**	**3.0%**
6	1.8%	18.9%	30.2%	0.0%	27.9%	7.2%	22.9%	0.0%	15.6%	22.9%	**15.4%**	**15.7%**
7	2.3%	14.8%	17.0%	0.0%	14.1%	6.1%	23.9%	0.0%	9.4%	23.9%	**9.3%**	**9.5%**
8	0.0%	2.3%	4.3%	0.0%	2.9%	1.6%	9.1%	0.0%	2.1%	9.1%	**2.1%**	**2.1%**
9+	0.0%	4.0%	7.4%	0.0%	3.5%	2.8%	3.2%	0.0%	3.1%	3.2%	**3.0%**	**3.1%**
Sum 3+	**24.1%**	**66.1%**	**93.0%**	**0.0%**	**73.9%**	**22.6%**	**94.1%**	**0.0%**	**43.6%**	**94.1%**	**43.3%**	**44.0%**
Quarter: 4												
0	94.6%	0.0%	0.0%	0.0%	68.2%	78.7%	37.5%	0.0%	72.0%	3.6%	**62.8%**	**60.9%**
1	4.9%	6.4%	0.0%	7.2%	6.6%	0.5%	0.2%	0.0%	4.4%	0.0%	**3.8%**	**3.7%**
2	0.5%	29.0%	0.0%	32.5%	9.7%	2.2%	0.1%	6.0%	7.0%	5.4%	**6.4%**	**6.7%**
3	0.0%	11.4%	0.0%	12.8%	2.2%	1.8%	6.3%	10.2%	2.1%	9.8%	**3.1%**	**3.3%**
4	0.0%	9.8%	5.7%	10.3%	3.8%	3.4%	17.3%	18.2%	3.7%	18.1%	**5.7%**	**6.0%**
5	0.0%	4.2%	0.0%	4.8%	1.6%	0.8%	3.6%	17.9%	1.3%	16.6%	**3.6%**	**3.8%**
6	0.0%	18.4%	45.3%	15.2%	4.0%	5.1%	9.8%	23.5%	4.4%	22.2%	**6.9%**	**7.3%**
7	0.0%	14.6%	0.0%	16.3%	3.3%	4.2%	17.4%	17.1	3.6%	17.1	**5.5%**	**5.8%**
8	0.0%	2.3%	18.3%	0.3%	0.4%	1.3%	6.4%	2.7%	0.7%	3.0%	**1.0%**	**1.1%**
9+	0.0%	3.8%	30.7%	0.6%	0.2%	2.0%	1.3%	4.5%	0.8%	4.2%	**1.3%**	**1.4%**
Sum 3+	**0.1%**	**64.6%**	**100.0%**	**60.3%**	**15.5%**	**18.6%**	**62.1%**	**94.0%**	**16.6%**	**90.9%**	**27.0%**	**28.6%**

Table 2.2.6. Total catch of herring caught in the North Sea and Division 3.a: North Sea autumn spawners (NSAS). Catch in numbers (millions) at mean weight-at-age (kg) by fleet, and SOP catches ('000 t). SOP catch might deviate from reported catch as used for the assessment. A fleet figure includes unsampled bycatch in the industrial fishery.

2020	Fleet A		Fleet B		Fleet C		Fleet D		TOTAL	
Winter rings	Numbers	Mean weight	Numbers	Mean weight Mean	Numbers	Mean weight Mean	Numbers	Mean weight	Numbers	Mean weight Mean
0	0.0	0.004	2047.9	0.004	68.3	0.014	11.2	0.009	2'127.4	0.004
1	69.8	0.107	15.7	0.036	22.9	0.034	3.7	0.053	112.1	0.081
2	499.7	0.139	5.4	0.117	43.2	0.065	1.0	0.098	549.3	0.133
3	209.4	0.157	0.6	0.156	5.1	0.140	0.2	0.115	215.2	0.156
4	288.2	0.172	1.5	0.149	2.1	0.171	0.1	0.116	291.9	0.172
5	144.8	0.191	0.7	0.150	0.3	0.178	0.0	0.117	145.8	0.190
6	512.7	0.215	2.0	0.169	0.6	0.200	0.0	0.116	515.4	0.215
7	346.6	0.221	2.0	0.175	0.8	0.218	0.0	0.000	349.4	0.221
8	68.5	0.240	0.3	0.195	0.0	0.000	0.0	0.000	68.8	0.240
9+	107.6	0.248	0.3	0.203	0.0	0.000	0.0	0.000	107.8	0.248
TOTAL	2'247.3		2'076.5		143.2		16.2		4'483.2	
SOP catch		416.9		9.8		6.0		0.4		433.2

Table 2.2.7. Catch-at-age (numbers in millions) of North Sea herring, 2005–2020.

Year/rings	0	1	2	3	4	5	6	7	8	9+	Total
2005	919	408	203	487	1326	480	577	116	108	39	4664
2006	844	72	354	309	475	1017	257	252	65	44	3689
2007	553	46	142	413	284	307	628	147	133	23	2677
2008	713	148	260	183	199	137	118	215	74	43	2090
2009	533	98	253	108	96	88	40	58	112	34	1421
2010	526	84	243	234	124	84	63	34	59	56	1508
2011	575	124	306	271	218	130	63	52	60	66	1865
2012	627	110	412	671	403	306	151	104	89	109	2982
2013	461	327	239	482	571	422	327	145	153	160	3287
2014	1104	309	303	380	616	487	284	192	92	123	3890
2015	508	225	454	241	282	456	431	270	167	170	3204
2016	1450	86	578	813	293	280	368	307	186	173	4534
2017	462	133	74	1075	836	222	146	176	107	115	3345
2018	1323	54	178	200	1179	852	225	146	144	189	4491
2019	513	35	34	292	197	740	542	140	85	138	2717
2020	2048	86	505	210	290	146	515	349	69	108	4324

Table 2.2.8. Catch-at-age (numbers in millions) of WBSS Herring taken in the North Sea, and transferred to the assessment of the spring-spawning stock in 3.a, 2005–2020.

Year/rings	0	1	2	3	4	5	6	7	8	9+	Total
2005	0.0	0.0	6.6	17.4	12.7	2.6	3.8	1.1	0.4	0.3	44.8
2006	0.0	0.1	3.5	8.8	14.0	22.4	5.1	5.3	2.1	1.0	62.2
2007	0.0	0.0	0.1	2.6	1.3	0.6	0.8	0.4	0.5	0.2	6.3
2008	0.0	0.0	0.1	0.1	0.2	0.1	0.1	0.2	0.0	0.0	0.7
2009	0.0	0.0	1.0	2.1	3.4	1.4	1.7	4.5	1.8	1.4	17.2
2010	0.0	0.0	0.0	0.5	1.0	0.4	0.5	0.3	0.3	0.7	3.8
2011	0.0	0.0	0.1	0.4	0.4	0.2	0.1	0.1	0.1	0.2	1.6
2012	0.0	0.0	0.0	0.2	0.4	0.0	1.4	0.0	1.1	6.3	9.4
2013	0.0	0.0	0.1	0.4	0.2	0.5	0.3	0.1	0.2	0.5	2.2

Year/rings	0	1	2	3	4	5	6	7	8	9+	Total
2014	0.0	0.0	2.5	3.4	5.4	0.8	2.1	1.0	0.5	1.1	16.8
2015	0.0	0.0	0.1	0.9	1.4	3.9	1.8	1.4	0.9	1.2	11.7
2016	0.0	0.0	1.2	4.1	1.0	1.1	1.2	0.7	0.4	0.8	10.6
2017	0.0	0.0	0.0	2.4	1.0	0.2	0.1	0.1	0.0	0.1	4.0
2018	0.0	0.0	0.3	0.9	2.3	4.3	1.7	0.9	0.3	0.4	11.0
2019	5.3	30.6	53.0	16.2	5.5	2.5	1.4	0.3	0.1	0.0	114.9
2020	0.0	1.8	3.2	5.8	7.5	1.2	10.7	5.3	1.8	2.8	40.2

Table 2.2.9. Catch-at-age (numbers in millions) of NSAS taken in 3.a, and transferred to the assessment of NSAS, 2005–2020.

Year/rings	0	1	2	3	4	5	6	7	8+	Total
2005	96.4	307.5	159.2	16.2	5.4	2.4	2.3	0.5	0.2	589.9
2006	35.1	150.1	50.2	10.2	3.3	3.3	0.6	0.4	0.2	253.3
2007	67.7	189.3	76.9	2.1	0.4	1.4	0.3	0.6	0.0	338.7
2008	85.7	86.6	72.0	1.9	0.3	0.1	0.1	0.3	0.1	247.0
2009	116.8	77.5	7.0	0.4	0.2	0.0	0.0	0.0	0.1	202.0
2010	48.6	197.0	43.3	0.3	0.1	0.1	0.0	0.1	0.0	289.6
2011	203.8	35.4	61.5	3.2	0.3	0.2	0.1	0.1	0.0	304.6
2012	145.8	174.9	43.7	1.9	1.2	0.2	0.2	0.1	0.0	368.0
2013	0.9	86.2	85.8	2.4	0.4	0.3	0.0	0.0	0.0	175.9
2014	284.7	61.1	80.2	5.9	0.5	0.5	0.2	0.0	0.1	433.3
2015	30.7	169.6	97.6	7.0	1.3	4.9	1.1	1.2	0.4	313.6
2016	133.3	23.3	47.6	6.0	0.5	0.3	0.2	0.0	0.1	211.3
2017	0.1	76.0	34.4	6.9	3.0	1.2	0.1	0.0	0.0	121.8
2018	14.5	19.2	28.5	1.1	1.8	1.0	0.2	0.1	0.1	66.5
2019	23.7	101.3	19.8	4.6	0.1	0.1	0.1	0.0	0.0	149.8
2020	79.4	26.6	44.2	5.3	2.2	0.3	0.6	0.8	0.0	159.3

Table 2.2.10. Catch-at-age (numbers in millions) of the total NSAS stock 2005–2020.

Year/rings	0	1	2	3	4	5	6	7	8	9+	Total
2005	1016	716	355	486	1318	480	576	115	108	39	5209
2006	879	222	401	311	465	999	253	249	63	44	3885
2007	621	236	219	412	283	308	628	147	132	23	3009
2008	798	235	332	185	199	137	118	215	74	43	2336
2009	650	176	259	107	93	86	38	53	110	33	1606
2010	575	281	287	233	123	83	63	34	59	55	1794
2011	779	160	368	274	218	130	63	52	60	65	2168
2012	773	285	455	673	404	306	150	104	88	102	3341
2013	462	413	325	484	571	422	327	145	152	160	3461
2014	1389	371	383	386	617	488	285	192	92	123	4323
2015	538	395	552	248	283	461	432	271	168	170	3517
2016	1584	109	625	819	293	280	368	307	186	173	4745
2017	462	209	109	1080	838	223	146	176	107	115	3463
2018	1337	73	206	201	1179	849	224	145	144	188	4546
2019	537	137	54	296	197	740	542	140	85	138	2866
2020	2127	112	549	215	292	146	515	349	69	108	4483

Table 2.2.11. Comparison of mean weight (kg) at age (rings) in the catch of adult North Sea herring (by Division) and NSAS caught in Division 3.a in 2010–2020

		Age (Rings)							
Division	**Year**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9+**
3.a	2010	0.077	0.122	0.149	0.191	0.221	0.216	0.205	-
	2011	0.084	0.114	0.134	0.191	0.193	0.234	0.248	-
	2012	0.067	0.124	0.169	0.175	0.2	0.221	0.216	-
	2013	0.075	0.134	0.16	0.201	0	0	0	-
	2014	0.074	0.109	0.162	0.191	0.209	0.221	0.228	-
	2015	0.068	0.133	0.157	0.18	0.196	0.197	0.215	-
	2016	0.059	0.123	0.149	0.157	0.208	0.211	0.235	-
	2017	0.068	0.103	0.139	0.173	0.171	0.185	0.162	-
	2018	0.058	0.103	0.156	0.179	0.19	0.187	0.203	-
	2019	0.062	0.085	0.116	0.118	0.164	0.202	0.159	-
	2020	0.066	0.139	0.168	0.175	0.199	0.216	-	-
4.a(E)	2010	0.131	0.154	0.201	0.201	0.21	0.223	0.248	0.235
	2011	0.142	0.162	0.18	0.204	0.215	0.209	0.216	0.222
	2012	0.146	0.185	0.195	0.203	0.216	0.225	0.225	0.232
	2013	0.129	0.147	0.184	0.191	0.205	0.215	0.215	0.228
	2014	0.146	0.161	0.167	0.195	0.2	0.216	0.227	0.224
	2015	0.127	0.148	0.163	0.178	0.191	0.203	0.212	0.227
	2016	0.129	0.153	0.167	0.183	0.195	0.205	0.216	0.229
	2017	0.132	0.154	0.17	0.182	0.193	0.198	0.203	0.209
	2018	0.125	0.152	0.173	0.188	0.201	0.212	0.219	0.23
	2019	0.134	0.155	0.173	0.212	0.204	0.209	0.22	0.25
	2020	0.126	0.144	0.158	0.169	0.18	0.191	0.197	0.21
4.a(W)	2010	0.137	0.166	0.195	0.223	0.22	0.216	0.236	0.252
	2011	0.141	0.161	0.185	0.195	0.216	0.223	0.22	0.243
	2012	0.132	0.184	0.186	0.206	0.226	0.24	0.242	0.254
	2013	0.139	0.158	0.201	0.197	0.218	0.234	0.234	0.251
	2014	0.143	0.172	0.184	0.215	0.212	0.227	0.246	0.242
	2015	0.124	0.158	0.198	0.211	0.233	0.228	0.239	0.252
	2016	0.138	0.161	0.189	0.215	0.227	0.242	0.233	0.25
	2017	0.12	0.16	0.177	0.192	0.218	0.226	0.236	0.236
	2018	0.114	0.156	0.188	0.193	0.22	0.241	0.25	0.258
	2019	0.134	0.154	0.174	0.205	0.206	0.22	0.246	0.248
	2020	0.138	0.16	0.174	0.195	0.216	0.218	0.239	0.246
4.b	2010	0.134	0.176	0.182	0.229	0.237	0.235	0.232	0.265
	2011	0.145	0.162	0.187	0.206	0.235	0.234	0.24	0.268
	2012	0.131	0.141	0.178	0.209	0.214	0.245	0.25	0.258
	2013	0.125	0.162	0.205	0.206	0.228	0.251	0.261	0.246
	2014	0.133	0.187	0.208	0.233	0.24	0.249	0.256	0.277
	2015	0.14	0.162	0.189	0.203	0.208	0.216	0.227	0.25

		Age (Rings)							
Division	**Year**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9+**
	2016	0.126	0.161	0.192	0.211	0.218	0.236	0.236	0.253
	2017	0.095	0.157	0.184	0.194	0.23	0.24	0.249	0.263
	2018	0.117	0.138	0.192	0.211	0.237	0.248	0.246	0.258
	2019	0.148	0.163	0.163	0.21	0.229	0.251	0.244	0.253
	2020	0.15	0.174	0.186	0.212	0.234	0.241	0.252	0.265

Table 2.2.11 continued: Comparison of mean weight (kg) at age (rings) in the catch of adult North Sea herring (by Division) and NSAS caught in Division 3.a in 2010–2020.

		Age (Rings)							
Division	**Year**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9+**
4.a & 4.b	2010	0.136	0.167	0.192	0.224	0.222	0.22	0.236	0.25
	2011	0.142	0.161	0.184	0.198	0.22	0.224	0.224	0.243
	2012	0.132	0.171	0.185	0.207	0.222	0.239	0.243	0.248
	2013	0.132	0.158	0.198	0.198	0.217	0.234	0.235	0.244
	2014	0.138	0.174	0.187	0.216	0.213	0.227	0.246	0.243
	2015	0.129	0.157	0.19	0.203	0.223	0.219	0.228	0.245
	2016	0.134	0.159	0.185	0.21	0.218	0.235	0.226	0.242
	2017	0.116	0.159	0.176	0.19	0.217	0.223	0.231	0.23
	2018	0.117	0.152	0.187	0.195	0.22	0.238	0.245	0.254
	2019	0.136	0.153	0.173	0.208	0.21	0.22	0.239	0.251
	2020	0.136	0.159	0.173	0.192	0.215	0.221	0.238	0.249
4.c & 7.d	2010	0.145	0.167	0.187	0.204	0.207	0.207	0.223	0.216
	2011	0.122	0.154	0.179	0.189	0.195	0.205	0.209	0.217
	2012	0.119	0.165	0.186	0.202	0.212	0.234	0.209	0.226
	2013	0.126	0.144	0.18	0.196	0.206	0.216	0.218	0.226
	2014	0.119	0.148	0.166	0.183	0.208	0.222	0.227	0.233
	2015	0.114	0.127	0.154	0.157	0.183	0.197	0.204	0.21
	2016	0.114	0.127	0.137	0.166	0.177	0.199	0.193	0.216
	2017	0.1	0.122	0.146	0.165	0.186	0.193	0.22	0.241
	2018	0.113	0.116	0.144	0.156	0.164	0.189	0.196	0.209
	2019	0.118	0.126	0.153	0.165	0.185	0.196	0.203	0.223
	2020	0.116	0.127	0.153	0.177	0.188	0.199	0.229	0.216
Total North Sea Catch	2010	0.138	0.167	0.192	0.222	0.219	0.217	0.234	0.245
	2011	0.141	0.16	0.183	0.197	0.217	0.221	0.223	0.24
	2012	0.13	0.171	0.185	0.206	0.222	0.239	0.239	0.247
	2013	0.131	0.156	0.198	0.198	0.215	0.233	0.234	0.241
	2014	0.137	0.173	0.186	0.215	0.212	0.226	0.244	0.241
	2015	0.123	0.154	0.188	0.2	0.221	0.217	0.226	0.243
	2016	0.132	0.155	0.18	0.206	0.215	0.231	0.221	0.239

		Age (Rings)							
Division	**Year**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9+**
	2017	0.114	0.156	0.173	0.189	0.215	0.22	0.23	0.231
	2018	0.117	0.145	0.184	0.192	0.215	0.234	0.242	0.249
	2019	0.135	0.148	0.169	0.204	0.208	0.219	0.236	0.248
	2020	0.136	0.155	0.17	0.189	0.213	0.219	0.237	0.246

Table 2.2.12. Sampling of commercial landings of North Sea herring (Division 4 and 7.d) in 2020 by quarter. Sampled catch means the proportion of the reported catch to which sampling was applied. Métiers are each reported combination of nation/fleet/area/quarter.

Country (fleet)	Q	Métiers (n)	Métiers sampled	Sam. Catch (%)	Official Catch	Samples	Fish aged	Fish meas-ured	>1 sample per 1 kt catch
Belgium	1	2	0	0%	26	0	0	0	n
	2	4	0	0%	13	0	0	0	n
	3	1	0	0%	0	0	0	0	n
	4	2	0	0%	80	0	0	0	n
total		9	0	0%	119	0	0	0	n
Denmark (A)	1	2	1	98%	6697	2	67	133	n
	2	2	0	0%	2380	0	0	0	n
	3	3	2	100%	53112	73	1904	5465	y
	4	2	2	100%	23623	14	350	1165	n
total		9	5	97%	85812	89	2321	6763	y
Denmark (B)	1	4	0	0%	61	0	0	0	n
	2	3	1	81%	910	11	102	546	y
	3	2	1	88%	3837	16	215	571	y
	4	4	0	0%	4995	0	0	0	n
total		13	2	42%	9803	27	317	1117	y
UK(E&W)	1	3	0	0%	2346	9	0	1150	n
	2	3	0	0%	6	0	0	0	n
	3	4	2	100%	11930	30	624	2778	y
	4	4	0	0%	4198	7	0	960	n
total		14	2	65%	18479	46	624	4888	y
France	1	2	0	0%	1468	0	0	0	n

Country (fleet)	Q	Métiers (n)	Métiers sampled	Sam. Catch (%)	Official Catch	Samples	Fish aged	Fish meas-ured	>1 sample per 1 kt catch
	2	3	0	0%	1440	0	0	0	n
	3	3	0	0%	10964	0	0	0	n
	4	4	0	0%	5897	0	0	0	n
total		12	0	0%	19768	0	0	0	n
Germany	2	2	1	100%	5268	25	216	10192	y
	3	2	1	90%	10733	17	238	6885	n
	4	4	1	64%	13438	5	194	689	n
total		8	3	80%	29439	47	648	17766	n
Ireland	1	1	0	0%	8	0	0	0	n
	4	1	0	0%	226	0	0	0	n
total		2	0	0%	235	0	0	0	n
Nether-lands	1	2	0	0%	27	0	0	0	n
	2	1	0	0%	8991	0	0	0	n
	3	3	2	100%	46375	76	1888	9579	y
	4	4	3	85%	19643	11	275	2014	n
total		10	5	84%	75036	87	2163	11593	y
Norway	1	3	0	0%	728	0	0	0	n
	2	3	2	100%	74652	20	873	1423	n
	3	3	3	100%	32820	6	200	372	n
	4	3	2	98%	7679	2	69	196	n
total		12	7	99%	115879	28	1142	1991	n
UK (Scotl.)	1	2	0	0%	6	0	0	0	n
	2	1	1	100%	2850	5	152	655	y
	3	2	2	100%	46016	17	823	21891	n
	4	3	0	0%	820	0	0	0	n
total		8	3	98%	49692	22	975	22546	n
Sweden	1	1	0	0%	297	0	0	0	n
	2	1	0	0%	2761	0	0	0	n

Country (fleet)	Q	Métiers (n)	Métiers sampled	Sam. Catch (%)	Official Catch	Samples	Fish aged	Fish meas-ured	>1 sample per 1 kt catch
	3	2	0	0%	8882	0	0	0	n
	4	2	0	0%	1148	0	0	0	n
total		6	0	0%	13088	0	0	0	n
Sweden (B)	2	1	0	0%	4	0	0	0	n
	3	1	0	0%	57	0	0	0	n
total		2	0	0%	61	0	0	0	n
Faroese	1	1	0	0%	36	0	0	0	n
	3	2	0	0%	260	0	0	0	n
	4	1	0	0%	508	0	0	0	n
total		4	0	0%	804	0	0	0	n
UK(NI)	1	1	0	0%	18	0	0	0	n
	3	1	0	0%	2555	0	0	0	n
	4	1	0	0%	108	0	0	0	n
total		3	0	0%	2681	0	0	0	n
Lithuania	3	2	0	0%	6120	0	0	0	n
	4	1	0	0%	22	0	0	0	n
total		3	0	0%	6142	0	0	0	n
Period total	1	24	1	56%	11716	11	67	1283	y
Period total	2	24	5	84%	99276	61	1343	12816	y
Period total	3	32	14	87%	233945	236	5928	47577	y
Period total	4	36	8	68%	82385	39	888	5024	y
Total 2020		117	28	82%	427321	347	8226	66700	n
Human Cons. only		101	26	83%	417457	320	7909	65583	n
Total 2018		103	33	83%	602328	394	8868	63991	n
Total 2019		104	29	83%	445633	376	7781	57198	n
Human Cons. Only 2019		92	28	83%	440471	315	7284	56254	n

2.3.1.1. North Sea herring. Acoustic Surveys in the North Sea (HERAS) in June–July 2020. Vessels, areas and cruise dates.

Vessel	Period	Contributing to Stocks	Strata
Celtic Explorer (IRL) EIGB	22 June – 12 July	MSHAS, WoS	2, 3, 4, 5, 6
Scotia (SCO) MXHR6	3 Juny – 25 July	MSHAS,WoS, NSAS, Sprat NS	1, 91 (north of 58°30'N), 111, 121
Johan Hjort (NOR) LDGJ	27 June – 14 July	NSAS, WBSS, Sprat NS	11, 141
Tridens (NED) PBVO	25 June – 12 July	NSAS, Sprat NS	81, 91 (south of 58°30'N), 101
Solea (GER) DBFH	29 June – 19 July	NSAS, Sprat NS	51, 61, 71, 131
Dana (DEN) OXBH	25 June – 09 July	NSAS, WBSS, Sprat NS, Sprat 3.a	21, 31, 41, 42, 151, 152

Table 2.3.1.2. North Sea herring. Acoustic Surveys in the North Sea (HERAS) in June–July 2020. Total numbers (millions of fish) and biomass (thousands of tonnes) of North Sea autumn spawning herring in the area surveyed in the pelagic acoustic surveys, with mean weight and mean length by age ring.

Age (ring)	Numbers	Biomass	Maturity	Weight(g)	Length (cm)
0	7178	27	0.00	3.8	8.3
1	7130	315	0.03	44.1	17.5
2	2736	340	0.75	124.3	23.9
3	1156	183	0.98	158.7	26.0
4	1371	261	1.00	190.7	27.4
5	1674	371	1.00	221.9	28.8
6	1666	389	1.00	233.4	29.1
7	504	124	0.99	246.8	29.7
8	164	42	0.99	255.6	30.2
9+	188	50	1.00	268.3	30.7
Immature	14851	387		26.0	13.4
Mature	8915	1717		192.6	27.1
Total	23766	2104	0.38	88.5	18.5

Table 2.3.1.3. Estimates of North Sea autumn spawners (millions) at age from acoustic surveys, 1986–2020. For 1986 the estimates are the sum of those from the Division 4.a summer survey, the Division 4.b autumn survey, and the divisions 4.c, 7.d winter survey. The 1987 to 2019 estimates are from summer surveys in divisions 4.a, b, c, and 3.a excluding estimates of Western Baltic spring spawners. For 1999 and 2000, the Kattegat was excluded from the results because it was not surveyed. Total numbers include 0-ringers from 2008 onwards.

Years / Age (rings)	1	2	3	4	5	6	7	8	9+	Total	SSB (‘000t)
1986	1639	3206	1637	833	135	36	24	6	8	7542	942
1987	13736	4303	955	657	368	77	38	11	20	20165	817
1988	6431	4202	1732	528	349	174	43	23	14	13496	897
1989	6333	3726	3751	1612	488	281	120	44	22	16377	1637
1990	6249	2971	3530	3370	1349	395	211	134	43	18262	2174
1991	3182	2834	1501	2102	1984	748	262	112	56	12781	1874
1992	6351	4179	1633	1397	1510	1311	474	155	163	17173	1545
1993	10399	3710	1855	909	795	788	546	178	116	19326	1216
1994	3646	3280	957	429	363	321	238	220	132	13003	1035

Years / Age (rings)	1	2	3	4	5	6	7	8	9+	Total	SSB ('000t)
1995	4202	3799	2056	656	272	175	135	110	84	11220	1082
1996	6198	4557	2824	1087	311	99	83	133	206	18786	1446
1997	9416	6363	3287	1696	692	259	79	78	158	22028	1780
1998	4449	5747	2520	1625	982	445	170	45	121	16104	1792
1999	5087	3078	4725	1116	506	314	139	54	87	15107	1534
2000	24735	2922	2156	3139	1006	483	266	120	97	34928	1833
2001	6837	12290	3083	1462	1676	450	170	98	59	26124	2622
2002	23055	4875	8220	1390	795	1031	244	121	150	39881	2948
2003	9829	18949	3081	4189	675	495	568	146	178	38110	2999
2004	5183	3415	9191	2167	2590	317	328	342	186	23722	2584
2005	3113	1890	3436	5609	1211	1172	140	127	107	16805	1868
2006	6823	3772	1997	2098	4175	618	562	84	70	20199	2130
2007	6261	2750	1848	898	806	1323	243	152	65	14346	1203
2008	3714	2853	1709	1485	809	712	1749	185	270	20355	1784
2009	4655	5632	2553	1023	1077	674	638	1142	578	31526	2591
2010	14577	4237	4216	2453	1246	1332	688	1110	1619	43705	3027
2011	10119	4166	2534	2173	1016	651	688	440	1207	25524	2431
2012	7437	4718	4067	1738	1209	593	247	218	478	23641	2269
2013	6388	2683	3031	2895	1546	849	464	250	592	36484	2261
2014	11634	4918	2827	2939	1791	1236	669	211	250	61339	2610
2015	6714	9495	2831	1591	1549	926	520	275	221	24508	2280
2016	9034	12011	5832	1273	822	909	395	220	146	51686	2648
2017	3054	1761	6095	3142	787	365	298	153	140	30055	1943
2018	9938	4254	1692	5150	2440	719	529	293	111	32606	2337
2019	10146	1303	2345	1212	3506	1657	395	252	172	25560	1919
2020	7130	2736	1156	1371	1674	1666	504	164	188	23766	1717

Table 2.3.2.1. North Sea herring – LAI time-series of herring larval abundance <10 mm long (<11 mm for the SNS), by standard sampling area and time periods. The number of larvae are expressed as mean number per ICES rectangle * 10^9.

Period/ Year	Orkney/Shetland		Buchan		Central North Sea			Southern North Sea		
	1–15 Sep.	16–30 Sep.	1–15 Sep.	16–30 Sep.	1–15 Sep.	16–30 Sep.	1–15 Oct.	16–31 Dec.	1–15 Jan.	16–31 Jan.
1972	1133	4583	30		165	88	134	2	46	
1973	2029	822	3	4	492	830	1213			1
1974	758	421	101	284	81		1184		10	
1975	371	50	312			90	77	1	2	
1976	545	81		1	64	108			3	
1977	1133	221	124	32	520	262	89	1		
1978	3047	50		162	1406	81	269	33	3	
1979	2882	2362	197	10	662	131	507		111	89
1980	3534	720	21	1	317	188	9	247	129	40
1981	3667	277	3	12	903	235	119	1456		70
1982	2353	1116	340	257	86	64	1077	710	275	54
1983	2579	812	3647	768	1459	281	63	71	243	58
1984	1795	1912	2327	1853	688	2404	824	523	185	39
1985	5632	3432	2521	1812	130	13039	1794	1851	407	38
1986	3529	1842	3278	341	1611	6112	188	780	123	18
1987	7409	1848	2551	670	799	4927	1992	934	297	146
1988	7538	8832	6812	5248	5533	3808	1960	1679	162	112
1989	11477	5725	5879	692	1442	5010	2364	1514	2120	512
1990		10144	4590	2045	19955	1239	975	2552	1204	
1991	1021	2397		2032	4823	2110	1249	4400	873	
1992	189	4917		822	10	165	163	176	1616	
1993		66		174		685	85	1358	1103	
1994	26	1179				1464	44	537	595	
1995		8688					43	74	230	164
1996		809		184		564		337	675	691
1997		3611		23				9374	918	355
1998		8528		1490	205	66		1522	953	170
1999		4064		185		134	181	804	1260	344
2000		3352	28	83		376		7346	338	106
2001		11918		164		1604		971	5531	909
2002		6669		1038			3291	2008	260	925
2003		3199		2263		12018	3277	12048	3109	1116
2004		7055		3884		5545		7055	2052	4175
2005		3380		1364		5614		498	3999	4822
2006	6311	2312		280		2259		10858	2700	2106
2007		1753		1304		291		4443	2439	3854
2008	4978	6875		533		11201		8426	2317	4008

Period/ Year	Orkney/Shetland		Buchan		Central North Sea			Southern North Sea		
	1–15 Sep.	16–30 Sep.	1–15 Sep.	16–30 Sep.	1–15 Sep.	16–30 Sep.	1–15 Oct.	16–31 Dec.	1–15 Jan.	16–31 Jan.
2009		7543		4629		4219		15295	14712	1689
2010		2362		1493		2317		7493	13230	8073
2011		3831		2839		17766		5461	6160	1215
2012		19552		5856		517		22768	11103	3285
2013		21282		8618		7354		5	9314	2957
2014		6604		5033		1149				1851
2015		9631		3496		3424		2011	1200	645
2016				3872		3288		20710	1442	1545
2017				5833		3965		10553	5880	
2018		102		1740		1509		1140		
2019	2488		5654	3794		10605		14082	5258	
2020		3208		3418		7663		4077	9704	

Table 2.3.3.1. North Sea herring. Density and abundance estimates of 0-ringers caught in February during the IBTS. Values given for the 1991 to 2020 year classes by areas are density estimates in numbers per square metre according to the new index calculation algorithm. Total abundance is found by multiplying density by area and summing up. Data for the period 1976 to 1990, calculated with the old algorithm, are recorded in the stock annex.

Area	Northwest	Northeast	Central west	Central east	Southwest	Southeast	Division 3.a	South'Bight	IBTS-0 index
Area $m^2 \times 10^9$	83	34	86	102	37	93	31	31	
Year class									no. in 109
1991	0.227	0.074	0.364	0.444	0.466	0.329	0.33	0.259	164
1992	0.191	0.037	0.576	0.387	0.638	0.3	0.359	0.871	195.8
1993	0.574	0.231	0.545	0.178	0.117	0.14	0.223	0.322	155.1
1994	0.131	0.023	0.438	0.359	0.36	0.174	0.503	1.277	170.5
1995	0.222	0.053	0.644	0.069	0.246	0.015	0.015	0.424	107
1996	0.026	0.003	0.878	0.099	0.443	0.298	0.04	0.034	134.5
1997	0.039	0.021	0.295	0.059	0.181	0.035	0.021	0.186	51.7
1998	0.095	0.054	1.074	0.543	0.994	0.296	0.242	0.839	255.5
1999	0.042	0.011	0.725	0.149	0.316	0.141	0.105	0.043	111.1
2000	0.237	0.005	0.764	0.161	0.813	0.79	0.065	4.354	342
2001	0.076	0.018	0.528	0.456	0.487	0.301	0.261	NA	152.9
2002	0.117	0.031	0.241	0.03	0.127	0.058	0.003	0.841	70.9
2003	0.044	0.004	0.248	0.068	0.119	0.019	0.036	0.145	43.9
2004	0.016	0.008	0.205	0.097	0.511	0.228	0.053	0.399	83.3
2005	0.013	0.018	0.315	0.079	0.291	0.154	0.011	0.068	64.5
2006	0.004	0.001	0.213	0.038	0.133	0.02	0.065	0.698	52.9
2007	0.013	0.009	0.185	0.031	0.084	0.058	0.019	0.32	39.5
2008	0.145	0.138	0.281	0.253	0.158	0.139	0.16	0.279	99.2
2009	0.073	0.074	0.194	0.052	0.39	0.291	0	0.042	73.5
2010	0.025	0.004	0.595	0.063	0.188	0.082	NA	0.096	77.6
2011	0.008	0.001	0.312	0.132	0.214	0.129	0.076	0.059	65.1
2012	0.022	0.003	0.193	0.072	0.144	0.257	0.005	0.195	61.2
2013	0.132	0.151	0.24	0.253	0.389	0.313	0.037	0.213	113.8
2014	0.009	0.006	0.15	0.047	0.038	0.002	0.009	0.038	21.7
2015	0.015	0.015	0.136	0.059	0.083	0.324	0.002	0.927	81.2
2016	0.005	0.001	0.143	0.02	0.082	0.035	0.02	0.196	27.8
2017	0.111	0.001	0.395	0.181	0.397	0.26	0.031	0.019	102.1
2018	0.017	0.023	0.29	0.103	0.112	0.029	0.083	0.144	51.6
2019	0.017	0.002	0.159	0.141	0.166	0.244	0.065	0.066	62.4
2020	0.015	0.005	0.449	0.079	0.328	0.256	0.055	0.304	95.2

Table 2.3.3.2. North Sea herring. Indices of 1-ringers from the IBTS 1st Quarter for the 1995 to 2019 year classes (the data for the 1977 to 1994 year classes can be found in the stock annex). Estimation of the small sized component (possibly Downs herring) in different areas. " North Sea" = total area of sampling minus 3.a.

Year class	Year of sampling	All 1-ringers in total area (IBTS-1 index) (no/hour)	Small<13cm 1-ringers in total area (no/hour)	Proportion of small in total area vs. all sizes	Small<13cm 1-ringers in North Sea (no/hour)	Proportion of small in North Sea vs. all sizes	Proportion of small in 3.a vs.small in total area
1995	1997	4403	1356	0.31	1089	0.25	0.25
1996	1998	2276	1322	0.58	1399	0.61	0.02
1997	1999	753	152	0.2	149	0.20	0.09
1998	2000	3304	1068	0.32	939	0.28	0.18
1999	2001	2499	328	0.13	307	0.12	0.13
2000	2002	3881	1520	0.39	1436	0.37	0.12
2001	2003	2837	664	0.23	180	0.06	0.75
2002	2004	979	665	0.68	710	0.73	0.01
2003	2005	1015	341	0.34	357	0.35	0.02
2004	2006	900	115	0.13	121	0.13	0.02
2005	2007	1322	303	0.23	304	0.23	0.07
2006	2008	1792	417	0.23	444	0.25	0.01
2007	2009	2339	734	0.31	623	0.27	0.21
2008	2010	1206	279	0.23	286	0.24	0.05
2009	2011	2939	1331	0.45	1407	0.48	0.02
2010	2012	1353	279	0.21	288	0.21	0.04
2011	2013	1665	747	0.45	796	0.48	0.01
2012	2014	2615	1297	0.5	1245	0.48	0.11
2013	2015	3918	1808	0.46	1105	0.28	0.43
2014	2016	783	368	0.47	364	0.47	0.08
2015	2017	2396	1306	0.54	1008	0.42	0.28
2016	2018	778	406	0.52	424	0.55	0.03
2017	2019	1543	432	0.28	397	0.26	0.15
2018	2020	1021	168	0.16	150	0.15	0.17
2019	2021	3128	487	0.16	256	0.08	0.51

Table 2.4.1.1. North Sea herring. Mean stock weight-at-age (wr) in the third quarter, in divisions 4.a, 4.b and 3.a. Mean catch weight-at-age for the same quarter and area is included for comparison. AS = acoustic survey, 3Q = catch.

W. rings	1		2		3		4		5		6		7		8		9+	
Year	AS	3Q	AS	3Q	AS	3Q	AS	3Q	AS	3Q	AS	3Q	AS	3Q	AS	3Q	AS	3Q
1996	45	75	119	135	196	186	253	224	262	229	299	253	306	292	325	300	335	302
1997	45	43	120	129	168	175	233	220	256	247	245	255	265	278	269	295	329	295
1998	52	54	109	131	198	172	238	209	275	237	307	263	289	269	308	313	363	298
1999	52	62	118	128	171	163	207	193	236	228	267	252	272	263	230	275	260	306
2000	46	54	118	123	180	172	218	201	232	228	261	241	295	266	300	286	280	271
2001	50	69	127	136	162	167	204	199	228	218	237	237	255	262	286	288	294	298
2002	45	50	138	140	172	177	194	200	224	224	247	244	261	252	280	281	249	298
2003	46	65	104	119	185	177	209	198	214	210	243	236	281	247	290	272	307	282
2004	35	45	116	125	139	159	206	203	231	234	253	250	262	264	279	262	270	299
2005	43	53	135	124	171	177	181	201	229	234	248	249	253	261	274	287	295	270
2006	45	61	127	139	158	163	188	192	188	205	225	242	243	257	244	260	265	285
2007	66	75	123	153	155	171	171	183	204	215	198	211	218	252	247	263	233	273
2008	62	67	141	151	180	192	183	207	194	211	230	240	217	243	268	276	282	312
2009	56	56	148	166	208	217	236	242	232	259	240	261	266	274	249	274	263	292
2010	38	74	138	150	183	190	229	222	245	245	233	239	237	248	252	265	251	271
2011	35	86	151	155	171	176	210	201	242	227	258	244	249	246	252	253	275	267
2012	48	61	125	142	192	198	194	205	212	223	232	223	242	251	239	256	243	268
2013	38	48	131	149	161	170	221	217	210	207	236	222	257	252	249	254	252	265
2014	44	49	130	142	177	191	195	208	225	239	218	233	225	243	250	264	246	266
2015	49	33	121	134	146	168	183	212	200	226	220	253	205	243	210	255	229	276
2016	37	31	112	141	158	169	187	200	223	227	235	241	243	259	232	244	236	263
2017	43	47	100	109	156	167	178	187	198	207	225	235	233	242	237	254	230	252
2018	40	45	92	126	145	163	192	202	224	211	228	235	240	254	272	262	273	270
2019	38	51	105	137	145	158	162	179	205	218	226	219	240	235	258	255	256	263
2020	44	71	124	145	159	169	191	184	222	211	233	230	247	238	256	251	268	270

Table 2.4.2.1. North Sea herring. Percentage maturity at 2, 3, 4, 5, 6 and 7+ ring for autumn spawning herring in the North Sea. The values are derived from the acoustic survey for 1988 to 2020. In the period 1988–2014, maturity of age 5+ were set to 100%.

Year \ Ring	2	3	4	5	6	7+
1988	65.6	87.7	100	100	100	100
1989	78.7	93.9	100	100	100	100
1990	72.6	97.0	100	100	100	100
1991	63.8	98.0	100	100	100	100
1992	51.3	100	100	100	100	100
1993	47.1	62.9	100	100	100	100
1994	72.1	85.8	100	100	100	100
1995	72.6	95.4	100	100	100	100
1996	60.5	97.5	100	100	100	100
1997	64.0	94.2	100	100	100	100
1998	64.0	89.0	100	100	100	100
1999	81.0	91.0	100	100	100	100
2000	66.0	96.0	100	100	100	100
2001	77.0	92.0	100	100	100	100
2002	86.0	97.0	100	100	100	100
2003	43.0	93.0	100	100	100	100
2004	69.8	64.9	100	100	100	100
2005	76.0	97.0	96.0	100	100	100
2006	66.0	88.0	98.0	100	100	100
2007	71.0	92.0	93.0	100	100	100
2008	86.0	98.0	99.0	100	100	100
2009	89.0	100	100	100	100	100
2010	45.0	90.0	100	100	100	100
2011	87.0	84.0	99.0	100	100	100
2012	91.0	99.0	100	100	100	100
2013	83.0	96.0	98.0	100	100	100
2014	85.0	100	100	100	100	100
2015	70.0	90.0	96.0	98.0	99.0	100

Year \ Ring	2	3	4	5	6	7+
2016	71.0	89.0	95.0	97.0	98.0	100
2017	55.0	96.0	97.0	98.0	98.0	100
2018	37.0	91.0	98.0	100	100	100
2019	59.0	97.0	99.0	100	100	100
2020	75.0	98.0	100	100	100	100

Table 2.6.1.1. North Sea herring. Years of duration of survey and years used in the assessment.

Survey	Age range	Years survey has been running	Years used in assessment
LAI (Larvae survey)	SSB	1972–2020	1973–2020
IBTS 1st Quarter (Trawl survey)	1 wr	1971–2021	1984–2021
IBTS 3rd Quarter (Trawl survey)	0-5 wr	1991–2020	1998–2020
Acoustic (+trawl)	1 wr 2-9+ wr	1995–2020 1984–2020	1997–2020 1989–2020
IBTS0	0wr	1977–2021	1992–2021

Table 2.6.1.2 North Sea herring input data. Maturity at age.

Year	0	1	2	3	4	5	6	7	8
1947	0	0	1	1	1	1	1	1	1
1948	0	0	1	1	1	1	1	1	1
1949	0	0	1	1	1	1	1	1	1
1950	0	0	1	1	1	1	1	1	1
1951	0	0	1	1	1	1	1	1	1
1952	0	0	1	1	1	1	1	1	1
1953	0	0	1	1	1	1	1	1	1
1954	0	0	1	1	1	1	1	1	1
1955	0	0	1	1	1	1	1	1	1
1956	0	0	1	1	1	1	1	1	1
1957	0	0	1	1	1	1	1	1	1
1958	0	0	1	1	1	1	1	1	1
1959	0	0	1	1	1	1	1	1	1
1960	0	0	1	1	1	1	1	1	1
1961	0	0	1	1	1	1	1	1	1
1962	0	0	1	1	1	1	1	1	1
1963	0	0	1	1	1	1	1	1	1
1964	0	0	1	1	1	1	1	1	1
1965	0	0	1	1	1	1	1	1	1
1966	0	0	1	1	1	1	1	1	1
1967	0	0	1	1	1	1	1	1	1
1968	0	0	1	1	1	1	1	1	1
1969	0	0	1	1	1	1	1	1	1
1970	0	0	1	1	1	1	1	1	1
1971	0	0	1	1	1	1	1	1	1
1972	0	0	0.82	1	1	1	1	1	1
1973	0	0	0.82	1	1	1	1	1	1
1974	0	0	0.82	1	1	1	1	1	1
1975	0	0	0.82	1	1	1	1	1	1
1976	0	0	0.82	1	1	1	1	1	1
1977	0	0	0.82	1	1	1	1	1	1
1978	0	0	0.82	1	1	1	1	1	1
1979	0	0	0.82	1	1	1	1	1	1
1980	0	0	0.82	1	1	1	1	1	1
1981	0	0	0.82	1	1	1	1	1	1
1982	0	0	0.82	1	1	1	1	1	1
1983	0	0	0.82	1	1	1	1	1	1
1984	0	0	0.82	1	1	1	1	1	1
1985	0	0	0.7	1	1	1	1	1	1
1986	0	0	0.75	1	1	1	1	1	1
1987	0	0	0.8	1	1	1	1	1	1
1988	0	0	0.85	0.93	1	1	1	1	1
1989	0	0	0.82	0.94	1	1	1	1	1
1990	0	0	0.91	0.97	1	1	1	1	1
1991	0	0	0.86	0.99	1	1	1	1	1
1992	0	0	0.5	0.99	1	1	1	1	1
1993	0	0	0.47	0.61	1	1	1	1	1
1994	0	0	0.73	0.93	1	1	1	1	1
1995	0	0	0.67	0.95	1	1	1	1	1
1996	0	0	0.61	0.98	1	1	1	1	1
1997	0	0	0.64	0.94	1	1	1	1	1
1998	0	0	0.64	0.89	1	1	1	1	1
1999	0	0	0.69	0.91	1	1	1	1	1
2000	0	0	0.67	0.96	1	1	1	1	1
2001	0	0	0.77	0.92	1	1	1	1	1
2002	0	0	0.87	0.97	1	1	1	1	1
2003	0	0	0.43	0.93	1	1	1	1	1
2004	0	0	0.7	0.65	1	1	1	1	1
2005	0	0	0.76	0.96	0.96	1	1	1	1
2006	0	0	0.66	0.88	0.98	1	1	1	1
2007	0	0	0.71	0.92	0.93	1	1	1	1
2008	0	0	0.86	0.98	0.99	1	1	1	1
2009	0	0	0.89	1	1	1	1	1	1
2010	0	0	0.45	0.9	1	1	1	1	1
2011	0	0	0.87	0.84	1	1	1	1	1
2012	0	0	0.91	0.99	1	1	1	1	1
2013	0	0	0.83	0.96	0.98	1	1	1	1

2014	0	0	0.85	1	1	1	1	1	1
2015	0	0	0.7	0.9	0.96	1	1	1	1
2016	0	0	0.71	0.89	0.95	1	1	1	1
2017	0	0	0.55	0.96	0.97	1	1	1	1
2018	0	0	0.37	0.91	0.98	1	1	1	1
2019	0	0	0.59	0.97	0.99	1	1	1	1
2020	0	0	0.75	0.98	1	1	1	1	1

Table 2.6.1.3 North Sea herring input data. Natural mortality at age.

Year	0	1	2	3	4	5	6	7	8
1947	0.7124	0.4974	0.3026	0.2727	0.252	0.2323	0.2218	0.2157	0.2159
1948	0.7124	0.4974	0.3026	0.2727	0.252	0.2323	0.2218	0.2157	0.2159
1949	0.7124	0.4974	0.3026	0.2727	0.252	0.2323	0.2218	0.2157	0.2159
1950	0.7124	0.4974	0.3026	0.2727	0.252	0.2323	0.2218	0.2157	0.2159
1951	0.7124	0.4974	0.3026	0.2727	0.252	0.2323	0.2218	0.2157	0.2159
1952	0.7124	0.4974	0.3026	0.2727	0.252	0.2323	0.2218	0.2157	0.2159
1953	0.7124	0.4974	0.3026	0.2727	0.252	0.2323	0.2218	0.2157	0.2159
1954	0.7124	0.4974	0.3026	0.2727	0.252	0.2323	0.2218	0.2157	0.2159
1955	0.7124	0.4974	0.3026	0.2727	0.252	0.2323	0.2218	0.2157	0.2159
1956	0.7123	0.4974	0.3026	0.2727	0.252	0.2323	0.2218	0.2157	0.2159
1957	0.7123	0.4974	0.3026	0.2727	0.252	0.2323	0.2218	0.2157	0.2159
1958	0.7124	0.4974	0.3026	0.2727	0.252	0.2323	0.2218	0.2157	0.2159
1959	0.7124	0.4974	0.3026	0.2727	0.252	0.2323	0.2218	0.2157	0.2159
1960	0.7124	0.4973	0.3026	0.2727	0.252	0.2323	0.2218	0.2157	0.2159
1961	0.7123	0.4973	0.3026	0.2727	0.252	0.2323	0.2219	0.2158	0.2159
1962	0.7123	0.4974	0.3026	0.2727	0.252	0.2323	0.2218	0.2157	0.2159
1963	0.7124	0.4978	0.3027	0.2728	0.2519	0.2322	0.2218	0.2156	0.2158
1964	0.7124	0.4973	0.3026	0.2727	0.252	0.2323	0.2218	0.2157	0.2159
1965	0.7123	0.4969	0.3025	0.2727	0.252	0.2323	0.2219	0.2159	0.216
1966	0.7122	0.497	0.3025	0.2727	0.252	0.2323	0.2219	0.2158	0.216
1967	0.7123	0.4979	0.3028	0.2728	0.2519	0.2322	0.2217	0.2156	0.2158
1968	0.7128	0.4997	0.3032	0.273	0.2517	0.2319	0.2213	0.2151	0.2152
1969	0.7123	0.4951	0.302	0.2724	0.2522	0.2325	0.2223	0.2163	0.2165
1970	0.7119	0.4947	0.302	0.2724	0.2523	0.2326	0.2224	0.2164	0.2167
1971	0.7119	0.4975	0.3027	0.2729	0.2521	0.2323	0.2219	0.2158	0.216
1972	0.7129	0.5025	0.3039	0.2734	0.2514	0.2317	0.2208	0.2145	0.2145
1973	0.7149	0.5089	0.3052	0.2739	0.2503	0.2306	0.2193	0.2126	0.2124
1974	0.7099	0.4717	0.2964	0.2694	0.2548	0.2352	0.2268	0.222	0.2229
1975	0.7098	0.493	0.3018	0.2727	0.253	0.2332	0.2231	0.2172	0.2176
1976	0.7121	0.5116	0.3063	0.2749	0.2508	0.231	0.2194	0.2125	0.2124
1977	0.7176	0.5274	0.3096	0.2761	0.248	0.2283	0.2156	0.2079	0.2072
1978	0.725	0.5406	0.3121	0.2763	0.2449	0.2253	0.2118	0.2035	0.202
1979	0.7336	0.5514	0.3135	0.2757	0.2415	0.2221	0.208	0.1992	0.197
1980	0.7446	0.5596	0.3139	0.2742	0.2379	0.2187	0.2043	0.195	0.1921
1981	0.7581	0.5651	0.3133	0.2717	0.2339	0.2151	0.2006	0.1911	0.1873
1982	0.7713	0.5685	0.3119	0.2685	0.2299	0.2113	0.1969	0.1873	0.1827
1983	0.7914	0.5689	0.3094	0.2642	0.2252	0.2071	0.1932	0.1836	0.178
1984	0.8183	0.5662	0.3058	0.2585	0.2198	0.2023	0.1894	0.1801	0.1732
1985	0.8387	0.562	0.3015	0.2525	0.2146	0.1975	0.1854	0.1765	0.1686
1986	0.8493	0.5533	0.294	0.2437	0.2085	0.1915	0.1801	0.1723	0.1638
1987	0.8559	0.5406	0.2841	0.2327	0.2013	0.1844	0.174	0.1679	0.1587
1988	0.8584	0.53	0.2772	0.2249	0.1963	0.1794	0.1693	0.1642	0.1547
1989	0.8531	0.5217	0.274	0.2216	0.1952	0.178	0.1666	0.1615	0.1524
1990	0.8416	0.5131	0.2718	0.2199	0.1961	0.1783	0.1646	0.1594	0.1511
1991	0.8321	0.5061	0.271	0.2193	0.1967	0.1784	0.1631	0.1576	0.15
1992	0.8203	0.4994	0.2728	0.2211	0.197	0.1789	0.1622	0.1565	0.1495
1993	0.8033	0.4926	0.2767	0.2251	0.1982	0.1804	0.1619	0.1558	0.1496
1994	0.791	0.4883	0.28	0.228	0.199	0.1813	0.1617	0.1553	0.1497
1995	0.7803	0.4826	0.282	0.2284	0.1973	0.1799	0.1605	0.1541	0.1493
1996	0.772	0.4795	0.2848	0.2295	0.196	0.179	0.1599	0.1535	0.1493
1997	0.7734	0.4853	0.2888	0.232	0.1966	0.1785	0.1603	0.1534	0.1497
1998	0.7794	0.4948	0.2934	0.2348	0.1972	0.1776	0.1608	0.1535	0.1502
1999	0.7874	0.506	0.2988	0.2391	0.2	0.1788	0.1629	0.1551	0.1519
2000	0.8003	0.5269	0.3075	0.2464	0.2069	0.1835	0.1676	0.1588	0.1553
2001	0.818	0.5556	0.3182	0.2555	0.2164	0.19	0.1738	0.1636	0.1595
2002	0.8327	0.5748	0.3259	0.2626	0.2244	0.1962	0.18	0.1689	0.164

2003	0.846	0.5848	0.3318	0.2699	0.2338	0.2048	0.1884	0.1765	0.1704
2004	0.8616	0.594	0.3383	0.2786	0.2455	0.216	0.1993	0.1863	0.1783
2005	0.8745	0.598	0.3419	0.2839	0.253	0.2239	0.2071	0.1937	0.1844
2006	0.887	0.5914	0.3407	0.2838	0.2547	0.2275	0.2113	0.1987	0.1888
2007	0.9004	0.5777	0.3368	0.2814	0.2542	0.2299	0.2147	0.2036	0.1931
2008	0.9082	0.5656	0.3327	0.2788	0.2531	0.2313	0.217	0.2073	0.1966
2009	0.9104	0.5549	0.3273	0.2747	0.25	0.2305	0.217	0.2087	0.1983
2010	0.9099	0.542	0.3203	0.2687	0.2448	0.2279	0.2154	0.2087	0.1991
2011	0.9046	0.5311	0.3147	0.2647	0.2415	0.2266	0.2147	0.2093	0.2003
2012	0.8947	0.5218	0.3105	0.2623	0.2397	0.2262	0.2147	0.2102	0.2017
2013	0.8812	0.512	0.3058	0.2597	0.2375	0.2253	0.2141	0.2106	0.2026
2014	0.863	0.5031	0.3017	0.2578	0.2358	0.2246	0.2136	0.2108	0.2034
2015	0.84	0.4952	0.298	0.2566	0.2347	0.2242	0.2131	0.2109	0.204
2016	0.8128	0.4876	0.2945	0.2558	0.2337	0.2237	0.2123	0.2106	0.2043
2017	0.7812	0.4806	0.2912	0.2555	0.2332	0.2233	0.2116	0.2101	0.2045
2018	0.745	0.4746	0.2886	0.2563	0.2336	0.2235	0.2112	0.2098	0.2047
2019	0.7043	0.4691	0.2864	0.2578	0.2346	0.224	0.2109	0.2093	0.2049
2020	0.7767	0.4814	0.2918	0.2564	0.234	0.2237	0.2118	0.2101	0.2045

Table 2.6.1.4 North Sea herring input data. Stock weight at age.

Year	0	1	2	3	4	5	6	7	8
1947	0.015	0.05	0.122	0.14	0.156	0.171	0.185	0.197	0.2625
1948	0.015	0.05	0.122	0.14	0.156	0.171	0.185	0.197	0.2625
1949	0.015	0.05	0.124	0.1417	0.1577	0.1727	0.1863	0.1983	0.263
1950	0.015	0.05	0.126	0.1453	0.161	0.1757	0.189	0.2007	0.264
1951	0.015	0.05	0.13	0.151	0.1677	0.1817	0.1943	0.2053	0.2658
1952	0.015	0.05	0.133	0.1577	0.175	0.1893	0.2013	0.2113	0.2683
1953	0.015	0.05	0.136	0.163	0.183	0.1977	0.2097	0.2187	0.2713
1954	0.015	0.05	0.1377	0.167	0.1887	0.205	0.217	0.226	0.2743
1955	0.015	0.05	0.1387	0.1687	0.1927	0.21	0.223	0.2323	0.2772
1956	0.015	0.05	0.1397	0.1703	0.195	0.2137	0.2273	0.2377	0.2795
1957	0.015	0.05	0.1403	0.1717	0.1967	0.216	0.2307	0.2413	0.2815
1958	0.015	0.05	0.1407	0.173	0.198	0.2177	0.2327	0.2437	0.2828
1959	0.015	0.05	0.1417	0.1743	0.1993	0.2193	0.2343	0.2453	0.284
1960	0.015	0.05	0.1463	0.179	0.2077	0.2263	0.2487	0.2637	0.2936
1961	0.015	0.05	0.151	0.1833	0.2157	0.233	0.2627	0.2817	0.3034
1962	0.015	0.05	0.155	0.187	0.223	0.239	0.276	0.299	0.309
1963	0.015	0.05	0.155	0.187	0.223	0.239	0.276	0.299	0.3093
1964	0.015	0.05	0.155	0.187	0.223	0.239	0.276	0.299	0.3101
1965	0.015	0.05	0.155	0.187	0.223	0.239	0.276	0.299	0.307
1966	0.015	0.05	0.155	0.187	0.223	0.239	0.276	0.299	0.3103
1967	0.015	0.05	0.155	0.187	0.223	0.239	0.276	0.299	0.3101
1968	0.015	0.05	0.155	0.187	0.223	0.239	0.276	0.299	0.3112
1969	0.015	0.05	0.155	0.187	0.223	0.239	0.276	0.299	0.3089
1970	0.015	0.05	0.155	0.187	0.223	0.239	0.276	0.299	0.309
1971	0.015	0.05	0.155	0.187	0.223	0.239	0.276	0.299	0.312
1972	0.015	0.05	0.155	0.187	0.223	0.239	0.276	0.299	0.3076
1973	0.015	0.05	0.155	0.187	0.223	0.239	0.276	0.299	0.3078
1974	0.015	0.05	0.155	0.187	0.223	0.239	0.276	0.299	0.3081
1975	0.015	0.05	0.155	0.187	0.223	0.239	0.276	0.299	0.3078
1976	0.015	0.05	0.155	0.187	0.223	0.239	0.276	0.299	0.3077
1977	0.015	0.05	0.155	0.187	0.223	0.239	0.276	0.299	0.306
1978	0.015	0.05	0.155	0.187	0.223	0.239	0.276	0.299	0.3096
1979	0.015	0.05	0.155	0.187	0.223	0.239	0.276	0.299	0.3069
1980	0.015	0.05	0.155	0.187	0.223	0.239	0.276	0.299	0.3072
1981	0.015	0.05	0.155	0.187	0.223	0.239	0.276	0.299	0.307
1982	0.015	0.05	0.155	0.187	0.223	0.239	0.276	0.299	0.3074
1983	0.015	0.05	0.155	0.187	0.223	0.239	0.276	0.299	0.3091
1984	0.01733	0.05667	0.1503	0.1903	0.2297	0.2433	0.282	0.3107	0.3435
1985	0.01567	0.05633	0.138	0.187	0.2323	0.2467	0.2747	0.321	0.3544
1986	0.014	0.061	0.13	0.1833	0.2317	0.252	0.273	0.3147	0.3628
1987	0.009	0.05033	0.1217	0.17	0.2123	0.23	0.242	0.2747	0.3056
1988	0.008	0.04833	0.123	0.1663	0.2083	0.229	0.2483	0.2587	0.2854
1989	0.008667	0.04367	0.1223	0.1653	0.2047	0.2283	0.2523	0.2613	0.2886
1990	0.01233	0.052	0.1257	0.1743	0.2117	0.2437	0.2707	0.2837	0.3079
1991	0.01133	0.059	0.139	0.1837	0.212	0.2387	0.2653	0.2797	0.3095

1992	0.01033	0.06367	0.1367	0.194	0.214	0.2343	0.253	0.2717	0.2987
1993	0.005667	0.061	0.134	0.1843	0.213	0.2343	0.2617	0.2727	0.3079
1994	0.007333	0.06	0.1263	0.1917	0.2143	0.2397	0.2747	0.2913	0.3205
1995	0.006	0.05733	0.1293	0.1857	0.2107	0.2243	0.268	0.2933	0.3261
1996	0.006	0.054	0.1297	0.1993	0.2273	0.2343	0.2737	0.3007	0.3271
1997	0.005	0.04867	0.1233	0.1833	0.2303	0.2373	0.2567	0.2803	0.31
1998	0.005667	0.04733	0.116	0.1873	0.2413	0.2643	0.2837	0.2867	0.3083
1999	0.006	0.05067	0.116	0.1793	0.2263	0.256	0.2733	0.276	0.2781
2000	0.005667	0.05133	0.1157	0.1837	0.2213	0.2483	0.2787	0.286	0.2842
2001	0.006	0.05067	0.1217	0.1717	0.21	0.2327	0.2553	0.2747	0.2745
2002	0.006333	0.04733	0.128	0.1717	0.2053	0.2283	0.2483	0.2703	0.2865
2003	0.006667	0.047	0.123	0.173	0.2023	0.222	0.2423	0.2657	0.2849
2004	0.006667	0.042	0.1193	0.1653	0.2027	0.223	0.2477	0.2677	0.2805
2005	0.005667	0.04133	0.118	0.1643	0.198	0.2247	0.248	0.265	0.2849
2006	0.006667	0.041	0.1257	0.1553	0.191	0.216	0.242	0.2523	0.2702
2007	0.006	0.05133	0.128	0.1607	0.1797	0.207	0.2237	0.238	0.2564
2008	0.008	0.05767	0.1303	0.1643	0.1807	0.1953	0.2177	0.226	0.2556
2009	0.007333	0.06133	0.1373	0.181	0.1967	0.21	0.2227	0.2337	0.2557
2010	0.007333	0.052	0.1423	0.1903	0.216	0.2237	0.2343	0.24	0.2607
2011	0.006667	0.043	0.1457	0.1873	0.225	0.2397	0.2437	0.2507	0.2573
2012	0.006	0.04033	0.138	0.182	0.2113	0.233	0.241	0.2427	0.2525
2013	0.006	0.04033	0.1357	0.1747	0.2087	0.2213	0.242	0.2493	0.2518
2014	0.005667	0.04333	0.1287	0.1767	0.2037	0.2157	0.2287	0.2413	0.2466
2015	0.005333	0.04367	0.1273	0.1613	0.2	0.2117	0.2247	0.229	0.2394
2016	0.005	0.04333	0.121	0.1603	0.1887	0.216	0.2243	0.2243	0.2337
2017	0.004167	0.04287	0.1109	0.1532	0.183	0.2071	0.2265	0.2271	0.2292
2018	0.004567	0.03997	0.1013	0.153	0.1858	0.215	0.2292	0.2388	0.2468
2019	0.004	0.04023	0.099	0.1485	0.1774	0.209	0.2261	0.2379	0.2541
2020	0.003733	0.04073	0.1072	0.1495	0.1816	0.2168	0.2291	0.2424	0.2642

Table 2.6.1.5 North Sea herring input data. Catch weight at age.

Year	0	1	2	3	4	5	6	7	8
1947	0.015	0.05	0.122	0.14	0.156	0.171	0.185	0.197	0.242
1948	0.015	0.05	0.122	0.14	0.156	0.171	0.185	0.197	0.242
1949	0.015	0.05	0.128	0.145	0.161	0.176	0.189	0.201	0.2435
1950	0.015	0.05	0.128	0.151	0.166	0.18	0.193	0.204	0.245
1951	0.015	0.05	0.134	0.157	0.176	0.189	0.201	0.211	0.2475
1952	0.015	0.05	0.137	0.165	0.183	0.199	0.21	0.219	0.251
1953	0.015	0.05	0.137	0.167	0.19	0.205	0.218	0.226	0.254
1954	0.015	0.05	0.139	0.169	0.193	0.211	0.223	0.233	0.2565
1955	0.015	0.05	0.14	0.17	0.195	0.214	0.228	0.238	0.2595
1956	0.015	0.05	0.14	0.172	0.197	0.216	0.231	0.242	0.261
1957	0.015	0.05	0.141	0.173	0.198	0.218	0.233	0.244	0.2625
1958	0.015	0.05	0.141	0.174	0.199	0.219	0.234	0.245	0.2635
1959	0.015	0.05	0.143	0.176	0.201	0.221	0.236	0.247	0.2645
1960	0.015	0.05	0.126	0.176	0.211	0.243	0.251	0.267	0.271
1961	0.015	0.05	0.126	0.176	0.211	0.243	0.251	0.267	0.271
1962	0.015	0.05	0.126	0.176	0.211	0.243	0.251	0.267	0.271
1963	0.015	0.05	0.126	0.176	0.211	0.243	0.251	0.267	0.271
1964	0.015	0.05	0.126	0.176	0.211	0.243	0.251	0.267	0.271
1965	0.015	0.05	0.126	0.176	0.211	0.243	0.251	0.267	0.271
1966	0.015	0.05	0.126	0.176	0.211	0.243	0.251	0.267	0.271
1967	0.015	0.05	0.126	0.176	0.211	0.243	0.251	0.267	0.271
1968	0.015	0.05	0.126	0.176	0.211	0.243	0.251	0.267	0.271
1969	0.015	0.05	0.126	0.176	0.211	0.243	0.251	0.267	0.271
1970	0.015	0.05	0.126	0.176	0.211	0.243	0.251	0.267	0.271
1971	0.015	0.05	0.126	0.176	0.211	0.243	0.251	0.267	0.271
1972	0.015	0.05	0.126	0.176	0.211	0.243	0.251	0.267	0.271
1973	0.015	0.05	0.126	0.176	0.211	0.243	0.251	0.267	0.271
1974	0.015	0.05	0.126	0.176	0.211	0.243	0.251	0.267	0.271
1975	0.015	0.05	0.126	0.176	0.211	0.243	0.251	0.267	0.271
1976	0.015	0.05	0.126	0.176	0.211	0.243	0.251	0.267	0.271
1977	0.015	0.05	0.126	0.176	0.211	0.243	0.251	0.267	0.271
1978	0.015	0.05	0.126	0.176	0.211	0.243	0.251	0.267	0.271
1979	0.015	0.05	0.126	0.176	0.211	0.243	0.251	0.267	0.271
1980	0.015	0.05	0.126	0.176	0.211	0.243	0.251	0.267	0.271

1981	0.007	0.049	0.118	0.142	0.189	0.211	0.222	0.267	0.271
1982	0.01	0.059	0.118	0.149	0.179	0.217	0.238	0.265	0.2742
1983	0.01	0.059	0.118	0.149	0.179	0.217	0.238	0.265	0.2745
1984	0.01	0.059	0.118	0.149	0.179	0.217	0.238	0.265	0.2746
1985	0.009	0.036	0.128	0.164	0.194	0.211	0.22	0.258	0.2821
1986	0.006	0.067	0.121	0.153	0.182	0.208	0.221	0.238	0.2572
1987	0.011	0.035	0.099	0.15	0.18	0.211	0.234	0.258	0.2881
1988	0.011	0.055	0.111	0.145	0.174	0.197	0.216	0.237	0.2566
1989	0.017	0.043	0.115	0.153	0.173	0.208	0.231	0.247	0.2631
1990	0.019	0.055	0.114	0.149	0.177	0.193	0.229	0.236	0.2608
1991	0.017	0.058	0.13	0.166	0.184	0.203	0.217	0.235	0.263
1992	0.01	0.053	0.102	0.175	0.189	0.207	0.223	0.237	0.2632
1993	0.01	0.033	0.115	0.145	0.189	0.204	0.228	0.244	0.2735
1994	0.006	0.056	0.13	0.159	0.181	0.214	0.24	0.255	0.2762
1995	0.009	0.042	0.13	0.169	0.198	0.207	0.243	0.247	0.2809
1996	0.015	0.018	0.112	0.156	0.188	0.204	0.212	0.261	0.2815
1997	0.015	0.044	0.108	0.148	0.195	0.227	0.226	0.235	0.2549
1998	0.021	0.051	0.114	0.145	0.183	0.219	0.238	0.247	0.2879
1999	0.009	0.045	0.115	0.151	0.171	0.207	0.233	0.245	0.2677
2000	0.015	0.033	0.113	0.157	0.179	0.201	0.216	0.246	0.2731
2001	0.012	0.048	0.118	0.149	0.177	0.198	0.213	0.238	0.2697
2002	0.012	0.037	0.118	0.153	0.17	0.199	0.214	0.228	0.2504
2003	0.014	0.037	0.104	0.158	0.174	0.184	0.205	0.222	0.2366
2004	0.014	0.036	0.1	0.138	0.183	0.201	0.216	0.228	0.2545
2005	0.011	0.044	0.099	0.153	0.166	0.208	0.223	0.24	0.2654
2006	0.01	0.049	0.117	0.144	0.172	0.181	0.22	0.237	0.246
2007	0.0124	0.0638	0.1214	0.1513	0.1634	0.1933	0.19	0.2232	0.2375
2008	0.0079	0.0535	0.1288	0.1796	0.1812	0.1832	0.2157	0.2161	0.2621
2009	0.0094	0.0514	0.144	0.1811	0.2158	0.2162	0.239	0.2428	0.2533
2010	0.0075	0.0571	0.1292	0.1669	0.1912	0.2203	0.2193	0.216	0.2384
2011	0.008	0.0413	0.1317	0.1593	0.1831	0.197	0.2167	0.2211	0.2319
2012	0.0106	0.0463	0.1243	0.1706	0.1854	0.2058	0.2215	0.2387	0.2427
2013	0.0077	0.0468	0.1162	0.1563	0.1977	0.198	0.2154	0.2334	0.2378
2014	0.0075	0.0522	0.124	0.1719	0.1861	0.2148	0.2118	0.2264	0.2427
2015	0.0087	0.0261	0.1135	0.1538	0.1883	0.2001	0.2212	0.217	0.2347
2016	0.0071	0.0265	0.1267	0.1549	0.1803	0.2059	0.2151	0.2313	0.2299
2017	0.009	0.038	0.099	0.156	0.173	0.188	0.215	0.22	0.2305
2018	0.0054	0.0394	0.1085	0.1451	0.1838	0.1914	0.2151	0.2342	0.2456
2019	0.0064	0.0395	0.121	0.1465	0.1688	0.2036	0.2081	0.2195	0.2435
2020	0.004	0.0706	0.1303	0.1553	0.1707	0.1888	0.2135	0.219	0.2435

Table 2.6.1.6 North Sea herring input data. Catch at age.

Year	0	1	2	3	4	5	6	7	8+
1947	0	0	494000	415000	638000	526000	756000	431000	1311000
1948	0	3000	247000	672000	328000	601000	487000	4e+05	917000
1949	0	0	478000	644000	396000	287000	652000	462000	1037000
1950	0	0	535000	1039000	617000	290000	254000	331000	597000
1951	0	462000	660000	959000	1255000	630000	262000	142000	445000
1952	0	722000	1346000	576000	610000	652000	464000	236000	554000
1953	150000	1023000	1322000	1003000	474000	386000	473000	278000	392000
1954	219000	1451000	1493000	1111000	591000	361000	330000	379000	511000
1955	164000	2072000	1931000	1032000	479000	337000	232000	120000	215000
1956	96000	1697000	1860000	1221000	516000	249000	194000	104000	292000
1957	279000	1483000	1644000	736000	644000	344000	207000	147000	253000
1958	97000	4279000	1029000	999000	322000	461000	147000	73000	118000
1959	0	1609000	4934000	488000	497000	233000	249000	120000	301000
1960	194600	2392700	1142300	1966700	165900	167700	112900	125800	270600
1961	1269200	336000	1889400	479900	1455900	124000	157900	61400	143500
1962	141800	2146900	269600	797400	335100	1081800	126900	145100	173100
1963	442800	1262200	2961200	177200	158300	80600	229700	22400	93000
1964	496900	2971700	1547500	2243100	148400	149000	95000	256300	84000
1965	157100	3209300	2217600	1324600	2039400	145100	151900	117600	491400
1966	374500	1383100	2569700	741200	450100	889800	45300	64800	331800
1967	645400	1674300	1171500	1364700	371500	297800	393100	67900	254400
1968	839300	2425000	1795200	1494300	621400	157100	145000	163400	105500
1969	112000	2503300	1883000	296300	133100	190800	49900	42700	52500

1970	898100	1196200	2002800	883600	125200	50300	61000	7900	24200
1971	684000	4378500	1146800	662500	208300	26900	30500	26800	12500
1972	750400	3340600	1440500	343800	130600	32900	5000	200	1500
1973	289400	2368000	1344200	659200	150200	59300	30600	3700	2000
1974	996100	846100	772600	362000	126000	56100	22300	5000	3100
1975	263800	2460500	541700	259600	140500	57200	16100	9100	4800
1976	238200	126600	901500	117300	52000	34500	6100	4400	1400
1977	256800	144300	44700	186400	10800	7000	4100	1500	700
1978	.	.	.	.	.	.	.	.	.
1979	.	.	.	.	.	.	.	.	.
1980	1262700	245100	134000	91800	32200	21700	2300	1400	500
1981	9519700	872000	284300	56900	39500	28500	22700	18700	6600
1982	11956700	1116400	299400	230100	33700	14400	6800	7800	4700
1983	13296900	2448600	573800	216400	105100	26200	22800	12800	23100
1984	6973300	1818400	1146200	441400	201500	81100	22600	25200	29700
1985	4211000	3253000	1326300	1182400	368500	124500	43600	20200	29200
1986	3724700	4801400	1266700	840800	465900	129800	62100	20500	28400
1987	8229200	6836300	2137200	667900	467100	245800	74700	23800	16200
1988	3164800	7867000	2232500	1090700	383700	255800	128100	38000	23800
1989	3057800	3145900	1593700	1363800	809300	211800	123700	61000	28200
1990	1302800	3020000	899300	779100	861000	387500	80200	54400	40700
1991	2386600	2138900	1132800	556700	548900	501200	205300	39300	38600
1992	10331300	2303100	1284900	442700	361500	360500	375600	152400	62500
1993	10265400	3826800	1176300	609000	305500	215600	226000	188000	129000
1994	4498900	1785200	1783200	489100	347600	109000	91800	76400	116600
1995	7438469	1664874	1444061	816703	231794	118536	55128	41409	98200
1996	2311226	1606393	642084	525601	172099	57586	22534	9264	21143
1997	431175	479702	687920	446909	284920	109178	31389	11832	24467
1998	259526	977680	1220105	537932	276333	175817	88927	15232	20550
1999	1566349	303520	616354	1058716	294066	135648	69299	27998	12228
2000	1105085	1171677	622853	463170	646814	213466	82481	35706	17087
2001	1832691	614469	842635	485628	278884	321743	90918	38252	20602
2002	730279	837557	579592	970577	292205	140701	174570	48908	43322
2003	369074	617021	1221992	529386	835552	244780	107751	123291	46715
2004	715597	206648	447918	1366155	543376	753231	169324	104945	97142
2005	1015554	715547	355453	485746	1318647	479961	576154	115212	146808
2006	878637	222111	401087	310602	464620	997782	252150	247042	106412
2007	621005	235553	219115	417452	285746	309454	629187	147830	156750
2008	798284	235022	331772	184771	199069	137529	118349	215542	117258
2009	650043	175923	259434	106738	93321	86137	37951	53130	143131
2010	574895	280728	293887	236804	126241	83893	61542	33305	113675
2011	778927	159504	367820	275016	218711	130127	62938	52081	125734
2012	773241	284906	455259	673465	404265	306234	152577	104461	205427
2013	461571	413000	324920	485185	571269	422765	327213	145330	313638
2014	1388685	370590	382990	386131	616563	487582	284562	191729	214513
2015	538228	394878	551802	247555	282813	461041	432034	271280	337811
2016	1583568	109135	625483	818585	293372	280451	367844	307347	359076
2017	462148	209356	108706	1079854	837770	222790	145511	175533	221296
2018	1337404	73260	206232	200527	1178604	848961	223637	144999	332482
2019	649197	172202	105505	307520	198443	730016	528327	133409	217686
2020	2127371	112088	549256	215250	291883	145821	515402	349435	176646

Table 2.6.1.7 North Sea herring input data. HERAS survey index at age.

Year	1	2	3	4	5	6	7	8+
1989	-1	4090000	3903000	1633000	492000	283000	120000	66000
1990	-1	3306000	3521000	3414000	1366000	392000	210000	176000
1991	-1	2634000	1700000	1959000	1849000	644000	228000	145000
1992	-1	3734000	1378000	1147000	1134000	1246000	395000	218000
1993	-1	2984000	1637000	902000	741000	777000	551000	296000
1994	-1	3185000	839000	399000	381000	321000	326000	350000
1995	-1	3849000	2041000	672000	299000	203000	138000	212000
1996	-1	4497000	2824000	1087000	311000	99000	83000	339000
1997	9361000	5960000	2935000	1441000	601000	215000	46000	237000
1998	4449000	5747000	2520000	1625000	982000	445000	170000	166000
1999	5087000	3078000	4725000	1116000	506000	314000	139000	141000
2000	24736000	2923000	2156000	3140000	1007000	483000	266000	217000

2001	6837000	12290000	3083000	1462000	1676000	450000	170000	157000
2002	23055000	4875000	8220000	1390000	794600	1031000	244400	270500
2003	9829400	18949400	3081000	4188900	675100	494800	568300	323200
2004	5183700	3415900	9191800	2167300	2590700	317100	327600	527650
2005	3114100	2055100	3648500	5789600	1212900	1174900	139900	233200
2006	6822800	3772300	1997200	2097500	4175100	618200	562100	154700
2007	6261000	2750000	1848000	898000	806000	1323000	243000	217000
2008	3714000	2853000	1709000	1485000	809000	712000	1749000	455000
2009	4655000	5632000	2553000	1023000	1077000	674000	638000	1720000
2010	14577000	4237000	4216000	2453000	1246000	1332000	688000	2729000
2011	10119000	4166000	2534000	2173000	1016000	651000	688000	1737000
2012	7437000	4719000	4067000	1738000	1209000	593000	247000	696000
2013	6388000	2683000	3031000	2895000	1546000	849000	464000	842000
2014	11634000	4918000	2827000	2939000	1791000	1236000	669000	461000
2015	6714000	9495000	2831000	1591000	1549000	926000	520000	496000
2016	9034000	12011000	5832000	1273000	822000	909000	395000	366000
2017	3054000	1761000	6095000	3142000	787000	365000	298000	293000
2018	9938000	4254000	1692000	5150000	2440000	719000	529000	404000
2019	10146000	1303000	2345000	1212000	3506000	1657000	395000	424000
2020	7130000	2736000	1156000	1371000	1674000	1666000	504000	352000

Table 2.6.1.8 North Sea herring input data. IBTS0 survey index at age.

Year	Value
1992	163
1993	195.8
1994	155.7
1995	171.2
1996	105.6
1997	133.5
1998	51.72
1999	255.2
2000	110.6
2001	341.5
2002	150.7
2003	72.44
2004	43.11
2005	68.73
2006	67.28
2007	50.76
2008	39.49
2009	92.36
2010	56.53
2011	77.62
2012	65.1
2013	61.55
2014	113.7
2015	21.76
2016	81.71
2017	27.83
2018	102.2
2019	51.63
2020	62.39
2021	95.24

Table 2.6.1.9 North Sea herring input data. IBTSQ1 survey index at age. This index is normalized Using the data from DATRAS following the method described in the stock annex

Year	Value
1984	1057817
1985	1446897
1986	1661096
1987	3137067
1988	1482843

1989	1591869
1990	744095
1991	1071987
1992	1114619
1993	1819697
1994	2689360
1995	2098605
1996	1232897
1997	807578
1998	1449610
1999	700200
2000	2040323
2001	1561990
2002	1727130
2003	1331163
2004	761958
2005	902034
2006	725301
2007	859058
2008	711772
2009	702501
2010	857704
2011	1496233
2012	782949
2013	486052
2014	1615026
2015	1887540
2016	546220
2017	1339906
2018	664630
2019	962149
2020	1123548
2021	1213197

Table 2.6.1.10 North Sea herring input data. IBTSQ3 survey index at age. This index is normalized Using the data from DATRAS following the method described in the stock annex

Year	0	1	2	3	4	5
1998	719773	455714	316775	93361	24297	11505
1999	4541143	295220	213730	124536	50986	18432
2000	1737104	773325	266121	118352	69886	17892
2001	1845109	321669	227932	96962	42963	26429
2002	2201182	1961996	455396	352498	82049	32678
2003	883932	473736	575503	152070	113444	19400
2004	2102067	391439	294586	426275	97329	51332
2005	1074321	386041	116365	84271	99832	31922
2006	1015001	290901	197834	80049	46619	53582
2007	2201537	135003	97101	102389	50900	31186
2008	565133	153916	117814	61448	36091	19461
2009	2794963	202906	98021	65138	27721	12481
2010	1310958	510778	180637	83358	37295	15758
2011	816825	320129	180333	101912	50637	21915
2012	769491	208984	93256	68896	38859	22368
2013	1798965	264571	146546	126210	86043	40312
2014	7253797	442997	198984	90513	80426	45453
2015	518307	723028	360968	128454	67567	46000
2016	1693195	175029	375536	213840	68403	43301
2017	848528	279280	79209	200643	128757	41359
2018	1882241	328189	117615	49491	86881	39764
2019	1484308	137972	72442	41243	26007	36248
2020	761929	312232	269581	75962	66438	26408

Table 2.6.1.11 North Sea herring input data. LAI index from the IHLS larvae survey for the Southern North Sea component (Downs). The columns corresponds to survey time windows: 0=16-31Dec, 1=01-15Jan, 2=16-31Jan.

Year	0	1	2
1972	2	46	0
1973	-1	-1	1
1974	-1	10	-1
1975	1	2	0
1976	-1	3	-1
1977	1	0	-1
1978	33	3	-1
1979	-1	111	89
1980	247	129	40
1981	1456	-1	70
1982	710	275	54
1983	71	243	58
1984	523	185	39
1985	1851	407	38
1986	780	123	18
1987	934	297	146
1988	1679	162	112
1989	1514	2120	512
1990	2552	1204	-1
1991	4400	873	-1
1992	176	1616	-1
1993	1358	1103	-1
1994	537	595	-1
1995	74	230	164
1996	337	675	691
1997	9374	918	355
1998	1522	953	170
1999	804	1260	344
2000	7346	338	106
2001	971	5531	909
2002	2008	260	925
2003	12048	3109	1116
2004	6528	2052	4175
2005	498	3999	4822
2006	10858	2700	2106
2007	4443	2439	3854
2008	8426	2317	4008
2009	15295	14712	1689
2010	7493	13230	8073
2011	5461	6160	1215
2012	22768	11103	3285
2013	5	9314	2957
2014	-1	-1	1851
2015	2011	1200	645
2016	20710	1442	1545
2017	10553	5880	-1
2018	1140	-1	-1
2019	14082	5258	-1
2020	4077	9704	-1

Table 2.6.1.12 North Sea herring input data. LAI index from the IHLS larvae survey for the Central North Sea component (Banks). The columns corresponds to survey time windows in: 0=01-15Sep, 1=16-30Sep, 2=01-15Oct, 3=16-31Oct.

Year	0	1	2	3
1972	165	88	134	22
1973	492	830	1213	152
1974	81	-1	1184	-1
1975	-1	90	77	6
1976	64	108	0	10
1977	520	262	89	3
1978	1406	81	269	2
1979	662	131	507	7
1980	317	188	9	13

1981	903	235	119	0
1982	86	64	1077	23
1983	1459	281	63	-1
1984	688	2404	824	433
1985	130	13039	1794	215
1986	1611	6112	188	36
1987	799	4927	1992	113
1988	5533	3808	1960	206
1989	1442	5010	2364	2
1990	19965	1239	975	-1
1991	4823	2110	1249	-1
1992	10	165	163	-1
1993	-1	685	85	-1
1994	-1	1464	44	-1
1995	-1	-1	43	-1
1996	-1	564	-1	-1
1997	-1	-1	-1	-1
1998	205	66	-1	-1
1999	-1	134	181	-1
2000	-1	376	-1	-1
2001	-1	1604	-1	-1
2002	-1	-1	3291	-1
2003	-1	12018	3277	-1
2004	-1	5545	-1	-1
2005	-1	5614	-1	-1
2006	-1	2259	-1	-1
2007	-1	291	-1	-1
2008	-1	11201	-1	-1
2009	-1	4219	-1	-1
2010	-1	2317	-1	-1
2011	-1	17766	-1	-1
2012	-1	517	-1	-1
2013	-1	7354	-1	-1
2014	-1	1149	-1	-1
2015	-1	3424	-1	-1
2016	-1	3288	-1	-1
2017	-1	3965	-1	-1
2018	-1	1509	-1	-1
2019	-1	10605	-1	-1
2020	-1	7663	-1	-1

Table 2.6.1.13 North Sea herring input data. LAI index from the IHLS larvae survey for the Bunchan component. The columns corresponds to survey time windows in: 0=01-15Sep, 1=16-30Sep.

Year	0	1
1972	30	0
1973	3	4
1974	101	284
1975	312	-1
1976	0	1
1977	124	32
1978	-1	162
1979	197	10
1980	21	1
1981	3	12
1982	340	257
1983	3647	768
1984	2327	1853
1985	2521	1812
1986	3278	341
1987	2551	670
1988	6812	5248
1989	5879	692
1990	4590	2045
1991	-1	2032
1992	-1	822
1993	-1	174

1994	-1	-1
1995	-1	-1
1996	-1	184
1997	-1	23
1998	-1	1490
1999	-1	185
2000	28	155
2001	-1	164
2002	-1	1038
2003	-1	2263
2004	-1	3884
2005	-1	1364
2006	-1	280
2007	-1	1304
2008	-1	533
2009	-1	4629
2010	-1	1493
2011	-1	2839
2012	-1	5856
2013	-1	8618
2014	-1	5033
2015	-1	3496
2016	-1	3872
2017	-1	5833
2018	-1	1740
2019	5654	3794
2020	-1	3418

Table 2.6.1.14 North Sea herring input data. LAI index from the IHLS larvae survey for the Orkney/Shetland component. The columns corresponds to survey time windows in: 0=01-15Sep, 1=16-30Sep.

Year	0	1
1972	1133	4583
1973	2029	822
1974	758	421
1975	371	50
1976	545	81
1977	1133	221
1978	3047	50
1979	2882	2362
1980	3534	720
1981	3667	277
1982	2353	1116
1983	2579	812
1984	1795	1912
1985	5632	3432
1986	3529	1842
1987	7409	1848
1988	7538	8832
1989	11477	5725
1990	-1	10144
1991	1021	2397
1992	189	4917
1993	-1	66
1994	26	1179
1995	-1	8688
1996	-1	809
1997	-1	3611
1998	-1	8528
1999	-1	4064
2000	-1	3972
2001	-1	11918
2002	-1	6669
2003	-1	3199
2004	-1	7055
2005	-1	3380
2006	6311	2312

2007	-1	1753
2008	4978	6875
2009	-1	7543
2010	-1	2362
2011	-1	3831
2012	-1	19552
2013	-1	21282
2014	-1	6604
2015	-1	9631
2016	-1	-1
2017	-1	-1
2018	-1	102
2019	2488	-1
2020	-1	3208

Table 2.6.2.1 North Sea herring single fleet assessment. observation variance per data source and at age.

fleet	age	value	CV	lbnd	ubnd
catch unique	0	0.42	0.1295	0.3258	0.5414
catch unique	1	0.42	0.1295	0.3258	0.5414
catch unique	2	0.1203	0.1797	0.08459	0.1711
catch unique	3	0.1203	0.1797	0.08459	0.1711
catch unique	4	0.1203	0.1797	0.08459	0.1711
catch unique	5	0.1203	0.1797	0.08459	0.1711
catch unique	6	0.1203	0.1797	0.08459	0.1711
catch unique	7	0.188	0.1969	0.1278	0.2765
catch unique	8	0.188	0.1969	0.1278	0.2765
HERAS	1	0.4677	0.1549	0.3452	0.6336
HERAS	2	0.277	0.1495	0.2066	0.3713
HERAS	3	0.1503	0.192	0.1032	0.219
HERAS	4	0.2146	0.1028	0.1754	0.2625
HERAS	5	0.2146	0.1028	0.1754	0.2625
HERAS	6	0.2146	0.1028	0.1754	0.2625
HERAS	7	0.2948	0.1273	0.2297	0.3783
HERAS	8	0.2948	0.1273	0.2297	0.3783
IBTS-Q1	1	0.2801	0.1515	0.2082	0.377
IBTS0	0	0.3311	0.1717	0.2365	0.4635
IBTS-Q3	0	0.4962	0.1345	0.3812	0.6459
IBTS-Q3	1	0.4962	0.1345	0.3812	0.6459
IBTS-Q3	2	0.3198	0.09693	0.2645	0.3867
IBTS-Q3	3	0.3198	0.09693	0.2645	0.3867
IBTS-Q3	4	0.3198	0.09693	0.2645	0.3867
IBTS-Q3	5	0.3198	0.09693	0.2645	0.3867
LAI-ORSH	0	1.186	0.04378	1.089	1.293
LAI-BUN	0	1.186	0.04378	1.089	1.293
LAI-CNS	0	1.186	0.04378	1.089	1.293
LAI-SNS	0	1.186	0.04378	1.089	1.293

Table 2.6.2.2 North Sea herring single fleet assessment. Catchabilities at age.

fleet	age	value	CV	lbnd	ubnd
HERAS	1	0.9736	0.06892	0.8506	1.114
HERAS	2	0.9736	0.06892	0.8506	1.114
HERAS	3	1.111	0.05787	0.9921	1.245
HERAS	4	1.111	0.05787	0.9921	1.245
HERAS	5	1.111	0.05787	0.9921	1.245
HERAS	6	1.111	0.05787	0.9921	1.245
HERAS	7	1.111	0.05787	0.9921	1.245
HERAS	8	1.111	0.05787	0.9921	1.245
IBTS-Q1	1	0.1046	0.06874	0.09144	0.1197
IBTS0	0	3.256e-06	0.08747	2.743e-06	3.865e-06
IBTS-Q3	0	0.09443	0.1243	0.07402	0.1205
IBTS-Q3	1	0.04673	0.1201	0.03693	0.05914
IBTS-Q3	2	0.04292	0.08835	0.0361	0.05104

IBTS-Q3	3	0.03882	0.08741	0.03271	0.04607
IBTS-Q3	4	0.03249	0.08886	0.0273	0.03868
IBTS-Q3	5	0.02543	0.0899	0.02132	0.03033
LAI-ORSH	0	0.01634	0.1084	0.01322	0.02021
LAI-BUN	0	0.01634	0.1084	0.01322	0.02021
LAI-CNS	0	0.01634	0.1084	0.01322	0.02021
LAI-SNS	0	0.01634	0.1084	0.01322	0.02021

Table 2.6.2.3 North Sea herring single fleet assessment. Numbers at age.

Year	0	1	2	3	4	5	6	7	8
1947	34857881	16680211	14660510	5425498	7277607	4449931	3924311	2074043	6325976
1948	33168667	16187259	9543339	8681479	3657537	5098815	2949151	2232636	4890220
1949	27738944	15537033	11577103	7236067	4193053	2291596	3253556	1876381	4271621
1950	39631096	12084218	9003995	9355772	5179172	2342726	1452529	1816396	3243745
1951	38360314	19088869	6487739	6041255	6836818	3625286	1474115	842354	2795739
1952	38129475	17636661	10465234	3853368	3573078	3786985	2164242	939014	2272124
1953	43298993	17305639	9202520	5719870	2628711	2112546	2221294	1230766	1766283
1954	40509210	20067363	8842474	5245050	3098707	1712297	1242620	1281490	1707087
1955	34330892	18209442	10518999	5103956	2663062	1787491	1056176	664209	1408756
1956	25331383	16054303	8628867	6053882	2883634	1462171	1043436	582614	1387132
1957	57963495	10812125	8069740	3749229	3535432	1680721	930477	649597	1173520
1958	24750757	32719724	4741248	4547890	1881058	2251610	924820	543666	1009764
1959	28494509	11012382	19162399	2162398	2339013	1102672	1161482	565241	1192216
1960	12367216	14423512	4966163	10522033	1057661	1141799	605727	616521	1089061
1961	53361602	4138894	7300411	2358295	7110642	669132	791812	344387	870537
1962	28315663	27303876	1582948	3197868	1370387	4379456	425932	513021	709262
1963	34500367	13017996	16027038	1006587	1247776	674159	2245959	203487	694291
1964	34525401	14923259	6519608	9343192	663285	733233	506575	1536287	545429
1965	17044568	16549405	6223506	3394630	5410037	389402	424945	320077	1376011
1966	18512296	7870349	7515213	2139546	1362624	2331009	167865	188111	843336
1967	25695882	7857955	3576051	3135318	848526	651482	865371	101042	465422
1968	22010621	11650464	3122995	1881190	1146857	290548	245781	277496	164772
1969	12613954	9881122	4268170	656699	301304	350062	78421	65458	95289
1970	22028340	5778197	4123154	1523208	210230	99161	108060	16313	42985
1971	17203786	10136867	2325572	1205937	371550	50929	31733	30017	17499
1972	12689647	7686035	3289672	756597	313779	95230	13979	1050	6516
1973	6837978	5415084	2652965	1130932	291865	120700	47504	7462	4447
1974	10910155	2757854	1558627	728578	262988	97774	40071	11366	5278
1975	2523737	5374724	926433	432972	232235	81126	26821	11722	5882
1976	3316846	823949	1814023	210166	93143	61564	13545	6305	2464
1977	4408473	1395086	279817	614578	49371	24709	18595	4556	2120
1978	4284612	1873406	704192	219598	248557	30461	11451	10094	3164
1979	7817493	1689144	909159	407271	175764	121744	20564	7019	7297
1980	12579125	3211513	752052	476612	228267	155953	62300	16908	8080
1981	27479729	4657428	1599985	322459	218736	138200	120509	54266	20189
1982	46668043	8062729	1841134	1035370	199014	119523	76757	70873	39184
1983	46332060	14935007	3220681	1051336	502265	125254	102656	52268	82683
1984	46430895	13363932	6133080	1792274	671652	272551	79210	67102	80892
1985	54857205	14879024	5711834	3584437	995104	358122	123896	46884	74951
1986	66589031	19868171	5448494	2982583	1543296	426092	169011	54204	61010
1987	57753733	26261354	8693814	2593006	1541899	774858	222020	76439	50328
1988	37584120	18965563	9960509	4557099	1326761	803112	387644	111535	66689
1989	29601203	12878841	6888564	5477231	2639122	689988	398854	192021	89387
1990	27314412	9856830	4447087	3904302	3607786	1547698	370521	215721	161202
1991	29768324	10495112	4143256	2311420	2293798	2138016	875406	212058	195856
1992	52687967	10251094	4465858	1770582	1321879	1330987	1291741	519107	242211
1993	55478713	16789015	3709483	1997534	935276	729725	738683	634231	402580
1994	42818450	16891069	5843508	1421385	858324	400336	343160	336688	464138
1995	44509451	13850076	6023246	2593486	719137	369200	197793	171229	371868
1996	35721124	14046247	5131069	3052111	1084083	339765	150869	96276	262705
1997	29399447	13515440	6353427	2957339	1656944	661134	209031	88297	221301
1998	18671594	12044905	8851140	3158182	1468259	888050	434125	129117	172623
1999	57118961	8161444	5503217	5398176	1658768	745983	430706	224751	148320
2000	39913773	22592181	5403398	2873619	3161767	1027590	469949	267389	192499
2001	69493485	15798562	11134746	3503680	1684905	1763461	549118	277565	221530
2002	36544676	29090250	7874546	8080049	1896410	912324	1076200	319658	306603

2003	20448136	14030920	17030853	4411714	4906427	1062319	562983	649505	333484
2004	23148557	7688985	6201456	10804646	2945095	2964686	544446	363524	491119
2005	20618261	9632810	3816209	3819177	6431627	1743669	1594204	268014	401314
2006	21102267	7181087	4894101	2427044	2373262	4071355	850498	714648	279865
2007	24216457	7568169	3147984	2848749	1524446	1348256	2266159	440109	459004
2008	21414758	8611089	4308626	2066651	1678380	978784	854478	1446952	560066
2009	35173993	8532231	5284804	2562902	1397486	1114075	665705	622011	1594208
2010	27075893	12737198	5441542	3860553	1895774	1040715	986899	511842	1728964
2011	24662241	11175270	6590373	3479572	2424209	1218597	711217	641481	1464792
2012	22821042	9010834	5783853	4928300	2573030	1685121	789097	463816	1170997
2013	30576450	8410358	4510187	4009966	3385734	1935187	1174750	496635	1015130
2014	47591435	13669299	5272924	3113374	3292025	2267687	1226766	689046	744763
2015	13105001	18853171	9531387	2921972	1918310	2042486	1358805	709002	800657
2016	23845023	5088352	11564153	6805937	1800290	1212702	1150899	685728	707570
2017	14290297	8800444	2498258	8220706	4728236	1194975	619655	541186	584752
2018	25779018	5865147	4223435	1886892	5867194	3351792	785001	415514	680883
2019	22973841	10313476	2552430	2651584	1422376	3665829	1969431	417338	555067
2020	24676160	9830005	6762472	1592844	1778346	1025975	2153938	961056	472236
2021	30422344	10430934	5562841	4371804	978694	1081013	626713	1195599	651684

Table 2.6.2.4 North Sea herring single fleet assessment. Harvest at age.

Year	0	1	2	3	4	5	6	7	8
1947	0.0001157	0.001001	0.03874	0.09546	0.1107	0.148	0.2434	0.27	0.27
1948	9.34e-05	0.000785	0.03304	0.08732	0.1057	0.1398	0.2101	0.2394	0.2394
1949	0.0002352	0.002242	0.04986	0.1096	0.1253	0.1587	0.2559	0.3049	0.3049
1950	0.0005803	0.006255	0.07411	0.1364	0.1484	0.1639	0.2183	0.2371	0.2371
1951	0.001799	0.02262	0.1306	0.2025	0.2141	0.2098	0.2351	0.2269	0.2269
1952	0.003094	0.04189	0.1609	0.2107	0.2197	0.2254	0.2822	0.3074	0.3074
1953	0.00464	0.0664	0.1906	0.233	0.2283	0.2339	0.2824	0.2986	0.2986
1954	0.006564	0.1014	0.2338	0.2751	0.2577	0.2722	0.3645	0.3796	0.3796
1955	0.007037	0.121	0.2509	0.2666	0.2354	0.2405	0.2706	0.2344	0.2344
1956	0.007211	0.136	0.2756	0.2687	0.2289	0.2311	0.2456	0.2389	0.2389
1957	0.007962	0.1487	0.2854	0.2756	0.2413	0.2613	0.2864	0.273	0.273
1958	0.008671	0.1508	0.295	0.277	0.2309	0.2377	0.204	0.1728	0.1728
1959	0.01478	0.2138	0.3508	0.3148	0.2707	0.2709	0.2906	0.2882	0.2882
1960	0.01688	0.1918	0.3093	0.2567	0.2143	0.2109	0.2381	0.2689	0.2689
1961	0.01932	0.1967	0.3273	0.2935	0.2548	0.2404	0.2535	0.2374	0.2374
1962	0.01229	0.13	0.2739	0.3162	0.3024	0.3072	0.3796	0.3506	0.3506
1963	0.01236	0.1167	0.2352	0.2254	0.1796	0.1682	0.1305	0.1437	0.1437
1964	0.01855	0.1946	0.3406	0.3399	0.2879	0.2733	0.2262	0.2173	0.2173
1965	0.02421	0.2894	0.5231	0.5835	0.525	0.5226	0.5059	0.5132	0.5132
1966	0.02449	0.2534	0.4913	0.5597	0.496	0.513	0.4109	0.5118	0.5118
1967	0.02906	0.2872	0.5654	0.7341	0.6703	0.7105	0.763	0.9549	0.9549
1968	0.04956	0.5381	0.9943	1.298	1.004	0.9679	1.149	1.216	1.216
1969	0.0276	0.2961	0.6919	0.8796	0.8017	0.8537	1.191	1.069	1.069
1970	0.04675	0.4239	0.8172	1.023	0.9372	0.8549	1.174	0.9097	0.9097
1971	0.06861	0.5661	0.885	1.085	1.073	1.129	2.923	1.726	1.726
1972	0.06893	0.46	0.6992	0.729	0.6019	0.5294	0.539	0.3173	0.3173
1973	0.1016	0.6356	0.91	1.021	0.8642	0.8639	1.08	0.7063	0.7063
1974	0.1143	0.5424	0.8407	0.938	0.8404	0.9414	0.957	0.8424	0.8424
1975	0.1763	0.6803	1.011	1.242	1.117	1.294	1.285	1.619	1.619
1976	0.1491	0.4459	0.7307	1.014	0.88	0.9515	0.8044	1.151	1.151
1977	0.06785	0.1265	0.2632	0.3893	0.3317	0.4024	0.2731	0.4595	0.4595
1978	0.07722	0.112	0.2153	0.2811	0.2351	0.2652	0.1396	0.2527	0.2527
1979	0.1098	0.1291	0.2111	0.2496	0.1945	0.2004	0.08247	0.1525	0.1525
1980	0.1636	0.1566	0.216	0.2356	0.1736	0.1568	0.05054	0.09119	0.09119
1981	0.331	0.2668	0.2505	0.2799	0.2501	0.2647	0.213	0.3801	0.3801
1982	0.302	0.2375	0.2215	0.2521	0.2056	0.1747	0.107	0.1537	0.1537
1983	0.306	0.2709	0.2426	0.29	0.2863	0.2775	0.2585	0.3394	0.3394
1984	0.2201	0.2611	0.2608	0.3443	0.3891	0.3872	0.3917	0.4952	0.4952
1985	0.1888	0.3275	0.324	0.438	0.5006	0.4813	0.5229	0.5885	0.5885
1986	0.1459	0.3039	0.3101	0.3817	0.4372	0.4437	0.5182	0.5839	0.5839
1987	0.1808	0.3864	0.3281	0.3605	0.4175	0.429	0.4581	0.4595	0.4595
1988	0.1675	0.3919	0.3151	0.3302	0.3992	0.4254	0.4587	0.4728	0.4728
1989	0.1638	0.3907	0.3238	0.3286	0.3959	0.4099	0.4221	0.4296	0.4296
1990	0.1183	0.2817	0.2815	0.2678	0.3084	0.3159	0.2889	0.308	0.308

1991	0.1595	0.3418	0.3484	0.3125	0.3252	0.3111	0.2884	0.2626	0.2626
1992	0.2305	0.4171	0.3991	0.363	0.3811	0.3595	0.3801	0.3609	0.3609
1993	0.2669	0.4557	0.45	0.4488	0.4697	0.4062	0.4266	0.412	0.412
1994	0.2161	0.3603	0.4197	0.4861	0.5134	0.4038	0.3738	0.3279	0.3279
1995	0.1892	0.2925	0.3443	0.434	0.4534	0.4078	0.3976	0.3213	0.3213
1996	0.0701	0.1068	0.1738	0.2199	0.2214	0.2148	0.171	0.1169	0.1169
1997	0.03331	0.05968	0.1386	0.1938	0.2105	0.2126	0.188	0.1373	0.1373
1998	0.03779	0.07588	0.163	0.2321	0.2487	0.2542	0.245	0.1507	0.1507
1999	0.03777	0.06593	0.1461	0.2254	0.2363	0.2355	0.2012	0.1244	0.1244
2000	0.04309	0.06897	0.1394	0.2176	0.2519	0.2569	0.22	0.1369	0.1369
2001	0.03485	0.0486	0.1033	0.1704	0.2111	0.2293	0.2022	0.1418	0.1418
2002	0.0316	0.0413	0.09124	0.1487	0.1934	0.2183	0.2021	0.1718	0.1718
2003	0.03575	0.04474	0.09226	0.1523	0.2171	0.2717	0.2556	0.2131	0.2131
2004	0.04368	0.04813	0.09552	0.1582	0.2419	0.3306	0.4059	0.346	0.346
2005	0.06805	0.07025	0.1157	0.1768	0.2731	0.3734	0.5312	0.5731	0.5731
2006	0.0574	0.05444	0.1042	0.1646	0.2498	0.3245	0.4234	0.5099	0.5099
2007	0.05112	0.04771	0.09997	0.1622	0.2355	0.2949	0.3702	0.4524	0.4524
2008	0.04976	0.04189	0.08907	0.1121	0.1485	0.1772	0.1702	0.2159	0.2159
2009	0.02916	0.02209	0.05689	0.06111	0.07915	0.09585	0.06983	0.09698	0.09698
2010	0.03413	0.02548	0.06377	0.07314	0.08519	0.09988	0.07151	0.08083	0.08083
2011	0.03778	0.02727	0.06997	0.09432	0.112	0.1312	0.1043	0.1068	0.1068
2012	0.05491	0.04466	0.09909	0.1556	0.1949	0.2307	0.2496	0.2599	0.2599
2013	0.04571	0.03861	0.09097	0.1536	0.2162	0.2774	0.3563	0.4014	0.4014
2014	0.05265	0.03647	0.08629	0.1504	0.2195	0.2755	0.3228	0.3915	0.3915
2015	0.05422	0.02808	0.06814	0.1229	0.1953	0.2838	0.4179	0.5698	0.5698
2016	0.06981	0.02995	0.06864	0.1447	0.2197	0.3009	0.4533	0.6859	0.6859
2017	0.05842	0.02284	0.05936	0.1429	0.213	0.2563	0.3197	0.4824	0.4824
2018	0.06088	0.02082	0.06022	0.1459	0.2338	0.2938	0.3962	0.5639	0.5639
2019	0.05309	0.01717	0.05705	0.1356	0.1904	0.2371	0.346	0.5062	0.5062
2020	0.09221	0.02791	0.08446	0.1706	0.2038	0.2092	0.3168	0.5199	0.5199
2021	0.09187	0.0278	0.08431	0.1704	0.2035	0.2089	0.3162	0.5191	0.5191

Table 2.6.2.5 North Sea herring single fleet assessment. Analytical retrospective (Mohn Rho).

year	ssb	fbar	rec
2010	7.661	-7.753	9.465
2011	11.56	-12.53	15.54
2012	21.39	-26.88	27.13
2013	19.46	-24.83	17.64
2014	12.04	-14.21	3.966
2015	10.54	-11.21	3.418
2016	8.704	-8.299	-18.75
2017	16.73	-22.57	-3.747
2018	9.615	-10.59	-5.563
2019	2.642	-4.247	-5.887
2020	0	0	0
av_5y	8.037	-9.486	-5.089

Table 2.6.2.6 North Sea herring single fleet assessment. Assessment summary.

Year	Rec	Rec_lo	Rec_hi	TSB	TSB_lo	TSB_hi	SSB	SSB_lo	SSB_hi	Catch	Catch_lo	Catch_hi	Fbar	Fbar_lo	Fbar_hi	Landings	SOP
1947	34857881	19566759	62098781	8596428	6509047	11353209	5304809	3812859	7380551	851385	733005	988884	0.1273	0.08904	0.1819	581760	1.461
1948	33168667	19643157	56007315	7398166	5643991	9697544	4507224	3269228	6214025	661466	578381	756488	0.1152	0.0818	0.1622	502100	1.333
1949	27738944	16603093	46343714	6812224	5270800	8804431	4073143	2988470	5551502	724464	634002	827834	0.1399	0.1005	0.1947	508500	1.45
1950	39631096	24197834	64907620	6433639	5058209	8183076	3817484	2856938	5100980	648198	579018	725645	0.1482	0.1092	0.2011	491700	1.307
1951	38360314	23614595	62313739	6293017	5032127	7869846	3376403	2559170	4454607	778325	700391	864930	0.1984	0.1501	0.2624	600400	1.324
1952	38129475	23644950	61486990	6039356	4865442	7496507	3192340	2438907	4178525	834725	754075	924000	0.2198	0.167	0.2892	664400	1.272
1953	43298993	27707974	67662933	5811393	4703122	7180824	2959020	2265210	3865337	835824	754960	925350	0.2336	0.1783	0.3061	698500	1.198
1954	40509210	26015170	63078430	5667463	4601866	6979808	2702263	2056007	3551653	948533	851296	1056877	0.2807	0.2129	0.3701	762900	1.251
1955	34330892	22185594	53125021	5413699	4391804	6673371	2711088	2073292	3545086	844385	751597	948629	0.2528	0.1923	0.3324	806400	1.06
1956	25331383	16360988	39220062	5057134	4114586	6215596	2625707	2012275	3426140	834166	743053	936451	0.25	0.1912	0.3268	675200	1.271
1957	57963495	37135278	90473720	4946212	4037420	6059566	2376135	1820665	3101074	784036	703013	874397	0.27	0.2062	0.3536	682900	1.158
1958	24750757	16120130	3.8e+07	4956761	4029065	6098059	2019640	1548848	2633536	735801	627696	862524	0.2489	0.1918	0.323	670500	1.167
1959	28494509	18051180	44979723	5527220	4545199	6721414	2921352	2257045	3781181	1169672	1012979	1350603	0.2996	0.2313	0.3879	784500	1.519
1960	12367216	7921912	19306960	4627866	3804361	5629630	2512220	1946027	3243147	806359	705369	921808	0.2458	0.1914	0.3158	696200	1.183
1961	53361602	34292842	83033672	4800640	3982820	5786387	2537990	1994375	3229781	769317	684101	865148	0.2739	0.2168	0.346	696700	1.135
1962	28315663	18555381	43209934	4475692	3713501	5394322	1770623	1373269	2282950	729991	635062	839109	0.3158	0.249	0.4007	627800	1.171
1963	34500367	22737402	52348782	5175671	4328076	6189255	2790589	2234463	3485127	595946	513649	691430	0.1878	0.1517	0.2324	716000	0.8602
1964	34525401	22910327	52029083	5113229	4421466	5913223	2514252	2079298	3040190	902274	787863	1033300	0.2936	0.2445	0.3526	871200	1.066
1965	17044568	11298604	25712670	4617448	4077916	5228362	1993503	1678142	2368128	1306082	1151653	1481218	0.532	0.4503	0.6286	1168800	1.15
1966	18512296	12357458	27732653	3461372	3071396	3900863	1595712	1354624	1879707	933917	833911	1045917	0.4942	0.4218	0.579	895500	1.071
1967	25695882	17067719	38685800	2677224	2387640	3001930	957124	821887	1114612	833276	743404	934012	0.6887	0.5966	0.795	695500	1.176
1968	22010621	14742297	32862413	2275807	1999454	2590355	524139	448778	612154	914094	783434	1066546	1.083	0.9548	1.227	717800	1.255
1969	12613954	8330232	19100529	1689138	1460128	1954066	479677	394011	583968	502642	428863	589113	0.8835	0.7721	1.011	546700	0.9674
1970	22028340	14562338	33322106	1661830	1443715	1912898	455651	374003	555124	549385	473129	637931	0.9612	0.8452	1.093	563100	0.9657
1971	17203786	11504088	25727398	1469094	1250025	1726555	285726	236130	345738	525013	425292	648116	1.419	1.257	1.602	520100	1.075
1972	12689647	8425304	19112326	1324939	1138786	1541521	329391	272004	398884	394104	320627	484421	0.6197	0.5367	0.7156	497500	0.9197
1973	6837978	4553638	10268262	1106662	969162	1263670	278904	232982	333878	444968	374574	528592	0.9478	0.8332	1.078	484000	0.9575
1974	10910155	7148470	16651325	777475	676502	893519	191534	160941	227942	270959	233064	315015	0.9035	0.7917	1.031	275100	0.968
1975	2523737	1641013	3881290	615050	514217	735656	105793	87481	127939	270875	215506	340468	1.19	1.026	1.379	312800	0.9343
1976	3316846	2086489	5272720	453291	379076	542036	145064	110119	191098	159746	135463	188383	0.876	0.6861	1.119	174800	0.953
1977	4408473	2705689	7182878	318237	250457	404361	109640	79690	150847	52020	44214	61204	0.3319	0.242	0.4553	46000	1.198
1978	4284612	2600765	7058655	378021	288753	494886	136400	99908	186220	45455	26090	79192	0.2273	0.1421	0.3634	11000	.
1979	7817493	4920897	12419116	497105	394024	627153	186512	142851	243517	59261	33417	105092	0.1876	0.116	0.3033	25100	.
1980	12579125	8414357	18805284	667866	547932	814052	210081	167595	263337	80479	63254	102394	0.1665	0.132	0.21	70764	1.094
1981	27479729	18469675	40885155	1090857	890505	1336285	269723	215918	336935	147016	113201	190933	0.2516	0.2008	0.3153	174879	1.008
1982	46668043	31440694	69270296	1709514	1386183	2108264	383532	311037	472923	240514	175414	329775	0.1921	0.156	0.2366	275079	0.9786
1983	46332060	31905307	67282218	2349000	1948754	2831450	547127	447195	669392	384092	286229	515414	0.271	0.2235	0.3285	387202	1.077
1984	46430895	32037057	67291699	3116775	2649209	3666864	901451	736525	1103309	476438	387542	585725	0.3546	0.2956	0.4255	428631	1.054
1985	54857205	37752875	79710828	3551311	3049640	4135508	989707	816985	1198946	638933	546279	747303	0.4534	0.3787	0.5427	613780	1.042
1986	66589031	45655076	97121708	3949550	3370944	4627472	1026633	852629	1236147	717723	579583	888788	0.4182	0.349	0.5011	671488	1.137
1987	57753733	39661767	84098463	3935883	3387080	4573607	1202006	999625	1445361	767766	631803	932989	0.3986	0.3344	0.4752	792058	1.017
1988	37584120	25872048	54598154	3804949	3314623	4367809	1526300	1274147	1828354	880877	726450	1068130	0.3857	0.3255	0.4571	887686	1.164
1989	29601203	20385974	42982062	3441500	3053242	3879130	1575946	1352002	1836983	810108	701556	935457	0.376	0.3212	0.4403	787899	1.034
1990	27314412	18745128	39801121	3440816	3050789	3880706	1727079	1485408	2008069	632116	552214	723580	0.2925	0.2486	0.3441	645229	1.052
1991	29768324	20468236	43294065	3305793	2935077	3723332	1531311	1322180	1773521	685358	590845	794991	0.3171	0.2702	0.3723	658008	1.02
1992	52687967	37928528	73190868	3285883	2909769	3710613	1164571	1002480	1352872	708253	606169	827529	0.3765	0.3204	0.4425	716799	0.995
1993	55478713	39723675	77482447	3064196	2678580	3505326	828950	706094	973180	710257	598953	842246	0.4403	0.3732	0.5194	671397	1.023
1994	42818450	30532864	60047418	2959153	2553989	3428592	881872	749630	1037441	716297	578074	887570	0.4394	0.3725	0.5182	568234	1.05

1995	44509451	31612411	62668149	2780497	2406022	3213256	914363	771554	1083605	613167	521566	720854	0.4074	0.3422	0.4851	579371	1.008
1996	35721124	25470068	50097970	2728764	2344717	3175714	1072305	906626	1268260	266844	233359	305134	0.2002	0.1667	0.2404	275098	0.9987
1997	29399447	20852487	41449611	2816091	2437221	3253858	1239664	1052633	1459925	275177	243957	310392	0.1887	0.1575	0.226	264313	1.001
1998	18671594	13526686	25773379	3096764	2700347	3551377	1417070	1213544	1654729	377596	335404	425096	0.2286	0.1914	0.273	391628	1.002
1999	57118961	41264064	79065787	3150087	2762064	3592621	1513149	1297362	1764826	354680	315688	398488	0.2089	0.1759	0.2482	363163	1
2000	39913773	29077194	54788963	3755815	3266497	4318433	1532129	1314553	1785716	382515	340382	429864	0.2172	0.1826	0.2582	388157	1
2001	69493485	49864872	96848626	4214997	3666979	4844915	1920016	1647772	2237239	371748	332093	416139	0.1833	0.1539	0.2182	374065	0.9901
2002	36544676	26433923	50522707	5042634	4373540	5814091	2384603	2046244	2778911	395321	352979	442741	0.1708	0.1435	0.2032	394709	0.9974
2003	20448136	14871253	28116411	5286370	4604284	6069503	2330323	2012177	2698770	484912	436651	538508	0.1978	0.1668	0.2345	482281	1.015
2004	23148557	16788901	31917259	4631565	4083650	5252996	2303309	1994338	2660148	588693	531397	652165	0.2464	0.2075	0.2927	587698	0.9985
2005	20618261	15067739	28213438	3838831	3403381	4329996	2083193	1793322	2419918	662297	597533	734080	0.294	0.2482	0.3483	663813	1.003
2006	21102267	15375183	28962627	3221594	2854360	3636076	1695789	1462083	1966853	512080	461799	567835	0.2533	0.2135	0.3005	514597	0.995
2007	24216457	17496090	33518163	2676715	2363501	3031435	1337668	1149238	1556993	399258	359987	442813	0.2325	0.1951	0.2771	406482	1.006
2008	21414758	15415186	29749358	2719618	2378252	3109983	1434468	1234043	1667445	257730	231318	287158	0.1394	0.1172	0.1659	257870	1.004
2009	35173993	25412040	48685969	3180979	2765919	3658324	1780448	1528170	2074372	165178	148207	184092	0.07257	0.06066	0.0868	168443	1.002
2010	27075893	19615768	37373198	3817217	3322813	4385185	1898246	1624846	2217649	186563	167820	207399	0.0787	0.06593	0.09394	187611	1.003
2011	24662241	17956491	33872215	3805239	3339474	4335966	2221861	1926424	2562606	228659	206707	252943	0.1024	0.08637	0.1213	226478	0.9938
2012	22821042	16602006	31369702	3730300	3296404	4221308	2264241	1964970	2609092	432753	391569	478269	0.186	0.1572	0.22	434710	1.011
2013	30576450	22064920	42371298	3633498	3224810	4093980	2077294	1805613	2389854	499198	452360	550886	0.2189	0.1851	0.2588	511416	1.001
2014	47591435	34146390	66330428	3880489	3433813	4385269	2053097	1782519	2364749	508899	460990	561786	0.2109	0.1783	0.2495	517356	1.003
2015	13105001	9386471	18296659	4053495	3551127	4626931	1909564	1653864	2204797	486016	439208	537812	0.2176	0.1829	0.2588	494099	1.002
2016	23845023	17320888	32826558	4009190	3509912	4579489	2194754	1890684	2547726	549483	497245	607208	0.2375	0.1996	0.2825	563610	1
2017	14290297	10293992	19838037	3482791	3056497	3968542	2024908	1736379	2361382	469415	420541	523968	0.1983	0.1669	0.2355	498437	1.001
2018	25779018	18620703	35689189	3326421	2925479	3782313	1821019	1554109	2133770	553266	492911	621011	0.226	0.1899	0.269	603536	1.001
2019	22973841	16181616	32617099	2857195	2504853	3259098	1554082	1321951	1826974	427510	383572	476480	0.1932	0.1606	0.2326	442138	1.002
2020	24676160	17021651	35772844	2852471	2441175	3333064	1509337	1255290	1814799	422345	378273	471552	0.197	0.1597	0.2429	426900	1.003
2021	30422344	16949010	54606082	2806426	2235661	3522907	1461740	1094737	1951778	407544	220419	753532	0.1967	0.09847	0.3928	.	.

Table 2.6.2.7 North Sea herring single fleet assessment. SAM model control object.

```
An object of class "FLSAM.control"
Slot "name":
[1] "North Sea Herring"

Slot "desc":
[1] "Imported from a VPA file. ( ./bootstrap/data/index.txt ).  Tue Sep 07 09:28:12 2021"

Slot "range":
      min       max plusgroup   minyear   maxyear   minfbar   maxfbar
        0         8         8      1947      2021         2         6

Slot "fleets":
catch unique        HERAS      IBTS-Q1        IBTS0      IBTS-Q3     LAI-ORSH
           0            2            2            2            2            6
     LAI-BUN      LAI-CNS      LAI-SNS
           6            6            6

Slot "plus.group":
plusgroup
     TRUE

Slot "states":
              age
fleet           0  1  2  3  4  5  6  7  8
  catch unique  0  1  2  3  4  5  6  7  7
  HERAS        -1 -1 -1 -1 -1 -1 -1 -1 -1
  IBTS-Q1      -1 -1 -1 -1 -1 -1 -1 -1 -1
  IBTS0        -1 -1 -1 -1 -1 -1 -1 -1 -1
  IBTS-Q3      -1 -1 -1 -1 -1 -1 -1 -1 -1
  LAI-ORSH     -1 -1 -1 -1 -1 -1 -1 -1 -1
  LAI-BUN      -1 -1 -1 -1 -1 -1 -1 -1 -1
  LAI-CNS      -1 -1 -1 -1 -1 -1 -1 -1 -1
  LAI-SNS      -1 -1 -1 -1 -1 -1 -1 -1 -1

Slot "logN.vars":
0 1 2 3 4 5 6 7 8
0 1 1 1 1 1 1 1 1

Slot "logP.vars":
[1] 0 1 2

Slot "catchabilities":
              age
fleet           0  1  2  3  4  5  6  7  8
  catch unique -1 -1 -1 -1 -1 -1 -1 -1 -1
  HERAS        -1  1  1  2  2  2  2  2  2
  IBTS-Q1      -1  3 -1 -1 -1 -1 -1 -1 -1
  IBTS0         0 -1 -1 -1 -1 -1 -1 -1 -1
  IBTS-Q3       4  5  6  7  8  9 -1 -1 -1
  LAI-ORSH     10 -1 -1 -1 -1 -1 -1 -1 -1
  LAI-BUN      10 -1 -1 -1 -1 -1 -1 -1 -1
  LAI-CNS      10 -1 -1 -1 -1 -1 -1 -1 -1
  LAI-SNS      10 -1 -1 -1 -1 -1 -1 -1 -1

Slot "power.law.exps":
              age
fleet           0  1  2  3  4  5  6  7  8
  catch unique -1 -1 -1 -1 -1 -1 -1 -1 -1
  HERAS        -1 -1 -1 -1 -1 -1 -1 -1 -1
  IBTS-Q1      -1 -1 -1 -1 -1 -1 -1 -1 -1
  IBTS0        -1 -1 -1 -1 -1 -1 -1 -1 -1
  IBTS-Q3      -1 -1 -1 -1 -1 -1 -1 -1 -1
  LAI-ORSH     -1 -1 -1 -1 -1 -1 -1 -1 -1
  LAI-BUN      -1 -1 -1 -1 -1 -1 -1 -1 -1
  LAI-CNS      -1 -1 -1 -1 -1 -1 -1 -1 -1
  LAI-SNS      -1 -1 -1 -1 -1 -1 -1 -1 -1

Slot "f.vars":
```

```
             age
fleet           0  1  2  3  4  5  6  7  8
  catch unique  0  0  1  1  1  1  2  2  2
  HERAS        -1 -1 -1 -1 -1 -1 -1 -1 -1
  IBTS-Q1      -1 -1 -1 -1 -1 -1 -1 -1 -1
  IBTS0        -1 -1 -1 -1 -1 -1 -1 -1 -1
  IBTS-Q3      -1 -1 -1 -1 -1 -1 -1 -1 -1
  LAI-ORSH     -1 -1 -1 -1 -1 -1 -1 -1 -1
  LAI-BUN      -1 -1 -1 -1 -1 -1 -1 -1 -1
  LAI-CNS      -1 -1 -1 -1 -1 -1 -1 -1 -1
  LAI-SNS      -1 -1 -1 -1 -1 -1 -1 -1 -1

Slot "obs.vars":
             age
fleet           0  1  2  3  4  5  6  7  8
  catch unique  0  0  1  1  1  1  1  2  2
  HERAS        -1  3  4  5  6  6  6  7  7
  IBTS-Q1      -1  8 -1 -1 -1 -1 -1 -1 -1
  IBTS0         9 -1 -1 -1 -1 -1 -1 -1 -1
  IBTS-Q3      10 10 11 11 11 11 -1 -1 -1
  LAI-ORSH     12 -1 -1 -1 -1 -1 -1 -1 -1
  LAI-BUN      12 -1 -1 -1 -1 -1 -1 -1 -1
  LAI-CNS      12 -1 -1 -1 -1 -1 -1 -1 -1
  LAI-SNS      12 -1 -1 -1 -1 -1 -1 -1 -1

Slot "srr":
[1] 0

Slot "scaleNoYears":
[1] 0

Slot "scaleYears":
[1] NA

Slot "scalePars":
      age
years  0 1 2 3 4 5 6 7 8

Slot "cor.F":
[1] 2

Slot "cor.obs":
             age
fleet          0-1 1-2 2-3 3-4 4-5 5-6 6-7 7-8
  catch unique  NA  NA  NA  NA  NA  NA  NA  NA
  HERAS         -1  NA  NA  NA  NA  NA  NA  NA
  IBTS-Q1       -1  -1  -1  -1  -1  -1  -1  -1
  IBTS0         -1  -1  -1  -1  -1  -1  -1  -1
  IBTS-Q3        0   0   0   0   0  -1  -1  -1
  LAI-ORSH      -1  -1  -1  -1  -1  -1  -1  -1
  LAI-BUN       -1  -1  -1  -1  -1  -1  -1  -1
  LAI-CNS       -1  -1  -1  -1  -1  -1  -1  -1
  LAI-SNS       -1  -1  -1  -1  -1  -1  -1  -1

Slot "cor.obs.Flag":
[1] ID ID ID ID AR ID ID ID ID
Levels: ID AR US

Slot "biomassTreat":
[1] -1 -1 -1 -1 -1 -1 -1 -1 -1

Slot "timeout":
[1] 3600

Slot "likFlag":
[1] LN LN LN LN LN LN LN LN LN
Levels: LN ALN

Slot "fixVarToWeight":
[1] FALSE
```

```
Slot "simulate":
[1] FALSE

Slot "residuals":
[1] TRUE

Slot "sumFleets":
logical(0)
```

Table 2.6.3.1 North Sea herring multi fleet assessment. observation variance per data source and at age.

fleet	age	value	CV	lbnd	ubnd
catch A	1	1.235	0.1814	0.8656	1.762
catch A	2	0.1649	0.1222	0.1298	0.2095
catch A	3	0.1649	0.1222	0.1298	0.2095
catch A	4	0.1649	0.1222	0.1298	0.2095
catch A	5	0.1649	0.1222	0.1298	0.2095
catch A	6	0.1649	0.1222	0.1298	0.2095
catch A	7	0.1751	0.23	0.1115	0.2747
catch A	8	0.1751	0.23	0.1115	0.2747
catch BD	0	0.4011	0.2169	0.2622	0.6136
catch BD	1	0.3147	0.317	0.1691	0.5858
catch BD	2	1.455	0.09095	1.218	1.739
catch BD	3	1.455	0.09095	1.218	1.739
catch BD	4	1.455	0.09095	1.218	1.739
catch BD	5	1.455	0.09095	1.218	1.739
catch C	1	0.7248	0.1789	0.5104	1.029
catch C	2	0.5464	0.1631	0.3969	0.7521
catch C	3	0.6662	0.09645	0.5515	0.8048
catch C	4	0.6662	0.09645	0.5515	0.8048
catch C	5	0.6662	0.09645	0.5515	0.8048
catch C	6	0.6662	0.09645	0.5515	0.8048
HERAS	1	0.4683	0.1544	0.346	0.6338
HERAS	2	0.2679	0.1524	0.1987	0.3612
HERAS	3	0.1481	0.2006	0.09993	0.2194
HERAS	4	0.2241	0.1024	0.1834	0.2739
HERAS	5	0.2241	0.1024	0.1834	0.2739
HERAS	6	0.2241	0.1024	0.1834	0.2739
HERAS	7	0.3124	0.1227	0.2456	0.3973
HERAS	8	0.3124	0.1227	0.2456	0.3973
IBTS-Q1	1	0.2884	0.1466	0.2164	0.3843
IBTS0	0	0.3313	0.1703	0.2373	0.4627
IBTS-Q3	0	0.4989	0.133	0.3844	0.6474
IBTS-Q3	1	0.4989	0.133	0.3844	0.6474
IBTS-Q3	2	0.3142	0.09695	0.2598	0.3799
IBTS-Q3	3	0.3142	0.09695	0.2598	0.3799
IBTS-Q3	4	0.3142	0.09695	0.2598	0.3799
IBTS-Q3	5	0.3142	0.09695	0.2598	0.3799
LAI-ORSH	0	1.188	0.04383	1.09	1.295
LAI-BUN	0	1.188	0.04383	1.09	1.295
LAI-CNS	0	1.188	0.04383	1.09	1.295
LAI-SNS	0	1.188	0.04383	1.09	1.295

Table 2.6.3.2 North Sea herring multi fleet assessment. Catchabilities at age.

fleet	age	value	CV	lbnd	ubnd
HERAS	1	0.9806	0.06662	0.8606	1.117
HERAS	2	0.9806	0.06662	0.8606	1.117
HERAS	3	1.12	0.05628	1.003	1.251
HERAS	4	1.12	0.05628	1.003	1.251
HERAS	5	1.12	0.05628	1.003	1.251
HERAS	6	1.12	0.05628	1.003	1.251
HERAS	7	1.12	0.05628	1.003	1.251

HERAS	8	1.12	0.05628	1.003	1.251
IBTS-Q1	1	0.1058	0.06779	0.09263	0.1208
IBTS0	0	3.314e-06	0.08558	2.802e-06	3.919e-06
IBTS-Q3	0	0.09559	0.1232	0.07509	0.1217
IBTS-Q3	1	0.04727	0.1194	0.0374	0.05973
IBTS-Q3	2	0.0433	0.08593	0.03658	0.05124
IBTS-Q3	3	0.03905	0.08515	0.03305	0.04614
IBTS-Q3	4	0.03252	0.08668	0.02744	0.03855
IBTS-Q3	5	0.0257	0.08786	0.02163	0.03053
LAI-ORSH	0	0.01635	0.1081	0.01323	0.02021
LAI-BUN	0	0.01635	0.1081	0.01323	0.02021
LAI-CNS	0	0.01635	0.1081	0.01323	0.02021
LAI-SNS	0	0.01635	0.1081	0.01323	0.02021

Table 2.6.3.3 North Sea herring multi fleet assessment. Numbers at age.

Year	0	1	2	3	4	5	6	7	8
1947	36091481	13537986	11419270	4906003	6771170	4278003	3792063	2028300	6168982
1948	33892967	16747602	7721976	7096065	3233478	4630114	2817765	2146830	4716763
1949	29482668	15747707	10840706	6315130	3821370	2078438	2978002	1774239	4062359
1950	40713854	13032597	9022685	8801495	4722514	2231857	1317625	1659443	3031159
1951	39447205	19375290	7061589	6114746	6445599	3353337	1414674	765467	2590145
1952	39156492	18115137	10834057	4165225	3605070	3702166	2042932	888102	2113075
1953	42927945	17841436	9660711	5980171	2695345	2114195	2175972	1161995	1660588
1954	40277237	20260646	9279772	5396124	3228220	1714130	1241904	1246920	1625204
1955	34677907	18040393	10902054	5261859	2763714	1836646	1041615	660316	1367198
1956	25929688	16113744	8468302	6169191	2916780	1525471	1072585	579509	1366827
1957	62903615	10988244	8088320	3825194	3538412	1694659	946012	661106	1168651
1958	26015253	34415399	4764022	4446586	1926867	2186966	946202	552439	1016390
1959	28936224	11551266	19559816	2218161	2332830	1107593	1171670	574716	1201679
1960	11961545	14457870	5244857	10804626	1094388	1198107	608071	623279	1103488
1961	56408557	4155489	7076768	2513496	7057165	677366	813566	348253	886431
1962	27848991	28524405	1705113	3133741	1385792	4315488	422969	528467	723846
1963	32461643	12872292	16621827	1029158	1305593	705695	2299353	207530	714308
1964	34432572	14405591	6611881	9662082	668640	757897	510141	1570801	561899
1965	17667215	16540035	5939055	3422440	5331110	392987	428468	323545	1397267
1966	17973901	8061377	7546474	2142145	1383116	2271615	176253	189890	851307
1967	23845334	7703018	3624379	3202467	841274	657552	877271	103098	468748
1968	23563186	10655836	3020820	1710265	1164615	291195	253130	275645	166515
1969	12455812	10436828	4297248	674243	306660	347820	78206	64946	95037
1970	23548155	5676028	4165422	1477186	204458	96988	112855	16228	42994
1971	19092786	10723280	2379198	1239441	377686	54962	29794	30434	17441
1972	12963480	8598963	3344744	755619	308239	95295	14423	1056	6484
1973	6834120	5549185	2627256	1156108	294120	123221	45547	7655	4442
1974	10923746	2754597	1547868	751638	267558	97135	40175	11350	5342
1975	2557935	5203388	902742	439282	230250	79788	28427	11877	5940
1976	3277208	864743	1782557	211506	90500	60730	14704	6472	2531
1977	4025291	1366855	336963	595729	53563	25527	18859	4936	2300
1978	4503801	1709767	670603	244794	253649	32838	12024	10367	3599
1979	8387216	1716219	835159	393597	183642	128751	22231	7408	7909
1980	13108018	3282945	774296	468599	226890	151486	68687	18170	8740
1981	27856842	4898919	1682719	354937	228450	138288	115301	58097	21575
1982	46737392	7967678	2020252	1035541	206700	128019	78377	70689	41951
1983	45668757	14282291	3297683	1127311	518752	129511	102982	53619	84885
1984	45787494	12751735	6006435	1819224	677337	274148	81267	67939	82699
1985	56566615	14565602	5550546	3446775	984486	357397	126672	47664	75758
1986	68930718	20642346	5319577	2881961	1539936	433891	168170	54806	61361
1987	61633334	26894194	8738396	2586204	1513551	769584	221895	76154	50639
1988	37750826	20609055	10126589	4597600	1333445	793428	388931	111889	66759
1989	30447113	12864632	6909331	5474249	2610375	690060	398524	192997	89372
1990	26908664	10271549	4412055	3897152	3539332	1514066	368985	213784	159192
1991	28853211	10292969	3981332	2280447	2278195	2106802	859787	208327	195166
1992	50993334	9931273	4441082	1778602	1305928	1305177	1254569	514500	239156
1993	52752166	15984005	3692692	1993886	929194	711849	716200	617470	397894
1994	41736350	15757145	5851567	1419262	827526	404655	335491	321853	453874
1995	42929269	13691273	6253101	2577217	709028	358765	198032	164562	363489
1996	33541123	13579029	5506426	3028952	1097418	336417	153199	95812	252413

1997	28452121	12735361	5915109	3053871	1578718	643347	202503	94529	206236
1998	18700856	11768659	8368506	3094144	1485205	847659	425954	129960	170551
1999	58576494	8171523	5470861	5155315	1652811	762989	424337	230322	151731
2000	37457677	23745948	5331188	2918284	3001151	963278	471727	259476	214050
2001	71084548	14148937	11574084	3500775	1673485	1632544	495439	267785	278770
2002	35817477	30065432	7558108	7985823	1902660	929551	1000762	298859	305067
2003	19252232	13732759	17222656	4372504	4953816	1056444	575743	620315	320950
2004	23056724	7146961	6024821	10643525	2943829	2989108	561343	364738	474891
2005	20430347	9782878	3637821	3882870	6386121	1745904	1622756	280714	407420
2006	21196987	7129946	4924001	2422099	2404704	4006409	861169	726915	291305
2007	24753162	7650218	3181929	2753871	1504725	1366982	2178186	441314	470394
2008	21897784	8911414	4352073	2079129	1639224	951523	834117	1375893	559880
2009	34023642	8739793	5242496	2616966	1381362	1074350	646791	608817	1507352
2010	2.7e+07	12556971	5487596	3773919	1902986	1034358	893398	490537	1628971
2011	24556210	10971971	6623126	3494297	2410555	1219836	710231	599378	1394813
2012	23216549	9103396	5860433	4820674	2607562	1671873	795502	471464	1136899
2013	31314955	8509017	4461268	4022213	3359386	1919569	1153011	496083	1005168
2014	47217742	13703536	5284538	3115163	3209723	2256970	1218244	677968	747092
2015	12565961	18431868	9402443	3004136	1937090	2037286	1354797	707957	806723
2016	23054821	4848165	11460624	6771575	1878578	1203080	1151361	694408	723170
2017	13617840	8535408	2476825	7842427	4736203	1255250	613032	546511	602183
2018	25135181	5557960	4201897	1891115	5628850	3243826	795445	401184	692790
2019	21266861	10193587	2437991	2650224	1433774	3436581	1899687	418589	552584
2020	24819948	9127402	6477433	1589571	1807318	1026679	2034066	941348	463095
2021	30078264	10478907	5229951	4201018	978802	1094204	612548	1099645	628494

Table 2.6.3.4 North Sea herring multi fleet assessment. Harvest at age fleet A.

Year	0	1	2	3	4	5	6	7	8
1947	0	0.002595	0.04858	0.106	0.1215	0.1566	0.2469	0.2765	0.2765
1948	0	0.002526	0.04615	0.1036	0.1205	0.1525	0.2219	0.2505	0.2505
1949	0	0.002836	0.05697	0.1205	0.1404	0.1755	0.2779	0.3254	0.3254
1950	0	0.003288	0.07406	0.1399	0.1569	0.1779	0.239	0.2586	0.2586
1951	0	0.004201	0.1139	0.1897	0.2047	0.2124	0.2512	0.2479	0.2479
1952	0	0.004758	0.1416	0.2051	0.2162	0.231	0.3027	0.331	0.331
1953	0	0.005246	0.1677	0.2223	0.2199	0.2324	0.2923	0.3155	0.3155
1954	0	0.006037	0.2145	0.2665	0.2521	0.2691	0.3714	0.3963	0.3963
1955	0	0.006218	0.2253	0.2528	0.2244	0.2299	0.2591	0.2366	0.2366
1956	0	0.006744	0.2594	0.2662	0.2267	0.2284	0.246	0.2422	0.2422
1957	0	0.007011	0.2772	0.2796	0.2416	0.253	0.2803	0.2707	0.2707
1958	0	0.007117	0.2841	0.2745	0.2262	0.2257	0.199	0.171	0.171
1959	0	0.007689	0.3251	0.3109	0.2647	0.2656	0.2922	0.287	0.287
1960	0	0.00696	0.2721	0.2524	0.2143	0.2163	0.2388	0.2646	0.2646
1961	0	0.007306	0.2961	0.284	0.2435	0.2362	0.2418	0.2322	0.2322
1962	0	0.007253	0.2917	0.323	0.2941	0.2998	0.3572	0.3415	0.3415
1963	0	0.005997	0.2078	0.2134	0.1776	0.1723	0.1299	0.1401	0.1401
1964	0	0.007479	0.3062	0.3229	0.2753	0.2645	0.2142	0.2094	0.2094
1965	0	0.01026	0.535	0.5924	0.5165	0.5009	0.5031	0.5109	0.5109
1966	0	0.009665	0.4801	0.5564	0.4881	0.4893	0.4256	0.5058	0.5058
1967	0	0.01077	0.5802	0.7332	0.6652	0.6866	0.79	0.9429	0.9429
1968	0	0.01467	1.001	1.237	0.9938	0.9478	1.196	1.224	1.224
1969	0	0.01242	0.7437	0.9224	0.8243	0.8471	1.196	1.062	1.062
1970	0	0.01296	0.801	0.9927	0.891	0.8534	1.193	0.9141	0.9141
1971	0	0.0138	0.8929	1.129	1.093	1.177	2.859	1.751	1.751
1972	0	0.01103	0.5996	0.68	0.5714	0.5327	0.5198	0.3139	0.3139
1973	0	0.01361	0.8685	1.018	0.8618	0.8606	1.046	0.7057	0.7057
1974	0	0.01316	0.8179	0.9587	0.8426	0.8973	0.937	0.8298	0.8298
1975	0	0.01492	1.02	1.27	1.112	1.213	1.321	1.602	1.602
1976	0	0.01235	0.7292	0.9867	0.8525	0.8981	0.8186	1.108	1.108
1977	0	0.00671	0.2474	0.367	0.3258	0.3803	0.2574	0.4082	0.4082
1978	0	0.005816	0.1918	0.2634	0.2285	0.2501	0.1306	0.2182	0.2182
1979	0	0.005558	0.1768	0.2272	0.1859	0.1881	0.07807	0.1321	0.1321
1980	0	0.005594	0.1786	0.2161	0.1673	0.1519	0.05139	0.08457	0.08457
1981	0	0.006217	0.215	0.2757	0.2521	0.2643	0.2061	0.3542	0.3542
1982	0	0.005514	0.1735	0.2209	0.1921	0.1752	0.1028	0.1472	0.1472
1983	0	0.00613	0.209	0.2745	0.2753	0.2731	0.2405	0.326	0.326
1984	0	0.006805	0.2511	0.3416	0.3738	0.376	0.3805	0.4877	0.4877

1985	0	0.007784	0.3181	0.4311	0.4791	0.4688	0.5201	0.5888	0.5888
1986	0	0.007581	0.3032	0.3885	0.4405	0.4464	0.52	0.5842	0.5842
1987	0	0.007341	0.286	0.3481	0.4048	0.4151	0.4451	0.4567	0.4567
1988	0	0.007131	0.2715	0.3207	0.3873	0.4102	0.4508	0.4727	0.4727
1989	0	0.007233	0.2781	0.3154	0.3771	0.3913	0.4148	0.4298	0.4298
1990	0	0.006783	0.2481	0.2651	0.3042	0.3103	0.2918	0.3122	0.3122
1991	0	0.007539	0.299	0.3041	0.3214	0.3063	0.2803	0.2636	0.2636
1992	0	0.00812	0.3409	0.3587	0.3807	0.3586	0.378	0.3641	0.3641
1993	0	0.008833	0.3955	0.4461	0.4671	0.4117	0.4455	0.4248	0.4248
1994	0	0.008624	0.3792	0.4734	0.4933	0.4055	0.395	0.3443	0.3443
1995	0	0.007437	0.2916	0.4097	0.4372	0.3942	0.4031	0.3371	0.3371
1996	0	0.004749	0.1317	0.1971	0.2098	0.2005	0.1513	0.1149	0.1149
1997	0	0.00427	0.1091	0.1756	0.1902	0.185	0.1441	0.1117	0.1117
1998	0	0.004841	0.1356	0.2255	0.2419	0.2401	0.2181	0.1422	0.1422
1999	0	0.004542	0.1199	0.2156	0.2309	0.2272	0.1885	0.1169	0.1169
2000	0	0.004328	0.1093	0.2065	0.2353	0.2368	0.1952	0.1265	0.1265
2001	0	0.003681	0.08146	0.1639	0.2032	0.2233	0.1979	0.1682	0.1682
2002	0	0.003355	0.06865	0.1407	0.1852	0.2126	0.1936	0.1733	0.1733
2003	0	0.003337	0.06751	0.1457	0.2066	0.2553	0.2478	0.2149	0.2149
2004	0	0.003213	0.06295	0.1455	0.2246	0.3015	0.3685	0.3273	0.3273
2005	0	0.00352	0.07289	0.1646	0.262	0.358	0.5222	0.5548	0.5548
2006	0	0.003706	0.07895	0.1674	0.2528	0.3283	0.4461	0.5148	0.5148
2007	0	0.003632	0.07522	0.1558	0.2271	0.2872	0.3715	0.4449	0.4449
2008	0	0.003397	0.06596	0.1121	0.1495	0.1806	0.176	0.2217	0.2217
2009	0	0.002775	0.04591	0.06802	0.08642	0.1046	0.07734	0.1061	0.1061
2010	0	0.002854	0.04805	0.07269	0.08638	0.1014	0.07167	0.08548	0.08548
2011	0	0.003118	0.0562	0.09337	0.1126	0.1315	0.1028	0.1115	0.1115
2012	0	0.003847	0.08106	0.1512	0.1909	0.2259	0.2428	0.2601	0.2601
2013	0	0.003588	0.07149	0.1491	0.2105	0.2685	0.3465	0.4002	0.4002
2014	0	0.003444	0.06727	0.1455	0.2107	0.2663	0.3256	0.3941	0.3941
2015	0	0.003051	0.05538	0.1271	0.1974	0.2761	0.4059	0.5552	0.5552
2016	0	0.003052	0.05626	0.1441	0.2194	0.2982	0.4598	0.6762	0.6762
2017	0	0.002715	0.04597	0.1316	0.1991	0.2496	0.3241	0.4732	0.4732
2018	0	0.002866	0.05072	0.1452	0.2256	0.2862	0.4022	0.5718	0.5718
2019	0	0.002684	0.04519	0.1276	0.1867	0.2409	0.3535	0.5208	0.5208
2020	0	0.003418	0.06886	0.1659	0.2072	0.2321	0.3427	0.5358	0.5358
2021	0	0.003418	0.06886	0.1659	0.2072	0.232	0.3427	0.5358	0.5358

Table 2.6.3.5 North Sea herring multi fleet assessment. Harvest at age combined fleet B-D.

Year	0	1	2	3	4	5	6	7	8
1947	0.001193	0.001183	0.000465	0.0008502	0.0008502	0.0008502	0	0	0
1948	0.001156	0.001087	0.0004452	0.0008363	0.0008363	0.0008363	0	0	0
1949	0.001772	0.00342	0.0007752	0.00108	0.00108	0.00108	0	0	0
1950	0.002595	0.009533	0.001289	0.001368	0.001368	0.001368	0	0	0
1951	0.003652	0.02385	0.002052	0.001699	0.001699	0.001699	0	0	0
1952	0.004615	0.04468	0.002813	0.001919	0.001919	0.001919	0	0	0
1953	0.005405	0.06832	0.003474	0.002088	0.002088	0.002088	0	0	0
1954	0.006514	0.0953	0.004092	0.002218	0.002218	0.002218	0	0	0
1955	0.006802	0.1382	0.004946	0.002386	0.002386	0.002386	0	0	0
1956	0.006237	0.1414	0.005062	0.00236	0.00236	0.00236	0	0	0
1957	0.006939	0.1708	0.005516	0.002427	0.002427	0.002427	0	0	0
1958	0.007493	0.1548	0.005297	0.002357	0.002357	0.002357	0	0	0
1959	0.01193	0.1859	0.005744	0.002385	0.002385	0.002385	0	0	0
1960	0.01829	0.199	0.005872	0.002327	0.002327	0.002327	0	0	0
1961	0.01871	0.1365	0.004885	0.00213	0.00213	0.00213	0	0	0
1962	0.01239	0.1002	0.004085	0.001958	0.001958	0.001958	0	0	0
1963	0.0164	0.1427	0.004824	0.002085	0.002085	0.002085	0	0	0
1964	0.02006	0.2514	0.006342	0.002415	0.002415	0.002415	0	0	0
1965	0.01912	0.245	0.006288	0.002446	0.002446	0.002446	0	0	0
1966	0.0263	0.2585	0.006398	0.002493	0.002493	0.002493	0	0	0
1967	0.03397	0.3225	0.007011	0.002617	0.002617	0.002617	0	0	0
1968	0.03639	0.3408	0.007263	0.002669	0.002669	0.002669	0	0	0
1969	0.02749	0.3165	0.006982	0.002613	0.002613	0.002613	0	0	0
1970	0.04183	0.3537	0.007382	0.00269	0.00269	0.00269	0	0	0
1971	0.05766	0.571	0.009239	0.002976	0.002976	0.002976	0	0	0
1972	0.07493	0.6284	0.009794	0.003073	0.003073	0.003073	0	0	0
1973	0.08549	0.6603	0.009973	0.003106	0.003106	0.003106	0	0	0
1974	0.1128	0.5532	0.009103	0.002978	0.002978	0.002978	0	0	0

1975	0.1446	0.5351	0.008851	0.002945	0.002945	0.002945	0	0	0
1976	0.1159	0.2432	0.005929	0.002427	0.002427	0.002427	0	0	0
1977	0.1089	0.1473	0.004503	0.002109	0.002109	0.002109	0	0	0
1978	0.1333	0.1325	0.004363	0.00206	0.00206	0.00206	0	0	0
1979	0.1604	0.1235	0.00433	0.002042	0.002042	0.002042	0	0	0
1980	0.1932	0.1116	0.004258	0.002019	0.002019	0.002019	0	0	0
1981	0.3787	0.2173	0.005755	0.002257	0.002257	0.002257	0	0	0
1982	0.3758	0.2095	0.005726	0.002234	0.002234	0.002234	0	0	0
1983	0.3663	0.2363	0.006198	0.002308	0.002308	0.002308	0	0	0
1984	0.2362	0.2166	0.006149	0.002315	0.002315	0.002315	0	0	0
1985	0.1595	0.2847	0.007363	0.002525	0.002525	0.002525	0	0	0
1986	0.1276	0.2917	0.007884	0.002578	0.002578	0.002578	0	0	0
1987	0.1612	0.3759	0.009472	0.002793	0.002793	0.002793	0	0	0
1988	0.1569	0.4774	0.01127	0.003002	0.003002	0.003002	0	0	0
1989	0.1458	0.4008	0.01132	0.002975	0.002975	0.002975	0	0	0
1990	0.1235	0.351	0.01179	0.002982	0.002982	0.002982	0	0	0
1991	0.1552	0.2881	0.01234	0.003014	0.003014	0.003014	0	0	0
1992	0.247	0.3355	0.01458	0.003248	0.003248	0.003248	0	0	0
1993	0.2734	0.31	0.01544	0.003357	0.003357	0.003357	0	0	0
1994	0.1989	0.1668	0.01249	0.00306	0.00306	0.00306	0	0	0
1995	0.1827	0.1467	0.01265	0.003084	0.003084	0.003084	0	0	0
1996	0.09692	0.0948	0.01122	0.002876	0.002876	0.002876	0	0	0
1997	0.03775	0.034	0.0081	0.002459	0.002459	0.002459	0	0	0
1998	0.03118	0.03169	0.008363	0.002438	0.002438	0.002438	0	0	0
1999	0.0344	0.02215	0.007688	0.002357	0.002357	0.002357	0	0	0
2000	0.04016	0.02387	0.008003	0.002139	0.002139	0.002139	0	0	0
2001	0.03014	0.009028	0.005286	0.001628	0.001628	0.001628	0	0	0
2002	0.03664	0.02214	0.008229	0.001563	0.001563	0.001563	0	0	0
2003	0.03951	0.03352	0.00916	0.001156	0.001156	0.001156	0	0	0
2004	0.04888	0.03866	0.009738	0.0009579	0.0009579	0.0009579	0	0	0
2005	0.06724	0.05172	0.009722	0.0006447	0.0006447	0.0006447	0	0	0
2006	0.05531	0.02546	0.006466	0.0004543	0.0004543	0.0004543	0	0	0
2007	0.04106	0.01388	0.003501	0.0001755	0.0001755	0.0001755	0	0	0
2008	0.04247	0.01452	0.002686	0.0001009	0.0001009	0.0001009	0	0	0
2009	0.03626	0.0145	0.002594	0.000129	0.000129	0.000129	0	0	0
2010	0.0376	0.01356	0.002795	0.0002424	0.0002424	0.0002424	0	0	0
2011	0.0431	0.01618	0.002597	0.0002345	0.0002345	0.0002345	0	0	0
2012	0.04586	0.02258	0.003501	0.0003167	0.0003167	0.0003167	0	0	0
2013	0.0361	0.01948	0.003457	0.0003033	0.0003033	0.0003033	0	0	0
2014	0.04544	0.01999	0.003234	0.000273	0.000273	0.000273	0	0	0
2015	0.06234	0.02239	0.002532	0.0001554	0.0001554	0.0001554	0	0	0
2016	0.07972	0.02485	0.002417	0.0001483	0.0001483	0.0001483	0	0	0
2017	0.06669	0.01692	0.001473	7.631e-05	7.631e-05	7.631e-05	0	0	0
2018	0.06802	0.01094	0.001048	7.599e-05	7.599e-05	7.599e-05	0	0	0
2019	0.05924	0.006744	0.0008703	0.0001058	0.0001058	0.0001058	0	0	0
2020	0.07518	0.003959	0.0008888	0.0001773	0.0001773	0.0001773	0	0	0
2021	0.0751	0.003956	0.0008885	0.0001773	0.0001773	0.0001773	0	0	0

Table 2.6.3.6 North Sea herring multi fleet assessment. Harvest at age fleet C.

Year	0	1	2	3	4	5	6	7	8
1947	0	0.0002726	0.0007331	2.531e-07	1.802e-07	1.802e-07	1.802e-07	0	0
1948	0	0.0002689	0.0007254	2.451e-07	1.747e-07	1.747e-07	1.747e-07	0	0
1949	0	0.0003095	0.0008074	3.398e-07	2.398e-07	2.398e-07	2.398e-07	0	0
1950	0	0.0003556	0.0008976	4.691e-07	3.279e-07	3.279e-07	3.279e-07	0	0
1951	0	0.0004075	0.000996	6.441e-07	4.459e-07	4.459e-07	4.459e-07	0	0
1952	0	0.0004647	0.001101	8.745e-07	5.999e-07	5.999e-07	5.999e-07	0	0
1953	0	0.0005271	0.001212	1.172e-06	7.969e-07	7.969e-07	7.969e-07	0	0
1954	0	0.0005962	0.001331	1.56e-06	1.052e-06	1.052e-06	1.052e-06	0	0
1955	0	0.0006743	0.001462	2.076e-06	1.387e-06	1.387e-06	1.387e-06	0	0
1956	0	0.0007609	0.001603	2.749e-06	1.822e-06	1.822e-06	1.822e-06	0	0
1957	0	0.0008552	0.001752	3.604e-06	2.368e-06	2.368e-06	2.368e-06	0	0
1958	0	0.0009602	0.001913	4.713e-06	3.072e-06	3.072e-06	3.072e-06	0	0
1959	0	0.001076	0.002086	6.129e-06	3.964e-06	3.964e-06	3.964e-06	0	0
1960	0	0.001202	0.00227	7.934e-06	5.091e-06	5.091e-06	5.091e-06	0	0
1961	0	0.001339	0.002462	1.017e-05	6.475e-06	6.475e-06	6.475e-06	0	0
1962	0	0.001483	0.002661	1.288e-05	8.143e-06	8.143e-06	8.143e-06	0	0

1963	0	0.001667	0.002908	1.689e-05	1.059e-05	1.059e-05	1.059e-05	0	0
1964	0	0.001867	0.003169	2.194e-05	1.365e-05	1.365e-05	1.365e-05	0	0
1965	0	0.002081	0.003442	2.822e-05	1.742e-05	1.742e-05	1.742e-05	0	0
1966	0	0.00231	0.003724	3.588e-05	2.2e-05	2.2e-05	2.2e-05	0	0
1967	0	0.00256	0.004025	4.548e-05	2.768e-05	2.768e-05	2.768e-05	0	0
1968	0	0.002851	0.004369	5.836e-05	3.526e-05	3.526e-05	3.526e-05	0	0
1969	0	0.003163	0.004727	7.42e-05	4.45e-05	4.45e-05	4.45e-05	0	0
1970	0	0.003504	0.005108	9.4e-05	5.597e-05	5.597e-05	5.597e-05	0	0
1971	0	0.003881	0.00552	0.0001191	7.038e-05	7.038e-05	7.038e-05	0	0
1972	0	0.004304	0.005971	0.0001513	8.876e-05	8.876e-05	8.876e-05	0	0
1973	0	0.004742	0.006425	0.0001892	0.0001103	0.0001103	0.0001103	0	0
1974	0	0.005207	0.006896	0.0002347	0.0001359	0.0001359	0.0001359	0	0
1975	0	0.005702	0.007386	0.0002892	0.0001664	0.0001664	0.0001664	0	0
1976	0	0.006204	0.007869	0.0003508	0.0002007	0.0002007	0.0002007	0	0
1977	0	0.006716	0.00835	0.0004203	0.0002391	0.0002391	0.0002391	0	0
1978	0	0.007737	0.009316	0.0005865	0.0003303	0.0003303	0.0003303	0	0
1979	0	0.008867	0.01035	0.0008084	0.0004507	0.0004507	0.0004507	0	0
1980	0	0.01005	0.01141	0.001085	0.0005993	0.0005993	0.0005993	0	0
1981	0	0.01146	0.01261	0.001478	0.000813	0.000813	0.000813	0	0
1982	0	0.0132	0.01407	0.002075	0.001134	0.001134	0.001134	0	0
1983	0	0.01502	0.01554	0.00282	0.001539	0.001539	0.001539	0	0
1984	0	0.01705	0.01713	0.003815	0.002075	0.002075	0.002075	0	0
1985	0	0.01981	0.01924	0.005454	0.002948	0.002948	0.002948	0	0
1986	0	0.02209	0.02092	0.007035	0.003782	0.003782	0.003782	0	0
1987	0	0.02436	0.02256	0.008844	0.004736	0.004736	0.004736	0	0
1988	0	0.0261	0.02376	0.01032	0.005502	0.005502	0.005502	0	0
1989	0	0.02788	0.02499	0.012	0.006354	0.006354	0.006354	0	0
1990	0	0.02915	0.02583	0.01317	0.006908	0.006908	0.006908	0	0
1991	0	0.03191	0.02774	0.0164	0.008486	0.008486	0.008486	0	0
1992	0	0.03311	0.0285	0.01782	0.009135	0.009135	0.009135	0	0
1993	0	0.03512	0.02983	0.02064	0.01045	0.01045	0.01045	0	0
1994	0	0.03633	0.03063	0.02263	0.01135	0.01135	0.01135	0	0
1995	0	0.03779	0.03152	0.02488	0.01235	0.01235	0.01235	0	0
1996	0	0.03723	0.03103	0.02364	0.0116	0.0116	0.0116	0	0
1997	0	0.03604	0.03024	0.02175	0.01053	0.01053	0.01053	0	0
1998	0	0.03263	0.02777	0.01638	0.007984	0.007984	0.007984	0	0
1999	0	0.03062	0.02655	0.01432	0.006866	0.006866	0.006866	0	0
2000	0	0.02888	0.02545	0.01269	0.005925	0.005925	0.005925	0	0
2001	0	0.0155	0.01547	0.00256	0.001073	0.001073	0.001073	0	0
2002	0	0.009867	0.0109	0.0008578	0.0003719	0.0003719	0.0003719	0	0
2003	0	0.01727	0.01736	0.003968	0.001884	0.001884	0.001884	0	0
2004	0	0.01706	0.01741	0.003992	0.001902	0.001902	0.001902	0	0
2005	0	0.01731	0.0175	0.003879	0.001579	0.001579	0.001579	0	0
2006	0	0.01458	0.01521	0.002493	0.000912	0.000912	0.000912	0	0
2007	0	0.01076	0.01192	0.001136	0.0003853	0.0003853	0.0003853	0	0
2008	0	0.007884	0.00939	0.0005666	0.0001857	0.0001857	0.0001857	0	0
2009	0	0.005458	0.00708	0.0002528	8.787e-05	8.787e-05	8.787e-05	0	0
2010	0	0.004849	0.006556	0.0002042	6.779e-05	6.779e-05	6.779e-05	0	0
2011	0	0.006592	0.008662	0.0005513	0.0001741	0.0001741	0.0001741	0	0
2012	0	0.007121	0.009385	0.0007618	0.0002363	0.0002363	0.0002363	0	0
2013	0	0.006717	0.009158	0.0007522	0.000215	0.000215	0.000215	0	0
2014	0	0.007192	0.009948	0.001111	0.0003107	0.0003107	0.0003107	0	0
2015	0	0.009589	0.01283	0.002872	0.0008588	0.0008588	0.0008588	0	0
2016	0	0.006304	0.009237	0.001065	0.0003044	0.0003044	0.0003044	0	0
2017	0	0.007434	0.01056	0.001648	0.0004411	0.0004411	0.0004411	0	0
2018	0	0.006445	0.009466	0.001198	0.0002879	0.0002879	0.0002879	0	0
2019	0	0.005239	0.008015	0.0007057	0.0001395	0.0001395	0.0001395	0	0
2020	0	0.008077	0.0115	0.002398	0.000488	0.000488	0.000488	0	0
2021	0	0.008076	0.0115	0.002397	0.0004878	0.0004878	0.0004878	0	0

Table 2.6.3.7 North Sea herring multi fleet assessment. Assessment summary.

Year	Rec	Rec_lo	Rec_hi	TSB	TSB_lo	TSB_hi	SSB	SSB_lo	SSB_hi	Catch	Catch_lo	Catch_hi	Fbar	Fbar_lo	Fbar_hi	Landings
1947	36091481	20694563	62943826	7806568	6112768	9969707	4785959	3562383	6429798	852946	732993	992530	0.1367	0.09951	0.1877	248023
1948	33892967	20471371	56114130	6759839	5329587	8573915	3961165	2973630	5276658	666676	579910	766425	0.1297	0.09572	0.1757	385577
1949	29482668	17966318	48380961	6405088	5105734	8035115	3711112	2819633	4884450	730717	635510	840187	0.1552	0.1154	0.2088	370877
1950	40713854	25327614	65447061	6212986	5010108	7704664	3586841	2770287	4644077	648828	571889	736119	0.1588	0.1201	0.21	382794
1951	39447205	24721360	62944837	6212349	5070928	7610693	3300940	2577536	4227373	752730	662896	854739	0.196	0.1504	0.2555	358657
1952	39156492	24727056	62006206	6088586	4984672	7436975	3198501	2501452	4089788	838397	744619	943985	0.2213	0.1702	0.2876	371955
1953	42927945	27829221	66218470	5896661	4834899	7191589	3012363	2348815	3863367	835572	741703	941321	0.2291	0.1761	0.2981	480107
1954	40277237	26320051	61635740	5753458	4723064	7008645	2762402	2133514	3576664	953119	844264	1076009	0.2771	0.2112	0.3637	570865
1955	34677907	22821171	52694810	5504246	4505804	6723934	2795603	2161681	3615426	843486	737438	964785	0.241	0.1837	0.3162	666404
1956	25929688	17056532	39418840	5086498	4176973	6194068	2642466	2045193	3414165	838285	734299	956998	0.2481	0.1899	0.3241	524366
1957	62903615	4.1e+07	96501658	5053355	4164444	6132007	2392255	1851306	3091270	800990	704530	910655	0.2693	0.206	0.3518	408528
1958	26015253	17194987	39359925	5050176	4142359	6156946	2017648	1563358	2603949	749255	635460	883426	0.2447	0.1883	0.3181	259031
1959	28936224	18713703	44742886	5634058	4628457	6858141	2989676	2314602	3861643	1151368	968801	1368340	0.2947	0.2277	0.3814	172685
1960	11961545	7742274	18480173	4741837	3910910	5749307	2602365	2027066	3340938	822161	706008	957423	0.2418	0.1875	0.3118	187508
1961	56408557	36598385	86941686	4843868	4035337	5814399	2558058	2021916	3236366	734422	635844	848282	0.2631	0.2075	0.3336	224148
1962	27848991	18476837	41975058	4533116	3786044	5427602	1773734	1390162	2263142	712678	618479	821225	0.3157	0.2492	0.4	437236
1963	32461643	21878356	48164418	5276785	4408321	6316340	2910800	2324520	3644948	600669	505294	714046	0.183	0.1468	0.2282	511733
1964	34432572	23242774	51009488	5183388	4485970	5989232	2604326	2154520	3148040	915500	782226	1071480	0.28	0.2312	0.3391	517593
1965	17667215	11925776	26172760	4579220	4043115	5186411	1961604	1652746	2328180	1282125	1116340	1472531	0.533	0.4478	0.6344	494072
1966	17973901	12227120	26421686	3463874	3061889	3918634	1602573	1355963	1894033	930956	814037	1064668	0.4914	0.4155	0.5812	564880
1967	23845334	16247292	3.5e+07	2666531	2378117	2989923	963819	824256	1127013	859351	753121	980564	0.6948	0.5962	0.8097	499145
1968	23563186	1.6e+07	34705149	2207696	1942886	2508599	511290	436583	598781	821220	711372	948032	1.079	0.944	1.233	604449
1969	12455812	8354967	18569464	1722707	1483504	2e+06	467784	380337	575336	539444	453002	642381	0.9106	0.7905	1.049	451542
1970	23548155	15874082	34932137	1676959	1446760	1943785	458011	370955	565498	533604	451134	631151	0.9504	0.8279	1.091	434000
1971	19092786	12982740	28078394	1543230	1316058	1809617	286722	234809	350113	554017	449730	682487	1.435	1.268	1.624	.
1972	12963480	8808955	19077383	1381940	1181178	1616824	347030	282335	426547	428000	341480	536441	0.5858	0.4999	0.6864	248023
1973	6834120	4651034	10041895	1114654	970177	1280645	282198	233508	341042	449466	375205	538424	0.9363	0.8147	1.076	385577
1974	10923746	7289607	16369640	781071	679042	898430	192904	160744	231497	274825	234433	322177	0.8958	0.7773	1.032	370877
1975	2557935	1700220	3848343	604249	507741	719101	103834	85532	126053	252645	203317	313940	1.192	1.025	1.387	382794
1976	3277208	2106563	5098397	449711	370821	545385	142830	107173	190349	153385	126110	186559	0.8614	0.6736	1.102	358657
1977	4025291	2524518	6418241	317783	254142	397359	114235	82849	157509	54081	45198	64709	0.3197	0.2325	0.4395	371955
1978	4503801	2763199	7340849	374710	293694	478073	139023	103509	186721	48588	31777	74291	0.2172	0.1331	0.3545	480107
1979	8387216	5369155	13101762	497173	4e+05	617997	183425	142168	236655	60246	39444	92019	0.1758	0.1075	0.2875	570865
1980	13108018	8945967	19206435	682289	564039	825329	213609	171048	266758	79490	62893	100467	0.158	0.1237	0.2017	666404
1981	27856842	18983931	40876868	1129806	930095	1372399	284033	227951	353913	150569	117335	193217	0.2484	0.1977	0.3121	524366
1982	46737392	32126602	67992991	1738585	1428344	2116210	408528	331415	503583	250954	185200	340052	0.1793	0.1445	0.2224	408528
1983	45668757	31845854	65491583	2338425	1962429	2786462	571118	466918	698572	383194	295294	497260	0.2617	0.2146	0.3191	259031
1984	45787494	32191899	65124913	3060177	2616102	3579633	892756	729231	1092949	468538	391130	561266	0.3526	0.2926	0.425	172685
1985	56566615	39569836	80864170	3511088	3025432	4074704	960264	795155	1159656	620532	532662	722897	0.4531	0.3772	0.5443	187508
1986	68930718	48145277	98689721	3995626	3427547	4657858	997272	830671	1197287	746303	609063	914466	0.4307	0.3582	0.5179	224148
1987	61633334	4.3e+07	88345556	4e+06	3456714	4627920	1204638	1002212	1447950	772407	644548	925629	0.3925	0.3272	0.4708	437236

1988	37750826	26513409	53751098	3912488	3411729	4486747	1545207	1292235	1847702	968934	790276	1187980	0.3823	0.3205	0.4559	511733
1989	30447113	21349170	43422144	3444558	3063236	3873348	1578305	1358683	1833427	811013	702499	936288	0.3706	0.3134	0.4382	517593
1990	26908664	18822152	38469363	3427460	3050281	3851279	1698451	1465548	1968365	675842	583856	782320	0.3	0.2524	0.3566	494072
1991	28853211	20263653	41083797	3239140	2885519	3636098	1500496	1299267	1732892	669233	583342	767771	0.3204	0.2698	0.3806	564880
1992	50993334	37164246	69968326	3225149	2864487	3631222	1145570	988421	1327705	693551	601209	800077	0.383	0.3224	0.4549	499145
1993	52752166	38119163	7.3e+07	2979337	2616015	3393118	809410	690087	949365	674827	582320	782031	0.4547	0.3811	0.5425	604449
1994	41736350	30060961	57946347	2868509	2481565	3315789	866824	738108	1017985	623208	533569	727907	0.451	0.3782	0.5379	451542
1995	42929269	30777874	59878151	2779524	2402998	3215047	918702	775752	1087994	575839	498161	665628	0.4102	0.3404	0.4945	434000
1996	33541123	24261452	46370141	2733888	2359287	3167967	1088224	921042	1285751	284820	245131	330935	0.1999	0.1641	0.2437	.
1997	28452121	20380147	39721167	2710191	2358573	3114228	1207865	1028460	1418566	263084	230089	300810	0.1806	0.1487	0.2194	248023
1998	18700856	13673638	25576369	3006570	2631170	3435530	1373244	1179602	1598673	363341	318995	413850	0.229	0.1897	0.2764	385577
1999	58576494	42611183	80523597	3115788	2740640	3542287	1481882	1274312	1723263	352089	308125	402326	0.2117	0.1763	0.2542	370877
2000	37457677	27461252	51092994	3753811	3268034	4311796	1505116	1295252	1748983	365367	322101	414444	0.2107	0.1752	0.2533	382794
2001	71084548	51363508	98377489	4160378	3632154	4765422	1926494	1656384	2240651	349750	308572	396422	0.1803	0.1494	0.2175	358657
2002	35817477	26180224	4.9e+07	5007928	4359373	5752971	2340328	2015700	2717238	375329	330414	426349	0.1653	0.1372	0.1992	371955
2003	19252232	14126111	26238533	5281243	4610962	6048960	2337731	2025134	2698579	478304	422320	541708	0.1925	0.1607	0.2307	480107
2004	23056724	16880165	31493327	4565619	4034429	5166748	2305165	2003480	2652278	563004	496967	637816	0.2286	0.1901	0.2747	570865
2005	20430347	15052902	27728810	3837064	3407294	4321041	2094870	1810978	2423266	648335	571878	735014	0.2835	0.2367	0.3396	666404
2006	21196987	15569636	28858238	3223863	2862119	3631329	1691455	1463175	1955351	516107	456118	583986	0.2604	0.2172	0.3121	524366
2007	24753162	18017402	34007068	2657112	2352713	3000895	1323907	1142559	1534038	381321	336863	431648	0.227	0.1886	0.2733	408528
2008	21897784	15870756	30213618	2715577	2382673	3094994	1415712	1222121	1639968	247093	219988	277537	0.1395	0.1158	0.1681	259031
2009	34023642	24821169	46637942	3148229	2748963	3605486	1745423	1502192	2028039	172141	153153	193483	0.07857	0.06482	0.09523	172685
2010	2.7e+07	19746549	36929967	3744436	3272544	4284375	1846247	1584522	2151202	177650	158230	199454	0.07814	0.06463	0.09447	187508
2011	24556210	18046098	33414839	3771747	3323228	4280801	2201685	1916168	2529746	227331	202444	255277	0.1019	0.08499	0.1222	224148
2012	23216549	17022268	31664883	3726387	3304464	4202182	2262093	1971584	2595408	417061	370369	469640	0.1814	0.1516	0.2172	437236
2013	31314955	22764819	43076397	3620550	3223040	4067086	2070923	1807413	2372851	484483	430685	545001	0.2122	0.1775	0.2536	511733
2014	47217742	34214386	65163091	3858544	3426308	4345307	2044501	1782511	2344999	489065	435489	549232	0.2063	0.1725	0.2468	517593
2015	12565961	9110302	17332398	4032028	3548733	4581141	1913297	1664268	2199589	489265	435663	549461	0.2166	0.1805	0.2599	494072
2016	23054821	16903477	31444701	3995184	3507062	4551243	2196727	1899236	2540815	550954	489898	619619	0.2384	0.1984	0.2864	564880
2017	13617840	9896209	18739052	3425957	3015717	3892005	2007266	1729611	2329493	449422	394453	512052	0.1931	0.1609	0.2318	499145
2018	25135181	18290335	34541594	3244086	2856589	3684146	1780481	1524661	2079224	534780	466153	613510	0.2245	0.1866	0.2702	604449
2019	21266861	15028392	30094996	2772023	2434263	3156648	1503667	1282583	1762861	422496	370528	481752	0.1928	0.1581	0.2352	451542
2020	24819948	17063757	36101654	2764098	2371087	3222250	1463252	1217427	1758714	415420	365623	471998	0.2067	0.1645	0.2597	434000
2021	30078264	16734362	54062530	2716110	2182056	3380871	1399848	1051552	1863509	389894	208227	730056	0.2067	0.09909	0.4311	.

Table 2.6.3.8 North Sea herring multi fleet assessment. SAM model control object.

```
An object of class "FLSAM.control"
Slot "name":
[1] "North Sea herring multifleet"

Slot "desc":
[1] "Imported from a VPA file. ( ./bootstrap/data/index.txt ).  Tue Sep 07 09:28:12 2021"

Slot "range":
      min       max plusgroup   minyear   maxyear   minfbar   maxfbar
        0         8         8      1947      2021         2         6

Slot "fleets":
 catch A catch BD  catch C    HERAS  IBTS-Q1    IBTS0  IBTS-Q3 LAI-ORSH
       0        0        0        2        2        2        2        6
 LAI-BUN  LAI-CNS  LAI-SNS sumFleet
       6        6        6        7

Slot "plus.group":
plusgroup
     TRUE

Slot "states":
          age
fleet       0  1  2  3  4  5  6  7  8
  catch A  -1  0  1  2  3  4  5  6  6
  catch BD  7  8  9 10 10 10 -1 -1 -1
  catch C  -1 11 12 13 14 14 14 -1 -1
  HERAS    -1 -1 -1 -1 -1 -1 -1 -1 -1
  IBTS-Q1  -1 -1 -1 -1 -1 -1 -1 -1 -1
  IBTS0    -1 -1 -1 -1 -1 -1 -1 -1 -1
  IBTS-Q3  -1 -1 -1 -1 -1 -1 -1 -1 -1
  LAI-ORSH -1 -1 -1 -1 -1 -1 -1 -1 -1
  LAI-BUN  -1 -1 -1 -1 -1 -1 -1 -1 -1
  LAI-CNS  -1 -1 -1 -1 -1 -1 -1 -1 -1
  LAI-SNS  -1 -1 -1 -1 -1 -1 -1 -1 -1
  sumFleet -1 -1 -1 -1 -1 -1 -1 -1 -1

Slot "logN.vars":
0 1 2 3 4 5 6 7 8
0 1 1 1 1 1 1 1 1

Slot "logP.vars":
[1] 0 1 2

Slot "catchabilities":
          age
fleet       0  1  2  3  4  5  6  7  8
  catch A  -1 -1 -1 -1 -1 -1 -1 -1 -1
  catch BD -1 -1 -1 -1 -1 -1 -1 -1 -1
  catch C  -1 -1 -1 -1 -1 -1 -1 -1 -1
  HERAS    -1  1  1  2  2  2  2  2  2
  IBTS-Q1  -1  3 -1 -1 -1 -1 -1 -1 -1
  IBTS0     0 -1 -1 -1 -1 -1 -1 -1 -1
  IBTS-Q3   4  5  6  7  8  9 -1 -1 -1
  LAI-ORSH 10 -1 -1 -1 -1 -1 -1 -1 -1
  LAI-BUN  10 -1 -1 -1 -1 -1 -1 -1 -1
  LAI-CNS  10 -1 -1 -1 -1 -1 -1 -1 -1
  LAI-SNS  10 -1 -1 -1 -1 -1 -1 -1 -1
  sumFleet -1 -1 -1 -1 -1 -1 -1 -1 -1

Slot "power.law.exps":
          age
fleet       0  1  2  3  4  5  6  7  8
  catch A  -1 -1 -1 -1 -1 -1 -1 -1 -1
  catch BD -1 -1 -1 -1 -1 -1 -1 -1 -1
  catch C  -1 -1 -1 -1 -1 -1 -1 -1 -1
  HERAS    -1 -1 -1 -1 -1 -1 -1 -1 -1
  IBTS-Q1  -1 -1 -1 -1 -1 -1 -1 -1 -1
```

```
  IBTS0    -1 -1 -1 -1 -1 -1 -1 -1 -1
  IBTS-Q3  -1 -1 -1 -1 -1 -1 -1 -1 -1
  LAI-ORSH -1 -1 -1 -1 -1 -1 -1 -1 -1
  LAI-BUN  -1 -1 -1 -1 -1 -1 -1 -1 -1
  LAI-CNS  -1 -1 -1 -1 -1 -1 -1 -1 -1
  LAI-SNS  -1 -1 -1 -1 -1 -1 -1 -1 -1
  sumFleet -1 -1 -1 -1 -1 -1 -1 -1 -1
Slot "f.vars":
         age
fleet       0  1  2  3  4  5  6  7  8
  catch A  -1  0  1  1  1  1  2  2  2
  catch BD  3  4  4  4  4  4 -1 -1 -1
  catch C  -1  5  6  7  7  7  7 -1 -1
  HERAS    -1 -1 -1 -1 -1 -1 -1 -1 -1
  IBTS-Q1  -1 -1 -1 -1 -1 -1 -1 -1 -1
  IBTS0    -1 -1 -1 -1 -1 -1 -1 -1 -1
  IBTS-Q3  -1 -1 -1 -1 -1 -1 -1 -1 -1
  LAI-ORSH -1 -1 -1 -1 -1 -1 -1 -1 -1
  LAI-BUN  -1 -1 -1 -1 -1 -1 -1 -1 -1
  LAI-CNS  -1 -1 -1 -1 -1 -1 -1 -1 -1
  LAI-SNS  -1 -1 -1 -1 -1 -1 -1 -1 -1
  sumFleet -1 -1 -1 -1 -1 -1 -1 -1 -1

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  catch BD  3  4  5  5  5  5 -1 -1 -1
  catch C  -1  6  7  8  8  8  8 -1 -1
  HERAS    -1  9 10 11 12 12 12 13 13
  IBTS-Q1  -1 14 -1 -1 -1 -1 -1 -1 -1
  IBTS0    15 -1 -1 -1 -1 -1 -1 -1 -1
  IBTS-Q3  16 16 17 17 17 17 -1 -1 -1
  LAI-ORSH 18 -1 -1 -1 -1 -1 -1 -1 -1
  LAI-BUN  18 -1 -1 -1 -1 -1 -1 -1 -1
  LAI-CNS  18 -1 -1 -1 -1 -1 -1 -1 -1
  LAI-SNS  18 -1 -1 -1 -1 -1 -1 -1 -1
  sumFleet -1 -1 -1 -1 -1 -1 -1 -1 -1

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Slot "scalePars":
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  catch BD  NA  NA  NA  NA  NA  NA  NA  NA
  catch C   NA  NA  NA  NA  NA  NA  NA  NA
  HERAS     -1  NA  NA  NA  NA  NA  NA  NA
  IBTS-Q1   -1  -1  -1  -1  -1  -1  -1  -1
  IBTS0     -1  -1  -1  -1  -1  -1  -1  -1
  IBTS-Q3    0   0   0   0   0  -1  -1  -1
  LAI-ORSH  -1  -1  -1  -1  -1  -1  -1  -1
  LAI-BUN   -1  -1  -1  -1  -1  -1  -1  -1
  LAI-CNS   -1  -1  -1  -1  -1  -1  -1  -1
  LAI-SNS   -1  -1  -1  -1  -1  -1  -1  -1
  sumFleet  -1  -1  -1  -1  -1  -1  -1  -1
```

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Levels: ID AR US

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Slot "likFlag":
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Levels: LN ALN

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Slot "simulate":
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Slot "residuals":
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Slot "sumFleets":
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Table 2.7.1. North Sea herring. Intermediate year (2021) assumptions for the stock.

Variable	Value	Notes
Fages (wr) 2–6 (2021)	0.186	Based on estimated catch 2020
SSB (2021)	1 383 486	Calculated based on catch constraint (in tonnes)
Rage (wr) 0 (2021)	30 422 344	Estimated by assessment model (in thousands)
Rage (wr) 0 (2022)	23 599 592	Weighted mean over 2010–2019 (in thousands)
Total catch (2021)	370 667	Estimated realized catch of autumn spawning herring derived from agreed TACs for A-D fleets, the proportion of NSAS herring in the catch (for A, C and D fleets), the transfer of TAC to the North Sea (C fleet) and the uptake of the bycatch quota (for B and D fleets).

Table 2.7.2. North Sea herring. Intermediate year (2020), fleet wise assumptions for the catches and the fishing mortality. Weights are in tonnes

	Field	Value	Note
TACs	A-fleet TAC	356 357	
	B-fleet TAC	7750	
	C-fleet TAC	21604	Total TAC in IIIa (including WBSS and NSAS)
	D-fleet TAC	6659	Total TAC in IIIa (including WBSS and NSAS)
TACs to catches variables	WBSS/NSAS split in the North Sea	0.016	Value from terminal year
	B-fleet uptake	0.79	Average over the last 3 years (2017-2019)
	C-fleet transfer	0.48	Value for the Intermediate year
	C-fleet NSAS/WBSS split	0.30	Average over the last 3 years (2017-2019)
	D-fleet NSAS/WBSS split	0.64	Average over the last 3 years (2017-2019)
	D-fleet uptake	0.08	Average over the last 3 years (2017-2019)
F by fleet and total	$F_{(wr)\ 2–6}$ A-fleet	0.185	
	$F_{(wr)\ 0–1}$ B-fleet	0.03	
	$F_{(wr)\ 1–3}$ C-fleet	0.004	
	$F_{(wr)\ 0–1}$ D-fleet	0.002	
	$F_{(wr)\ 2–6}$	0.186	
	$F_{(wr)\ 0–1}$	0.036	
NSAS catches by fleet	Catches A-fleet	360 884	Includes C-fleet transfer and split of WBSS/NSAS in the North Sea
	Catches B-fleet	6103	Includes fleet uptake
	Catches C-fleet	3330	Includes TAC transfer to the A fleet and WBSS/NSAS split.
	Catches D-fleet	351	Includes WBSS/NSAS split and fleet uptake

Table 2.7.3. North Sea herring. reference points.

wg	fmsy	Fsq	Flim	Fpa	Blim	Bpa	msyBtrigger
IBPNSherring2021	0.31	.	0.4	0.31	874198	956483	1232828
WKPELA2018	0.26	.	0.34	0.3	8e+05	9e+05	1400000

Table 2.7.4. North Sea herring. All scenarios following WBSS TAC advice.

Basis	Fbar26A	Fbar01B	Fbar13C	Fbar01D	Fbar26	Fbar01	CatchA	CatchB	CatchC	CatchD	SSB1	SSB2
intermediate year	0.1847	0.03036	0.003506	0.001744	0.1864	0.03559	360884	6103	3330	350.6	1383486	.
fmsyAR_transfer	0.3096	0.05088	1.514e-08	3.063e-08	0.31	0.05348	523438	8745	0.01542	0.005265	1280829	1286757
fmsyAR_transfer_Btarget	0.3097	0.0474	1.514e-08	3.057e-08	0.31	0.05	523477	8162	0.01542	0.005265	1280829	1286893
fmsyAR_no_transfer	0.3096	0.05088	2.911e-08	3.063e-08	0.31	0.05348	523438	8745	0.02965	0.005265	1280829	1286757
fmsyAR_no_transfer_Btarget	0.3097	0.0474	2.911e-08	3.057e-08	0.31	0.05	523477	8162	0.02965	0.005265	1280829	1286893
fmsy	0.3096	0.05088	2.911e-08	3.063e-08	0.31	0.05348	523438	8745	0.02965	0.005265	1280829	1286757
nf	0	0	0	0	0	0	0	0	0	0	1614283	1998030
tacro	0.1966	0.03231	2.863e-08	3.024e-08	0.1969	0.03396	356357	5625	0.02965	0.005265	1390323	1491932
-15%	0.1636	0.02689	2.849e-08	3.012e-08	0.1638	0.02826	302903	4699	0.02965	0.005265	1424745	1561713
+15%	0.2311	0.03797	2.877e-08	3.036e-08	0.2313	0.03991	409811	6585	0.02965	0.005265	1355606	1424192
fsq	0.1862	0.0306	2.858e-08	3.02e-08	0.1864	0.03216	339749	5334	0.02965	0.005265	1401049	1513391
fpa	0.3096	0.05088	2.911e-08	3.063e-08	0.31	0.05348	523438	8745	0.02965	0.005265	1280829	1286757
flim	0.3995	0.06565	2.949e-08	3.095e-08	0.4	0.06901	640910	11169	0.02965	0.005265	1202140	1153649
bpa	0.7428	0.122	3.092e-08	3.215e-08	0.7436	0.1283	995805	19986	0.02965	0.005265	956483	802300
blim	0.8863	0.1456	3.151e-08	3.265e-08	0.8874	0.1531	1111504	23480	0.02965	0.005265	874198	703021
MSYBtrigger	0.3635	0.05973	2.934e-08	3.082e-08	0.3639	0.06279	595343	10204	0.02965	0.005265	1232828	1204229

Table 2.7.5. North Sea herring. All scenarios with status quo in C-D fleet catches.

Basis	Fbar26A	Fbar01B	Fbar13C	Fbar01D	Fbar26	Fbar01	CatchA	CatchB	CatchC	CatchD	SSB1	SSB2
intermediate year	0.1847	0.03036	0.003506	0.001744	0.1864	0.03559	360884	6103	3330	350.6	1383486	.
fmsyAR_transfer	0.3143	0.05042	0.003278	0.002043	0.3161	0.05692	529663	8653	3330	350.6	1275260	1274284
fmsyAR_transfer_Btarget	0.3144	0.04291	0.003278	0.002034	0.3161	0.0494	529761	7396	3330	350.6	1275250	1274562
fmsyAR_no_transfer	0.307	0.05044	0.006308	0.002044	0.31	0.05854	519293	8653	6405	350.6	1280821	1281588
fmsyAR_no_transfer_Btarget	0.307	0.04191	0.006307	0.002034	0.31	0.05	519391	7224	6405	350.6	1280819	1281919
fmsy	0.307	0.05044	0.006308	0.002044	0.31	0.05854	519293	8653	6405	350.6	1280821	1281588
nf	0	0	0	0	0	0	0	0	0	0	1614283	1998030
tacro	0.1968	0.03234	0.006206	0.002018	0.1997	0.03943	356357	5619	6405	350.6	1387630	1481508
-15%	0.1638	0.02691	0.006175	0.00201	0.1666	0.0337	302903	4694	6405	350.6	1422072	1551168
+15%	0.2313	0.03801	0.006238	0.002026	0.2342	0.04542	409811	6577	6405	350.6	1352893	1413893
fsq	0.1836	0.03017	0.006194	0.002015	0.1864	0.03714	335257	5250	6405	350.6	1401261	1508758
fpa	0.307	0.05044	0.006308	0.002044	0.31	0.05854	519293	8653	6405	350.6	1280821	1281588
flim	0.3968	0.06521	0.006391	0.002065	0.4	0.07413	636961	11072	6405	350.6	1201995	1148262
bpa	0.7391	0.1214	0.006701	0.002145	0.7428	0.1335	991541	19849	6405	350.6	956483	797441
blim	0.8822	0.145	0.006828	0.002179	0.8861	0.1583	1107178	23328	6405	350.6	874198	698338
MSYBtrigger	0.3607	0.05927	0.006358	0.002056	0.3638	0.06787	591183	10106	6405	350.6	1232828	1199070

Table 2.7.6. North Sea herring. Final scenario table.

Basis	Fbar26A	Fbar01B	Fbar13C	Fbar01D	Fbar26	Fbar01	CatchA	CatchB	CatchC	CatchD	total_catch	SSB1	SSB2	SSB_change	TAC_change	advice_change
fmsyAR_no_transfer	0.31	0.051	0	0	0.31	0.053	523438	8745	0	0	532183	1280829	1286757	-7.4	46.9	45.7
fmsy	0.31	0.051	0	0	0.31	0.053	523438	8745	0	0	532183	1280829	1286757	-7.4	46.9	45.7
nf	0	0	0	0	0	0	0	0	0	0	0	1614283	1998030	16.7	-100	-100
tacro	0.197	0.032	0.006	0.002	0.2	0.039	356357	5619	6405	351	368732	1387630	1481508	0.3	0	-0.8
fsq	0.186	0.031	0	0	0.186	0.032	339749	5334	0	0	345083	1401049	1513391	1.3	-4.7	-5.5
fpa	0.31	0.051	0	0	0.31	0.053	523438	8745	0	0	532183	1280829	1286757	-7.4	46.9	45.7
flim	0.4	0.066	0	0	0.4	0.069	640910	11169	0	0	652079	1202140	1153649	-13.1	79.9	78.3
bpa	0.743	0.122	0	0	0.744	0.128	995805	19986	0	0	1015791	956483	802300	-30.9	179.4	177.1
blim	0.886	0.146	0	0	0.887	0.153	1111504	23480	0	0	1134984	874198	703021	-36.8	211.9	209.3
MSYBtrigger	0.364	0.06	0	0	0.364	0.063	595343	10204	0	0	605547	1232828	1204229	-10.9	67.1	65.7
fmsyAR_no_transfer_Btarget	0.31	0.047	0	0	0.31	0.05	523477	8162	0	0	531639	1280829	1286893	-7.4	46.9	45.7
fmsyAR_transfer_sq TAC C&D	0.314	0.05	0.003	0.002	0.316	0.057	529663	8653	3330	351	541997	1275260	1274284	-7.8	48.6	47.4
fmsyAR_no_transfer_sq C&D	0.307	0.05	0.006	0.002	0.31	0.059	519293	8653	6405	351	534702	1280821	1281588	-7.4	45.7	44.5

Table 2.9.1. North Sea herring. Old and new reference points following WKNSHERRING 2021.

Framework ^	Reference point	Old Value	Old Technical basis	Old Source	New value	New basis
MSY approach	MSY $B_{trigger}$	1 400 000	5th percentile of B_{FMSY}	ICES (2018b)	1 232 828	unchanged
	F_{MSY}	0.26	Stochastic simulations with a segmented regression and Ricker stock–recruitment curve from the short time-series (2002–2016).	ICES (2018b)	0.31	Same rationale with extended time series (2002–2020)
Precautionary approach	B_{lim}	800 000	Breakpoint in the segmented regression of the stock–recruitment time-series (1947–2016).	ICES (2018b)	874 198	Breakpoint in the segmented regression of the stock–recruitment time-series (1947–2020, excluding the recovery period 1979-1990).
	B_{pa}	900 000	$B_{pa} = B_{lim} \times \exp(1.645 \times \sigma)$ with $\sigma \approx 0.10$, based on the average *CV* from the terminal assessment year.	ICES (2018b)	956 483	$B_{pa} = B_{lim} \times \exp(1.645 \times \sigma)$ with $\sigma \approx 0.06$, based on the σ from the terminal assessment year.
	F_{lim}	0.34	$F_{P50\%}$ leading to 50% probability of SSB > B_{lim} with a segmented regression and Ricker stock–recruitment curve (2002–2016).	ICES (2018b)	0.39	The F that on average leads to Blim
	F_{pa}	0.30	$F_{pa} = F_{lim} \times \exp(-1.645 \times \sigma)$ with $\sigma \approx 0.08$, based on the average *CV* from the terminal assessment year.	ICES (2018b)	0.31	The F that provides a 95% probability for SSB to be above Blim (FP05 with AR)

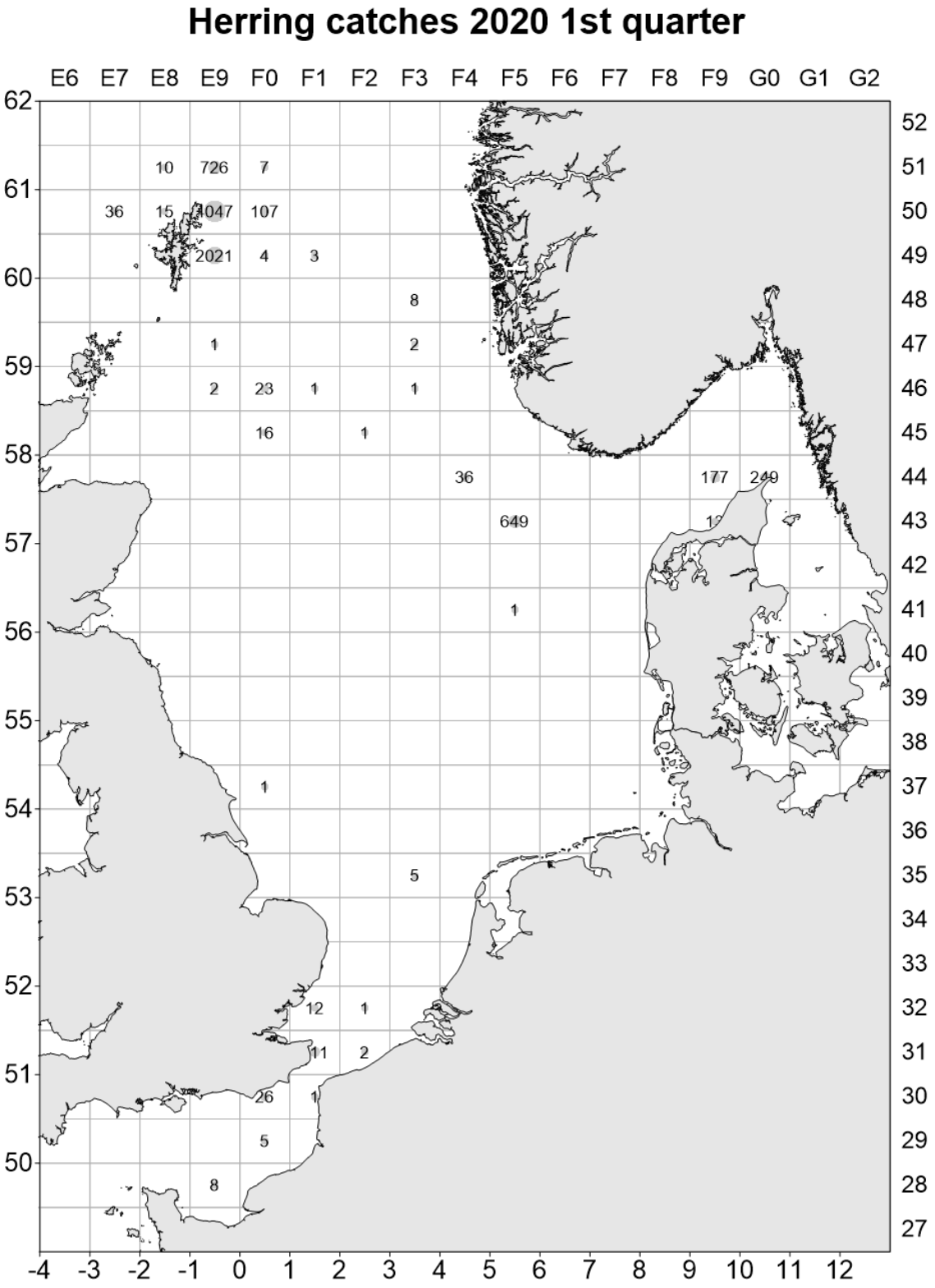


Figure 2.1.1a. Herring catches in the North Sea in the 1st quarter of 2020 (in tonnes) by statistical rectangle.

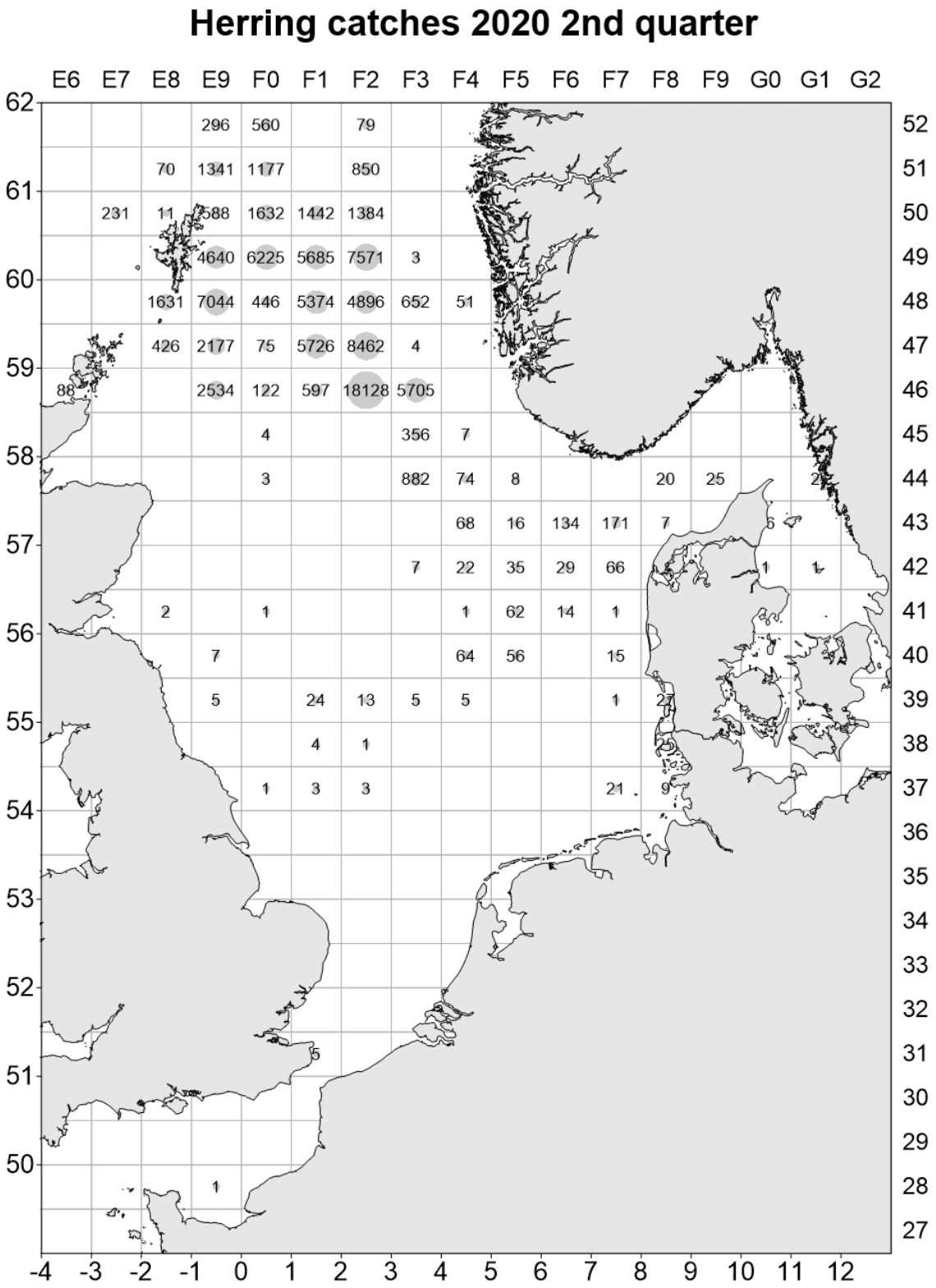


Figure 2.1.1b. Herring catches in the North Sea in the second quarter of 2020 (in tonnes) by statistical rectangle.

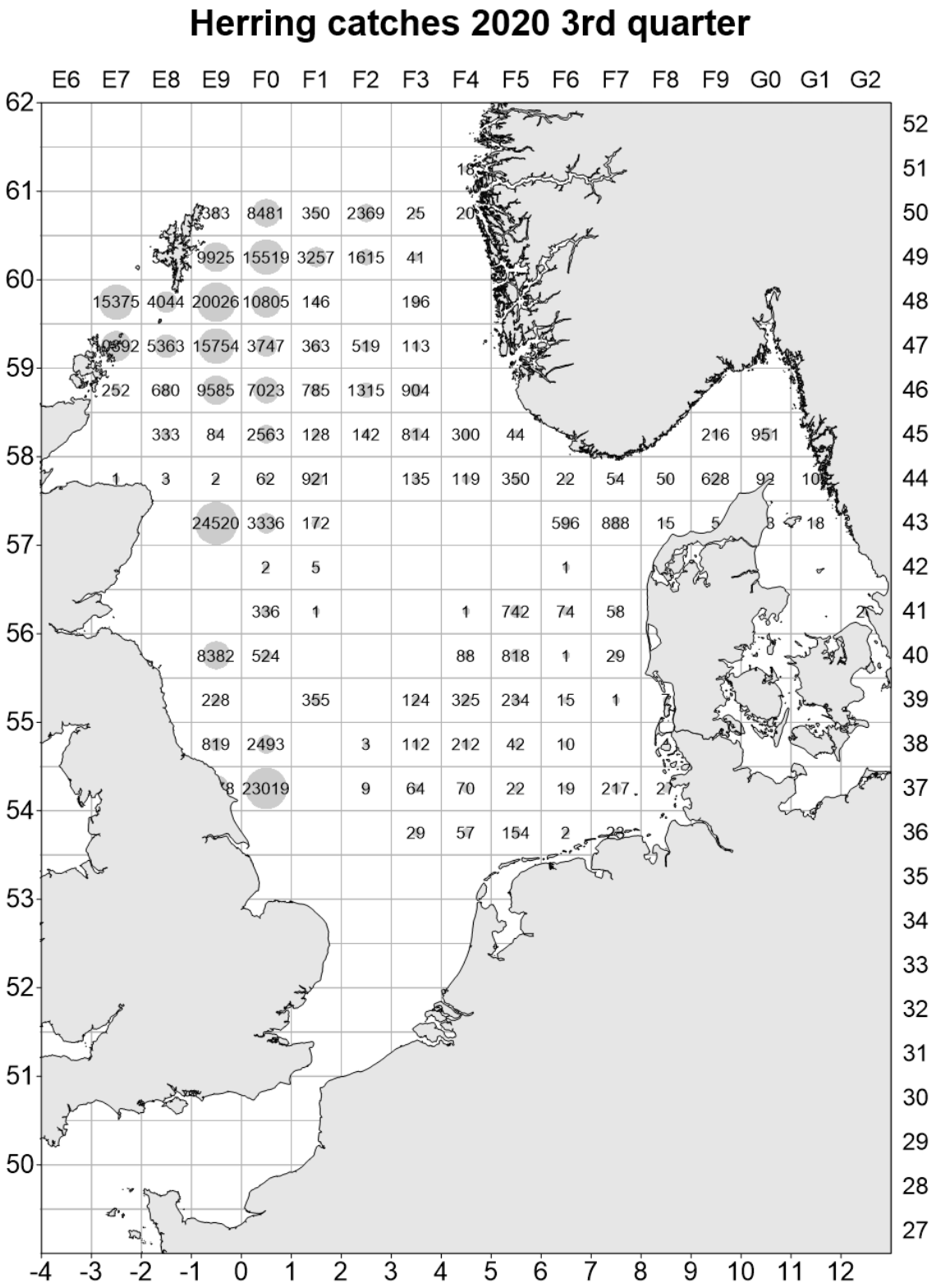


Figure 2.1.1c. Herring catches in the North Sea in the 3rd quarter of 2020 (in tonnes) by statistical rectangle.

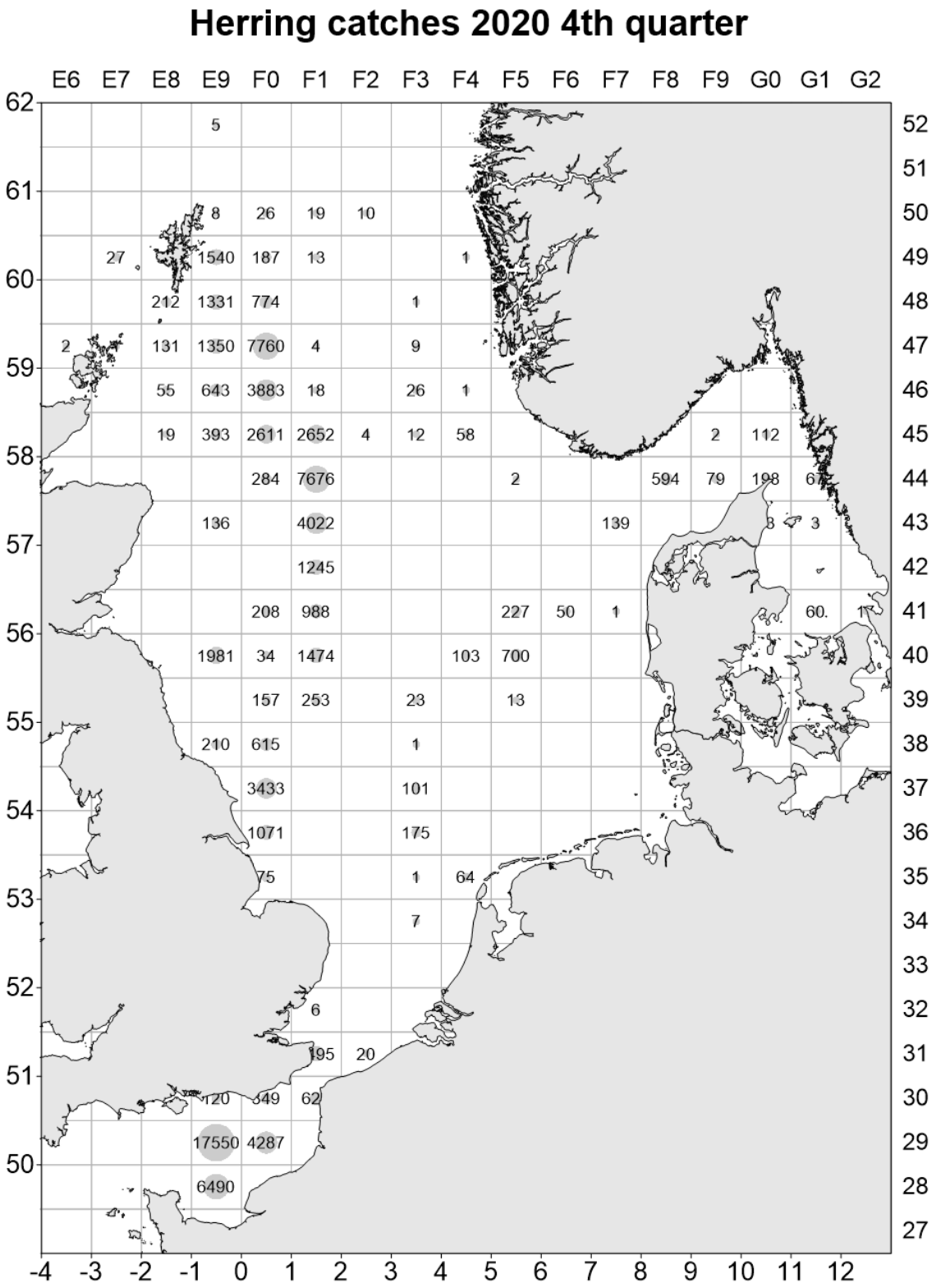


Figure 2.1.1d. Herring catches in the North Sea in the 4th quarter of 2020 (in tonnes) by statistical rectangle.

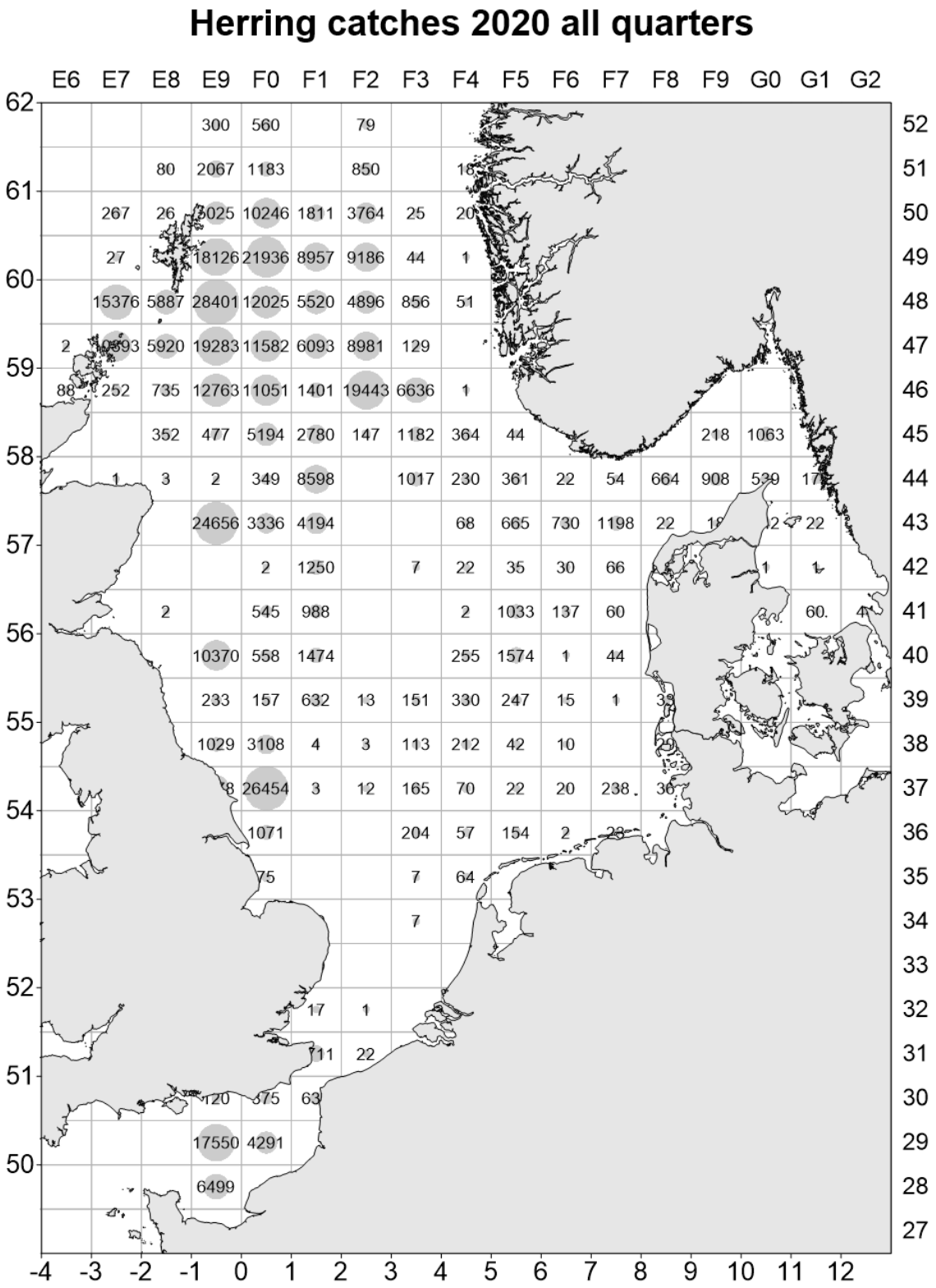


Figure 2.1.1e. Herring catches in the North Sea in all quarters of 2020 (in tonnes) by statistical rectangle.

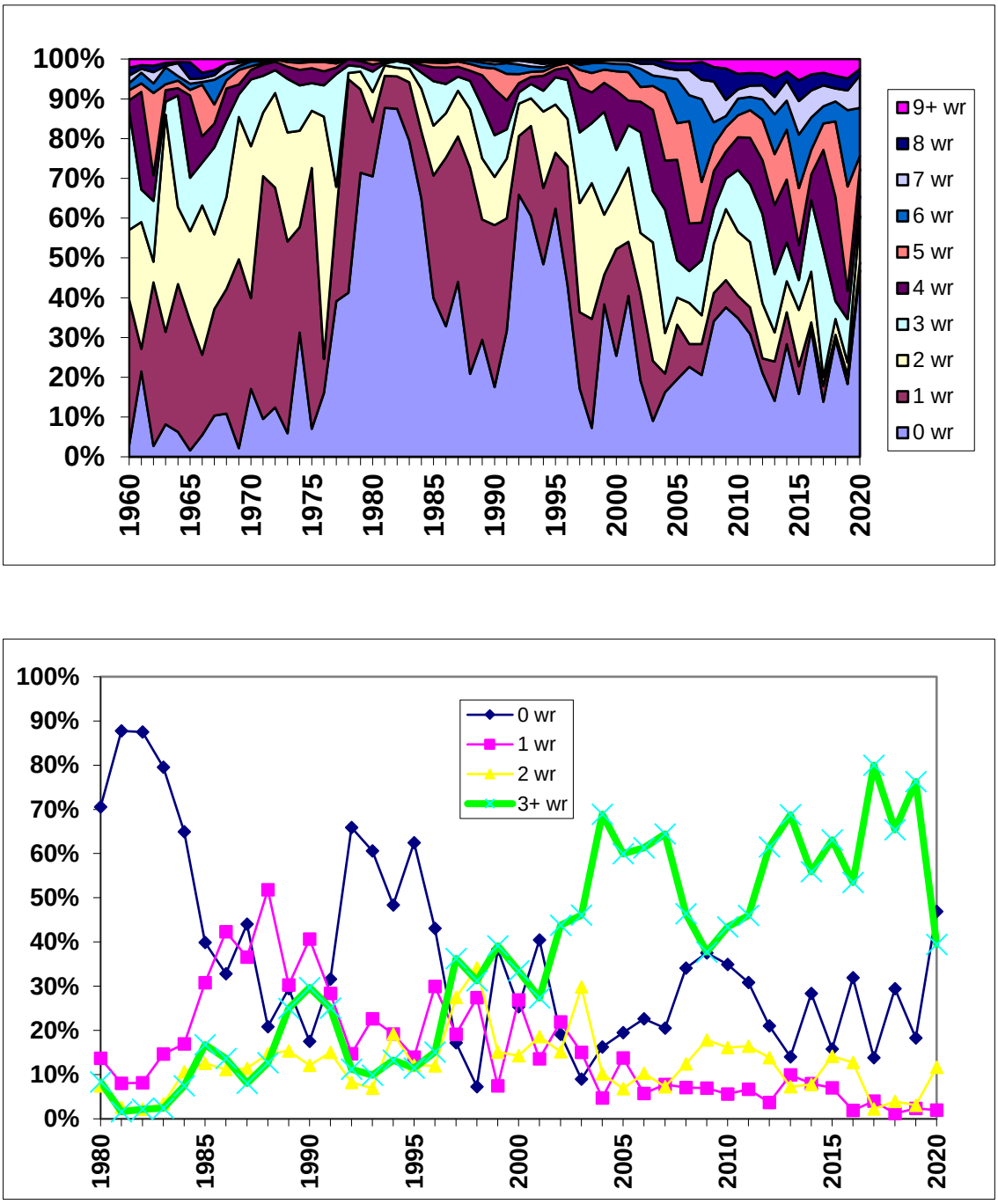


Figure 2.2.1. Proportions of age groups (numbers) in the total catch of herring caught in the North Sea (upper, 1960–2020, and lower panel, 1980–2020).

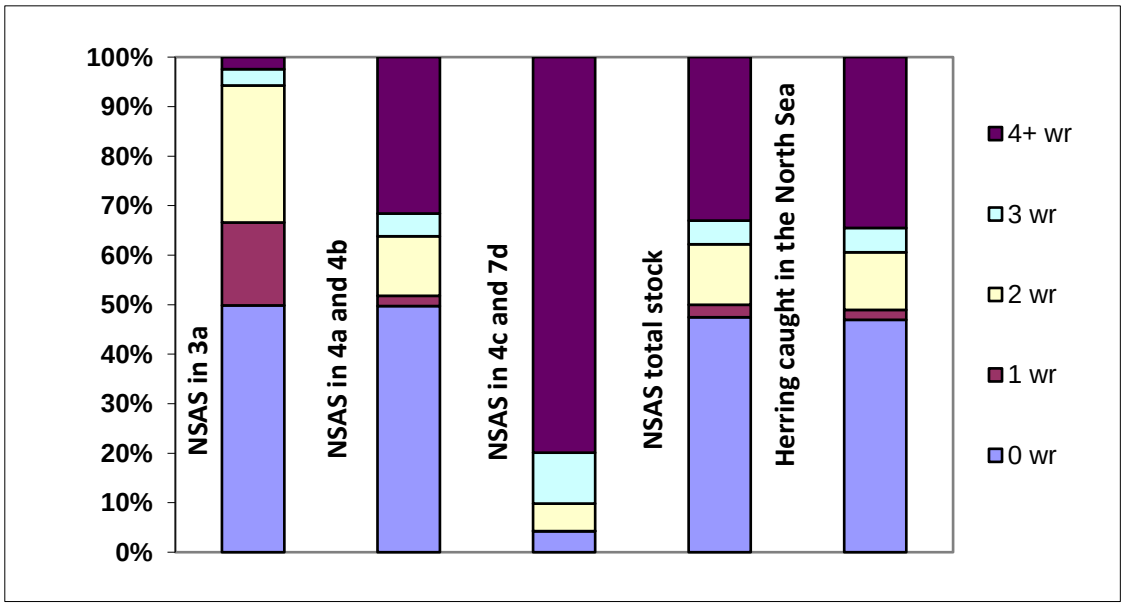


Figure 2.2.2. Proportion of age groups (numbers) in the total catch of NSAS and herring caught in the North Sea in 2020.

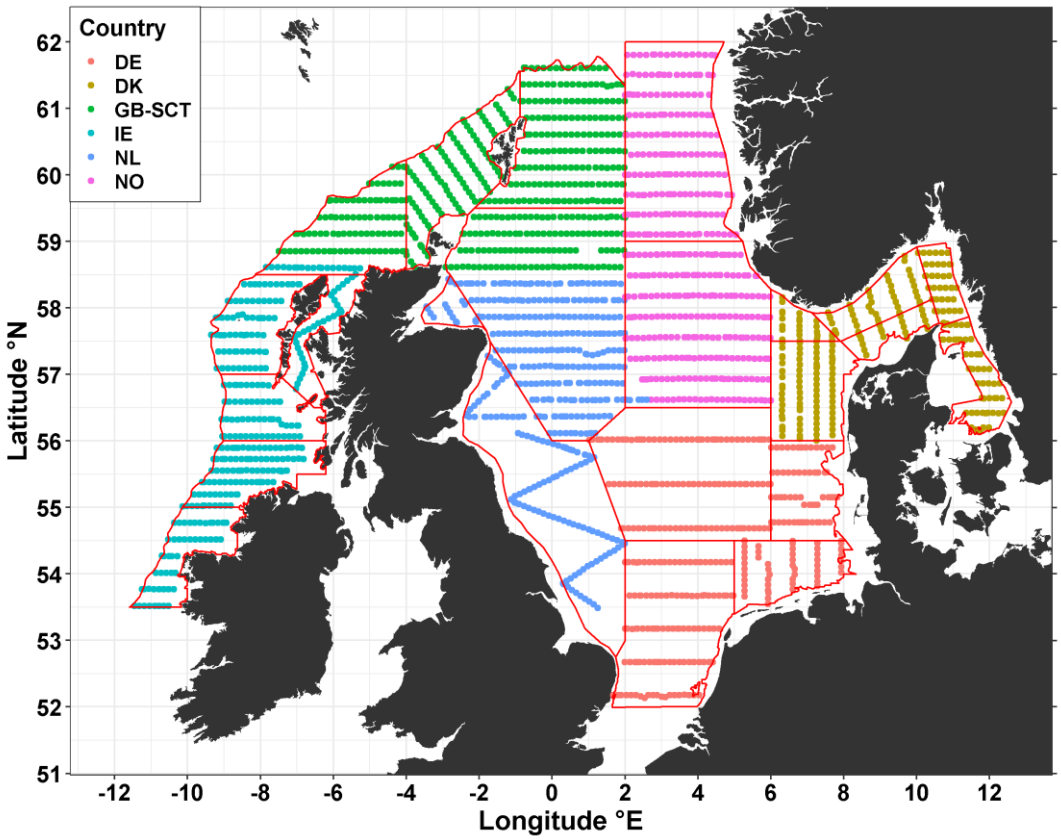


Figure 2.3.1.1. Cruise tracks and survey area coverage in the HERAS acoustic surveys in 2020 by nation.

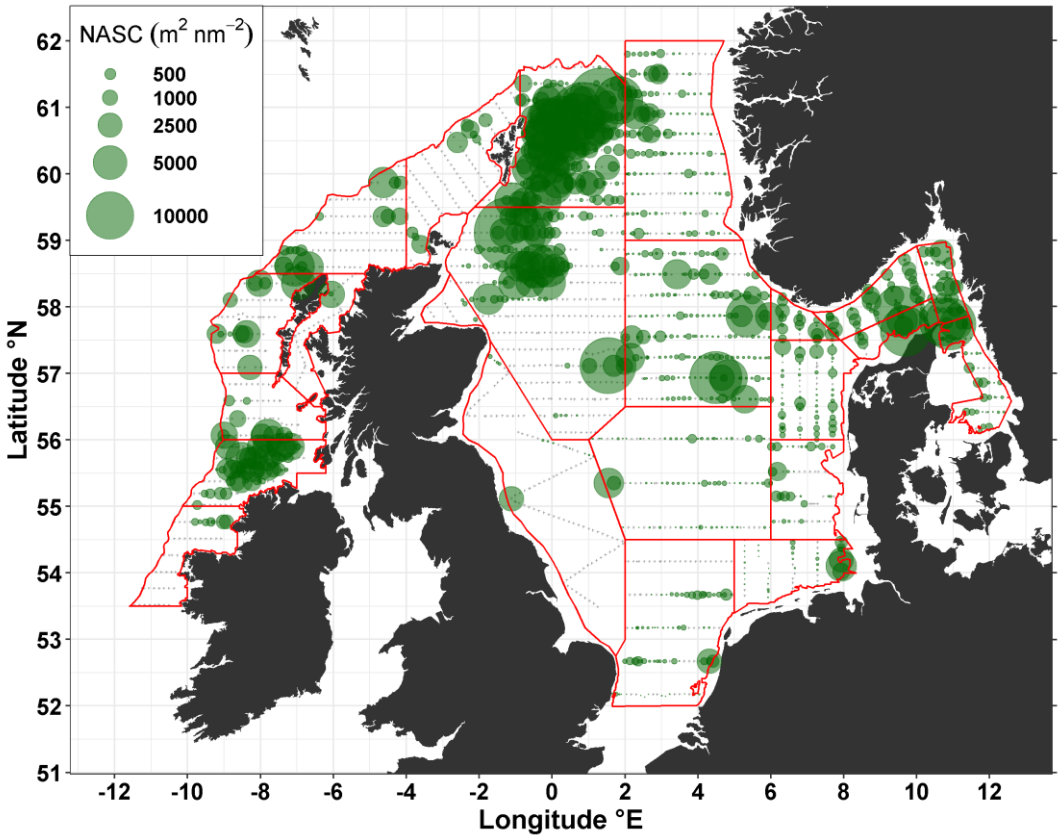


Figure 2.3.1.2. Distribution of NASC attributed to herring in HERAS in 2020. Acoustic intervals represented by light grey dot with green circles representing size and location of herring aggregations. NASC values are resampled at 5 nmi intervals along the cruise track. The red lines show the strata system.

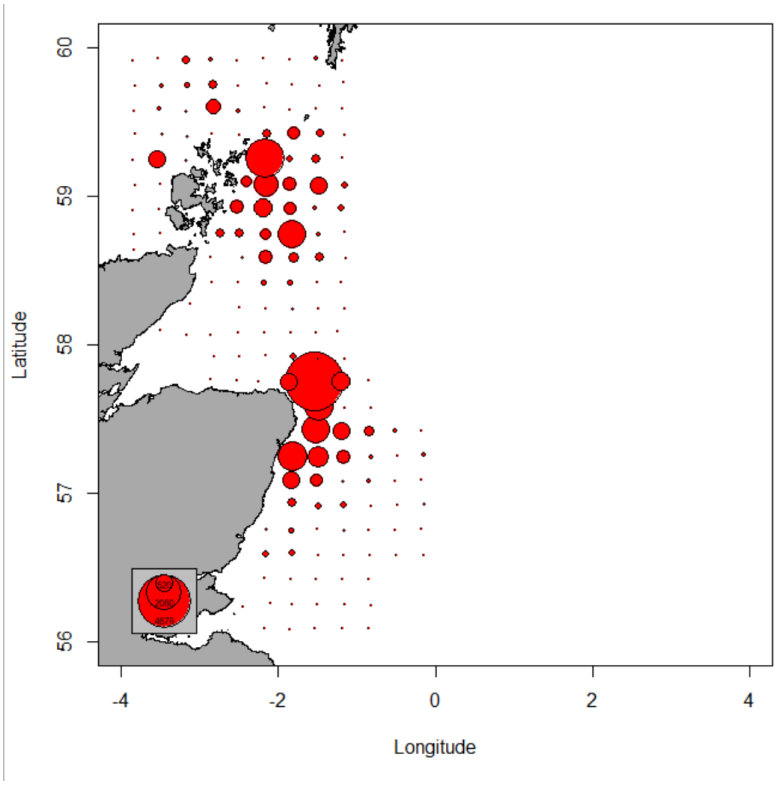


Figure 2.3.2.1. North Sea herring - Abundance of larvae < 10 mm (n/m²) in the Orkney/Shetlands and Buchan area, second half of September 2020 (maximum circle size = 4700 n/m²).

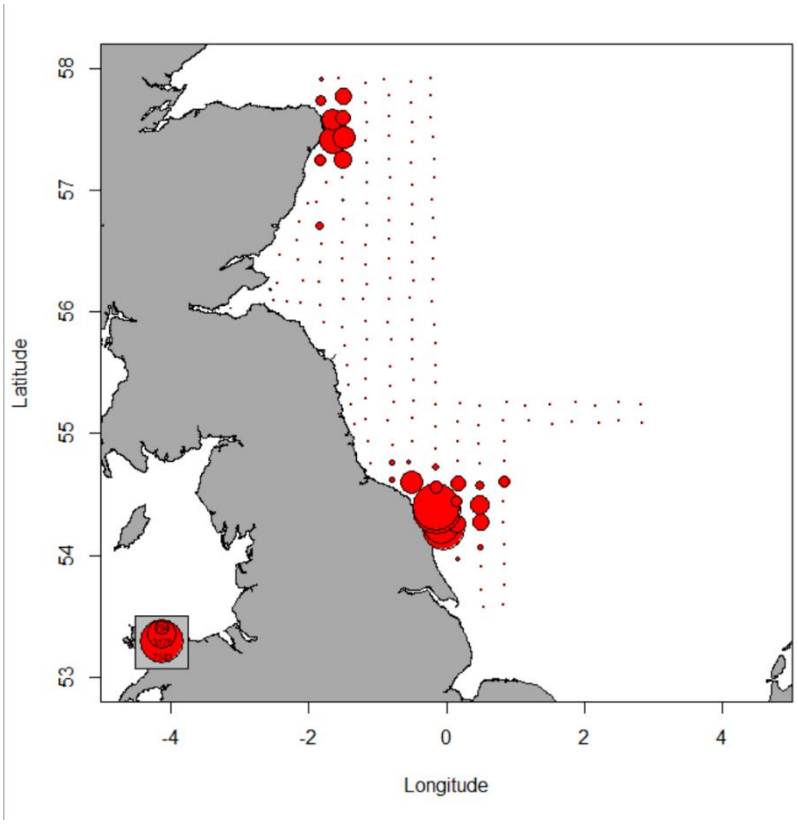


Figure 2.3.2.2: North Sea herring - Abundance of larvae < 10 mm (n/m²) in the Buchan and central North Sea area, second half of September 2020 (maximum circle size = 7100 n/m²).

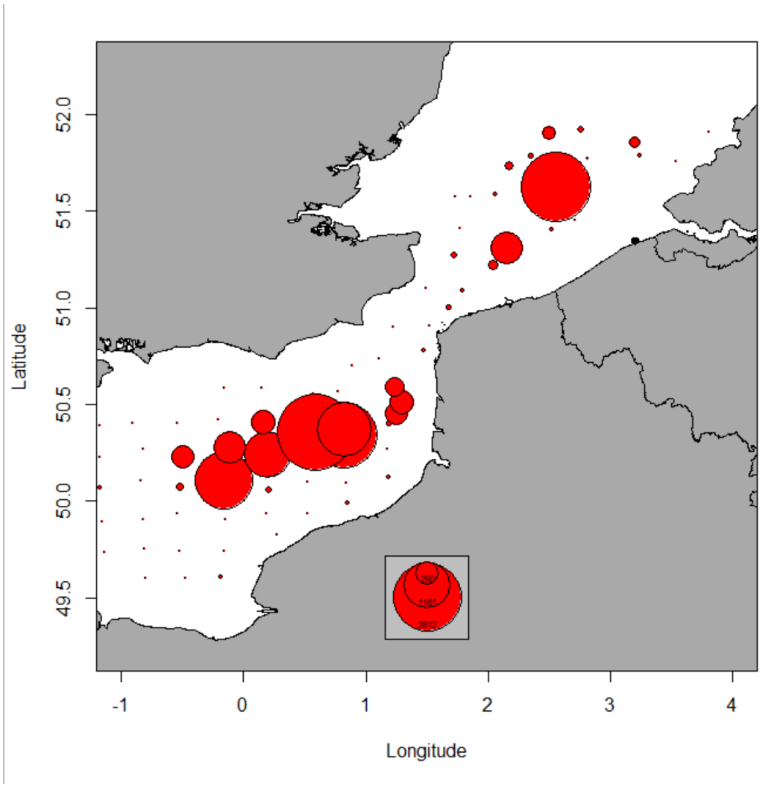


Figure 2.3.2.3. North Sea herring - Abundance of larvae <11 mm (n/m²) in the Southern North Sea and English Channel, second half of December 2020 (maximum circle size = 2600 n/m²).

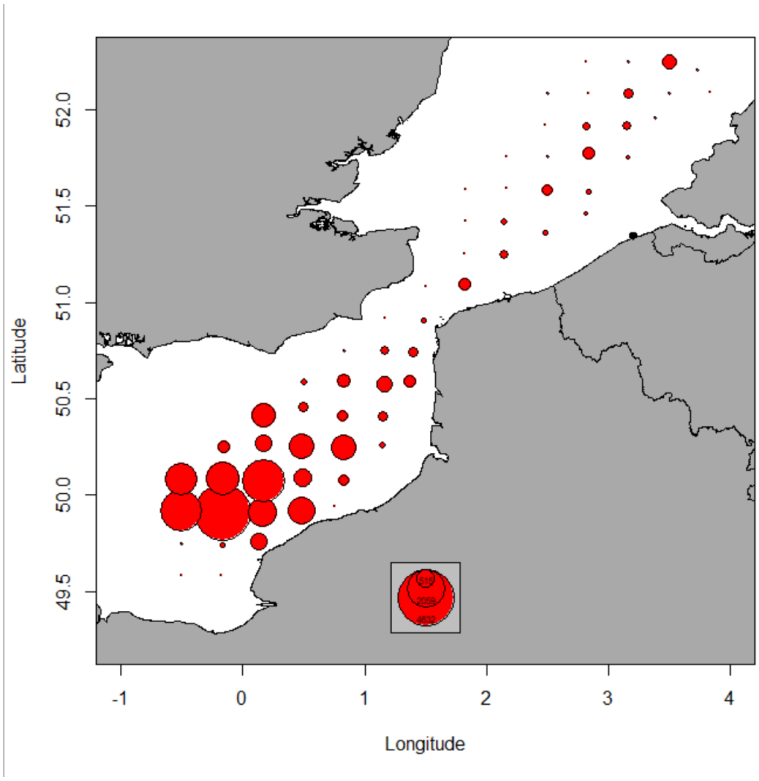


Figure 2.3.2.4. North Sea herring - Abundance of larvae <11 mm (n/m²) in the Southern North Sea and English Channel, first half of January 2021 (maximum circle size = 4600n/m²).

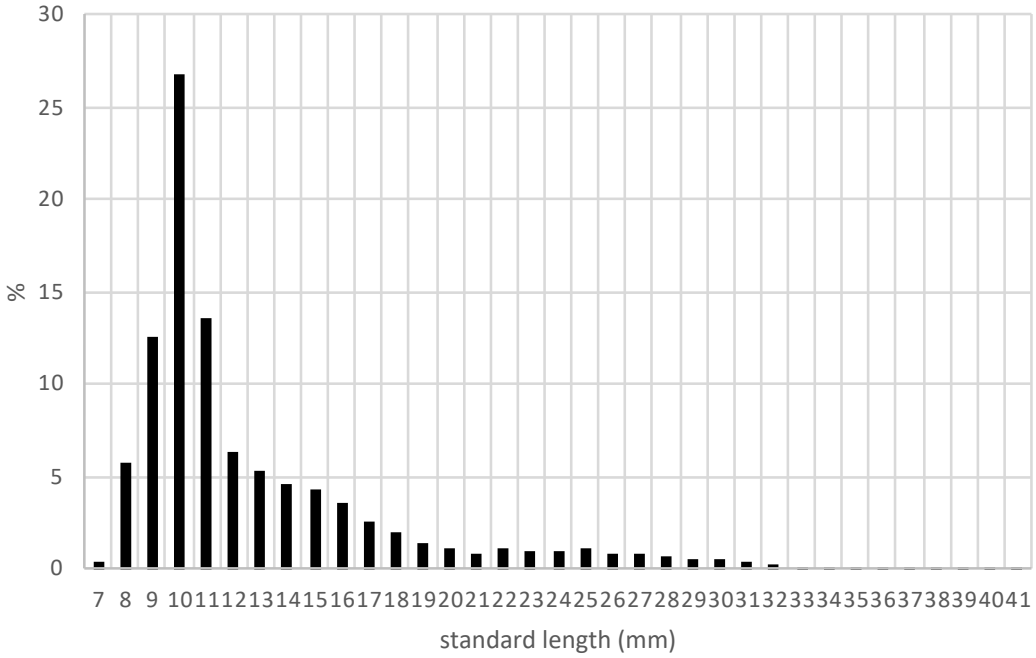


Figure 2.3.3.1.1 North Sea herring. Length distribution of all herring larvae caught during the 2021 Q1 IBTS.

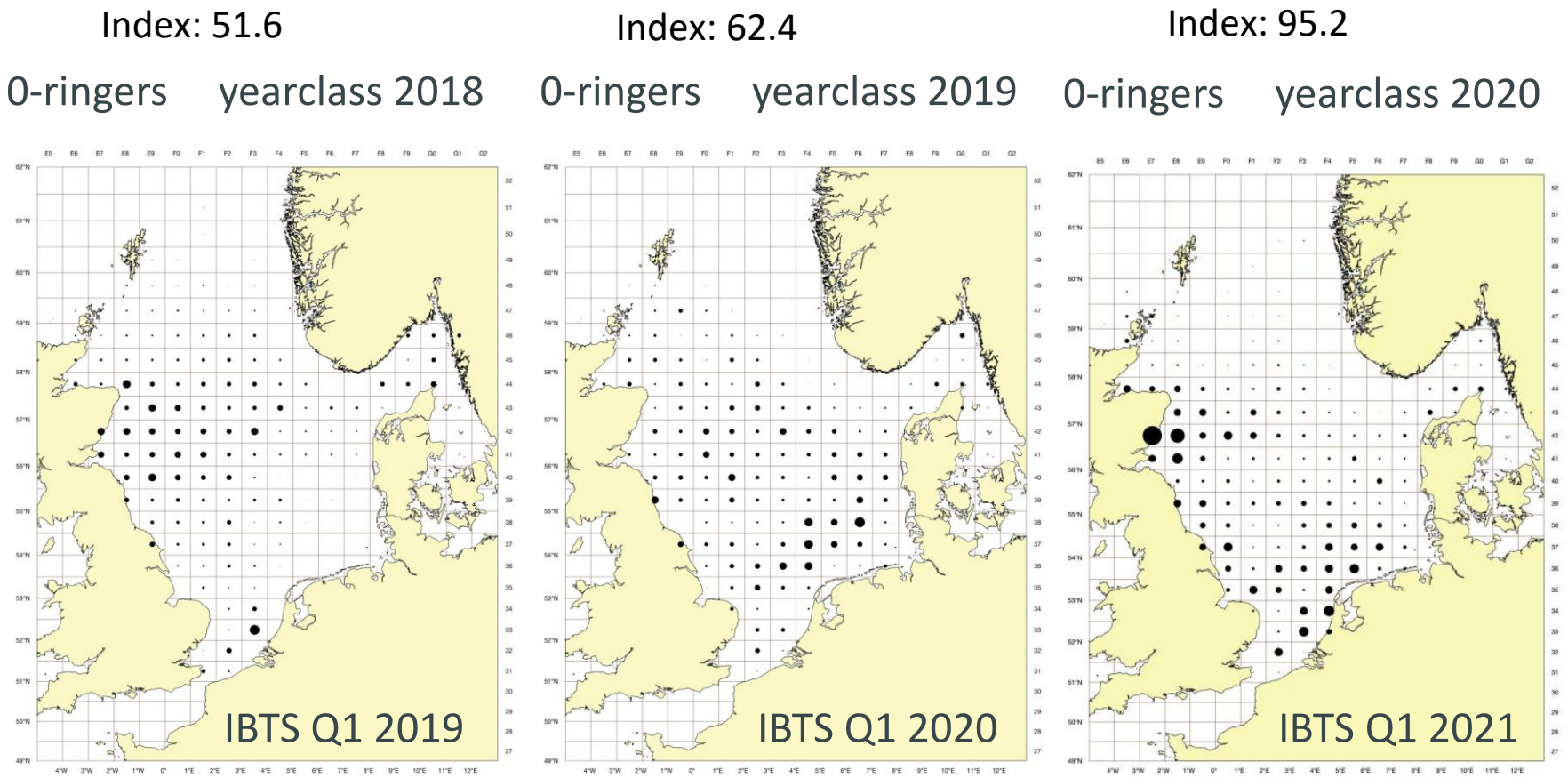


Figure 2.3.3.1.2 North Sea herring. Distribution of 0-ringer herring, year classes 2018–2020. Density estimates of 0-ringers within each statistical rectangle are based on MIK catches during IBTS in January/February 2019–2021. Areas of filled circles illustrate densities in no m^{-2}, the area of the largest circle represents a density of 4.28 m^{-2}. All circles are scaled to the same order of magnitude of the square root transformed densities.

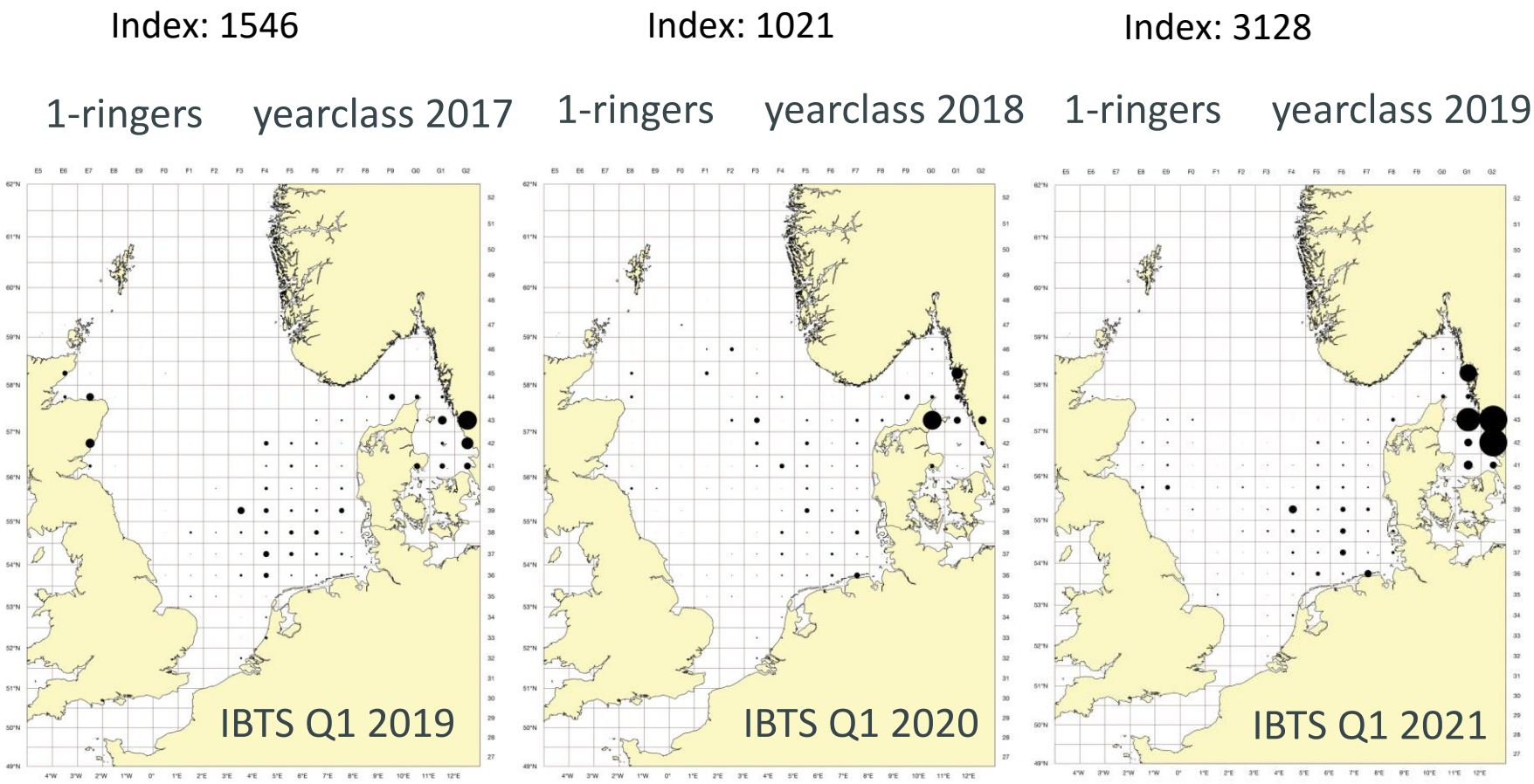


Figure 2.3.3.2.1 North Sea herring. Distribution of 1-ringer herring, year classes 2017–2019. Density estimates of 1-ringers within each statistical rectangle are based on GOV catches during IBTS in January/February 2019–2021. Areas of filled circles illustrate numbers per hour, scaled proportionally to the square root transformed CPUE data, the area of the largest circle extending across the boundary of a rectangle represents 201,826 h^{-1}.

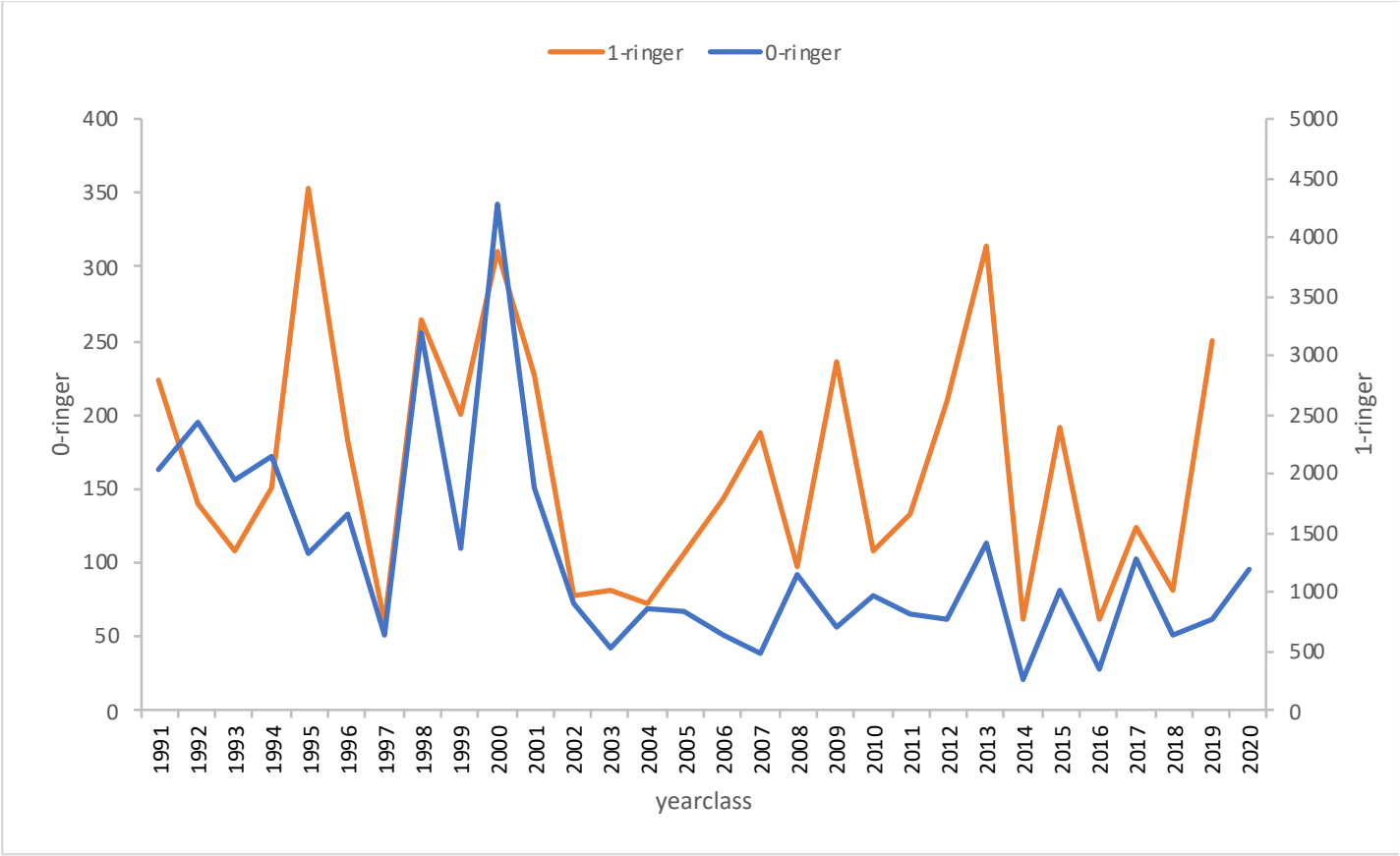
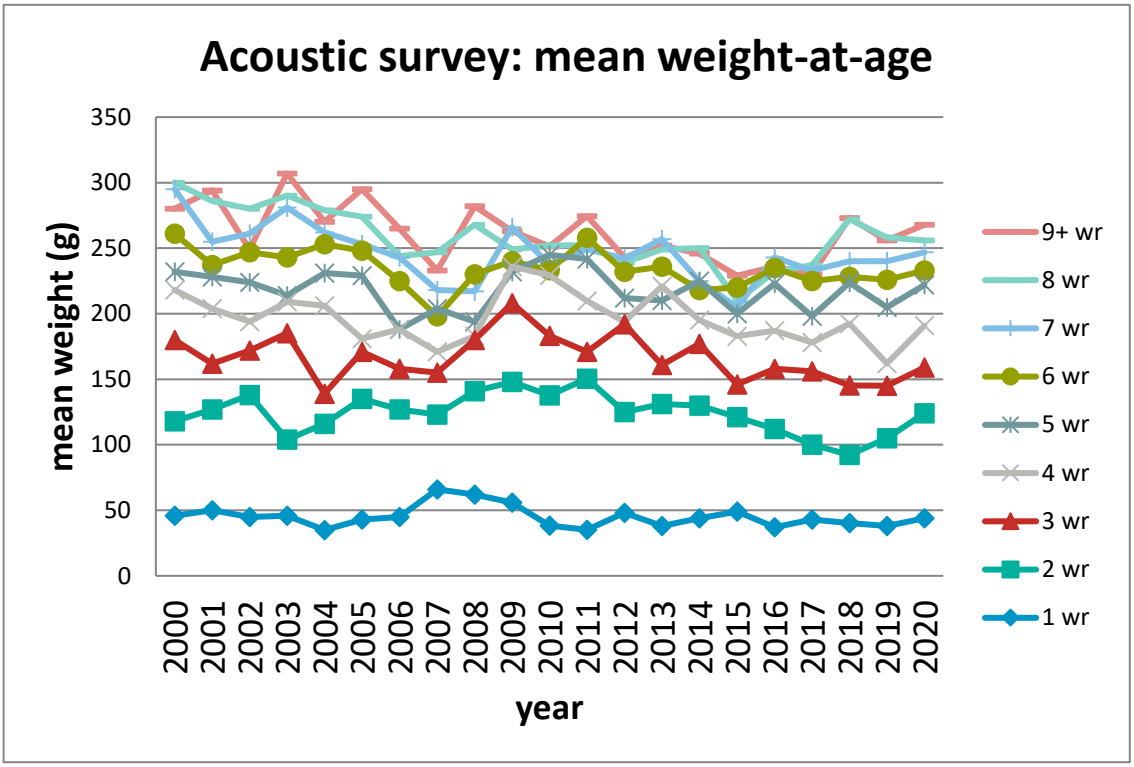


Figure 2.3.3.2.2 North Sea herring. Time series of 0-ringer (blue), and 1-ringer indices (red). Year classes 1991 to 2020 for 0-ringers, year classes 1991–2019 for 1-ringers.



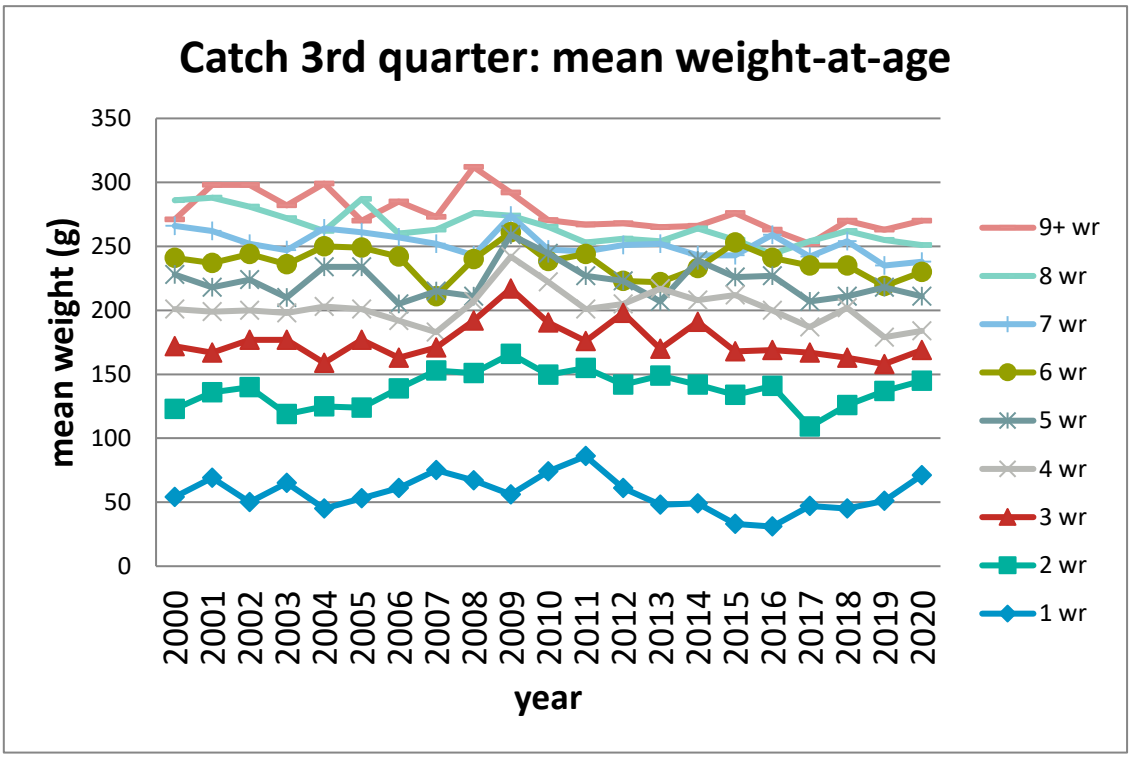


Figure 2.4.1.1. North Sea Herring. Mean weights-at-age for the 3rd quarter in Divisions 4 and 3.a from the acoustic survey (upper panel) and mean weights-in-the-catch (lower panel) for comparison.

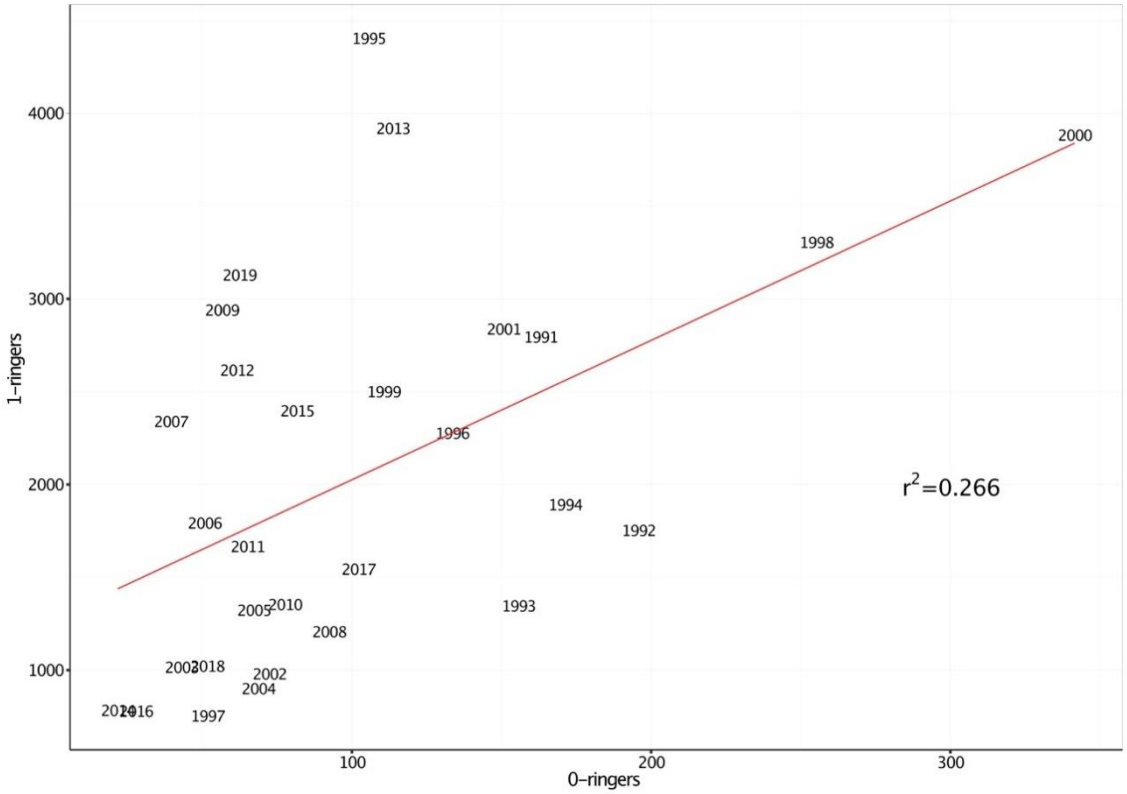


Figure 2.5.1.1 North Sea herring. Relationship between indices of 0-ringers, calculated with the new algorithm, and 1-ringers for year classes 1991 to 2019.

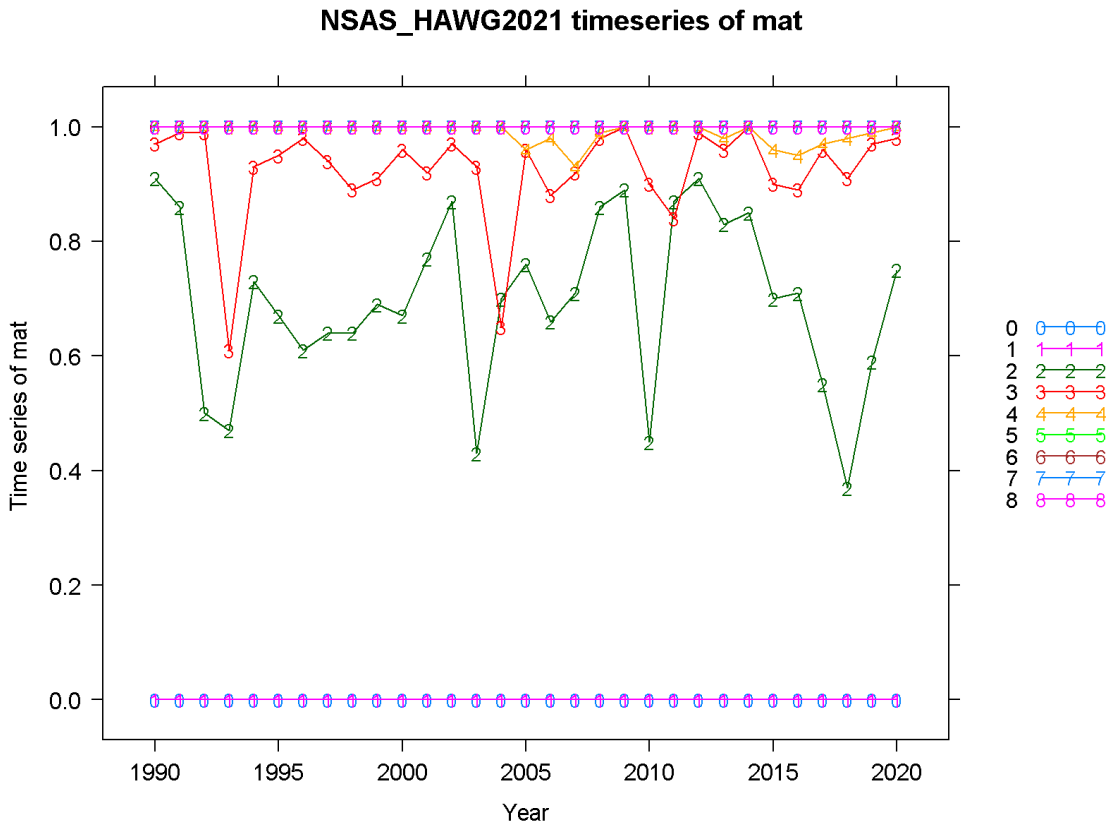


Figure 2.6.1.1. North Sea Herring. Time-series of proportion mature at ages 0 to 8+ as used in the North Sea herring assessment.

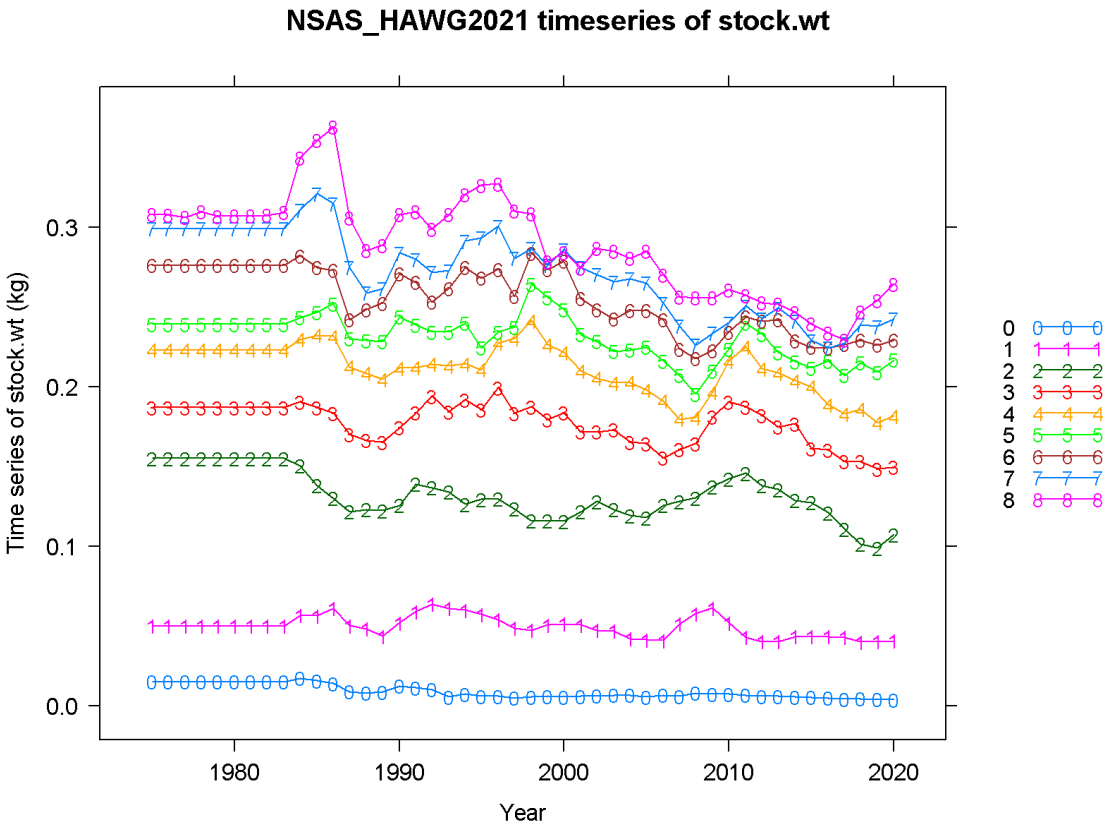


Figure 2.6.1.2. North Sea Herring. Time-series of stock weight at ages 0 to 8+ as used in the North Sea herring assessment.

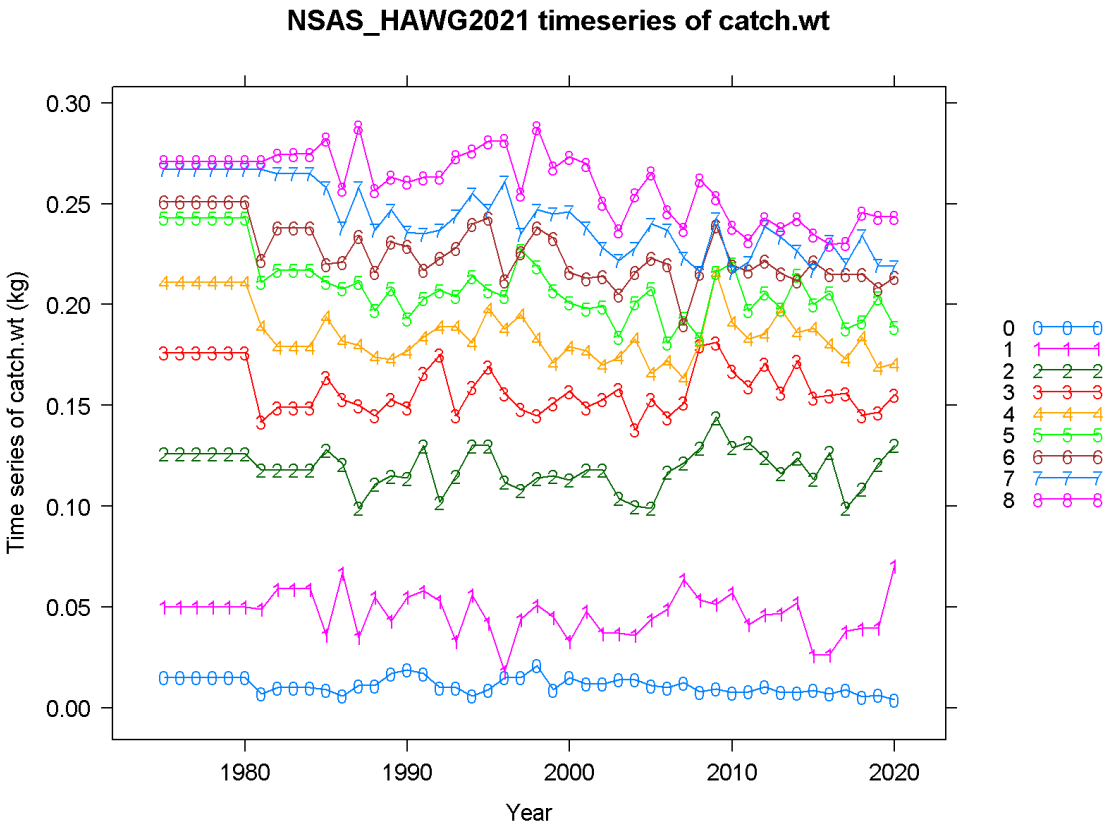


Figure 2.6.1.3. North Sea Herring. Time-series of catch weight at ages 0 to 8+ as used in the North Sea herring assessment.

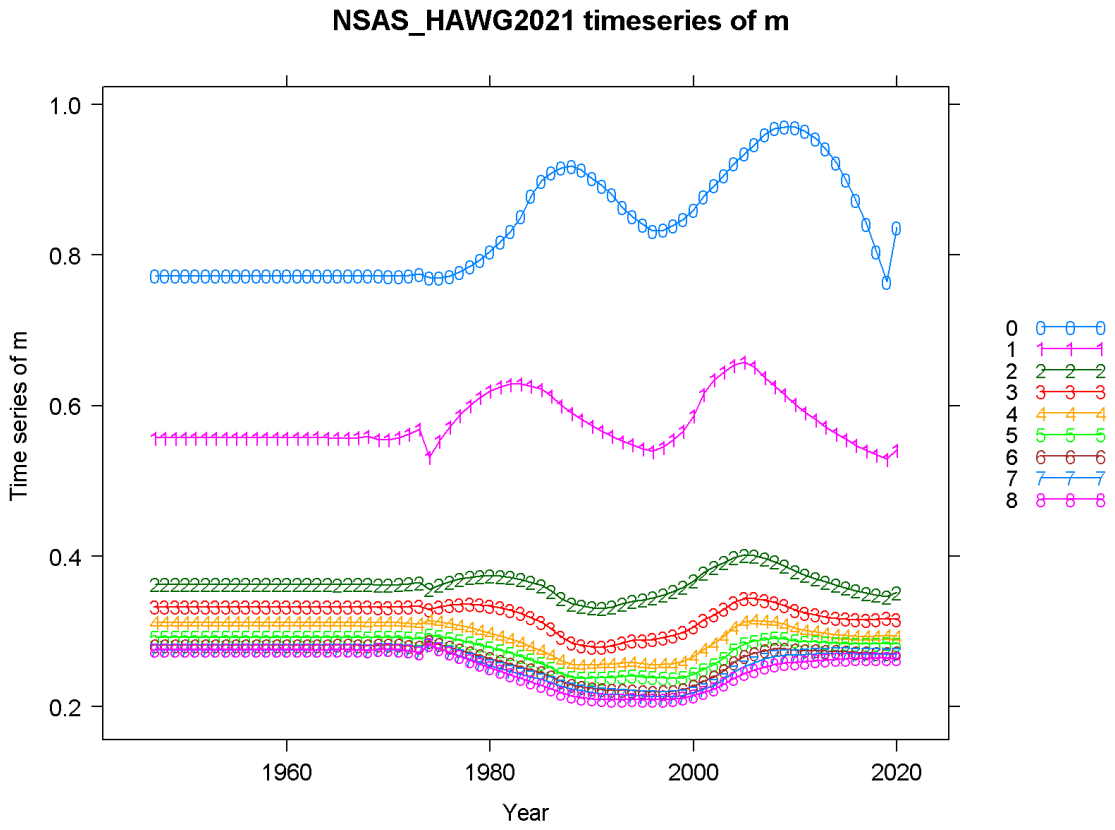


Figure 2.6.1.4. North Sea Herring. Time-series of absolute natural mortality values at age 0–8+ as used in the North Sea herring assessment. Natural mortality values are based on the 2019 North Sea key-run (ICES WGSAM, 2021).

Figure 2.6.1.5. North Sea Herring. Proportion of catch at age since 2000.

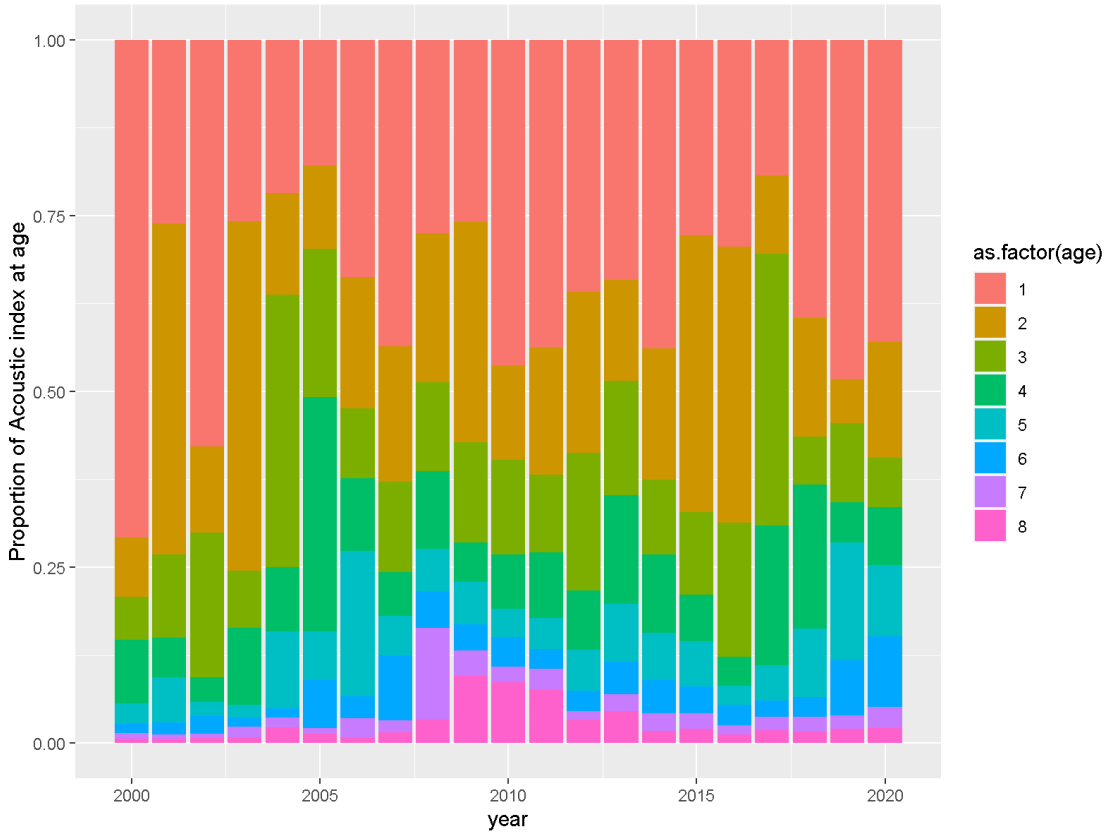


Figure 2.6.1.6. North Sea Herring. Proportion of HERAS index at age since 2000.

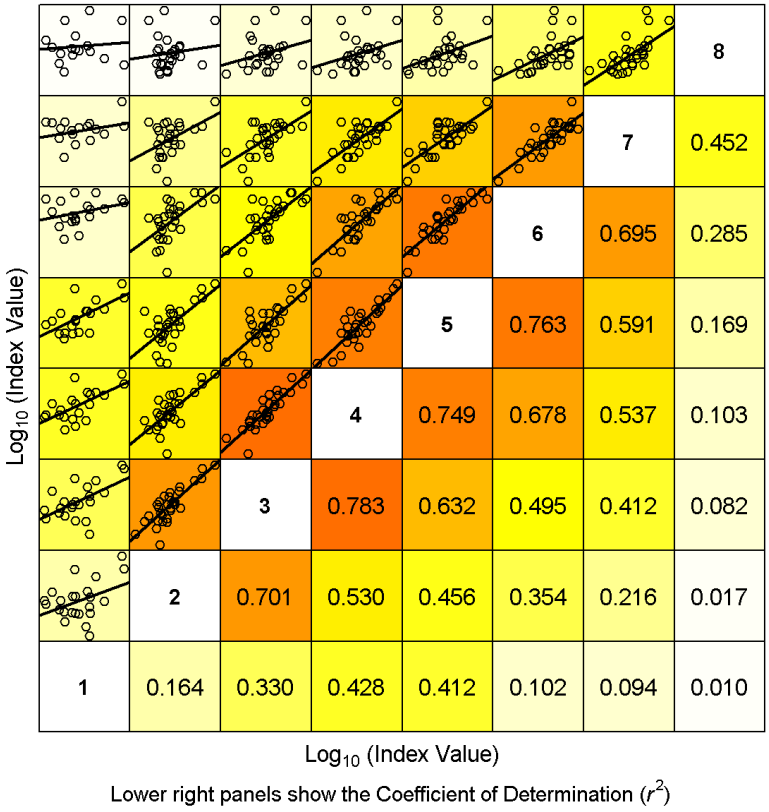


Figure 2.6.1.7. North Sea herring. Internal consistency plot of the acoustic survey (HERAS). Above the diagonal the linear regression is shown including the observations (in points) while under the diagonal the r2 value that is associated with the linear regression is given.

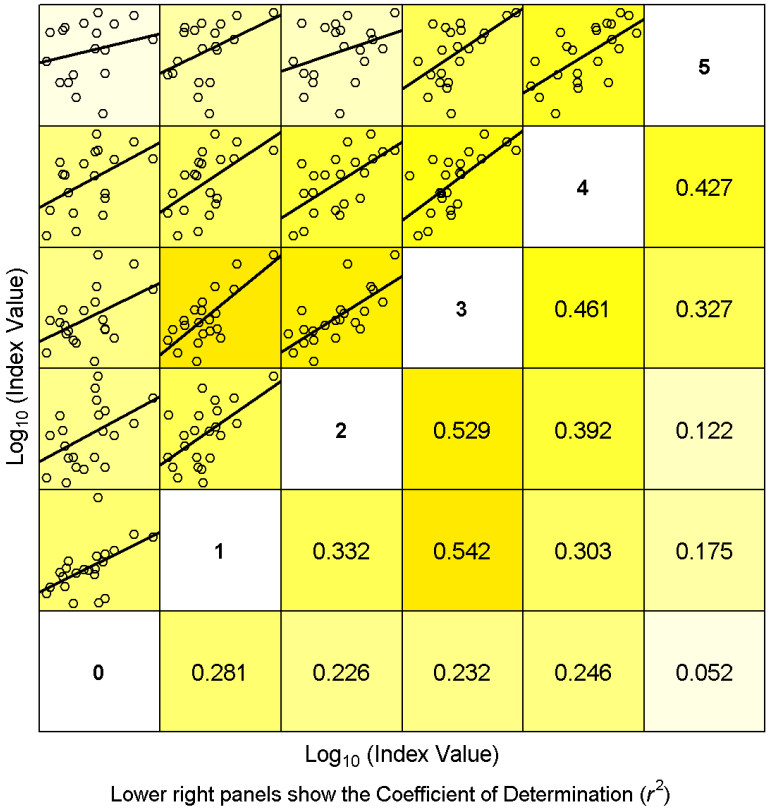


Figure 2.6.1.8. North Sea herring. Internal consistency plot of the IBTS in quarter 3. Above the diagonal the linear regression is shown including the observations (in points) while under the diagonal the r2 value that is associated with the linear regression is given.

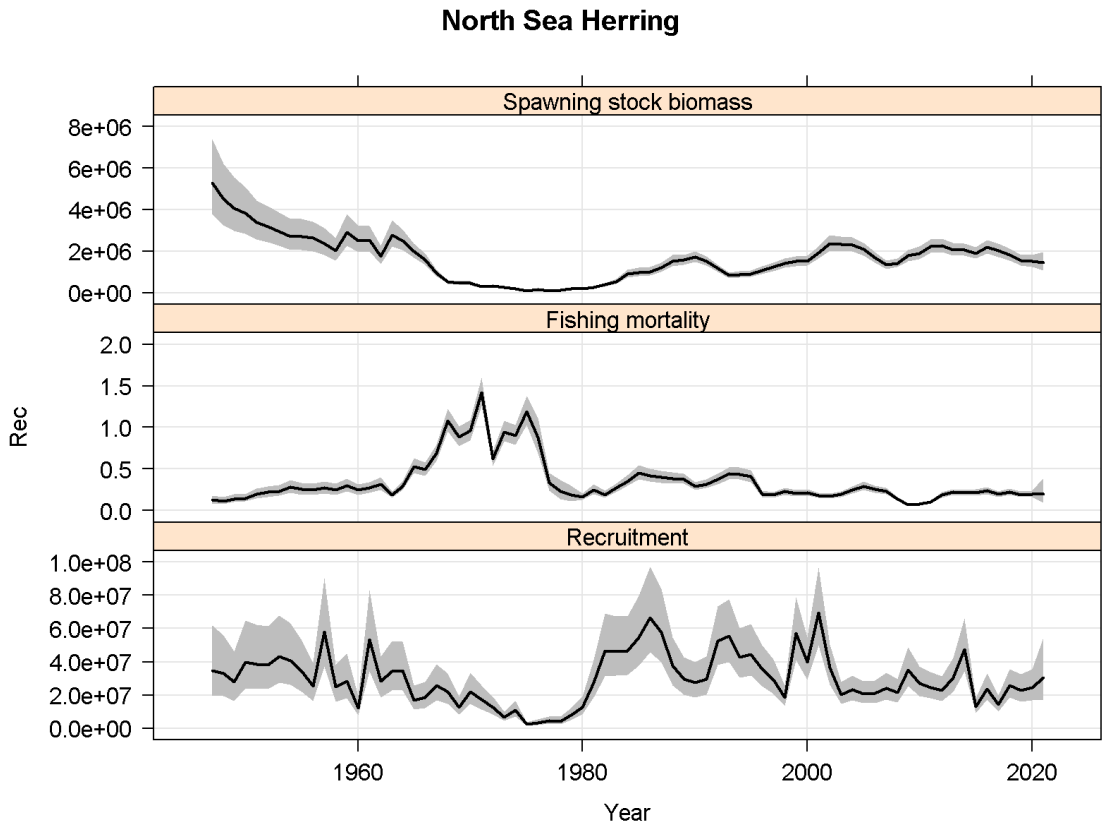


Figure 2.6.2.1. North Sea herring. Stock summary plot of North Sea herring with associated uncertainty for SSB (top panel), F ages 2–6 (middle panel) and recruitment (bottom panel).

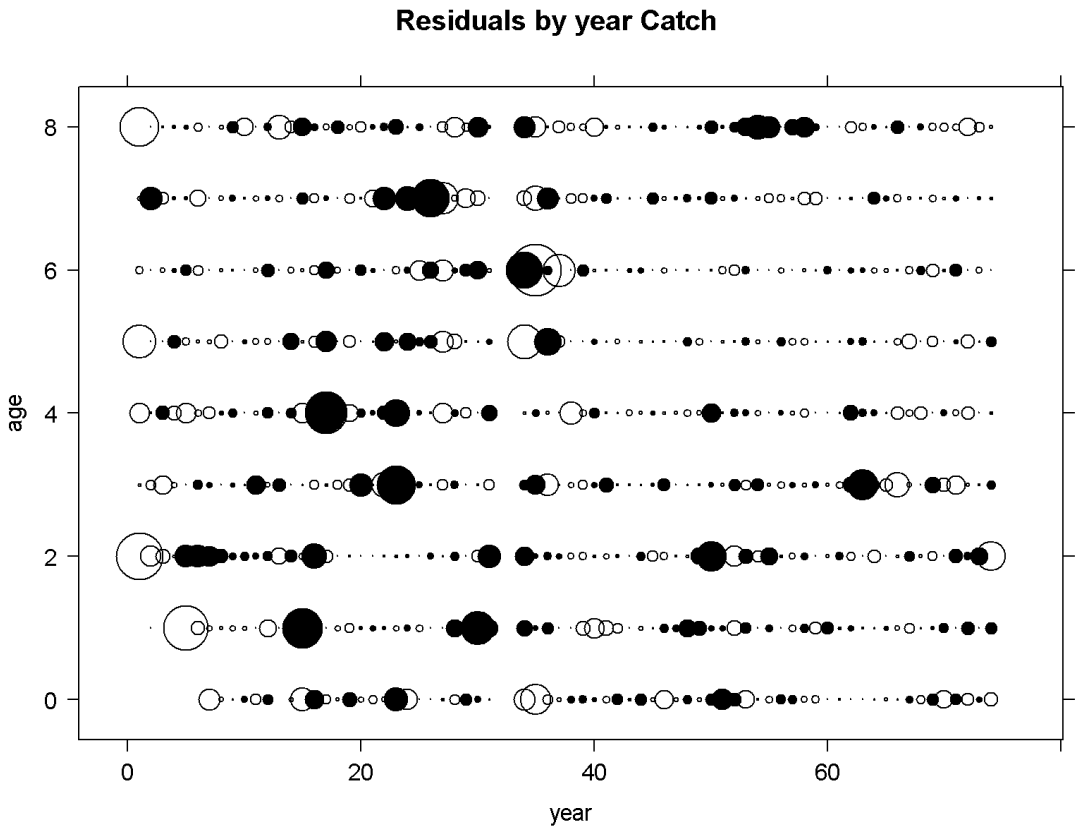


Figure 2.6.2.2. North Sea herring. Bubble plot of standardized catch residual at age.

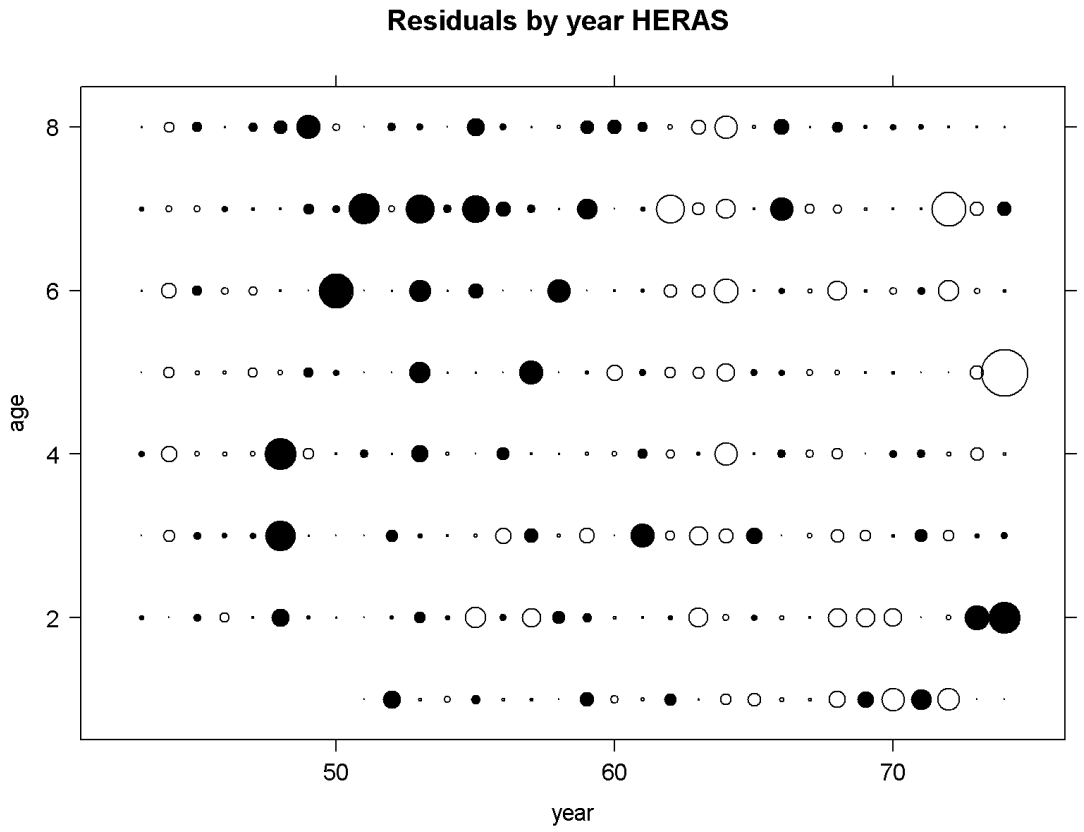


Figure 2.6.2.3. North Sea herring. Bubble plot of standardized acoustic survey residuals at age.

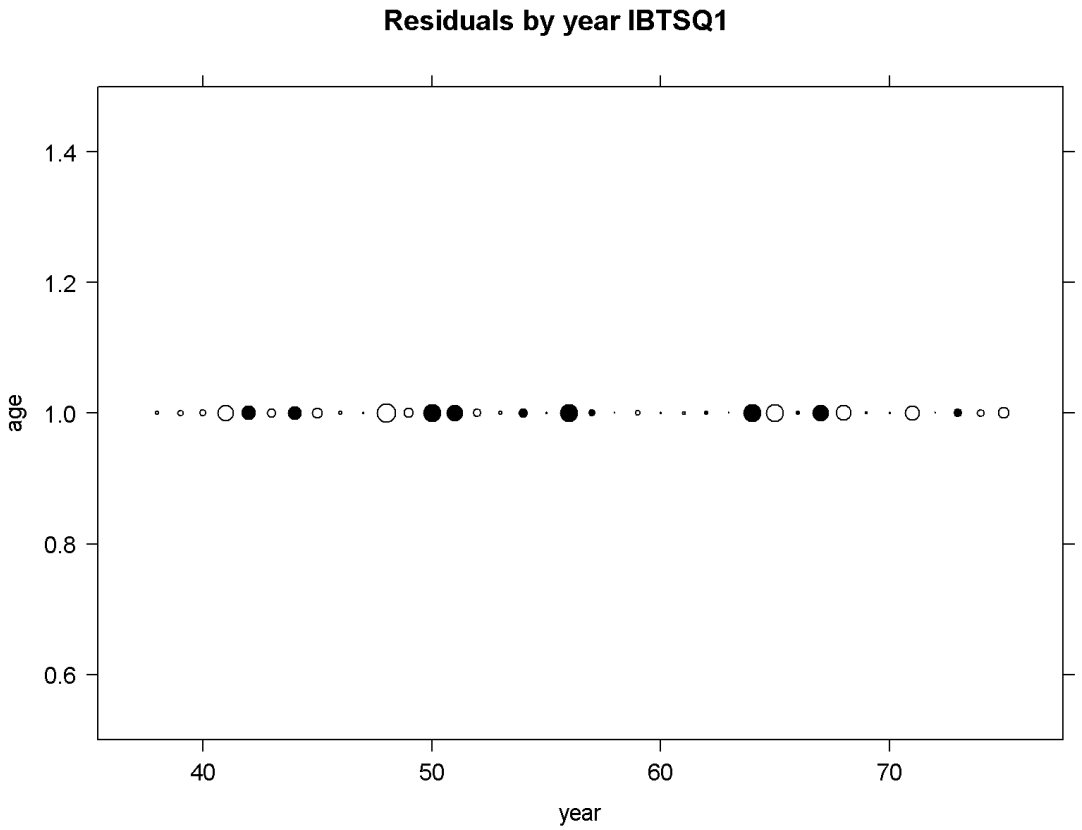


Figure 2.6.2.4. North Sea herring. Bubble plot of standardized IBTSQ1 residuals at age.

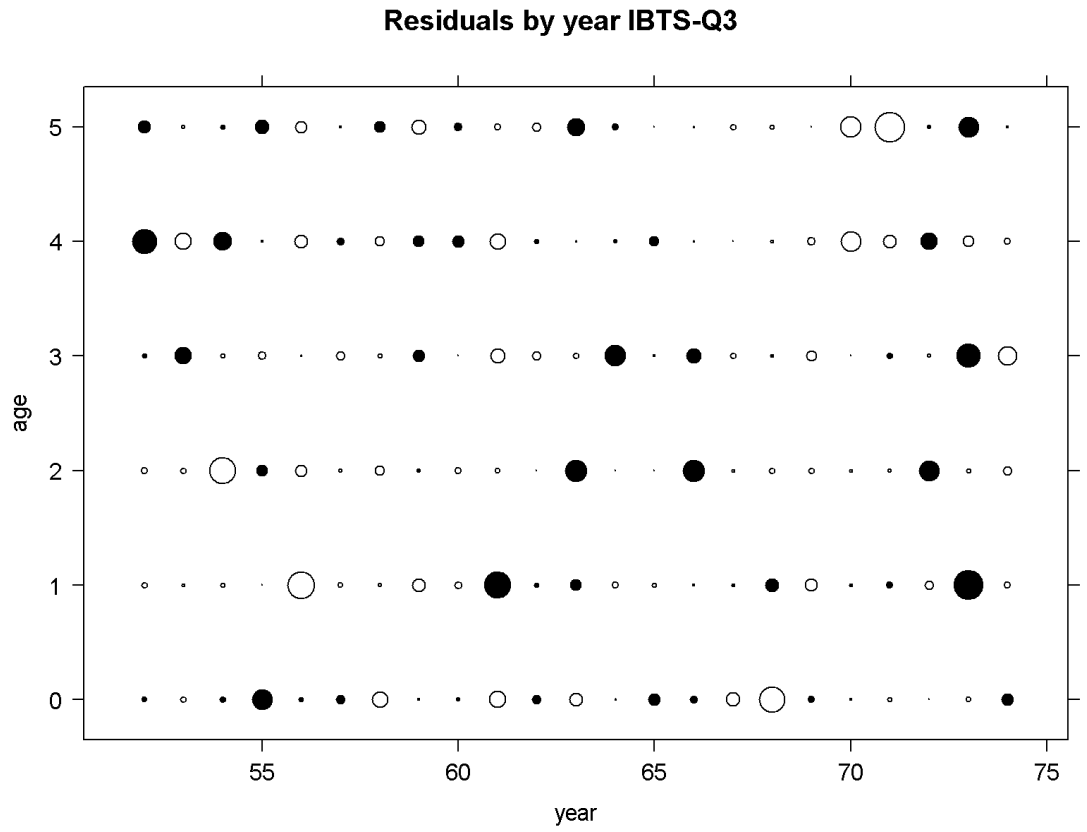


Figure 2.6.2.5. North Sea herring. Bubble plot of standardized IBTSQ3 residuals at age.

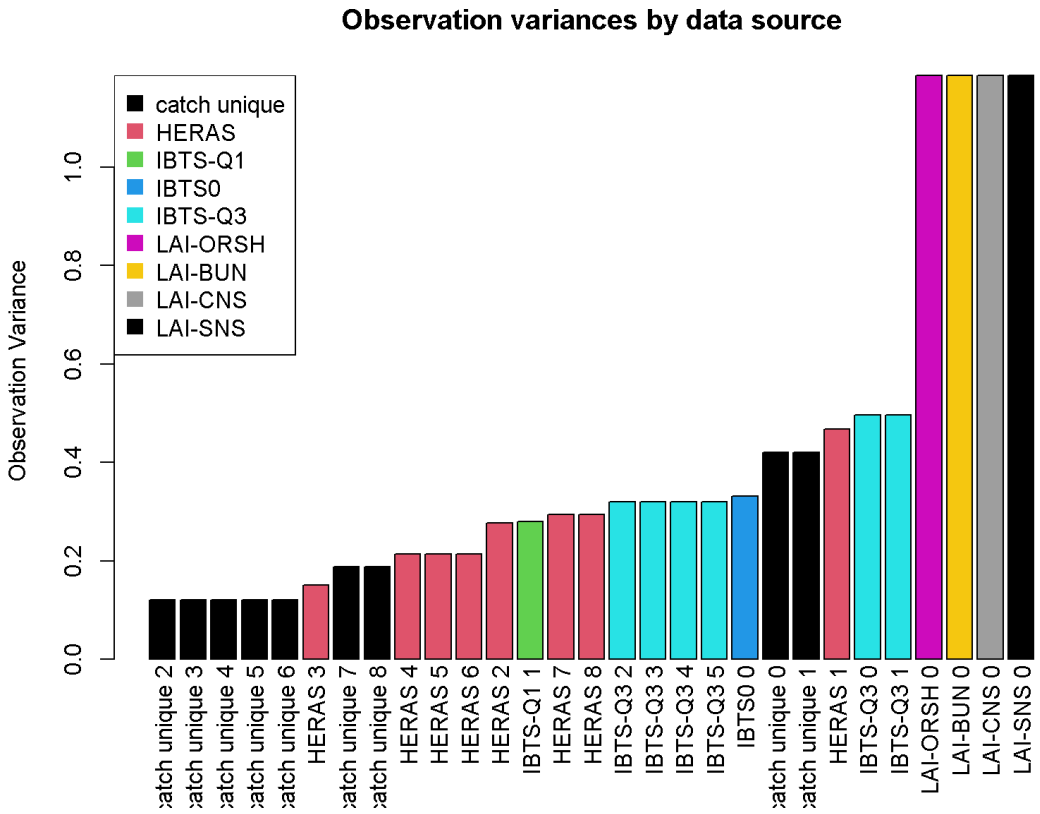


Figure 2.6.2.6. North Sea herring. Observation variance by data source as estimated by the assessment model. Observation variance is ordered from least (left) to most (right). Colours indicate the different data sources. Observation variance is not individually estimated for each data source thereby reducing the parameters needed to be estimated in the assessment model. In these cases of parameter bindings, observation variances have equal values.

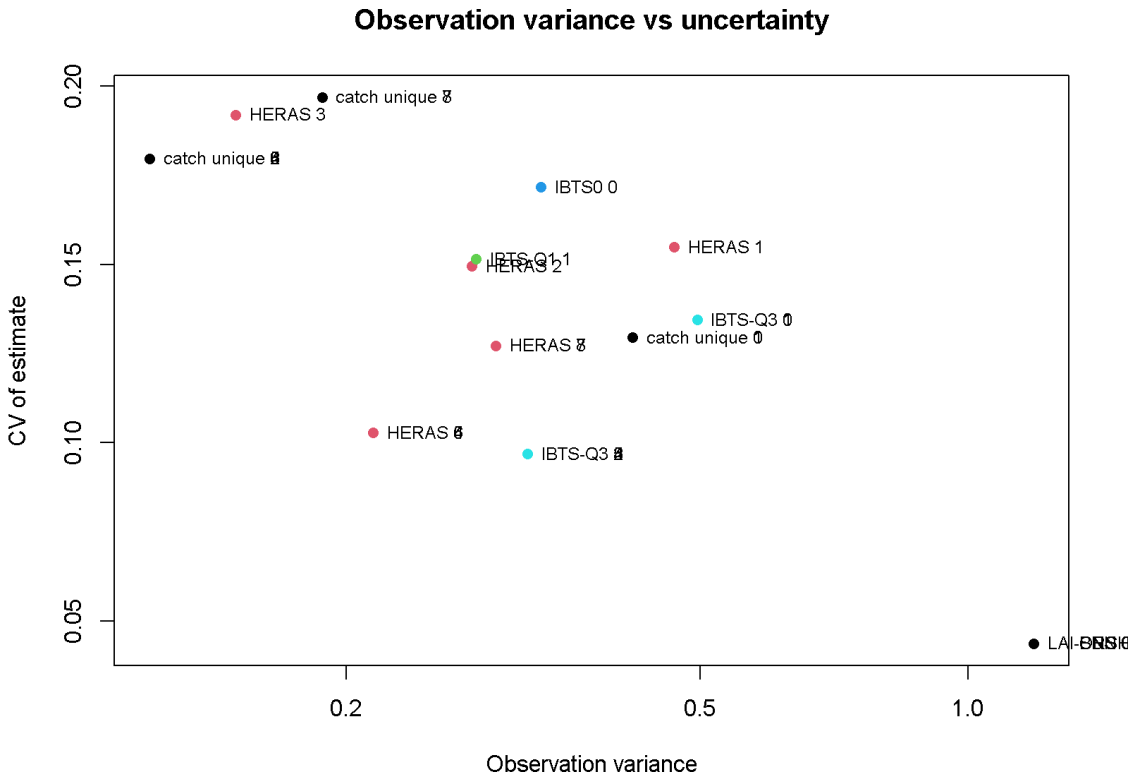


Figure 2.6.2.7. North Sea herring. Observation variance by data source as estimated by the assessment model plotted against the CV estimate of the observation variance parameter.

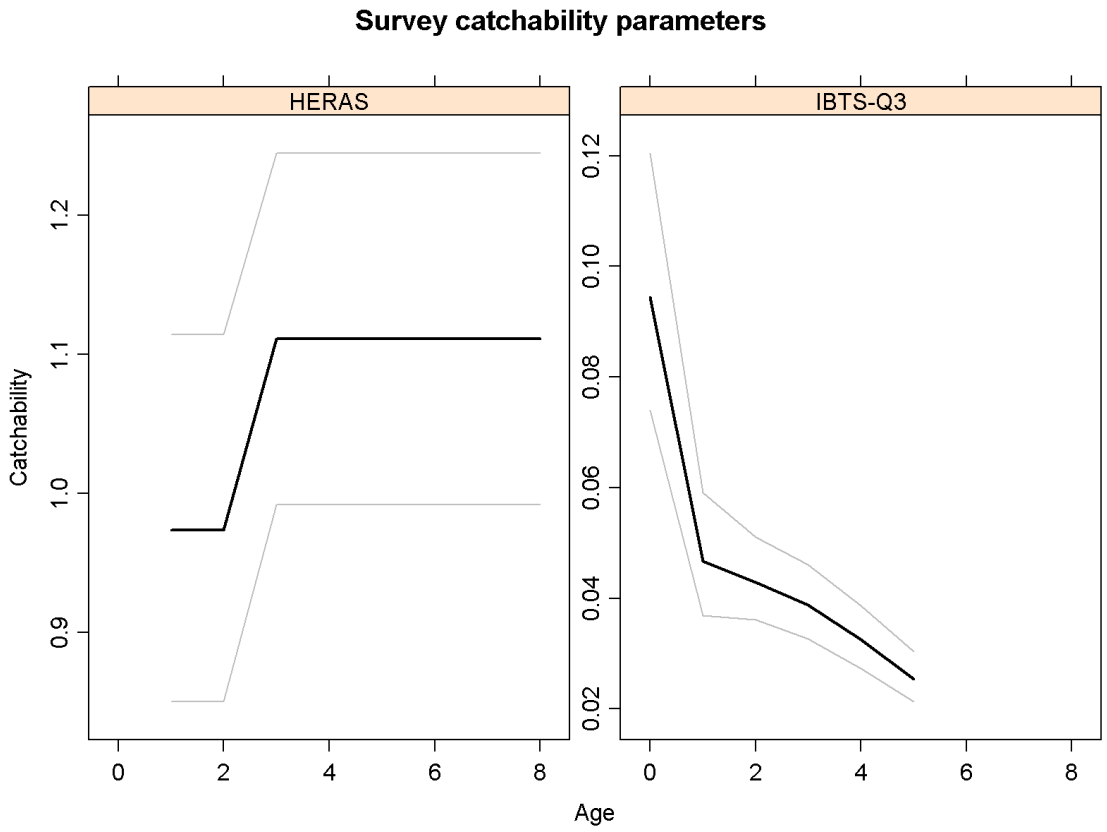


Figure 2.6.2.8. North Sea herring. Catchability at age for the HERAS and IBTSQ3 surveys.

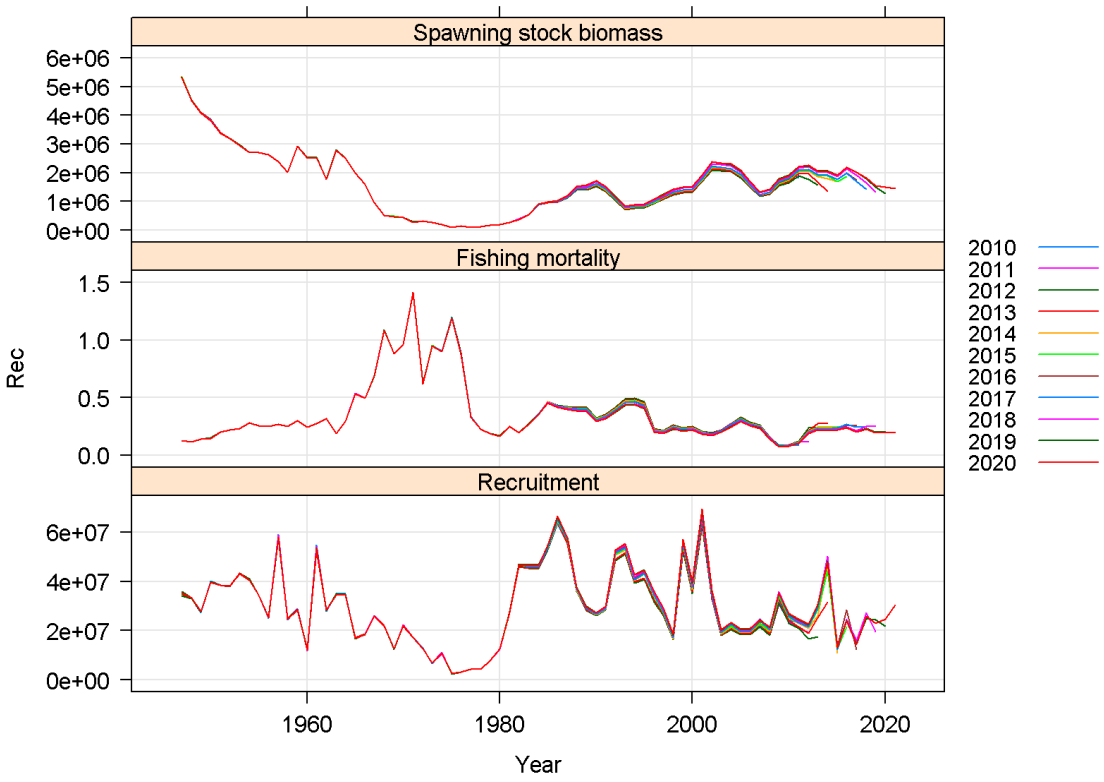


Figure 2.6.2.9. North Sea herring. Assessments retrospective pattern of SSB (top panel) F (middle panel) and recruitment (bottom panel).

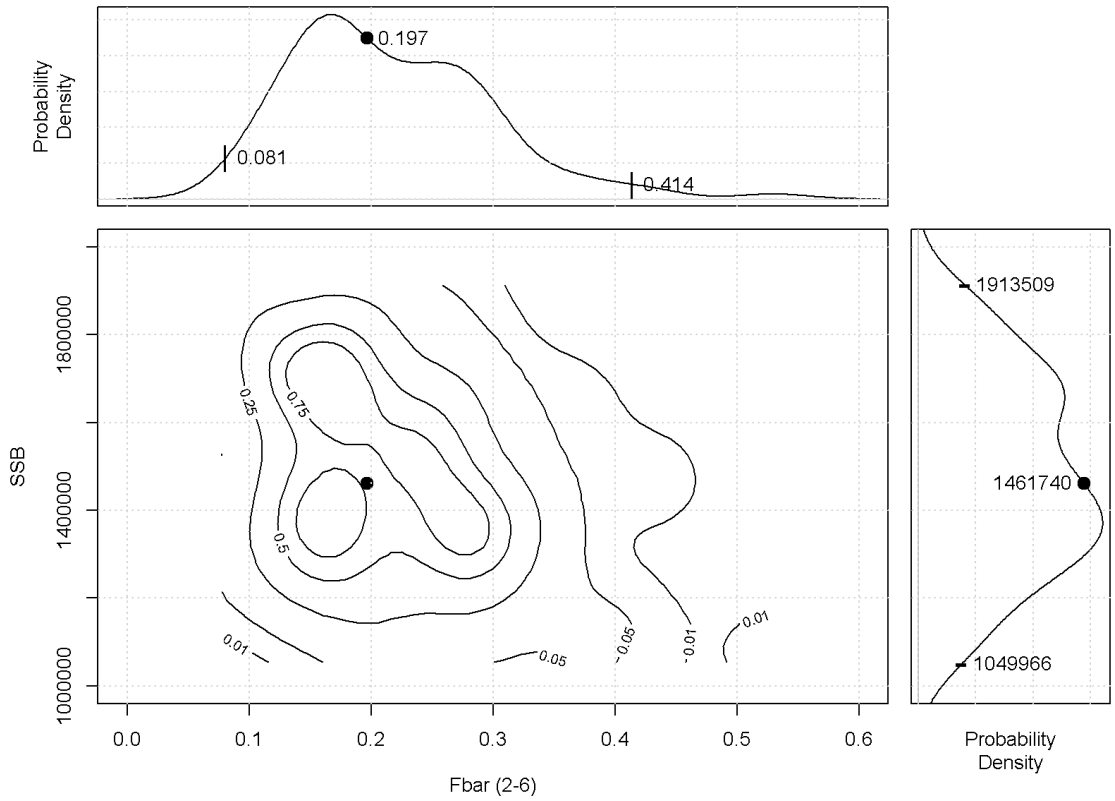


Figure 2.6.2.10. North Sea herring. Model uncertainty; distribution and quantiles of estimated SSB and F2–6 in the terminal year of the assessment. Estimates of precision are based on a parametric bootstrap from the FLSAM estimated variance/covariance estimates from the model.

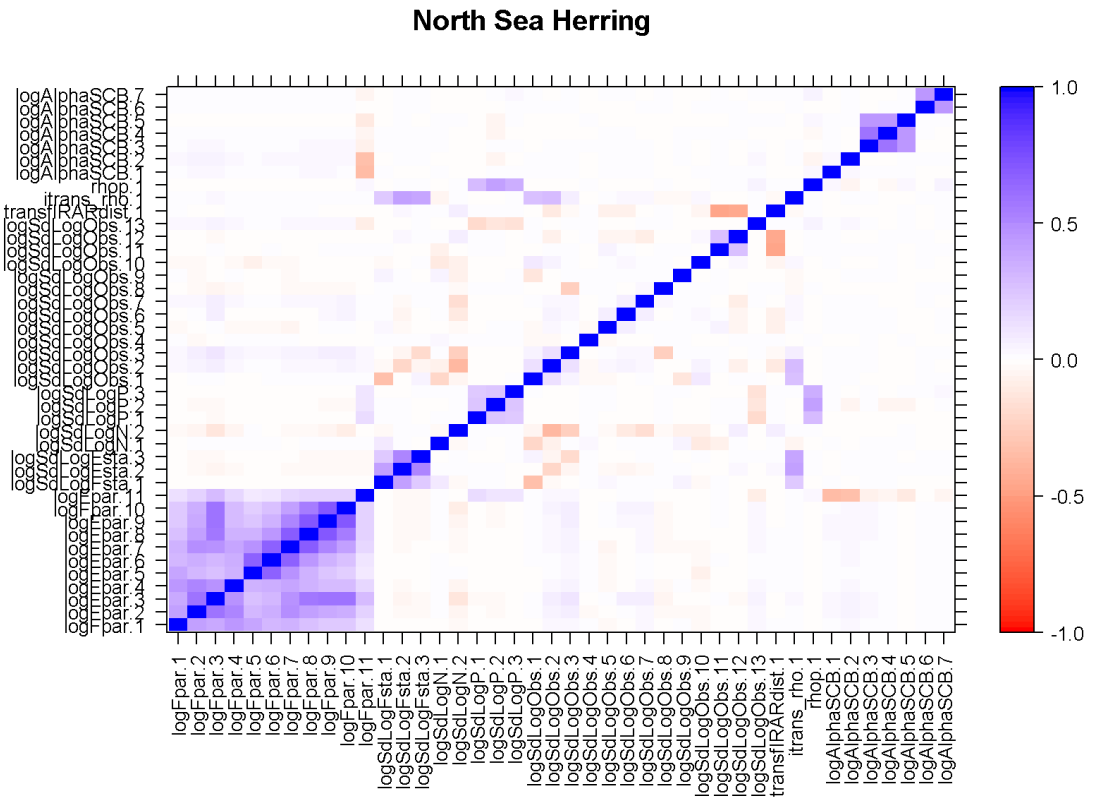


Figure 2.6.2.11. North Sea herring. Correlation plot of the FLSAM assessment model with the final set of parameters estimated in the model. The diagonal represents the correlation with the data source itself.

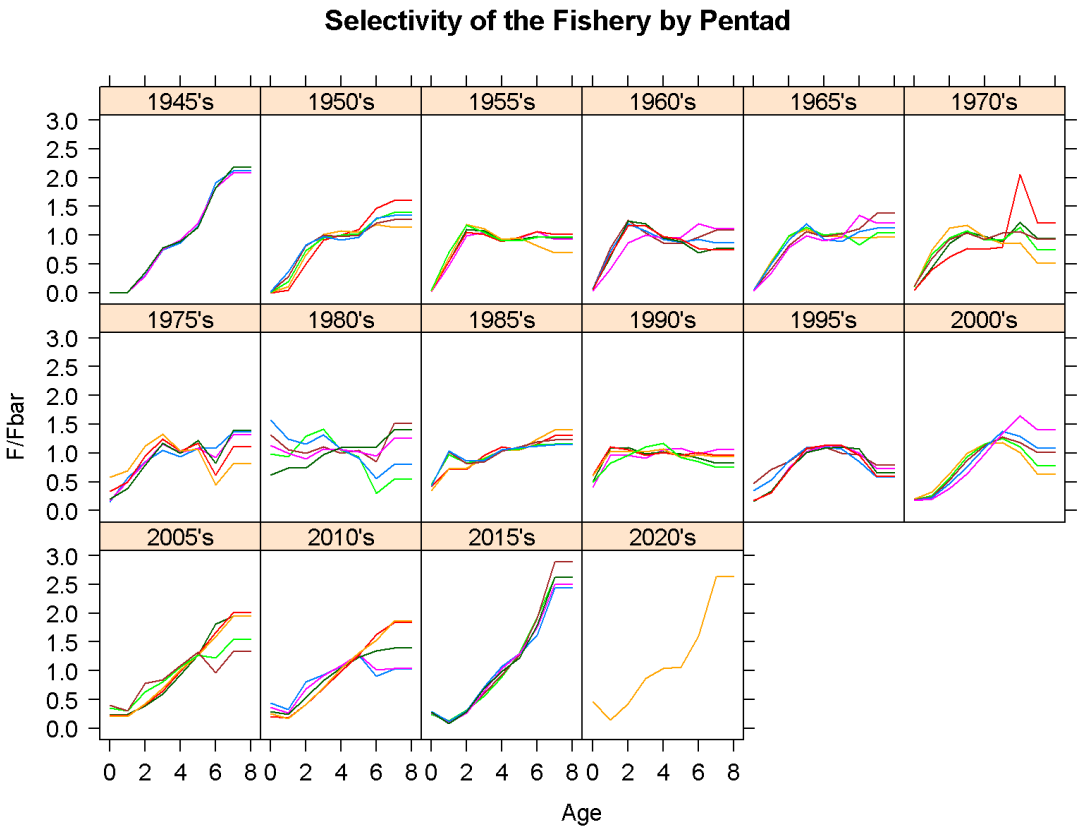


Figure 2.6.2.12. North Sea herring. Fishing selectivity by pentad.

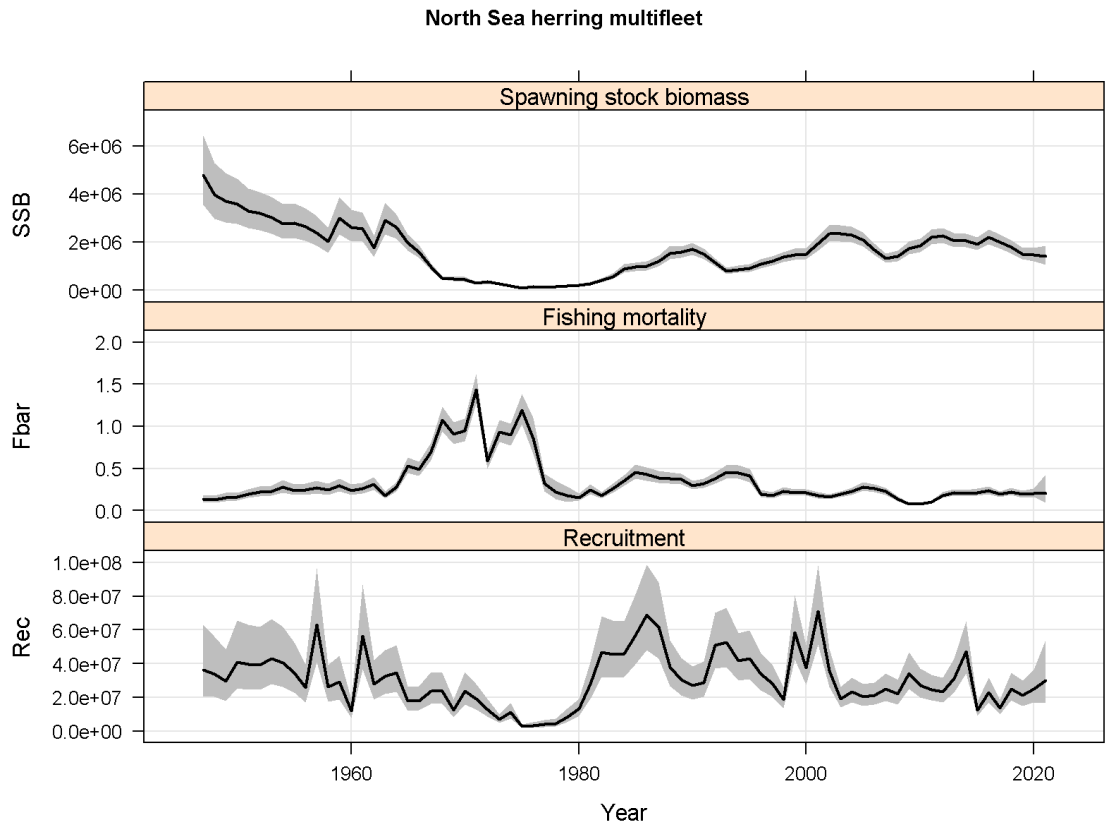


Figure 2.6.3.1 North Sea herring multi-fleet model. Stock summary plot with associated uncertainty for SSB (top panel), F ages 2–6 (middle panel) and recruitment (bottom panel).

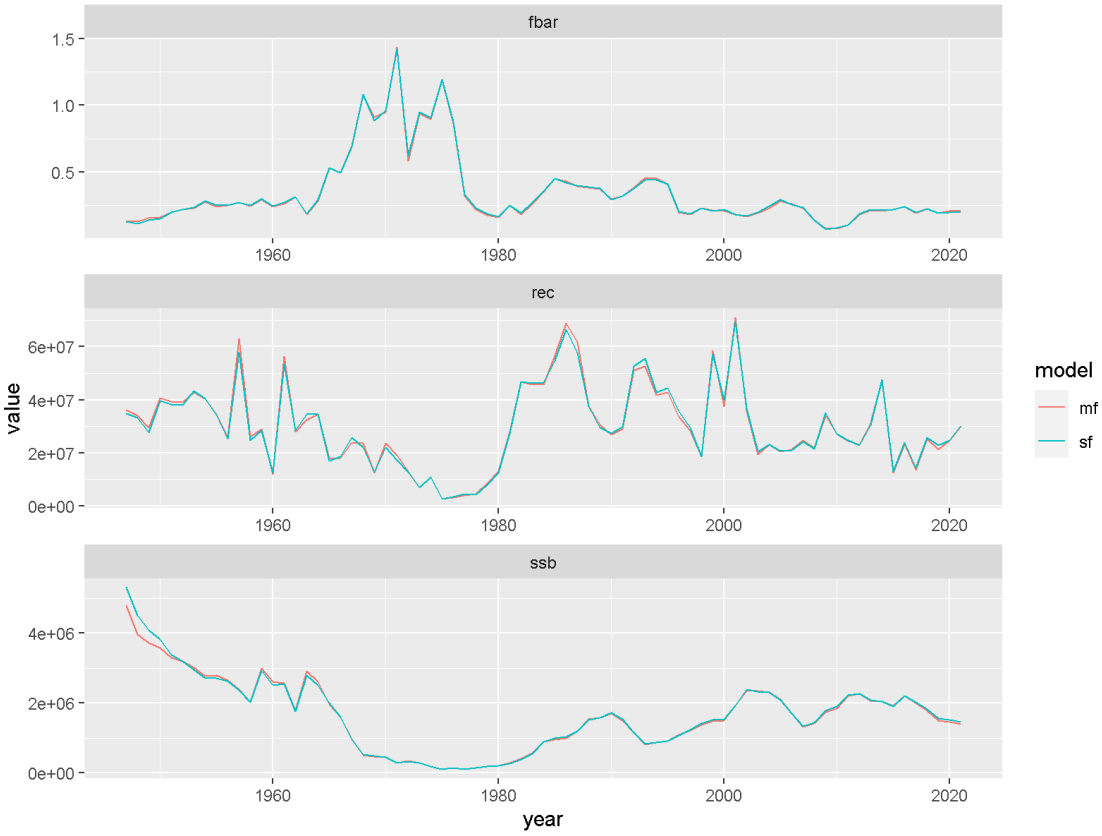


Figure 2.6.3.2 North Sea herring multi-fleet model. Comparison between single fleet and multi-fleet assessment models for SSB (top panel), F ages 2–6 (middle panel) and recruitment (bottom panel).

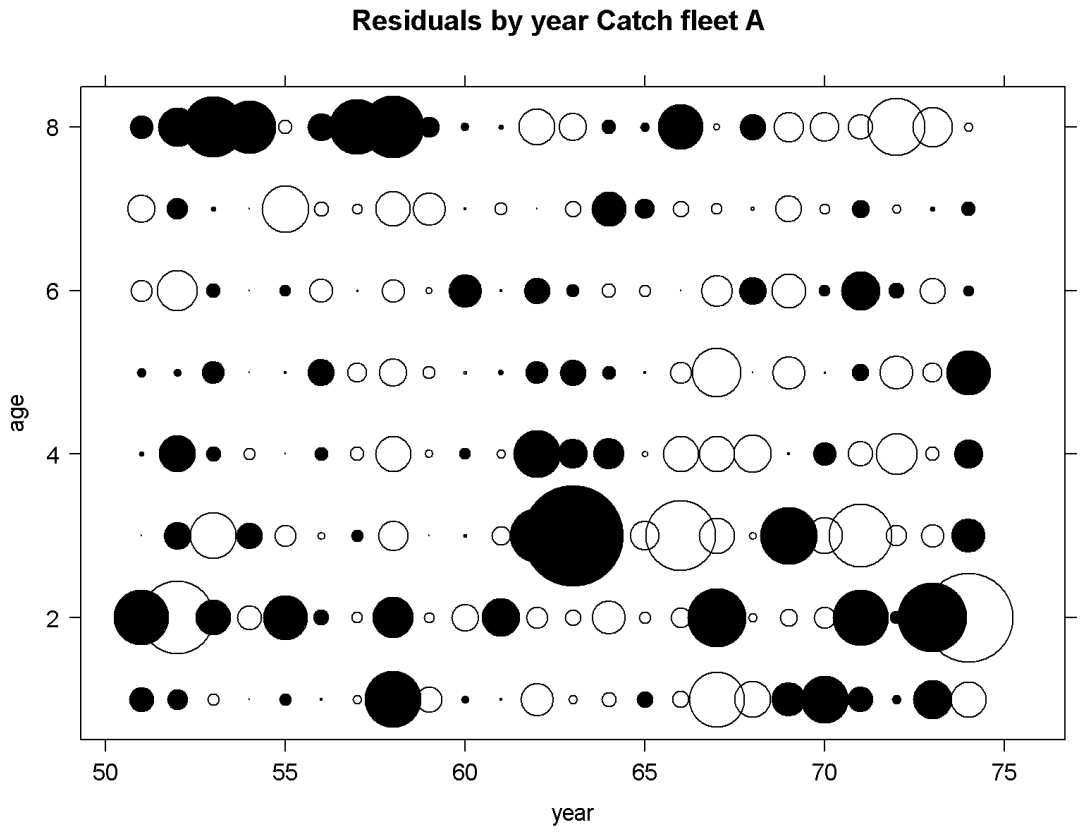


Figure 2.6.3.3. North Sea herring multifleet assessment model. Bubble plot of standardized residuals for catches of fleet A.

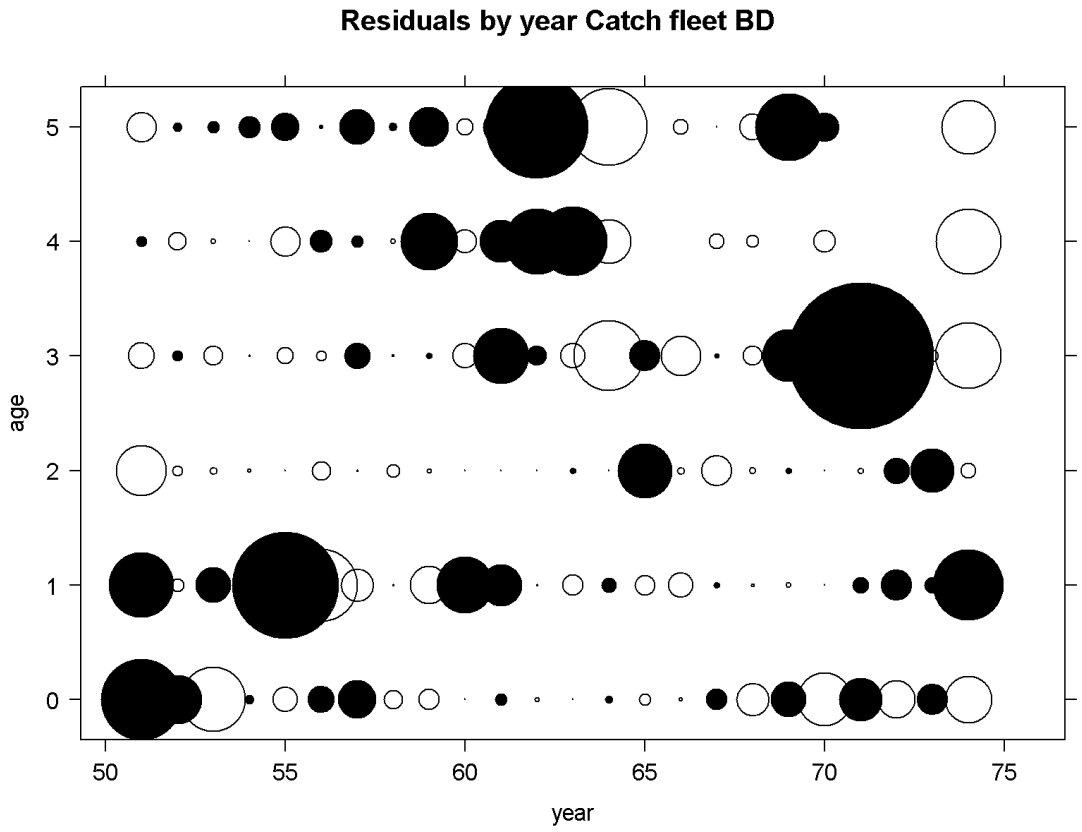


Figure 2.6.3.4. North Sea herring multifleet assessment model. Bubble plot of standardized residuals for catches of fleet B&D.

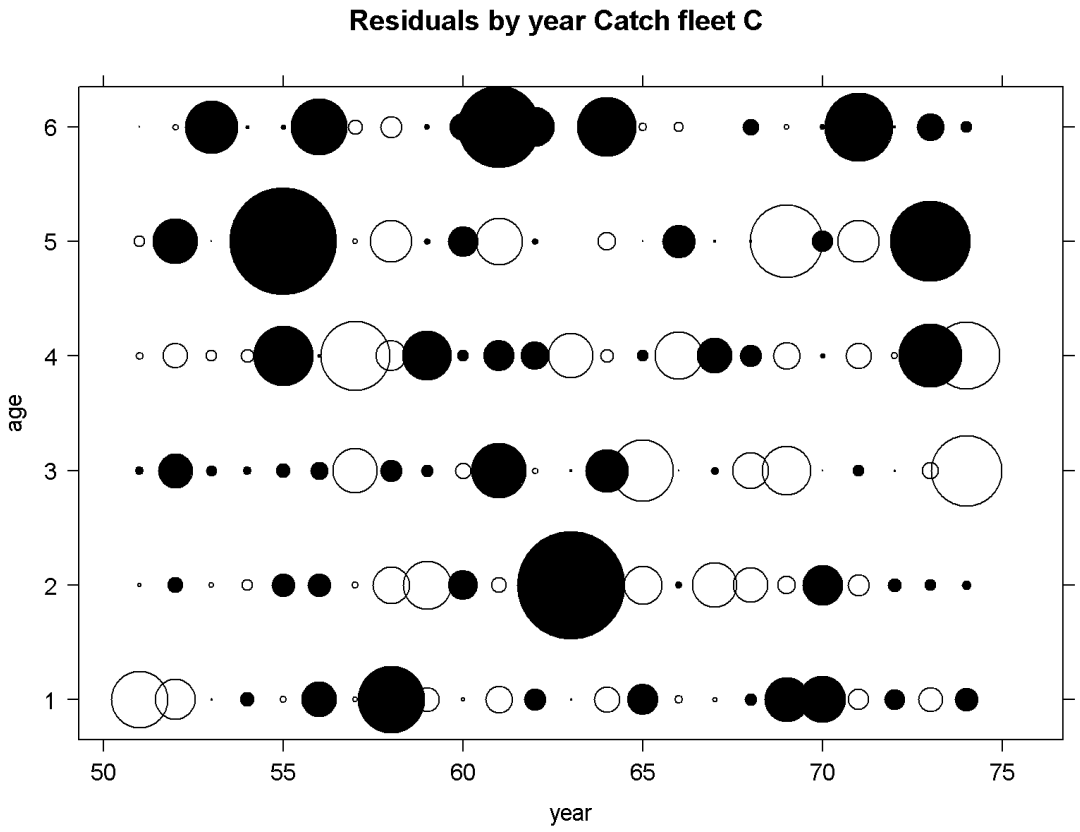


Figure 2.6.3.5. North Sea herring multifleet assessment model. Bubble plot of standardized residuals for catches of fleet C.

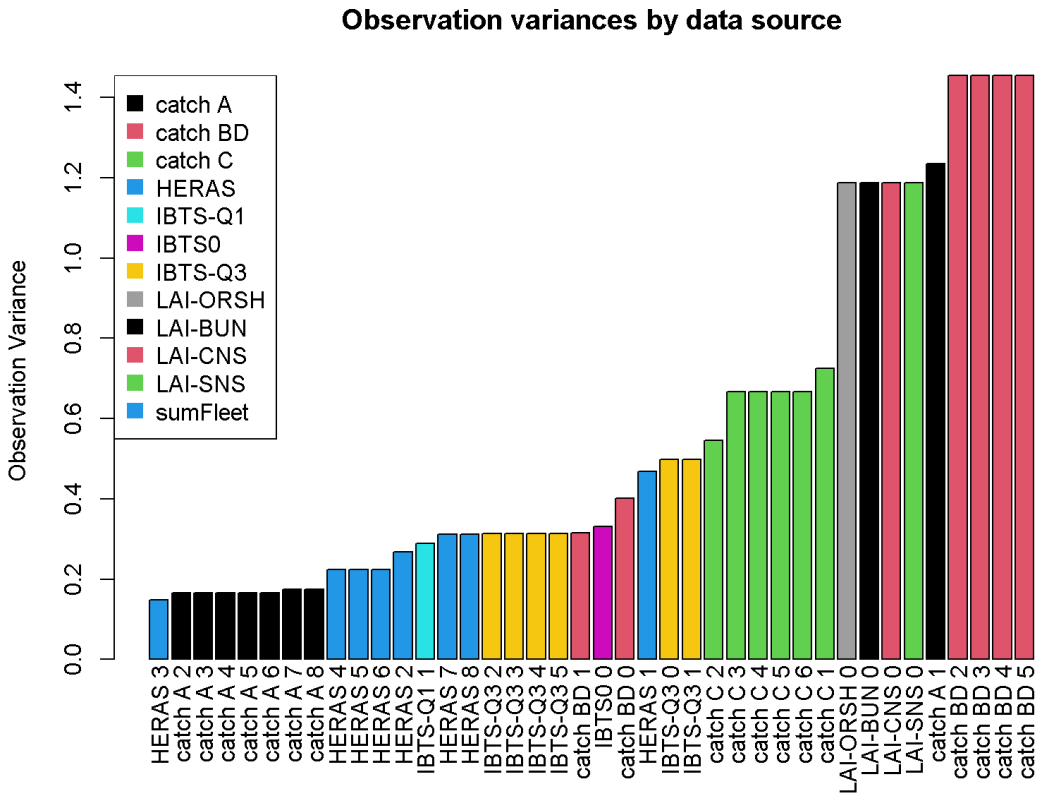


Figure 2.6.3.6. North Sea herring multifleet assessment model. Observation variance by data source as estimated by the assessment model. Observation variance is ordered from least (left) to most (right). Colours indicate the different data sources. Observation variance is not individually estimated for each data source thereby reducing the parameters needed to be estimated in the assessment model. In these cases of parameter bindings, observation variances have equal values.

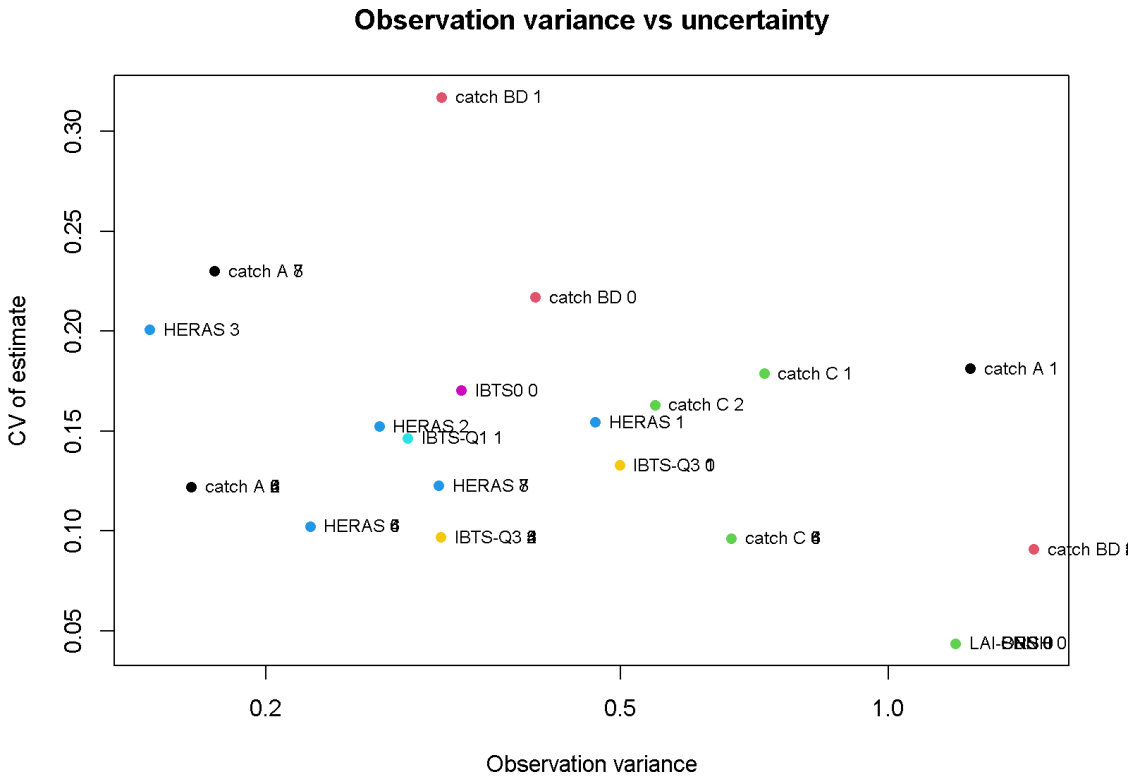


Figure 2.6.3.7. North Sea herring multifleet assessment model. Observation variance by data source as estimated by the assessment model plotted against the CV estimate of the observation variance parameter.

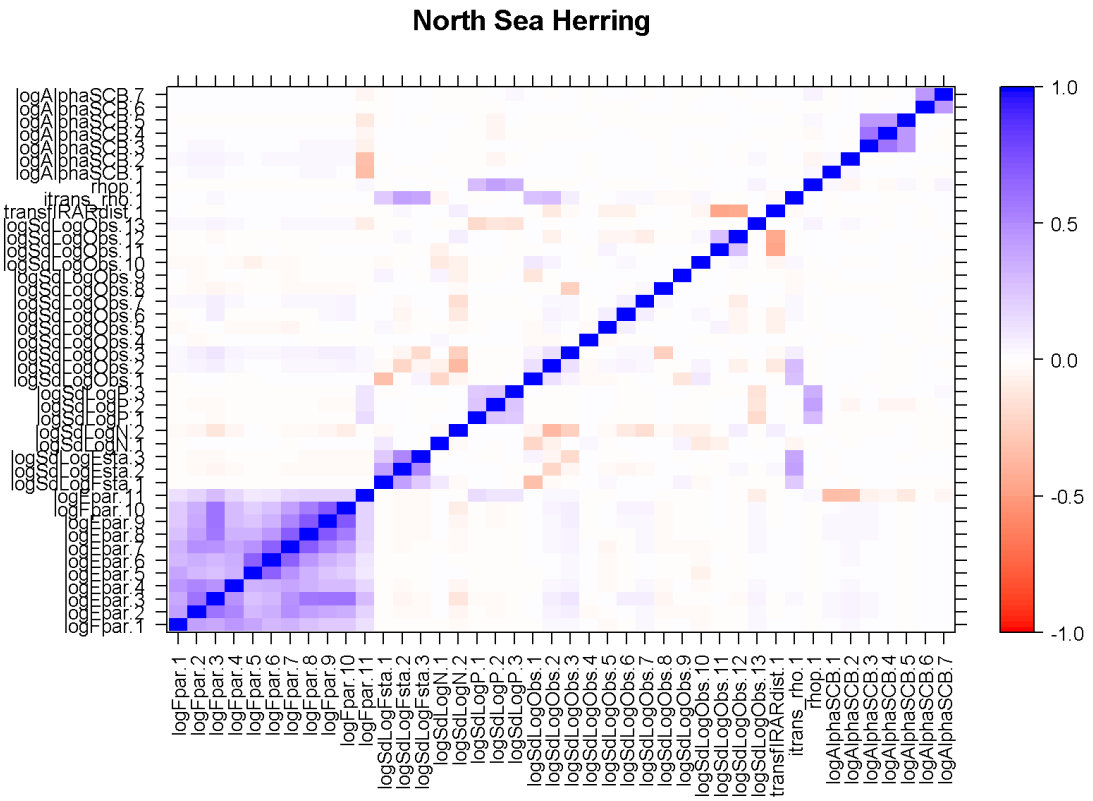


Figure 2.6.3.8. North Sea multifleet assessment model. Correlation plot of the FLSAM assessment model with the final set of parameters estimated in the model. The diagonal represents the correlation with the data source itself.

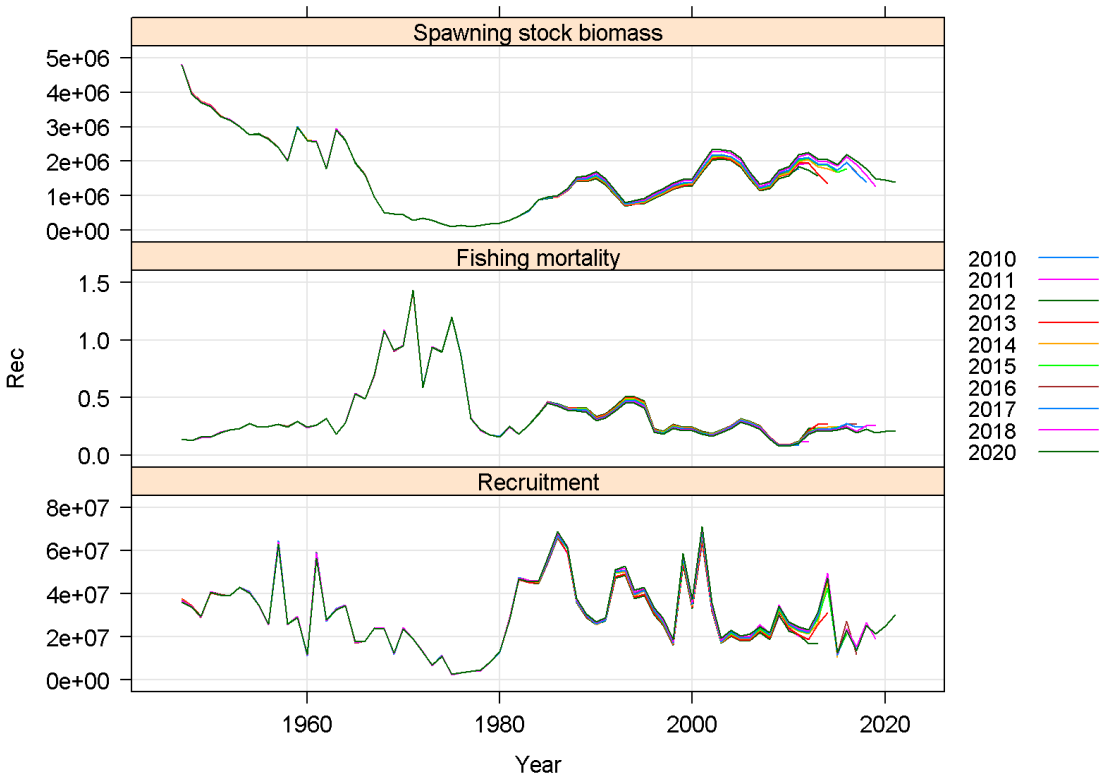


Figure 2.6.3.9. North Sea herring multifleet assessment model. Assessments retrospective pattern of SSB (top panel) F (middle panel) and recruitment (bottom panel).

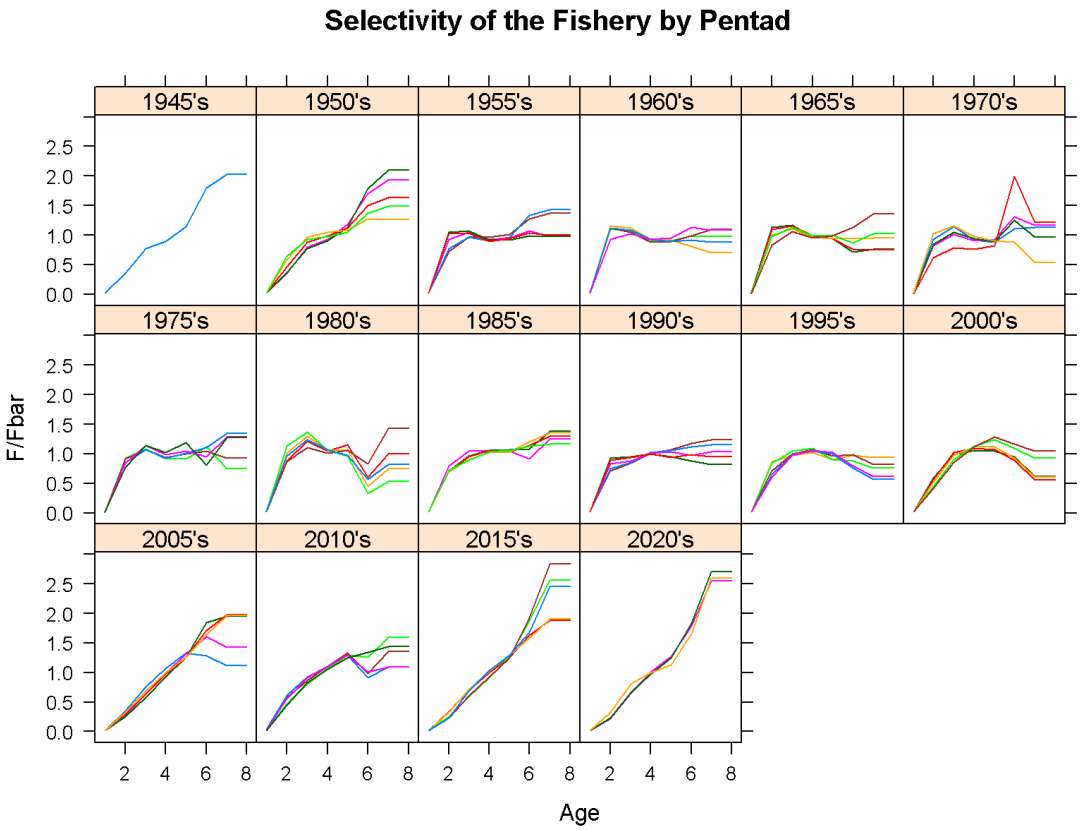


Figure 2.6.3.10. North Sea herring multifleet assessment model. Fishing selectivity fleet A.

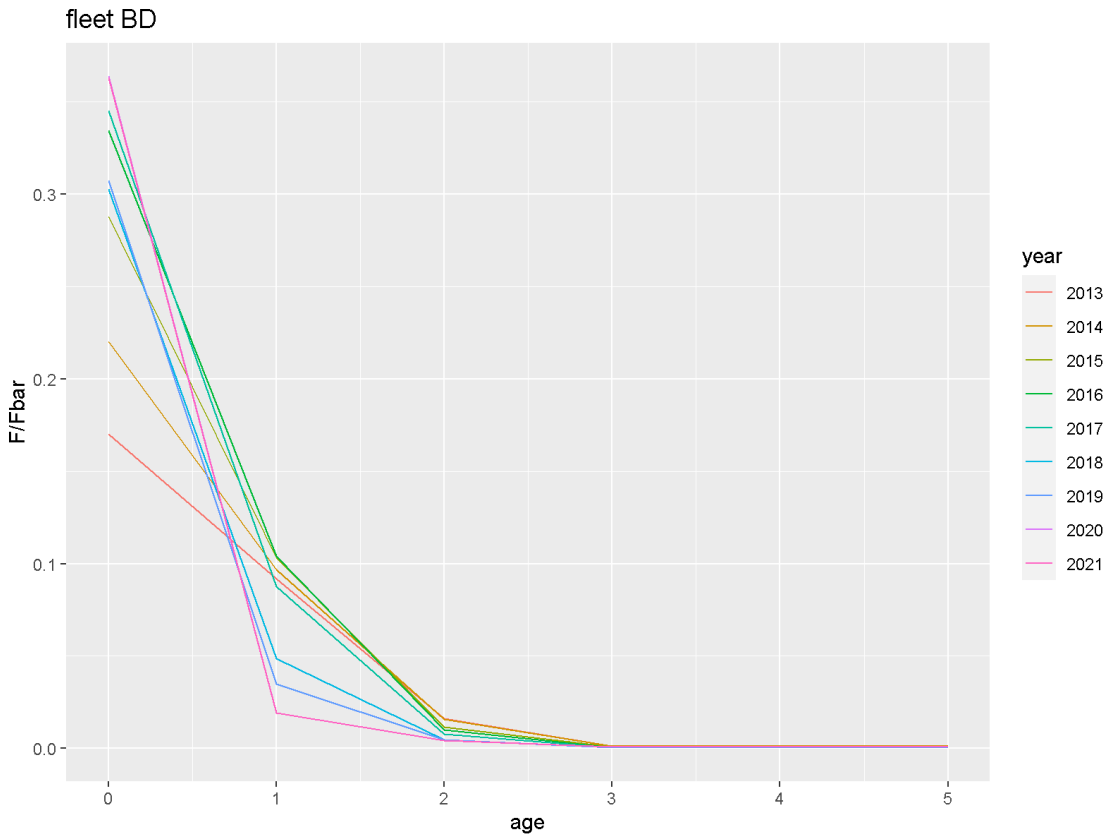


Figure 2.6.3.11. North Sea herring multifleet assessment model. Fishing selectivity fleet B and D combined.

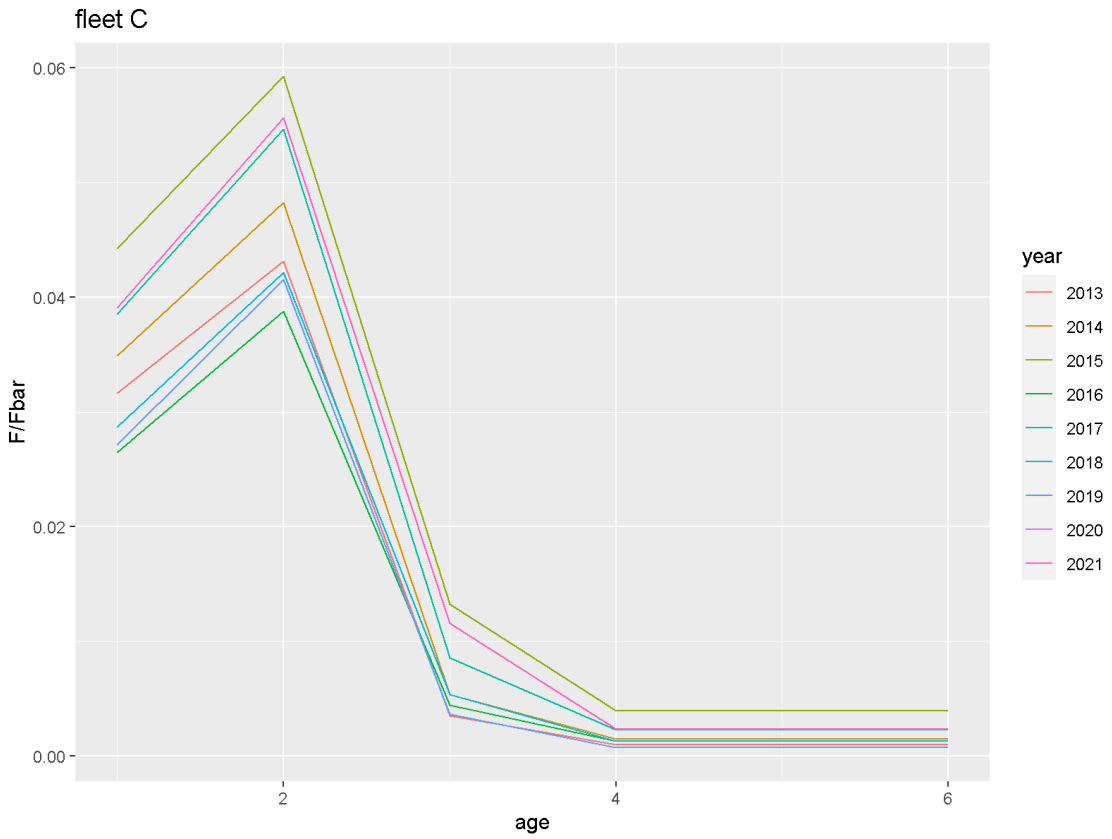


Figure 2.6.3.12. North Sea herring multifleet assessment model. Fishing selectivity fleet C.

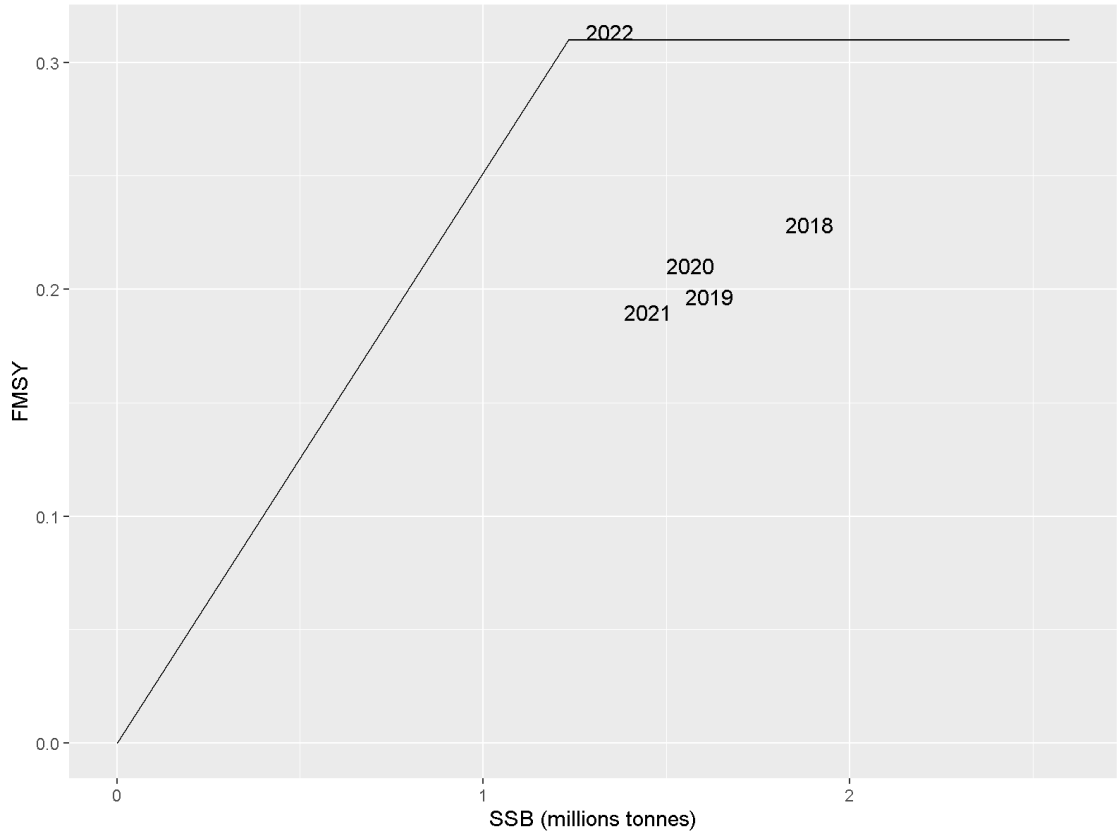


Figure 2.7.1.1. North Sea herring. FMSY advice rule and SSB/Fbar data point since 2018.

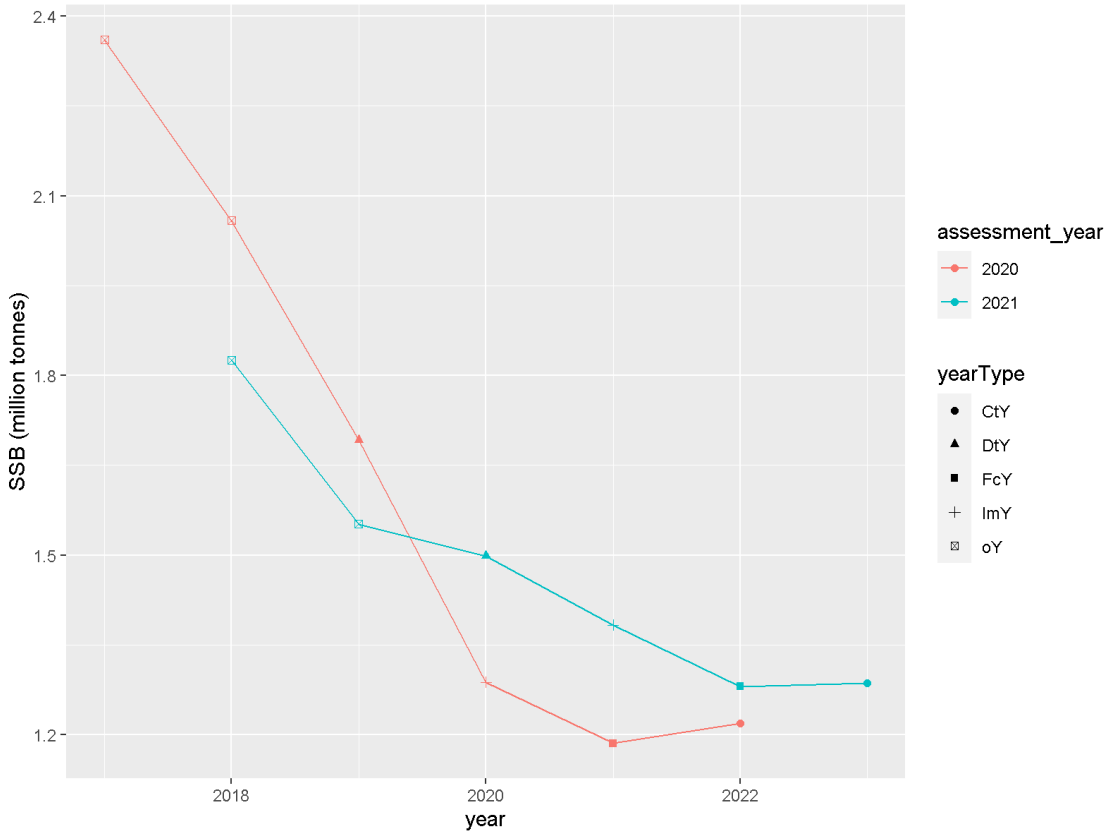


Figure 2.7.2.1. North Sea herring. comparison of SSB trajectory between short term forecasts applied to HAWG2020 and HAWG2021 data. oY: old years (prior to data year). DtY: data year. ImY: intermadiate year. FcY: forecast year. CtY: continuation year.

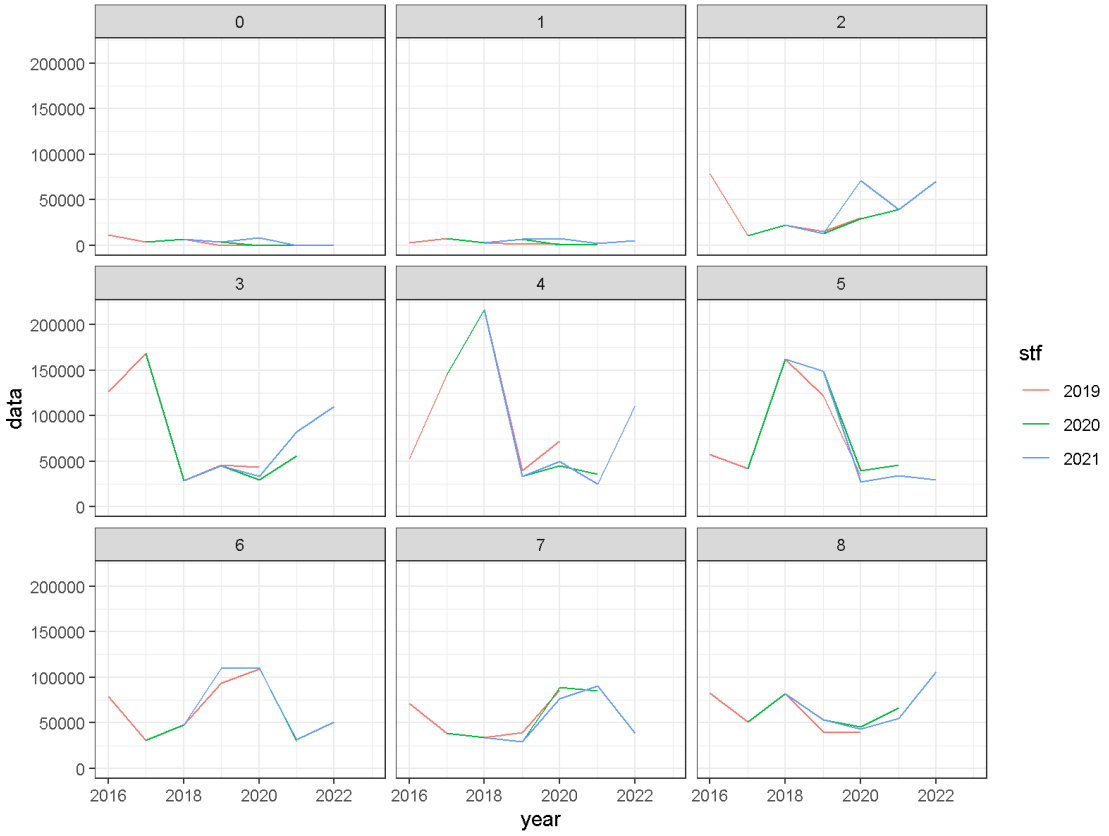


Figure 2.7.2.2. North Sea Herring. Realized and projected catch (in weight) by age (wr) between 2019 assessment (2020 as forecast year), 2020 assessment (2021 as forecast year) and 2021 assessment (2022 as forecast year).

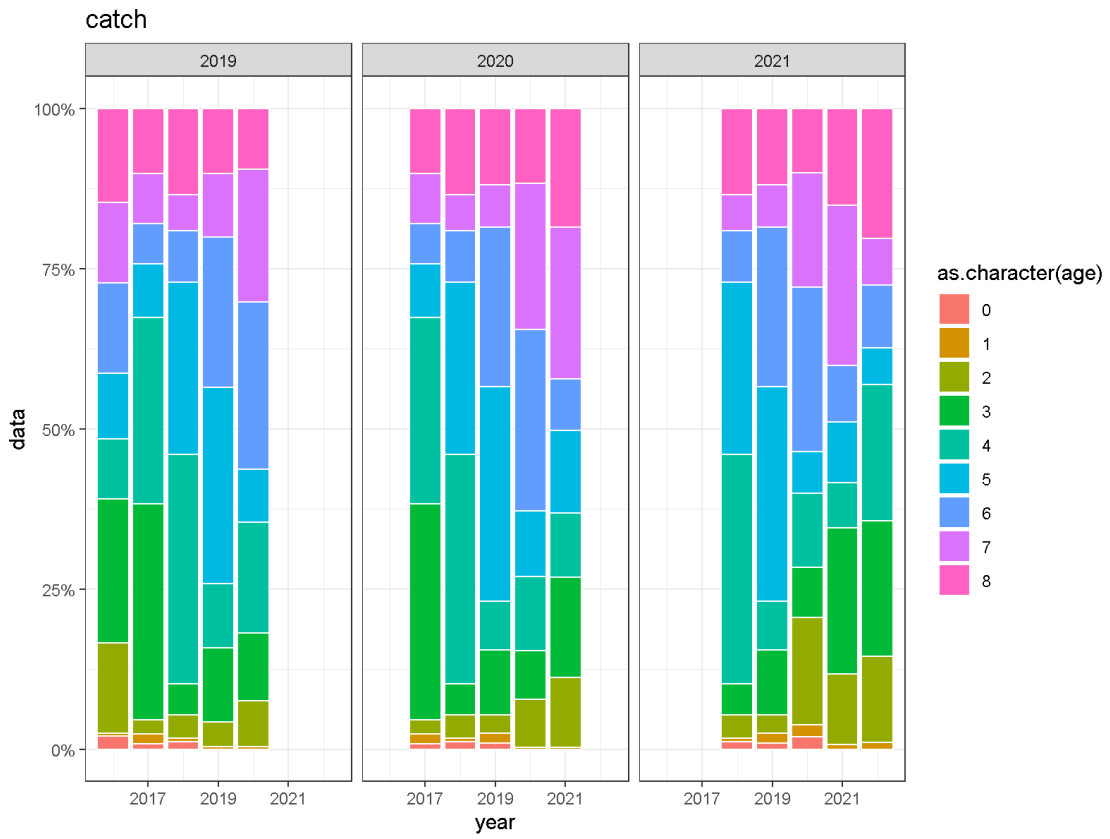


Figure 2.7.2.3. North Sea Herring. Catch proportions for the different ages between the 2019 short-term forecast (2020 as forecast year), 2020 short-term forecast (2021 as forecast year) and 2021 short term forecast (2022 as forecast year).

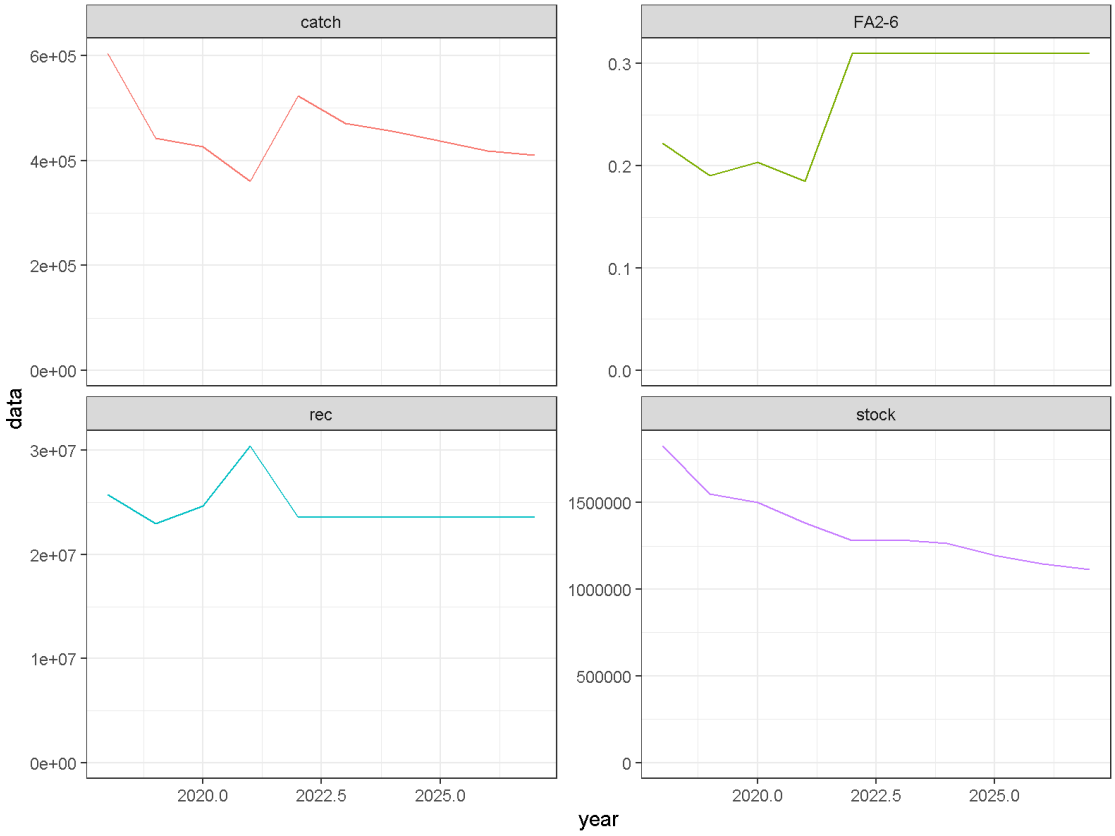


Figure 2.7.2.4. North Sea Herring. Short-term projections using an F status quo from TAC year (i.e. advice year). Intermediate year is in 2021 and the TAC year is 2022.

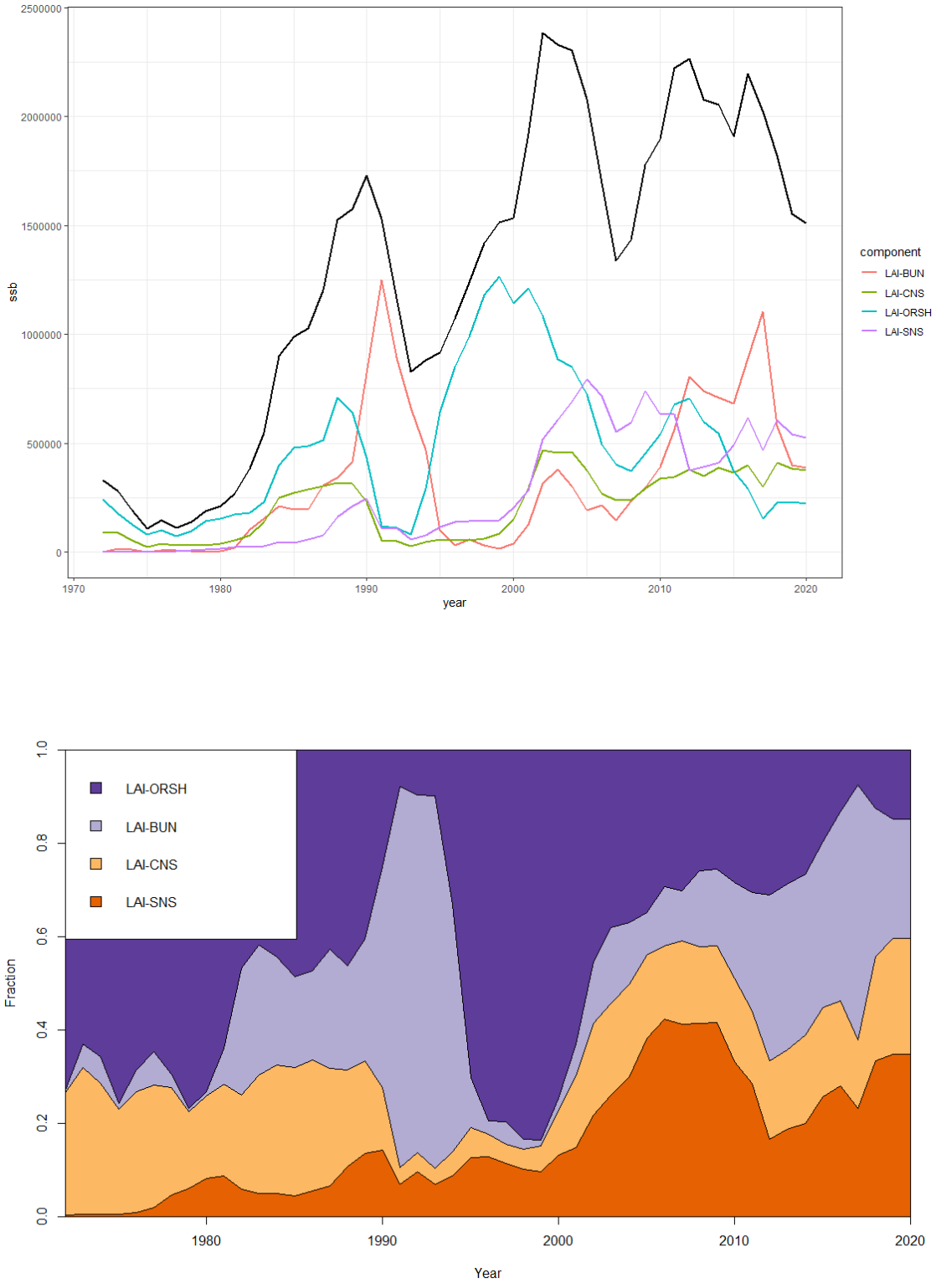


Figure 2.11.1. North Sea herring. Time-series of spawning-stock biomass of each component (top),; and contribution of each component to the total stock (bottom; Payne, 2010) as estimated from the LAI index Areas are arranged from top to bottom according to the south-to-north arrangement of the components.

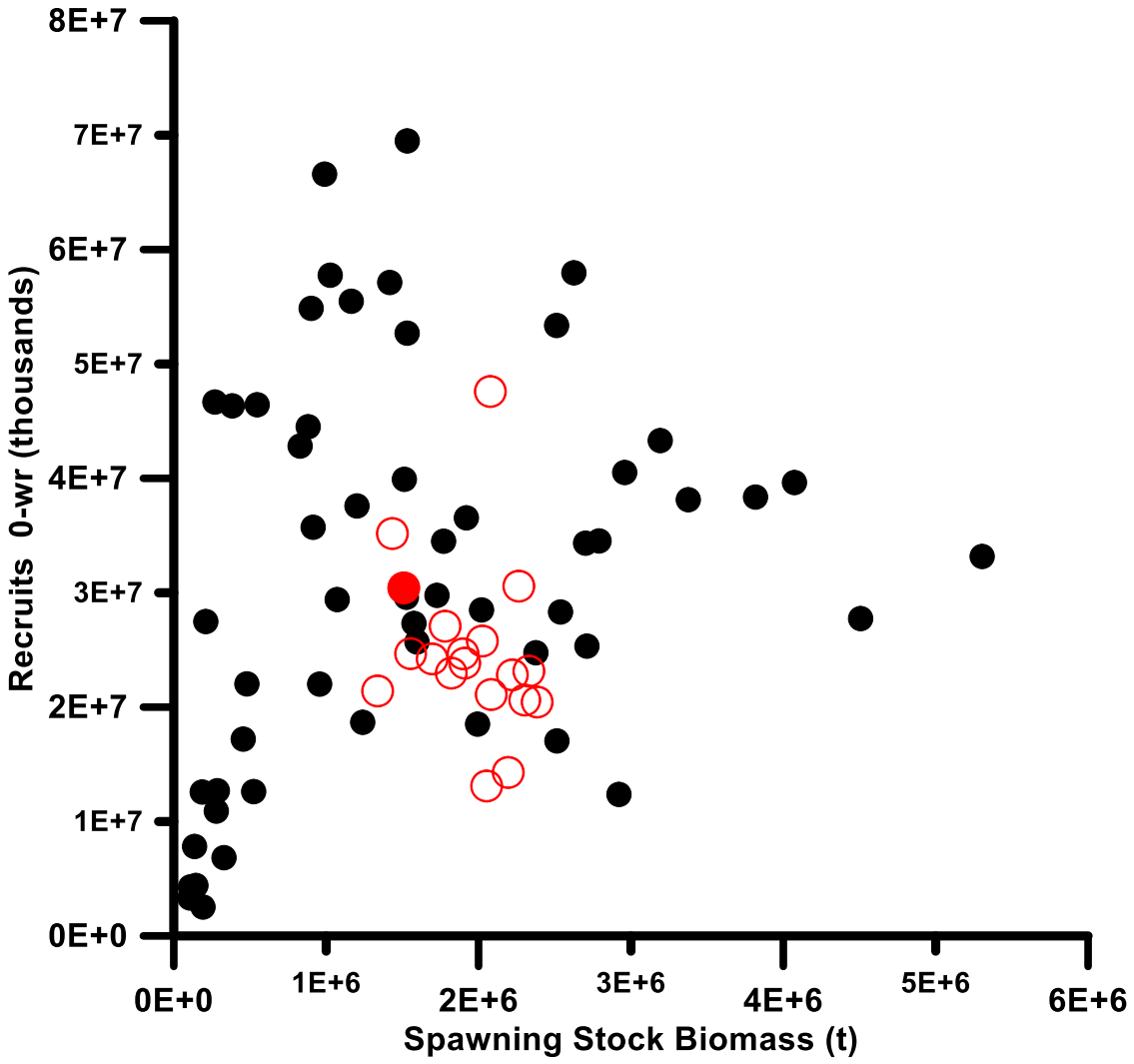


Figure 2.13.1. North Sea Autumn Spawning Herring stock recruitment curve, plotting estimated spawning-stock biomass against the resulting recruitment. Year classes spawned after 2001 are plotted with open red circles, to highlight the years of recent low recruitment. The most recent year class is plotted in solid red.

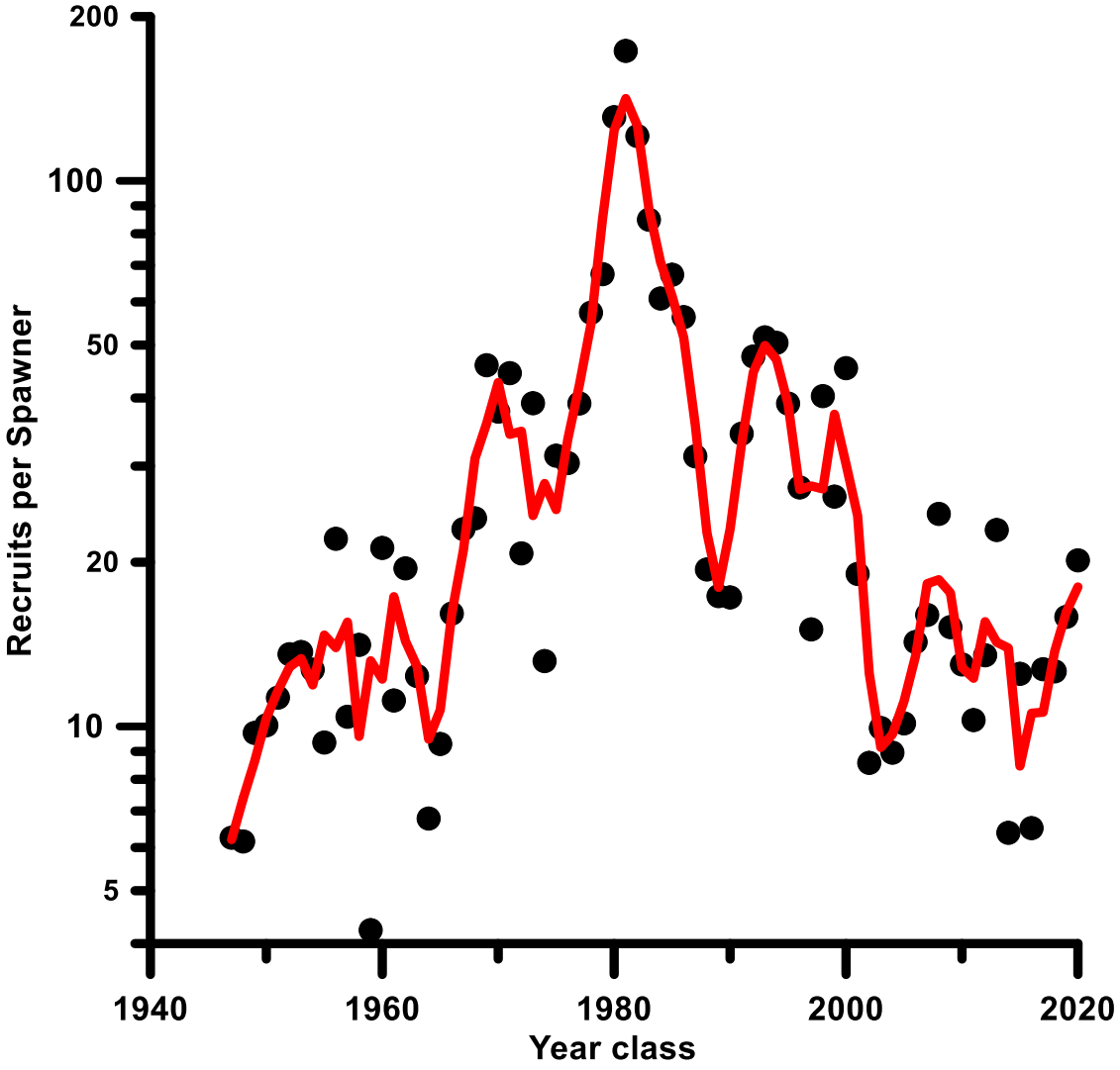


Figure 2.13.2. North Sea Autumn Spawning Herring time-series of recruits per spawner (RPS). RPS is calculated as the estimated number of recruits from the assessment divided by the estimated number of mature fish at the time of spawning and is plotted against the year in which spawning occurred. Black points: RPS in a given year. Red line: Smoother to aid visual interpretation. Note the logarithmic scale on the vertical axis.

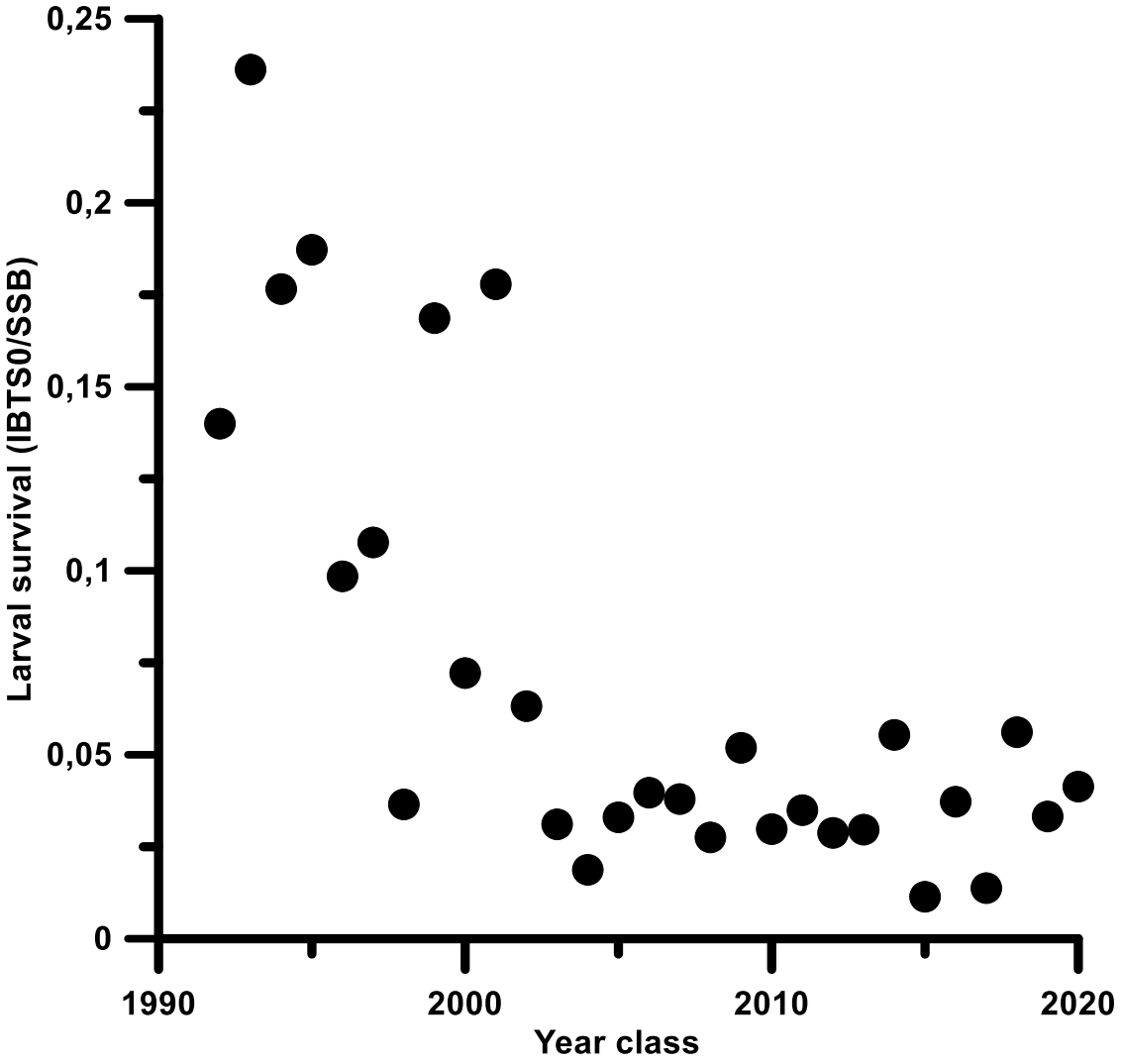


Figure 2.13.3. North Sea Autumn Spawning Herring time-series of larval survival ratio (Dickey-Collas & Nash, 2005; Payne *et al.,* 2009), defined as the ratio of the SSB larval index (representing larvae less than 10–11 mm) and the IBTS0 index (representing the late larvae, > 18 mm). Survival ratio is plotted against the year in which the larvae are spawned.

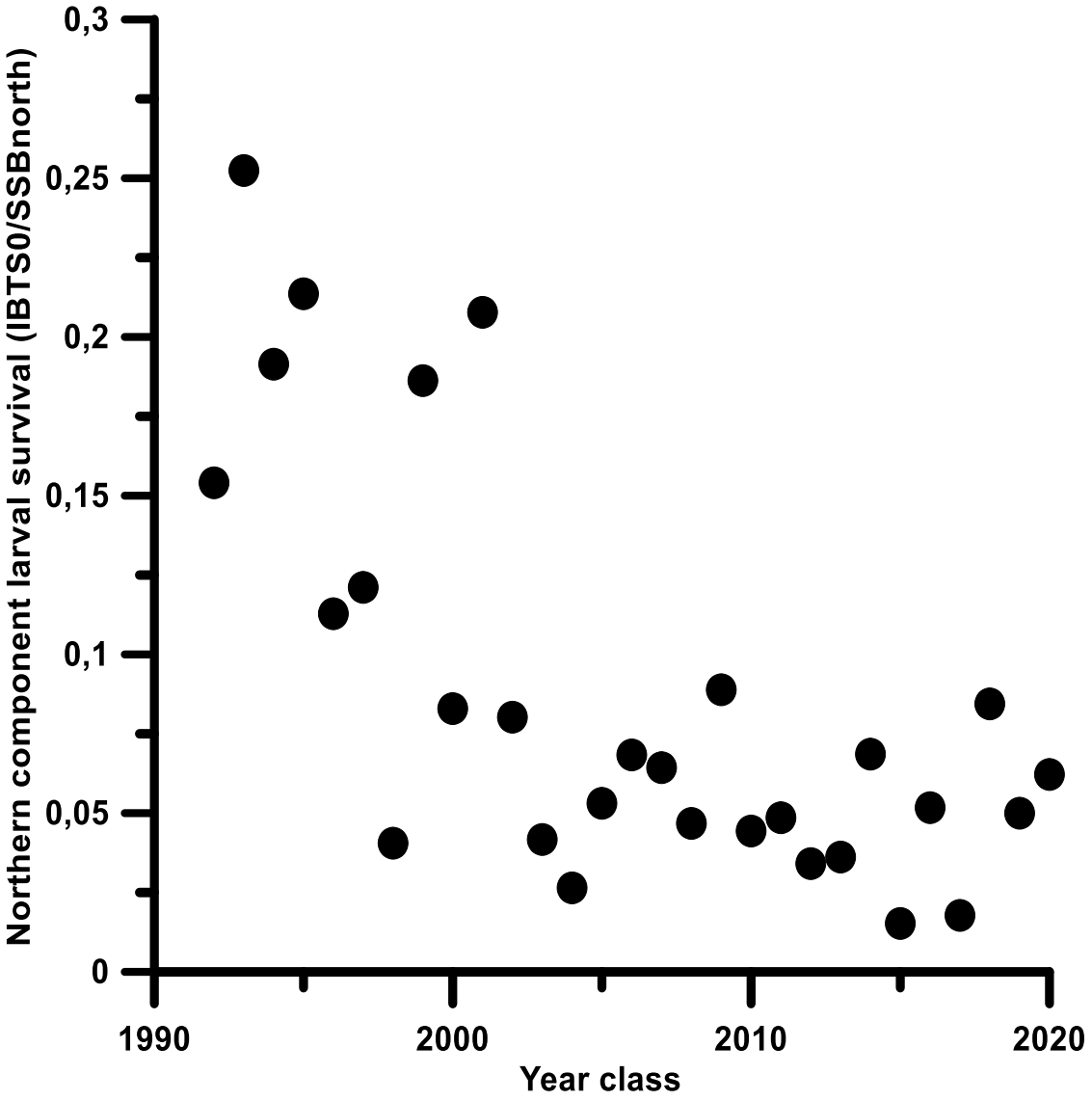


Figure 2.13.4. North Sea Autumn Spawning Herring time-series of larval survival ratio (Dickey-Collas & Nash, 2005; Payne *et al.,* 2009) for the northern-most spawning components (Banks, Buchan, Orkney-Shetland), defined as the ratio of the sum of the larvae indices for these components (representing larvae less than 10–11 mm) and the IBTS0 index (representing the late larvae, > 18 mm). Survival ratio is plotted against the year in which the larvae are spawned.