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

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 2021 and 2022

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 2021 was 364 107 tonnes for Area 4 and Division 7.d, where no more than 34 793 t should be caught in Division 4.c and 7.d. For 2022, the total TAC is 453 802 t (427 628 t for the A-Fleet), including a TAC of 47 039 t for Division 4.c and 7.d.

The bycatch TAC for the B-Fleet in the North Sea (and Division 2.a) was 7 750 t in 2021 and has increased by 6% to 8 174 t in 2022. As North Sea autumn spawners are also caught in Division 3.a, regulations for the fleets operating in this area have to be considered 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 2021

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 by statistical rectangle. Some catch figures in tables 2.1.1–2.1.5 are 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 364 615 t in 2021. Official catches by the human consumption fishery were 355 665 t, relatively close to the TAC for the human consumption fishery (356 357 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 36 091 t. The separate TAC for this area was 34 793 t, so the TAC in Division 4.c and 7.d was fully taken (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 8 788 tonnes in 2021. The bycatch ceiling for the B-Fleet was 7 750 t. Since the introduction of yearly bycatch ceilings in 1996, these ceilings have fully been taken in 2014, 2016 and since 2020.

The total North Sea TAC and catch estimates for the years 2016 to 2021 are shown in the table below (adapted from Table 2.1.6).

Year	2016	2017	2018	2019	2020	2021
TAC HC ('000 t)	518	482	601	385	385	356
"Official" landings HC ('000 t) *	545	485	594	439	415	356
Working Group catch HC ('000 t)	545	485	594	440	417	356
Excess of landings over TAC HC ('000 t)	27	3	-7	55	32	0
Bycatch ceiling ('000 t) **	13	11	10	13	9	8
Reported bycatches ('000 t) ***	15	7	8	5	10	9
Working Group catch North Sea ('000 t)	560	492	602	446	427	365

HC = human consumption fishery
*** Landings might be provided by WG members to HAWG; they may 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 2022, half of the EU quota for Division 3a (HER/03A.) can be taken in UK waters of the North Sea (HER/*4-UK) and 21 038 tonnes of the EU quota can be taken in 4b (HER/*4b-EU). In total, the transfer of 3.a quota into the North Sea is getting close to 100%. Catches in Division 3a are limited to 1 136 tonnes.

In the North Sea, Norway can take up to 2 700 tonnes of its quota in UK and EU waters in divisions 4.a and 4.b (HER/*4AB-C). 2 700 tonnes of the EU quota can be taken within Norwegian waters south of 62°N (HER/*4N-S62).

Half of the EU and UK quotas 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 EU waters in 4 (HER/*4-EU-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. Since 2021, this interannual quota flexibility is in place also for UK herring quotas.

At HAWG 2022, the effect of quota swaps and banking and borrowing could not be assessed by the WG.

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.

Having implemented the Brexit, access into UK waters was partly restricted in 2021. Norwegian vessels were not allowed to fish in UK waters and vice versa. This may have resulted in an increase in fishing effort in some rectangle in 4.a, along the Norwegian-UK maritime border. However, this effect is not clearly analysed yet. For 2022, there are mutual agreements put into place.

As in preceding years, the herring fishery concentrated in the north-western 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 50% of the total. Subdivision 4.aE provided 24% of the catches in 2021 and catches in Division 4.b contributed 16%.

The bycatch ceiling for the small-meshed fishery (B-Fleet) has fully been taken in 2021. Catches were distributed in 4.aW (41%) and 4.b (58%). Only 1% were caught in 4.c. 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 2006–2021 (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 2011–2021.

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 2.6 billion fish and NSAS amounts to 2.65 billion fish in 2021. The proportion of 0- and 1-ringers of herring taken in the North Sea is 24% of the total catch in numbers (Table 2.2.5), compared to 49% in 2020. Most of these young herring are still taken in the B-Fleet in Division 4.b. Here, 0-ringers amount to 52% of the total catch in numbers in 4.b.

The proportion of 3+ winter ring herring has re-increased to 62% of the total catch in numbers taken in the North Sea (compared to 39% in 2020).

In terms of biomass, the contribution of different age-groups is relatively homogeneous in 2021 (each 2-, 3-, 5- ,7- and 8-ringers contributed 13 to 19%).

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 2006–2021. After splitting the herring caught in the North Sea and 3.a between stocks, the total catch of North Sea Autumn spawners amounts to 365 351 tonnes.

Area	Allocated	Unallocated	BMS/Discard	Total
4.a West	181 381		64	181 445
4.a East	88 235		18	88 253
4.b	58 826			58 826
4.c/7.d	35 992		99	36 091
	Total catch in the North Sea			364 615
	Autumn spawners caught in Division 3.a (SOP)			4 243
	Baltic spring spawners caught in the North Sea (SOP)			-3 505
	Total catch NSAS used for the assessment			365 351

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. In 2021, they have been zero.

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. The TAC 2021 was set at 10 tonnes and reported catches amount to 2 tonnes.

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 2021, 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 96 tonnes in 2021. 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 2021 North Sea herring fishery. However, discards occurred in demersal fisheries not targeting on herring. These discards were 67 tonnes in 2021.

The sampling of commercial landings covers 81% 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 108 different reported métiers, 31 were sampled in 2021. The sampling level of more than 1 sample per 1000 t catch has been met for only 17 métiers. With regards to age readings, 20 métiers appear to be sampled sufficiently (>25 fish aged per 1000 t catch).

However, some of the métiers yielded very little catch. In 69 métiers, the catch is below 1000 t. The total catch in these métiers sums to 11 595 t, so the remaining 39 métiers represent 352 956 t of the working group catch (97%). Of these 39 métiers, 16 were sampled. 8 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 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 2021

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 2021). 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 2021 estimate of North Sea autumn spawning herring SSB (spawning-stock biomass) is lower than in the previous year at 1.5 million tonnes (2020: 1.7 million tonnes) with a further decrease in the number of mature fish (2020: 8 915 million fish, 2021: 8 170 million fish). The mean weight of mature fish is lower than last year at 183.7 g, contributing stronger than the concurrent decrease in numbers to the decrease in biomass. The spawning stock is dominated by fish of age 2, 3 and 7 wr. In the 2020 survey 2, 5 and 6 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 increased by 57% since last year from 14 851 million in 2020 to million 23 311 in 2021. While prior to 2020 2 winter ring fish contributed substantially to the abundance of immature fish, the maturity level in this age group was as in the previous year comparatively high (59% mature in 2019, 75% mature in 2020, 74% mature in 2021).

At 74%, the proportion mature at 2 winter rings in 2021 is again at the high end in the time series – compared to e.g., the all-time low of 37% in 2018. Maturities for ages 3 and above were again comparable to the long-term average with 99% of 3 winter ringers and 100% maturity for all ages 4 and above (Table 5.2). Since 2015, observed maturities are reported for all age groups. Previously maturity had been 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 2021–2022. 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 2021 and January 2022 (Figures 2.3.2.1–2.3.2.3).

The survey around the Orkneys revealed higher quantities of newly hatched larvae, compared to relatively low numbers in the two preceding years. In the Buchan and the central North Sea, larvae hatched in lower quantities, and concentrated in two areas, while the remaining stations contributed only low numbers of larvae (Figure 2.3.2.1).

The two surveys in the southern North Sea showed comparable quantities. However, the survey in December was influenced by some hot spots, yielding high numbers of larvae. This pattern is not uncommon when compared to the survey history, thus all stations were included in further calculations.

As in former 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 2022. Instead, an additional MIK sampling is scheduled for March–April 2022 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)

During the International Bottom Trawl Survey in the first quarter (Q1 IBTS), night-time catches are conducted with the MIK net, a fine meshed (1600 μm) 2-m-midwater ring net (ICES 2017) providing abundance estimates for large herring larvae (0-ringers) of the autumn spawning stock components. In addition, the Q1 IBTS also provides the time series for the 1-ringer herring abundance index in the North Sea from GOV catches carried out during daytime. For more details on the times series, the reader is referred to the previous reports of the working group.

2.3.3.1 2.3.3.1 The 0-ringer abundance (IBTS0 survey)

The total abundance of 0-ringers in the survey area from the MIK sampling is used as a recruitment index for the stock. Since 2017, this 0-ringer index (also called MIK index) time series is calculated with a new algorithm, which excludes larvae of Downs origin more rigorously. This is done by excluding the smaller larvae – presumably of Downs origin – from the analyses in certain parts of the survey area. Index values are calculated as described in detail in the Stock Annex. (Note that this new time-series based on the new algorithm only dates back to 1992, and that all French data before 2008 are excluded because of data quality issues). The results of the calculation can be found in Table 2.3.3.1. The index from the 2022 survey (corresponding to the 2021 year-class) is 47.8. This is one of the lowest values in the time-series, with only 4 other year-classes being even lower (2003, 2007, 2014 & 2016).

The 2022 MIK-IBTS survey was faced with numerous challenges. Most importantly, very severe weather conditions prevailed throughout most of the survey period. In addition, several cases of Covid-19 on RV Walther Herwig III delayed the German survey for 15 days, and the

Scottish survey had to be cancelled after 5 days due to mechanical issues on RV Scotia. Furthermore, minor technical issues also occurred on the Dutch RV Tridens and the Danish RV Dana, resulting in the need to go back to harbor for some minor repairs. All these various issues had severe impacts on the MIK sampling, and only 433 depth-integrated hauls were completed with the MIK-net, which is 250 MIK hauls less than in 2021. For the 2022 MIK 0-ringer index (corresponding to the 2021 year-class), all hauls north of 51° N were used, in total 410 hauls, which is 253 less than in 2020.

As a total of 714 MIK hauls were planned according to the 2022 NSIBTS Q1 program (the target is 4 hauls per ICES rectangle), only approximately 60% of the planned MIK-stations were sampled. However, there has been an increase in the number of MIK hauls throughout the time-series, and the 433 MIK hauls achieved in 2022 are still more hauls than were conducted in the early years of the time-series. Besides, thanks to intensive coordination between participants during the survey and more decent weather in the final part of the survey period, at least 1 MIK haul could be conducted in most ICES rectangles and the majority of rectangles was covered with 2 or more hauls. Nevertheless, 24 rectangles were not covered at all by the MIK sampling, but these were mainly located in the north-western parts of the survey area, which usually only yield low numbers of herring larvae. Thus, the majority of the main herring larvae distribution area could be covered.

In order to investigate whether the poor sampling coverage may have had an influence on the 0-ringer index from the 2022 survey, two data tests were conducted. In the first test, the entire 0-ringer index time-series from 1992 to 2021 was re-calculated without the 24 rectangles which were not covered in 2022 and compared to the existing, normal 0-ringer time-series. For most years, the deviances between the two time-series were max. 5% or less, except for one year with a deviance of about 10%. Furthermore, when plotting the two time-series together in the same figure, it became evident that the overall time-series trends were not affected at all and the discrepancy between the two time-series was negligible. In the second test, the entire time-series

since 1992 was calculated with only 1 and 2 randomly chosen MIK hauls per rectangle, conducting 100 different runs per year. For the test with only 1 random MIK haul per rectangle a relatively high variability of the index values was observed, whereas the test with 2 random hauls per rectangle only resulted in a low variability of the index. The overall trends, however, were not seriously affected in both runs. Thus, as the majority of rectangles was covered by at least 2 or more MIK hauls, the impact of the poor MIK sampling coverage during the 2022 survey on the resulting 0-ringer index seems negligible. In summary, despite the encountered issues and low overall number of MIK hauls, it can be assumed that the 2022 MIK survey provides a representative 0-ringer index.

Figure 2.3.3.1.1 shows the size distribution of MIK larvae in 2022. Herring larvae measured between 7 and 44 mm standard length (SL). Again, and as in most years, the smallest larvae <12 mm were the most numerous and the larvae between 7 to 11 mm made up almost 50% of the total number of larvae. Larger larvae >18 mm SL were rarer, making up about 10% of all larvae, and were caught in lower densities than last year. An interesting feature in the 2022 length distribution is the peak at 15 mm SL. Figure 2.3.3.1.2 illustrates the spatial distribution of 0-ringers in 2020, 2021 and 2022. 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 southeastern and eastern part of the North Sea, the potential nurseries, abundance of large herring larvae was lower than last year.

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 2020 is shown in Table 2.3.3.2. The index from the 2022 survey (corresponding to the 2020 year-class) is 806. This is less than half of the long-term average of the time series, and only 3 other year-classes were even lower (1997, 2014 & 2016).

Figure 2.3.3.2.1 illustrates the spatial distribution of 1-ringers as estimated by trawling in January/February 2020, 2021, and 2022. As in previous years, the majority of the 1-ringers of the 2020 year-class were found in the Kattegat/Skagerrak area, however at much lower abundance. In addition, 1-ringers were also found in the south-eastern parts of the North Sea as well as in the Moray Firth.

After a longer period where the trajectories of 1-ringer abundance and 0-ringer index seemed to be uncoupled (year-classes 2003-2012), the two trajectories again corresponded well for the year-classes 2013 – 2018 but weakened for the 2019 year-class (Fig. 2.3.3.2.2). The 0-ringer and 1-ringer data for the 2020 year-class correspond better than for the 2019 year-class, but the 1-ringer value seems rather low compared to the 0-ringer value.

This leads to the question if there may be an issue with the 1-ringer index for the 2020 year-class, which could e.g., be related to the various challenges during the 2022 survey described above (see section 2.3.3.1). Due to these challenges, a total number of 33 ICES rectangles were not covered by GOV hauls in 2022. However, the uncovered rectangles are mainly located in the north-western North Sea, which is an area that usually did not yield relevant catches of 1-ringers in previous years. Besides, the ICES rectangles in the north-western areas that actually were covered did not yield relevant catches of 1-ringers during the 2022 survey, indicating that the unsampled rectangles would not have yielded any relevant catches either. Thus, the poor spatial coverage in these areas in 2022 does not seem to have an influence on the 1-ringer index, which is mainly driven by catches in Kattegat, Skagerrak and the German Bight, i.e. areas that were decently covered in 2022.

However, the adverse weather conditions during much of the 2022 survey may have had a more general influence on the catchability of 1-ringers, e.g., by reducing the schooling effect due to low visibility in the water. Besides, it should be kept in mind that the 1-ringer index is based on

hauls with a GOV Trawl, i.e., a bottom trawl which might not be ideal to catch pelagic species like herring. Furthermore, differences in vertical net opening between participating vessels in the Q1 IBTS may also have an influence on catchability. Germany did e.g., report a relatively high vertical net opening while Norway reports a relatively low vertical net opening, which may result in higher and lower catchability of pelagic species, respectively. As Germany only conducted 10 out of their 67 planned GOV hauls in 2022, this may have had an effect on the total numbers of 1-ringer herring, but it is not clear if such an effect did indeed occur, nor can its magnitude be estimated. However, it should be kept in mind that the 1-ringer abundance from the 2022 survey, corresponding to the 2020 year-class, may be underestimated.

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 (timing of the HERAS survey) most fish are approaching their peak weights just prior to spawning.

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 since 2020. This is especially the case for age 2 and 3 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.

2.4.2 Maturity ogive

The percentages at age of North Sea autumn spawning herring that were considered mature in 2021 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 and 2022, 2 winter ringers were to 75% and 74% mature respectively, much more in line with previous years. Maturities for winter ringers 3 (989) 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 WKPELA2018, a benchmark interim model specification was used. In practice, the assessment profiling should have been performed using the WKPELA2018 final model configuration to ensure consistency in the derivation of additive rescaling. This discrepancy was only discovered at HAWG2021 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, 2021).

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 herring 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 2003 - 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 a 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 26 % 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 the 2014 MIK survey, the 2013 year-class 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-classes until the 2018 year-class (Figure 2.3.3.2.2). For the 2019 year-class, the relationship between the MIK 0-ringer and the IBTS 1-ringer index decreased again.

The most recent data that can be compared between 0-ringers and 1-ringers are for the 2020 year-class, corresponding to the 0-ringers from the 2021 MIK survey and the 1-ringers from the 2022 GOV survey. Generally, the 0-ringer and 1-ringer data for the 2020 year-class correspond better than for the 2019 year-class, but in contrast to the vast majority of other years in the time-series, the 1-ringer value is rather low in relation to the 0-ringer value (Figure 2.3.3.2.2). This may reflect some severe mass mortality among the larger herring larvae or young juveniles, in particular if one bears in mind that there are increasing numbers of mackerel in the North Sea during summer in recent years, which may prey heavily on the 0-group herring. However, this could also be a "sampling artefact" related to adverse weather conditions and several other challenges during the 2022 Q1 IBTS, which may have affected the catchability of 1-ringers of the 2020 year-class, but it is not clear if such an effect did indeed occur, nor can its magnitude be estimated (for further details see section 2.3.3). However, it should be kept in mind that the 1-ringer abundance from the 2022 survey, corresponding to the 2020 year-class, may be underestimated.

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 74%, 99%, 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 is substantially higher 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.

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 2021 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 2021 is estimated at approximately 1.35 million tonnes and still decreasing of the stock observed since 2016. As for recruitment, the 2022 estimates are substantially lower than estimated during 2021. Recruitment of the 2020- and 2021-year classes are estimated to be weak. Mean F2–6 in 2020 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 updated assessment model from the latest inter-benchmark (ICES 2021), the catchability of the HERAS survey is close to 1, 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.

The analytical retrospective analysis (Table 2.6.2.5, Figure 2.6.2.9) has mean Mohn's rho values with a 5-year peel of: -9% (F_{bar}), -10% (rec), and 7% (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 are 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 are 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 2021 was estimated at 1.35 million tonnes, which is above B_{pa} (0.96 million t) and MSY $B_{trigger}$(1.23 million t).

Since the strong 2013-year class, recruitment of herring has been low. The 2020-year class is estimated at 84% and the 2021-year class at 76% of the 10 year geometric mean recruitment.

Contrary to recent years' assessments, fishing mortality on older ages is now estimated somewhat lower.

2.7 Short-term predictions

Short-term predictions for the years 2021, 2022, and 2023 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 2024 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 2021 year class, obtained from the assessment (informed by the 2022 IBTS0 survey) served as the estimate for 2022.

For the intermediate year (2022), no overshoot for the A fleet was assumed. Negotiations between the EU, Norway, and UK for 2022 resulted in the allowance of 100% of the C-fleet and D-fleet TACs in the Kattegat-Skagerrak area to be taken in the North Sea. The arrangement is very different to the previous year's arrangements. The expected catches of NSAS herring during 2022 were estimated as follows:

- A-fleet: fleet TAC (427 628 t) + what is transferred from the C-fleet in 3a to the North Sea (23 885 t) scaled by the 3-year average proportion of NSAS in A-fleet catch (98.6%, 2019-2021)
- B-fleet: fleet TAC (8 174 t) + a 50% transfer from the D-fleet TAC (6 659 t) in 3a to the North Sea scaled with the fleet uptake in 2021 (78%)
- C-fleet: catches corresponding to 1 136 t catch in 3.a scaled by the 3-year average proportion of NSAS in the C-fleet catch (35.5%, 2019-2021)
- D-fleet: catches set at 0 t because considered negligible compared to the other fleets

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 2023, 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 2023. The catch scenarios with a zero 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 IBPNSherring 2021 (ICES, 2021), 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 2023, the SSB is calculated below MSY $B_{trigger}$ which results in a target $F_{(wr)\ 2–6} = 0.281$ (Figure 2.7.1.1).

There is no specific allowance in the ICES MSY AR for multiple fishing mortality targets, such as the fishing mortality 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.

All predictions are for North Sea autumn spawning herring only.

2.7.1 Comments on the short-term projections

While the HAWG 2021 forecast (REF) suggested that the steep decline of the stock since 2016 has stalled, the new assessment and forecast in HAWG 2022 concludes that the stock is still declining. Expanding the (deterministic) short term forecast for a limited number of years, suggested that the decline in stock size may halt around 2024-2025. Choosing a lower target fishing mortality than Fmsy=0.31, is expected to lead to a quicker recovery of the stock to above MSY Btrigger.

2.7.2 Exploratory short-term projections

A direct comparison of the forecast results with the last two assessments (2021 and 2020) 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 2023 relative to 2022.

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 2024–2028 (Figure 2.7.2.4). This

projection resulted catch of ~375 000 tonnes by 2026. 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 between EU, Norway, and UK.

2.9 Precautionary and Limit Reference Points and FMSY 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 Blim and MSYBtrigger and an upward estimate of Fmsy. 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, 2021). 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 contributetors. 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 ring net 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-ate 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.

Table 2.1.1. Herring caught in the North Sea. Total catch (tonnes) by country, 2017–2021. These figures do not in all cases correspond to the official statistics and cannot be used for legal purposes.

Country	2017	2018	2019	2020	2021
Belgium	13	32	60	119	47
Denmark *	110 318	132 231	91 680	95 615	62 943
Faroe Islands	442	497	614	804	0
France	28 801	31 505	25 288	19 768	25 070
Germany	43 707	51 636	37 699	29 439	25 741
Netherlands	84 914	111 302	79 465	75 036	66 402
Norway	134 132	162 594	128 614	115 879	95 061
Lithuania	0	0	0	0	466
Sweden *	18 518	19 408	13 184	13 149	18 765
Ireland	868	515	3	235	414
UK (England)	16 997	19 591	12 685	16 241	13 174
UK (Scotland)	49 514	66 005	50 771	49 692	51 194
UK (N.Ireland)	3 469	6 916	3 938	2 681	5 176
Unallocated landings	0	0	0	0	0
Total landings	491 693	602 232	444 001	424 800	364 453
Discards/BMS	-	96	1 630	2 522	162
Total catch	491 693	602 328	445 631	427 321	364 615
Estimates of the parts of the catches which have been allocated to spring-spawning stocks					
WBSS	632	2 164	8 832	6 802	3 505
Thames estuary **	0	0	-	-	2
Norw. Spring Spawners ***	83	310	5	88	0

*** 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	2017	2018	2019	2020	2021
Denmark *	76277	90763	54820	56676	37970
Faroe Islands	405	496	611	794	0
France	11064	14745	13344	7688	13795
Germany	32736	35884	19851	16694	16590
Lithuania	-	-	-	2789	466
Netherlands	55832	56990	44071	50363	48510
Norway	57744	78647	53254	35674	7119
Sweden	12447	14132	8557	7718	11100
Ireland	868	515	3	235	414
UK (England)	12072	12313	5640	1143	9487
UK (Scotland)	49012	64424	50771	42581	33416
UK (N. Ireland)	3469	5582	3938	2681	2514
Total Landings	311926	374491	254860	235330	181381
Discards/BMS	-	-	-	284	64
Total catch	**311926**	**374491**	**254860**	**235613**	**181445**

*** 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	2017	2018	2019	2020	2021
Denmark *	3928	751	0	62	18
Netherlands	0	0	100	0	0
Norway	74216	73452	64592	58535	87756
Sweden	705	377	0	0	479
Total landings	78849	74580	64692	58597	88253
Discards/BMS	-	-	-	-	-
Total catch	78849	74580	64692	58597	88253
Norw. Spring Spawners **	85	310	5	88	0

*** 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	2017	2018	2019	2020	2021
Belgium	0	0	0	11	1
Denmark*	30045	4067	36750	38842	24903
Faroe Islands	37	1	3	10	0
France	7423	6090	1359	5092	1569
Germany	2048	4964	8568	4197	3869
Netherlands	15739	34491	20700	8814	691
UK (N. Ireland)	0	1334	0	0	2662
Norway	2172	10495	10768	21671	186
Sweden*	5366	4899	4627	5431	7166
UK (England)	2435	3262	2750	919	4
UK (Scotland)	502	1581	0-	7082	17775
Unallocated landings	0	0	0	0	0
Total landings	65767	107794	85525	95422	58826
Discards	-	1	800	-	-
Total catch	65767	107795	86325	95422	58826

*** 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	2017	2018	2019	2020	2021
Belgium	13	32	60	108	46
Denmark*	68	40	110	36	53
France	10314	10670	10585	6988	9705
Germany	8923	10788	9280	8548	5282
Netherlands	13343	19821	14594	15859	17202
Sweden	0	0	0	0	21
UK (England)	2490	4016	4295	3883	3682
UK (Scotland)	-	-	-	30	2
Unallocated landings	0	0	0	0	0
Total landings	35151	45367	38924	35451	35992
Discards/BMS	-	95	830	2238	99
Total catch	35151	45462	39754	37689	36091
Coastal spring spawners included above**	-	10	-	-	2

*** 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	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Subarea 4 and Division 7.d: TAC (4 and 7.d)													
Agreed Divisions 4.a,b	149.0	173.5	360.4	427.7	418.3	396.3	461.2	428.7	534.5	342.7	342.7	321.6	380.6
Agreed Div. 4.c, 7.d	15.3	26.5	44.6	50.3	51.7	49.0	57.0	53.0	66.0	42.4	42.4	34.8	47.0
Bycatch ceiling in the small mesh fishery *	13.6	16.5	17.9	14.4	13.1	15.7	13.4	11.4	9.7	13.2	9.0	7.8	8.2
CATCH (4 and 7.d)													
National catch Divisions 4.a,b **	148.1	191.7	387.2	453.8	465.9	439	514.0	456.5	556.9	405.1	389.3	328.5	
Unallocated catch Divisions 4.a,b	0.0	0.0	-3.0	0.0	3.3	1.5	0.0	0.0	0.0	0.0	0.0	0.0	
Discard/slipping Divisions 4.a,b ***	0.0	-	-	-	0.0	-	0.1	-	0.0	0.8	0.3	0.1	
Total catch Divisions 4.a,b #	148.1	191.7	384.2	453.9	469.2	440.5	514.1	456.5	556.9	405.9	389.6	328.5	
National catch Divisions 4.c, 7.d **	26.5	26.7	37.1	44.7	38.2	41.1	45.8	35.2	45.4	38.9	35.5	36.0	
Unallocated catch Divisions 4.c,7.d	0.0	0.0	3.3	0.0	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	0.1	
Total catch Divisions 4.c, 7.d	26.5	26.7	40.4	44.7	38.2	41.1	45.8	35.2	45.5	39.8	37.7	36.1	
Total catch 4 and 7.d as used by ICES #	174.6	218.4	424.6	498.5	507.5	481.6	559.9	491.7	602.3	445.6	427.3	364.6	
CATCH BY FLEET/STOCK (4 and 7.d) ##													
North Sea autumn spawners directed fisheries (Fleet A)	164.8	209.2	411.8	489.9	490.5	471.5	543.6	484.1	591.7	440.5	417.5	352.3	
North Sea autumn spawners industrial (Fleet B)	9.1	8.9	10.6	8.1	14.0	7.9	14.5	7.0	8.5	5.2	9.9	8.8	

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
North Sea autumn spawners in 4 and 7.d total	173.9	218.1	422.5	498.1	504.5	479.4	558.1	491.1	600.2	436.8	420.5	361.1	
Baltic-3.a-type spring spawners in 4	0.8	0.3	2.1	0.5	3.0	2.2	1.8	0.6	2.2	8.8	6.8	3.5	
Coastal-type spring spawners	0.1	0.0	0.1	0.0	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 ###	56.9	12.2	9.6	3.2	2.3	2.2	0.2	0.1	0.3	0.0	0.1	0.0	
Division 3.a: TAC (3.a)													
Agreed herring TAC	33.9	30.0	45.0	55.0	46.8	43.6	51.1	50.7	48.4	29.3	24.5	21.6	25.0
Bycatch ceiling in the small mesh fishery	7.5	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7
CATCH (3.a)													
National catch	37.3	20.0	27.7	31.2	28.9	27.8	29.9	26.8	23.3	14.9	17.8	13.3	
Catch as used by ICES	37.3	20.0	27.7	31.2	28.9	27.8	29.9	26.8	23.3	14.9	17.8	13.3	
CATCH BY FLEET/STOCK (3.a) ##													
Autumn spawners human consumption (Fleet C)	12.0	6.6	7.8	11.8	9.5	10.2	4.1	7.4	3.2	5.8	6.0	4.1	
Autumn spawners mixed clupeoid (Fleet D)	1.8	1.8	4.4	1.6	3.3	4.4	1.4	0.2	0.2	0.3	0.4	0.1	
Autumn spawners in 3.a total	13.8	8.4	12.2	13.4	12.8	14.7	5.5	7.6	3.4	6.1	6.4	4.2	
Spring spawners human consumption (Fleet C)	23.0	10.8	14.5	16.6	15.4	11.3	23.3	19.0	19.7	8.8	10.9	9.0	
Spring spawners mixed clupeoid (Fleet D)	0.5	0.8	1.0	1.3	0.6	1.8	1.1	0.2	0.2	0.0	0.5	0.0	
Spring spawners in 3.a total	23.5	11.6	15.5	17.9	16.1	13.1	24.4	19.2	19.9	8.8	11.4	9.1	
North Sea autumn spawners Total as used by ICES	187.6	226.5	434.6	511.4	517.3	494.1	563.6	498.7	603.5	442.9	426.9	365.4	

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 2021. Catch in numbers (millions) at age (CANUM), by quarter and division.

WR	3.a NSAS	4.aE all	4.aE WBBS	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	**6.9**	**0.0**	**0.0**	**0.0**	**124.7**	**390.6**	**11.8**	**0.0**	**515.3**	**11.8**	**534.1**	**527.2**
1	**15.7**	**1.4**	**0.4**	**1.0**	**22.9**	**72.9**	**0.0**	**0.1**	**96.7**	**0.1**	**112.4**	**97.2**
2	**36.3**	**122.2**	**1.1**	**121.**	**227.7**	**16.5**	**0.0**	**5.7**	**365.3**	**5.7**	**407.**	**372.1**
3	**2.8**	**96.7**	**2.8**	**93.9**	**206.4**	**82.2**	**11.2**	**23.3**	**382.5**	**34.5**	**419.8**	**419.8**
4	**1.5**	**51.2**	**7.3**	**43.9**	**79.2**	**19.4**	**13.5**	**21.7**	**142.5**	**35.2**	**179.2**	**185.0**
5	**0.8**	**86.4**	**4.5**	**81.9**	**117.7**	**17.6**	**13.1**	**34.9**	**217.1**	**48.0**	**265.9**	**269.6**
6	**0.5**	**26.9**	**1.9**	**25.1**	**67.3**	**9.2**	**4.4**	**11.8**	**101.6**	**16.1**	**118.2**	**119.6**
7	**0.1**	**60.5**	**1.1**	**59.4**	**170.3**	**54.4**	**9.2**	**27.**	**284.0**	**36.**	**320.8**	**321.7**
8	**0.1**	**54.9**	**1.8**	**53.2**	**89.3**	**43.7**	**3.8**	**20.**	**186.1**	**24.**	**210.**	**211.9**
9+	**0.0**	**24.6**	**0.5**	**24.1**	**33.4**	**13.7**	**1.2**	**8.5**	**71.2**	**9.7**	**80.9**	**81.3**
Sum	**64.8**	**524.8**	**21.3**	**503.5**	**1138.7**	**720.0**	**68.2**	**153.7**	**2362.3**	**221.9**	**2648.9**	**2605.5**
Quarter: 1												
0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.2	0.0	**0.2**	**0.2**
1	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**2.6**	**0.0**
2	25.4	0.0	0.0	0.0	18.2	0.0	0.0	0.0	18.2	0.0	**43.6**	**18.3**
3	0.8	0.0	0.0	0.0	19.1	0.0	0.3	1.1	19.1	1.4	**21.3**	**20.6**
4	0.0	0.0	0.0	0.0	4.1	0.0	0.5	1.3	4.1	1.7	**5.9**	**5.9**
5	0.0	0.0	0.0	0.0	1.9	0.0	0.8	6.6	1.9	7.4	**9.4**	**9.4**
6	0.0	0.0	0.0	0.0	3.2	0.0	0.7	1.7	3.2	2.4	**5.6**	**5.6**
7	0.0	0.0	0.0	0.0	6.5	0.0	1.9	2.6	6.5	4.4	**10.9**	**10.9**
8	0.0	0.0	0.0	0.0	3.7	0.0	0.2	0.6	3.7	0.8	**4.5**	**4.5**
9+	0.0	0.0	0.0	0.0	2.2	0.0	0.1	0.0	2.2	0.1	**2.2**	**2.2**
Sum	**28.8**	**0.1**	**0.0**	**0.0**	**58.9**	**0.2**	**4.5**	**13.8**	**59.1**	**18.3**	**106.2**	**77.5**
Quarter: 2												
0	0.0	0.0	0.0	0.0	2.1	36.0	0.0	0.0	0.2	0.1	**38.1**	**38.1**
1	1.1	1.2	0.4	0.9	0.7	6.1	0.0	0.0	7.6	0.0	**8.7**	**8.0**
2	2.6	117.7	1.0	116.	60.3	0.6	0.0	0.0	177.6	0.0	**180.**	**178.7**
3	0.1	89.8	2.6	87.2	46.8	1.0	0.0	0.0	135.1	0.0	**135.2**	**137.7**
4	0.0	45.1	6.8	38.3	13.6	0.2	0.0	0.0	52.2	0.0	**52.2**	**59.0**
5	0.0	64.3	4.1	60.1	13.6	0.2	0.0	0.0	73.9	0.0	**74.0**	**78.1**
6	0.0	21.6	1.7	19.9	5.1	0.1	0.0	0.0	25.1	0.0	**25.1**	**26.8**
7	0.0	37.1	1.0	36.0	10.5	0.7	0.0	0.0	47.3	0.0	**47.3**	**48.3**
8	0.0	36.7	1.4	35.4	7.7	0.7	0.0	0.0	43.7	0.0	**43.8**	**45.1**
9+	0.0	14.7	0.4	14.3	1.7	0.2	0.0	0.0	16.2	0.0	**16.2**	**16.6**
Sum	**3.9**	**428.3**	**19.3**	**409.0**	**162.1**	**45.8**	**0.1**	**0.1**	**579.0**	**0.3**	**620.9**	**636.3**
Quarter: 3												
0	0.0	0.0	0.0	0.0	9.2	280.5	1.3	0.0	289.6	1.3	**290.9**	**290.9**
1	10.3	0.1	0.0	0.0	3.6	53.9	0.0	0.0	57.5	0.0	**67.8**	**57.6**
2	7.6	3.0	0.1	3.0	130.5	15.1	0.0	0.0	148.5	0.0	**156.**	**148.6**
3	1.7	4.8	0.2	4.6	122.5	76.6	0.0	0.0	203.7	0.0	**205.4**	**203.9**
4	1.1	4.8	0.6	4.2	48.9	17.8	0.0	0.0	70.9	0.0	**72.0**	**71.5**
5	0.4	16.9	0.3	16.6	93.1	14.7	0.0	0.0	124.3	0.0	**124.8**	**124.7**
6	0.3	4.1	0.1	3.9	54.7	7.9	0.0	0.0	66.5	0.0	**66.8**	**66.6**
7	0.1	19.3	0.1	19.2	129.8	45.4	0.0	0.0	194.4	0.0	**194.**	**194.5**
8	0.0	15.4	0.1	15.3	71.5	40.0	0.0	0.0	126.8	0.0	**126.**	**126.9**
9+	0.0	7.9	0.0	7.8	27.0	12.3	0.0	0.0	47.1	0.0	**47.1**	**47.2**
Sum	**21.4**	**76.1**	**1.6**	**74.5**	**690.8**	**564.1**	**1.3**	**0.0**	**1329.4**	**1.3**	**1352.1**	**1332.3**

Quarter: 4

0	6.9	0.0	0.0	0.0	113.5	74.0	10.5	0.0	187.5	10.5	**204.9**	**198.0**
1	1.8	0.0	0.0	0.0	18.6	12.8	0.0	0.1	31.5	0.1	**33.3**	**31.6**
2	0.7	1.4	0.0	1.4	18.7	0.8	0.0	5.7	20.9	5.7	**27.4**	**26.6**
3	0.2	2.1	0.0	2.1	18.0	4.6	10.8	22.2	24.7	33.0	**57.9**	**57.7**
4	0.4	1.3	0.0	1.3	12.5	1.4	13.0	20.4	15.2	33.4	**49.1**	**48.7**
5	0.3	5.2	0.0	5.2	9.1	2.7	12.3	28.3	16.9	40.5	**57.8**	**57.5**
6	0.2	1.2	0.0	1.2	4.3	1.3	3.7	10.1	6.8	13.7	**20.7**	**20.5**
7	0.1	4.2	0.0	4.2	23.4	8.3	7.3	24.	35.9	32.	**68.1**	**68.0**
8	0.1	2.8	0.3	2.5	6.4	3.0	3.5	19.	11.9	23.	**35.2**	**35.4**
9+	0.0	2.0	0.1	2.0	2.5	1.1	1.2	8.5	5.6	9.6	**15.3**	**15.3**
Sum	**10.7**	**20.3**	**0.4**	**19.9**	**227.0**	**110.0**	**62.3**	**139.8**	**356.8**	**202.1**	**569.6**	**559.3**

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 2021. 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	**0.011**	**0.000**	**0.000**	**0.004**	**0.008**	**0.008**	**0.007**	**0.008**	**0.008**	**0.004**	**0.004**
1	**0.047**	**0.120**	**0.119**	**0.079**	**0.040**	**0.037**	**0.000**	**0.041**	**0.000**	**0.071**	**0.082**
2	**0.071**	**0.136**	**0.138**	**0.138**	**0.133**	**0.143**	**0.100**	**0.134**	**0.101**	**0.130**	**0.136**
3	**0.116**	**0.149**	**0.149**	**0.160**	**0.157**	**0.168**	**0.125**	**0.155**	**0.139**	**0.155**	**0.155**
4	**0.159**	**0.162**	**0.160**	**0.174**	**0.173**	**0.189**	**0.141**	**0.169**	**0.159**	**0.171**	**0.170**
5	**0.174**	**0.178**	**0.168**	**0.195**	**0.199**	**0.210**	**0.173**	**0.191**	**0.183**	**0.189**	**0.189**
6	**0.192**	**0.180**	**0.174**	**0.216**	**0.214**	**0.225**	**0.189**	**0.205**	**0.199**	**0.214**	**0.213**
7	**0.206**	**0.200**	**0.181**	**0.218**	**0.225**	**0.231**	**0.192**	**0.220**	**0.202**	**0.219**	**0.219**
8	**0.186**	**0.203**	**0.194**	**0.239**	**0.226**	**0.241**	**0.188**	**0.219**	**0.196**	**0.238**	**0.237**
9+	**0.000**	**0.220**	**0.205**	**0.246**	**0.240**	**0.253**	**0.205**	**0.233**	**0.211**	**0.247**	**0.246**
Quarter: 1											
0	0.000	0.000	0.000	0.002	0.000	0.008	0.000	0.000	0.000	**0.002**	**0.002**
1	0.025	0.116	0.116	0.016	0.000	0.034	0.000	0.001	0.000	**0.025**	**0.029**
2	0.055	0.134	0.134	0.080	0.084	0.112	0.100	0.084	0.112	**0.055**	**0.100**
3	0.073	0.145	0.145	0.117	0.109	0.140	0.093	0.109	0.104	**0.123**	**0.132**
4	0.107	0.155	0.155	0.116	0.135	0.162	0.107	0.135	0.121	**0.133**	**0.134**
5	0.081	0.163	0.163	0.106	0.160	0.183	0.120	0.160	0.127	**0.130**	**0.131**
6	0.000	0.168	0.168	0.142	0.166	0.182	0.140	0.166	0.152	**0.162**	**0.162**
7	0.000	0.176	0.176	0.149	0.182	0.204	0.138	0.182	0.000	**0.162**	**0.162**
8	0.155	0.182	0.182	0.160	0.198	0.216	0.145	0.198	0.000	**0.189**	**0.189**
9+	0.000	0.193	0.193	0.180	0.190	0.223	0.173	0.190	0.222	**0.182**	**0.182**
Quarter: 2											
0	0.000	0.000	0.000	0.002	0.008	0.008	0.000	0.008	0.000	**0.002**	**0.002**
1	0.030	0.116	0.116	0.044	0.074	0.034	0.000	0.081	0.000	**0.089**	**0.093**
2	0.058	0.134	0.134	0.140	0.126	0.128	0.100	0.131	0.128	**0.129**	**0.130**
3	0.073	0.145	0.145	0.151	0.142	0.162	0.093	0.144	0.111	**0.147**	**0.146**
4	0.096	0.155	0.155	0.167	0.162	0.171	0.107	0.157	0.126	**0.164**	**0.163**
5	0.000	0.163	0.163	0.176	0.163	0.184	0.119	0.163	0.136	**0.172**	**0.172**
6	0.000	0.168	0.168	0.191	0.184	0.190	0.146	0.171	0.168	**0.186**	**0.185**
7	0.000	0.176	0.176	0.206	0.189	0.223	0.138	0.179	0.197	**0.199**	**0.198**
8	0.000	0.182	0.182	0.215	0.207	0.238	0.142	0.187	0.197	**0.204**	**0.203**
9+	0.000	0.193	0.193	0.230	0.206	0.251	0.173	0.194	0.235	**0.218**	**0.217**

Quarter: 3

0	0.000	0.000	0.000	0.004	0.008	0.008	0.007	0.008	0.008	**0.004**	**0.004**
1	0.054	0.158	0.158	0.075	0.069	0.038	0.000	0.070	0.000	**0.071**	**0.076**
2	0.125	0.187	0.187	0.145	0.143	0.143	0.000	0.144	0.000	**0.145**	**0.146**
3	0.134	0.202	0.202	0.168	0.170	0.168	0.000	0.171	0.000	**0.169**	**0.170**
4	0.159	0.214	0.214	0.184	0.179	0.189	0.000	0.181	0.000	**0.184**	**0.184**
5	0.172	0.224	0.224	0.213	0.205	0.207	0.000	0.208	0.000	**0.212**	**0.212**
6	0.196	0.232	0.232	0.229	0.219	0.225	0.000	0.220	0.000	**0.231**	**0.230**
7	0.206	0.241	0.241	0.237	0.233	0.229	0.000	0.234	0.000	**0.239**	**0.238**
8	0.201	0.248	0.248	0.251	0.231	0.241	0.000	0.233	0.000	**0.252**	**0.251**
9+	0.000	0.263	0.263	0.275	0.248	0.252	0.000	0.250	0.000	**0.271**	**0.270**

Quarter: 4

0	0.011	0.000	0.000	0.004	0.008	0.008	0.007	0.008	0.008	**0.005**	**0.004**
1	0.049	0.154	0.154	0.080	0.033	0.035	0.000	0.033	0.000	**0.076**	**0.079**
2	0.105	0.176	0.176	0.123	0.130	0.146	0.153	0.134	0.153	**0.124**	**0.125**
3	0.145	0.190	0.190	0.154	0.153	0.168	0.126	0.156	0.139	**0.142**	**0.142**
4	0.167	0.201	0.201	0.163	0.172	0.187	0.142	0.174	0.160	**0.162**	**0.162**
5	0.177	0.210	0.210	0.167	0.200	0.231	0.176	0.203	0.193	**0.178**	**0.178**
6	0.186	0.216	0.216	0.182	0.217	0.224	0.199	0.216	0.205	**0.193**	**0.193**
7	0.205	0.226	0.226	0.188	0.209	0.237	0.206	0.211	0.213	**0.202**	**0.202**
8	0.185	0.232	0.232	0.203	0.203	0.239	0.191	0.210	0.198	**0.229**	**0.229**
9+	0.000	0.248	0.248	0.252	0.219	0.256	0.207	0.229	0.213	**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 2021. 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**	**9.9**	**9.9**	**9.8**	9.9	**9.9**	**7.6**
1	**n.d.**	**23.0**	**n.d.**	**20.5**	**16.6**	**16.4**	**0.0**	16.7	**0.0**	**20.2**
2	**n.d.**	**24.2**	**n.d.**	**24.8**	**24.8**	**25.1**	**24.3**	24.6	**24.3**	**24.4**
3	**n.d.**	**25.1**	**n.d.**	**25.5**	**26.1**	**26.8**	**24.6**	25.9	**25.3**	**25.4**
4	**n.d.**	**25.8**	**n.d.**	**26.2**	**26.9**	**27.9**	**25.5**	26.5	**26.4**	**26.1**
5	**n.d.**	**26.6**	**n.d.**	**27.6**	**27.9**	**28.7**	**27.1**	27.4	**27.6**	**27.2**
6	**n.d.**	**26.9**	**n.d.**	**28.4**	**28.8**	**29.4**	**27.9**	28.3	**28.3**	**28.2**
7	**n.d.**	**27.9**	**n.d.**	**28.4**	**29.1**	**29.4**	**28.2**	28.8	**28.5**	**28.4**
8	**n.d.**	**28.0**	**n.d.**	**29.5**	**29.1**	**29.8**	**28.3**	28.8	**28.6**	**29.3**
9+	**n.d.**	**28.9**	**n.d.**	**30.1**	**29.9**	**30.5**	**28.3**	29.5	**28.6**	**29.8**

Quarter: 1

0	n.d.	0.0	n.d.	6.9	0.0	9.9	0.0	0.0	0.0	**6.9**
1	n.d.	22.8	n.d.	12.0	0.0	16.1	0.0	0.0	0.0	**13.4**
2	n.d.	24.1	n.d.	21.7	22.0	23.3	24.3	22.0	23.3	**22.7**
3	n.d.	24.9	n.d.	25.0	24.3	25.3	24.9	24.3	25.0	**25.3**
4	n.d.	25.5	n.d.	25.1	26.1	26.7	25.9	26.1	26.1	**25.4**
5	n.d.	26.0	n.d.	24.9	27.5	27.8	26.5	27.5	26.7	**25.6**
6	n.d.	26.4	n.d.	27.0	27.8	27.8	28.1	27.8	28.0	**27.3**
7	n.d.	26.9	n.d.	27.4	28.6	28.8	27.9	28.6	28.3	**27.6**
8	n.d.	27.2	n.d.	28.0	29.3	29.4	28.8	29.3	29.0	**28.6**
9+	n.d.	27.9	n.d.	29.2	29.3	29.8	30.0	29.3	29.8	**29.2**

Quarter: 2

0	n.d.	0.0	n.d.	6.9	9.9	9.9	0.0	9.9	0.0	**6.9**
1	n.d.	22.8	n.d.	14.8	19.6	16.1	0.0	20.1	0.0	**20.4**
2	n.d.	24.1	n.d.	24.2	24.0	23.9	24.3	24.1	23.9	**23.5**
3	n.d.	24.9	n.d.	24.8	25.1	25.8	24.9	25.0	25.1	**24.5**
4	n.d.	25.5	n.d.	25.6	26.1	26.4	25.9	25.6	26.0	**25.4**
5	n.d.	26.0	n.d.	26.1	26.4	27.0	26.5	26.1	26.6	**25.9**
6	n.d.	26.4	n.d.	26.9	27.3	27.2	28.3	26.6	27.8	**26.6**
7	n.d.	26.9	n.d.	27.6	27.6	28.7	27.8	27.1	0.0	**27.2**
8	n.d.	27.2	n.d.	28.0	28.2	29.3	28.6	27.4	0.0	**27.5**
9+	n.d.	27.9	n.d.	28.8	28.2	30.0	30.0	27.9	30.0	**28.1**

Quarter: 3

0	n.d.	0.0	n.d.	7.8	9.9	9.9	9.8	0.0	9.9	**7.8**
1	n.d.	24.7	n.d.	19.9	19.2	16.5	0.0	19.2	0.0	**19.4**
2	n.d.	26.4	n.d.	25.4	25.5	25.1	0.0	25.5	0.0	**25.2**
3	n.d.	27.2	n.d.	26.0	26.7	26.8	0.0	26.7	0.0	**26.1**
4	n.d.	27.8	n.d.	26.7	26.9	27.9	0.0	27.0	0.0	**26.7**
5	n.d.	28.3	n.d.	28.4	28.1	28.5	0.0	28.1	0.0	**28.3**
6	n.d.	28.7	n.d.	29.0	28.9	29.4	0.0	28.9	0.0	**28.9**
7	n.d.	29.2	n.d.	28.8	29.2	29.3	0.0	29.2	0.0	**29.0**
8	n.d.	29.5	n.d.	29.8	29.2	29.8	0.0	29.3	0.0	**29.9**
9+	n.d.	30.2	n.d.	30.7	30.0	30.4	0.0	30.1	0.0	**30.5**

Quarter: 4

0	n.d.	0.0	n.d.	7.8	9.9	9.9	9.8	9.9	9.9	**7.8**
1	n.d.	25.9	n.d.	20.8	16.0	16.2	0.0	16.0	0.0	**20.6**
2	n.d.	27.4	n.d.	24.3	25.3	25.4	26.2	25.5	26.2	**24.3**
3	n.d.	28.1	n.d.	25.7	26.8	26.7	24.5	26.9	25.3	**25.2**
4	n.d.	28.7	n.d.	26.1	27.7	28.1	25.5	27.8	26.5	**26.2**
5	n.d.	29.3	n.d.	26.7	28.9	30.0	27.2	29.0	28.0	**27.0**
6	n.d.	29.6	n.d.	27.7	29.8	30.0	27.9	29.7	28.4	**27.6**
7	n.d.	30.1	n.d.	28.1	29.3	30.2	28.3	29.4	28.8	**28.1**
8	n.d.	30.5	n.d.	29.7	29.0	29.6	28.3	29.3	28.5	**29.3**
9+	n.d.	31.3	n.d.	29.1	29.7	30.7	28.2	30.3	28.5	**29.3**

Table 2.2.4. North Sea autumn spawning herring (NSAS), and western Baltic spring spawners (WBSS) caught in the North Sea and Division 3.a in 2021. Catches (tonnes) at-age (SOP figures), 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	**0.1**	**0.0**	**0.0**	**0.0**	**0.5**	**3.1**	**0.1**	**0.0**	**3.6**	**0.1**	**3.8**	**3.7**
1	**0.7**	**0.2**	**0.0**	**0.1**	**1.8**	**2.9**	**0.0**	**0.0**	**4.8**	**0.0**	**5.6**	**4.9**
2	**2.6**	**16.6**	**0.2**	**16.4**	**31.4**	**2.2**	**0.0**	**0.6**	**50.1**	**0.6**	**53.2**	**50.8**
3	**0.3**	**14.4**	**0.4**	**14.0**	**32.9**	**12.9**	**1.9**	**2.9**	**59.8**	**4.8**	**64.9**	**65.0**
4	**0.2**	**8.3**	**1.2**	**7.1**	**13.8**	**3.4**	**2.5**	**3.0**	**24.2**	**5.6**	**30.1**	**31.0**
5	**0.1**	**15.4**	**0.7**	**14.6**	**23.0**	**3.5**	**2.8**	**6.0**	**41.1**	**8.8**	**50.0**	**50.6**
6	**0.1**	**4.8**	**0.3**	**4.5**	**14.5**	**2.0**	**1.0**	**2.2**	**21.0**	**3.2**	**24.3**	**24.5**
7	**0.0**	**12.1**	**0.2**	**11.9**	**37.1**	**12.2**	**2.1**	**5.3**	**61.3**	**7.4**	**68.7**	**68.9**
8	**0.0**	**11.1**	**0.3**	**10.8**	**21.3**	**9.8**	**0.9**	**3.8**	**42.0**	**4.7**	**46.7**	**47.0**
9+	**0.0**	**5.4**	**0.1**	**5.3**	**8.2**	**3.3**	**0.3**	**1.7**	**16.8**	**2.0**	**18.8**	**18.9**
Sum	**4.2**	**88.3**	**3.5**	**84.8**	**184.6**	**55.3**	**11.6**	**25.6**	**324.7**	**37.2**	**366.1**	**365.3**

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	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.1**	**0.0**
2	1.4	0.0	0.0	0.0	1.5	0.0	0.0	0.0	1.5	0.0	**0.0**	**1.5**
3	0.1	0.0	0.0	0.0	2.2	0.0	0.0	0.1	2.2	0.1	**2.4**	**2.4**
4	0.0	0.0	0.0	0.0	0.5	0.0	0.1	0.1	0.5	0.2	**0.7**	**0.7**
5	0.0	0.0	0.0	0.0	0.2	0.0	0.2	0.8	0.2	0.9	**1.1**	**1.1**
6	0.0	0.0	0.0	0.0	0.5	0.0	0.1	0.2	0.5	0.4	**0.8**	**0.8**
7	0.0	0.0	0.0	0.0	1.0	0.0	0.4	0.4	1.0	0.7	**1.7**	**1.7**
8	0.0	0.0	0.0	0.0	0.6	0.0	0.1	0.1	0.6	0.1	**0.7**	**0.7**
9+	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.4	0.0	**0.4**	**0.4**
Sum	**1.5**	**0.0**	**0.0**	**0.0**	**6.8**	**0.0**	**0.9**	**1.7**	**6.8**	**2.6**	**8.0**	**9.3**

Quarter: 2

0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.3	0.0	**0.3**	**0.3**
1	0.0	0.1	0.0	0.1	0.0	0.5	0.0	0.0	0.6	0.0	**0.6**	**0.6**
2	0.2	15.8	0.1	15.6	8.4	0.1	0.0	0.0	24.1	0.0	**24.3**	**24.3**
3	0.0	13.0	0.4	12.7	7.1	0.1	0.0	0.0	19.8	0.0	**19.9**	**20.2**
4	0.0	7.0	1.0	5.9	2.3	0.0	0.0	0.0	8.3	0.0	**8.3**	**9.3**
5	0.0	10.5	0.7	9.8	2.4	0.0	0.0	0.0	12.2	0.0	**12.2**	**12.9**
6	0.0	3.6	0.3	3.3	1.0	0.0	0.0	0.0	4.3	0.0	**4.3**	**4.6**
7	0.0	6.5	0.2	6.3	2.2	0.1	0.0	0.0	8.6	0.0	**8.6**	**8.8**
8	0.0	6.7	0.2	6.4	1.7	0.1	0.0	0.0	8.2	0.0	**8.2**	**8.5**
9+	0.0	2.8	0.1	2.8	0.4	0.0	0.0	0.0	3.2	0.0	**3.2**	**3.3**
Sum	**0.2**	**66.1**	**3.1**	**63.0**	**25.4**	**1.4**	**0.0**	**0.0**	**89.7**	**0.0**	**90.0**	**92.8**

Quarter: 3

0	0.0	0.0	0.0	0.0	0.0	2.2	0.0	0.0	2.3	0.0	**2.3**	**2.3**
1	0.6	0.0	0.0	0.0	0.3	3.7	0.0	0.0	4.0	0.0	**4.6**	**4.0**
2	0.9	0.6	0.0	0.0	19.0	2.2	0.0	0.0	21.1	0.0	**22.6**	**21.7**
3	0.2	1.0	0.0	0.0	20.6	13.0	0.0	0.0	33.6	0.0	**34.7**	**34.5**
4	0.2	1.0	0.1	0.0	9.0	3.2	0.0	0.0	12.2	0.0	**13.3**	**13.2**
5	0.1	3.8	0.1	3.7	19.8	3.0	0.0	0.0	26.5	0.0	**26.6**	**26.6**
6	0.1	0.9	0.0	0.0	12.5	1.7	0.0	0.0	14.3	0.0	**15.2**	**15.2**
7	0.0	4.6	0.0	4.6	30.8	10.6	0.0	0.0	46.0	0.0	**46.0**	**46.0**
8	0.0	3.8	0.0	3.8	17.9	9.2	0.0	0.0	31.0	0.0	**31.0**	**31.0**
9+	0.0	2.1	0.0	2.1	7.4	3.1	0.0	0.0	12.5	0.0	**12.5**	**12.5**
Sum	**2.1**	**17.8**	**0.4**	**14.2**	**137.3**	**52.0**	**0.0**	**0.0**	**203.5**	**0.0**	**208.8**	**207.1**

Quarter: 4

0	0.1	0.0	0.0	0.0	0.5	0.6	0.1	0.0	1.0	0.1	**1.2**	**1.1**
1	0.1	0.0	0.0	0.0	1.5	0.4	0.0	0.0	1.9	0.0	**2.0**	**1.9**
2	0.1	0.3	0.0	0.0	2.3	0.1	0.0	0.9	2.4	0.9	**3.6**	**3.5**
3	0.0	0.4	0.0	0.0	2.8	0.7	1.8	2.8	3.5	4.6	**8.5**	**8.5**
4	0.1	0.3	0.0	0.3	2.0	0.2	2.4	2.9	2.5	5.3	**7.9**	**7.9**
5	0.1	1.1	0.0	1.1	1.5	0.5	2.8	5.0	3.1	7.8	**11.0**	**10.9**
6	0.0	0.3	0.0	0.3	0.8	0.3	0.8	2.0	1.3	2.8	**4.2**	**4.1**
7	0.0	0.9	0.0	0.9	4.4	1.7	1.7	5.1	7.1	6.9	**13.9**	**13.9**
8	0.0	0.6	0.1	0.6	1.3	0.6	0.8	3.8	2.5	4.6	**7.1**	**7.2**
9+	0.0	0.5	0.0	0.5	0.6	0.2	0.3	1.8	1.4	2.0	**3.4**	**3.4**
Sum	**0.5**	**4.4**	**0.1**	**3.6**	**17.7**	**5.5**	**10.9**	**24.2**	**26.8**	**35.0**	**62.9**	**62.5**

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	**10.7%**	**0.0%**	**0.0%**	**0.0%**	**11.0%**	**54.2%**	**17.4%**	**0.0%**	**21.8%**	**5.3%**	**20.2%**	**20.2%**
1	**24.2%**	**0.3%**	**1.8%**	**0.2%**	**2.0%**	**10.1%**	**0.0%**	**0.1%**	**4.1%**	**0.0%**	**4.2%**	**3.7%**
2	**56.1%**	**23.3%**	**5.1%**	**24.1%**	**20.0%**	**2.3%**	**0.0%**	**3.7%**	**15.5%**	**2.6%**	**15.4**	**14.3**
3	**4.3%**	**18.4%**	**13.1%**	**18.6%**	**18.1%**	**11.4%**	**16.4%**	**15.2%**	**16.2%**	**15.5%**	**15.8%**	**16.1%**
4	**2.3%**	**9.8%**	**34.4%**	**8.7%**	**7.0%**	**2.7%**	**19.8%**	**14.1%**	**6.0%**	**15.9%**	**6.8%**	**7.1%**
5	**1.2%**	**16.5%**	**21.0%**	**16.3%**	**10.3%**	**2.4%**	**19.2%**	**22.7%**	**9.2%**	**21.6%**	**10.0%**	**10.3%**
6	**0.7%**	**5.1%**	**8.8%**	**5.0%**	**5.9%**	**1.3%**	**6.4%**	**7.7%**	**4.3%**	**7.3%**	**4.5%**	**4.6%**
7	**0.2%**	**11.5%**	**5.2%**	**11.8%**	**15.0%**	**7.5%**	**13.4%**	**17.9**	**12.0%**	**16.5**	**12.1**	**12.3**
8	**0.2%**	**10.5%**	**8.3%**	**10.6%**	**7.8%**	**6.1%**	**5.5%**	**13.2**	**7.9%**	**10.8**	**7.9%**	**8.1%**
9+	**0.0%**	**4.7%**	**2.3%**	**4.8%**	**2.9%**	**1.9%**	**1.8%**	**5.5%**	**3.0%**	**4.4%**	**3.1%**	**3.1%**
Sum 3+	**9.0%**	**76.5%**	**93.0%**	**75.8%**	**67.0%**	**33.3%**	**82.6%**	**96.2%**	**58.6%**	**92.0%**	**60.2%**	**61.8%**

Quarter: 1

0	0.0%	0.0%	0.0%	0.0%	0.0%	70.3%	0.0%	0.0%	0.3%	0.0%	**0.1%**	**0.2%**
1	8.9%	0.3%	0.0%	100.0	0.0%	12.0%	0.0%	0.0%	0.0%	0.0%	**2.4%**	**0.0%**
2	88.2%	27.5%	13.5%	0.0%	30.9%	3.8%	0.7%	0.0%	30.8%	0.2%	**41.1%**	**23.6**
3	2.7%	21.0%	18.1%	0.0%	32.4%	5.5%	7.5%	7.9%	32.3%	7.8%	**20.1%**	**26.5%**
4	0.2%	10.5%	9.8%	0.0%	7.0%	1.1%	10.0%	9.3%	7.0%	9.5%	**5.6%**	**7.6%**
5	0.0%	15.0%	34.6%	0.0%	3.3%	0.7%	18.5%	47.9%	3.2%	40.6%	**8.8%**	**12.1%**
6	0.0%	5.1%	6.3%	0.0%	5.5%	0.7%	15.2%	12.3	5.5%	13.0	**5.3%**	**7.3%**
7	0.0%	8.6%	0.0%	0.0%	11.0%	2.8%	41.1%	18.7	10.9%	24.2	**10.3**	**14.1**
8	0.0%	8.6%	17.7%	0.0%	6.2%	2.2%	5.5%	4.0%	6.2%	4.4%	**4.2%**	**5.8%**
9+	0.0%	3.4%	0.0%	0.0%	3.7%	0.9%	1.4%	0.0%	3.7%	0.3%	**2.1%**	**2.9%**
Sum 3+	**2.9%**	**72.2%**	**86.5%**	**0.0%**	**69.1%**	**14.0%**	**99.3%**	**100.0%**	**68.9%**	**99.8%**	**56.3%**	**76.2%**

Quarter: 2

0	0.0%	0.0%	0.0%	0.0%	1.3%	78.6%	0.0%	0.0%	0.0%	52.1%	**6.1%**	**6.0%**
1	29.0%	0.3%	1.9%	0.2%	0.4%	13.3%	0.0%	0.0%	1.3%	0.0%	**1.4%**	**1.3%**
2	68.2%	27.5%	5.2%	28.5%	37.2%	1.3%	0.4%	0.0%	30.7%	0.1%	**29.0**	**28.1**
3	2.5%	21.0%	13.3%	21.3%	28.9%	2.3%	3.9%	9.4%	23.3%	3.3%	**21.8%**	**21.6%**
4	0.3%	10.5%	35.0%	9.4%	8.4%	0.5%	5.2%	10.6%	9.0%	3.9%	**8.4%**	**9.3%**
5	0.0%	15.0%	21.3%	14.7%	8.4%	0.5%	19.6%	45.5%	12.8%	16.1%	**11.9%**	**12.3%**
6	0.0%	5.0%	8.8%	4.9%	3.2%	0.1%	13.9%	11.6	4.3%	6.1%	**4.0%**	**4.2%**
7	0.0%	8.7%	5.3%	8.8%	6.5%	1.5%	49.3%	18.5	8.2%	15.6	**7.6%**	**7.6%**
8	0.0%	8.6%	7.1%	8.6%	4.8%	1.5%	6.9%	4.3%	7.6%	2.6%	**7.0%**	**7.1%**
9+	0.0%	3.4%	2.0%	3.5%	1.0%	0.4%	0.7%	0.2%	2.8%	0.2%	**2.6%**	**2.6%**
Sum 3+	**2.8%**	**72.2%**	**92.9%**	**71.2%**	**61.1%**	**6.8%**	**99.6%**	**100.0%**	**68.0%**	**47.8%**	**63.4%**	**64.7%**

Quarter: 3

0	0.0%	0.0%	0.0%	0.0%	1.3%	49.7%	100.0%	0.0%	21.8%	100.0%	**21.5%**	**21.8%**
1	47.8%	0.1%	1.9%	0.0%	0.5%	9.6%	0.0%	0.0%	4.3%	0.0%	**5.0%**	**4.3%**
2	35.4%	4.0%	5.2%	0.0%	18.9%	2.7%	0.0%	0.0%	11.2	0.0%	**11.5**	**11.2**
3	8.0%	6.3%	13.2%	0.0%	17.7%	13.6	0.0%	0.0%	15.3%	0.0%	**15.2**	**15.3**
4	5.0%	6.2%	35.0%	0.0%	7.1%	3.2%	0.0%	0.0%	5.3%	0.0%	**5.3%**	**5.4%**
5	2.1%	22.2%	21.4%	0.0%	13.5%	2.6%	0.0%	0.0%	9.4%	0.0%	**9.2%**	**9.4%**
6	1.3%	5.4%	8.8%	0.0%	7.9%	1.4%	0.0%	0.0%	5.0%	0.0%	**4.9%**	**5.0%**
7	0.3%	25.3%	5.3%	0.0%	18.8%	8.0%	0.0%	0.0%	14.6	0.0%	**14.4**	**14.6**
8	0.1%	20.2%	7.2%	0.0%	10.4%	7.1%	0.0%	0.0%	9.5%	0.0%	**9.4%**	**9.5%**
9+	0.0%	10.3%	2.0%	0.0%	3.9%	2.2%	0.0%	0.0%	3.5%	0.0%	**3.5%**	**3.5%**
Sum 3+	**16.8%**	**95.9%**	**92.9%**	**0.0%**	**79.3%**	**38.0%**	**0.0%**	**0.0%**	**62.7%**	**0.0%**	**61.9%**	**62.7%**

Quarter: 4

0	64.7%	0.0%	0.0%	0.0%	50.0%	67.3%	16.9%	0.0%	52.5%	5.2%	**36.0%**	**35.4%**
1	16.4%	0.2%	0.0%	0.2%	8.2%	11.7%	0.0%	0.1%	8.8%	0.0%	**5.9%**	**5.6%**
2	6.9%	7.0%	0.0%	7.1%	8.2%	0.7%	0.0%	4.1%	5.9%	2.8%	**4.8%**	**4.8%**
3	1.8%	10.2%	0.0%	10.4%	7.9%	4.2%	17.4%	15.9%	6.9%	16.3%	**10.2%**	**10.3%**
4	3.6%	6.6%	2.8%	6.7%	5.5%	1.3%	20.9%	14.6%	4.3%	16.5%	**8.6%**	**8.7%**
5	3.2%	25.7%	0.0%	26.2%	4.0%	2.4%	19.7%	20.2%	4.7%	20.1%	**10.1%**	**10.3%**
6	1.6%	6.1%	10.2%	6.0%	1.9%	1.2%	5.9%	7.2%	1.9%	6.8%	**3.6%**	**3.7%**
7	0.7%	20.5%	0.0%	20.9%	10.3%	7.5%	11.7%	17.8	10.1%	15.9	**12.0**	**12.2**
8	0.9%	13.8%	70.6%	12.7%	2.8%	2.7%	5.7%	14.1	3.3%	11.5	**6.2%**	**6.3%**
9+	0.0%	10.0%	16.4%	9.9%	1.1%	1.0%	1.9%	6.1%	1.6%	4.8%	**2.7%**	**2.7%**
Sum 3+	**12.0%**	**92.8%**	**100.0%**	**92.6%**	**33.6%**	**20.3%**	**83.1%**	**95.9%**	**32.8%**	**91.9%**	**53.4%**	**54.2%**

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	527.2	0.008	6.9	0.011	0.0	0.000	534.1	0.008
1	10.1	0.074	86.6	0.033	13.9	0.048	1.8	0.045	112.4	0.039
2	367.4	0.136	3.6	0.116	36.0	0.071	0.3	0.067	407.4	0.130
3	414.8	0.156	2.2	0.135	2.8	0.116	0.0	0.000	419.8	0.155
4	176.1	0.171	1.6	0.163	1.5	0.159	0.0	0.000	179.2	0.171
5	264.4	0.189	0.7	0.174	0.8	0.173	0.0	0.000	265.9	0.189
6	117.6	0.214	0.2	0.162	0.5	0.193	0.0	0.000	118.2	0.213
7	318.2	0.219	2.4	0.181	0.1	0.206	0.0	0.000	320.8	0.219
8	209.3	0.238	0.8	0.189	0.1	0.186	0.0	0.000	210.2	0.238
9+	80.6	0.247	0.3	0.193	0.0	0.000	0.0	0.000	80.9	0.247
TOTAL	1'958.5		625.6		62.6		2.1		2'648.9	
SOP catch		359.8		8,7		4,1		0.1		372.7

Table 2.2.7. Catch-at-age (numbers in millions) of North Sea herring, 2006–2021.

Year/rings	0	1	2	3	4	5	6	7	8	9+	Total
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

Year/rings	0	1	2	3	4	5	6	7	8	9+	Total
2019	513	35	34	292	197	740	542	140	85	138	2717
2020	2048	86	505	210	290	146	515	349	69	108	4324
2021	527	97	372	420	185	270	120	322	212	81	2606

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, 2006–2021.

Year/rings	0	1	2	3	4	5	6	7	8	9+	Total
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
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
2021	0.0	0.4	1.1	2.8	7.3	4.5	1.9	1.1	1.8	0.5	21.3

Table 2.2.9. Catch-at-age (numbers in millions) of NSAS taken in 3.a, and transferred to the assessment of NSAS, 2006–2021.

Year/rings	0	1	2	3	4	5	6	7	8+	Total
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
2021	6.9	15.7	36.3	2.8	1.5	0.8	0.5	0.1	0.1	64.8

Table 2.2.10. Catch-at-age (numbers in millions) of the total NSAS stock 2006–2021.

Year/rings	0	1	2	3	4	5	6	7	8	9+	Total
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

Year/rings	0	1	2	3	4	5	6	7	8	9+	Total
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
2021	534	112	407	420	179	266	118	321	210	81	2649

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	2011	0.084	0.114	0.134	0.191	0.193	0.234	0.248	-
	2012	0.067	0.124	0.169	0.175	0.200	0.221	0.216	-
	2013	0.075	0.134	0.160	0.201	0.000	0.000	0.000	-
	2014	0.074	0.109	0.162	0.191	0.209	0.221	0.228	-
	2015	0.068	0.133	0.157	0.180	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	0.190	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	0.000	-
	2021	0.071	0.116	0.159	0.174	0.192	0.206	0.186	-
4.a(E)	2011	0.142	0.162	0.180	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	0.200	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	0.170	0.182	0.193	0.198	0.203	0.209

		Age (Rings)							
Division	Year	2	3	4	5	6	7	8	9+
	2018	0.125	0.152	0.173	0.188	0.201	0.212	0.219	0.230
	2019	0.134	0.155	0.173	0.212	0.204	0.209	0.220	0.250
	2020	0.126	0.144	0.158	0.169	0.180	0.191	0.197	0.210
	2021	0.126	0.149	0.162	0.178	0.180	0.200	0.203	0.220
4.a(W)	2011	0.141	0.161	0.185	0.195	0.216	0.223	0.220	0.243
	2012	0.132	0.184	0.186	0.206	0.226	0.240	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	0.250
	2017	0.120	0.160	0.177	0.192	0.218	0.226	0.236	0.236
	2018	0.114	0.156	0.188	0.193	0.220	0.241	0.250	0.258
	2019	0.134	0.154	0.174	0.205	0.206	0.220	0.246	0.248
	2020	0.138	0.160	0.174	0.195	0.216	0.218	0.239	0.246
	2021	0.138	0.160	0.174	0.195	0.216	0.218	0.239	0.246
4.b	2011	0.145	0.162	0.187	0.206	0.235	0.234	0.240	0.268
	2012	0.131	0.141	0.178	0.209	0.214	0.245	0.250	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	0.240	0.249	0.256	0.277
	2015	0.140	0.162	0.189	0.203	0.208	0.216	0.227	0.250
	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	0.230	0.240	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	0.210	0.229	0.251	0.244	0.253
	2020	0.150	0.174	0.186	0.212	0.234	0.241	0.252	0.265
	2021	0.133	0.157	0.173	0.199	0.214	0.225	0.226	0.240

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 2011-2021.

		Age (Rings)							
Division	Year	2	3	4	5	6	7	8	9+
4.a & 4.b	2011	0.142	0.161	0.184	0.198	0.220	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	0.190	0.203	0.223	0.219	0.228	0.245
	2016	0.134	0.159	0.185	0.210	0.218	0.235	0.226	0.242
	2017	0.116	0.159	0.176	0.190	0.217	0.223	0.231	0.230
	2018	0.117	0.152	0.187	0.195	0.220	0.238	0.245	0.254
	2019	0.136	0.153	0.173	0.208	0.210	0.220	0.239	0.251
	2020	0.136	0.159	0.173	0.192	0.215	0.221	0.238	0.249
	2021	0.134	0.155	0.169	0.191	0.205	0.220	0.219	0.233
4.c & 7.d	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	0.180	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	0.210
	2016	0.114	0.127	0.137	0.166	0.177	0.199	0.193	0.216
	2017	0.100	0.122	0.146	0.165	0.186	0.193	0.220	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
	2021	0.100	0.125	0.141	0.173	0.189	0.192	0.188	0.205
Total	2011	0.141	0.160	0.183	0.197	0.217	0.221	0.223	0.240
North Sea	2012	0.130	0.171	0.185	0.206	0.222	0.239	0.239	0.247
Catch	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	0.200	0.221	0.217	0.226	0.243
	2016	0.132	0.155	0.180	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	0.220	0.230	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	0.170	0.189	0.213	0.219	0.237	0.246
	2021	0.133	0.154	0.169	0.192	0.208	0.220	0.219	0.233

Table 2.2.12. Sampling of commercial landings of North Sea herring (Division 4 and 7.d) in 2021 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	3	0	0%	14	0	0	0	n
	2	2	0	0%	0	0	0	0	n
	4	3	0	0%	32	0	0	0	n
total		8	0	0%	47	0	0	0	n
Denmark (A)	1	2	1	100%	6387	5	134	646	n
	2	2	0	0%	3264	0	0	0	n
	3	2	2	100%	37390	30	777	3244	n
	4	2	1	75%	7500	3	80	390	n
total		8	4	91%	54541	38	991	4280	n
Denmark (B)	1	3	0	0%	345	0	0	0	n
	2	2	0	0%	490	0	0	0	n
	3	3	2	94%	3767	33	367	761	y
	4	4	0	0%	3800	0	0	0	n
total		12	2	42%	8403	33	367	761	y
France	1	2	1	15%	1884	3	73	601	y
	2	4	1	100%	3363	12	299	2502	y
	3	3	0	0%	11815	0	0	0	n
	4	4	0	0%	8075	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
total		13	2	14%	25136	15	372	3103	n
Germany	2	2	0	0%	4893	0	0	0	n
	3	2	1	86%	11155	29	247	11355	y
	4	3	2	77%	9748	11	337	1295	y
total		7	3	66%	25797	40	584	12650	y
Ireland	1	1	0	0%	3	0	0	0	n
	4	1	0	0%	411	0	0	0	n
total		2	0	0%	414	0	0	0	n
Netherlands	1	2	1	56%	1241	3	75	419	y
	2	1	1	100%	483	2	49	278	y
	3	2	1	100%	44047	35	870	5213	n
	4	4	3	97%	20630	11	273	1585	n
total		9	6	98%	66402	51	1267	7495	n
Norway	1	1	0	0%	16	0	0	0	n
	2	3	2	100%	70882	42	1999	2707	n
	3	2	2	100%	18574	10	406	515	n
	4	3	2	99%	5590	4	159	721	n
total		9	6	100%	95061	56	2564	3943	n
UK (Scot)	1	1	0	0%	31	0	0	0	n
	2	1	1	100%	2553	3	99	421	y
	3	2	2	100%	47905	29	1213	4462	n
	4	3	0	0%	705	0	0	0	n
total		7	3	99%	51194	32	1312	4883	n
Sweden	2	3	0	0%	3605	0	0	0	n
	3	3	0	0%	14224	0	0	0	n
	4	3	0	0%	551	0	0	0	n
total		9	0	0%	18380	0	0	0	n
Sweden (B)	2	1	0	0%	33	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	1	0	0%	142	0	0	0	n
	4	2	0	0%	210	0	0	0	n
total		4	0	0%	385	0	0	0	n
UK (NI)	1	1	0	0%	4	0	0	0	n
	3	2	0	0%	4975	0	0	0	n
	4	1	0	0%	198	0	0	0	n
total		4	0	0%	5176	0	0	0	n
Lithuania	4	1	0	0%	466	0	0	0	n
total		1	0	0%	466	0	0	0	n
UK (E+W)	1	3	1	99%	294	1	24	100	y
	2	4	1	99%	923	1	125	896	y
	3	4	1	100%	8099	5	875	3753	n
	4	4	2	19%	3898	2	50	208	n
total		15	5	76%	13214	9	1074	4957	n
Period total	**1**	19	4	75%	10219	12	306	1766	y
Period total	**2**	25	6	86%	90490	60	2571	6804	n
Period total	**3**	26	11	84%	202091	171	4755	29303	n
Period total	**4**	38	10	64%	61815	31	899	4199	n
Total 2021		108	31	81%	364615	274	8531	42072	n
Human Cons. Only		92	29	82%	355827	241	8164	41311	n
Total 2019		104	29	83%	445633	376	7781	57198	n
Total 2020		117	28	82%	427321	347	8226	66700	n
HC 2020		101	26	83%	417457	320	7909	65583	n

2.3.1.1. North Sea herring. Acoustic Surveys in the North Sea (HERAS) in June–July 2021. Vessels, areas and cruise dates.

Vessel	Period	Contributing to Stocks	Strata
Celtic Explorer (IRL) EIGB	30 June – 20 July	MSHAS, WoS	2, 3, 4, 5, 6
Scotia (SCO) MXHR6	7 – 26 July	MSHAS,WoS, NSAS, Sprat NS	1, 91 (north of 58°30'N), 111, 121
Johan Hjort (NOR) LDGJ	25 June – 12 July	NSAS, WBSS, Sprat NS	11, 141
Tridens (NED) PBVO	26 June – 12 July	NSAS, Sprat NS	81, 91 (south of 58°30'N), 101
Solea (GER) DBFH	30 June – 20 July	NSAS, Sprat NS	51, 61, 71, 131
Dana (DEN) OXBH	21 June – 06 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 2021. 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	17500	78	0.00	4.4	8.5
1	5196	248	0.02	47.7	17.9
2	2803	340	0.74	121.3	23.9
3	1800	299	0.99	165.8	26.4
4	773	148	1.00	191.0	27.4
5	877	178	1.00	203.4	27.9
6	915	202	1.00	220.8	28.7
7	1021	238	1.00	233.1	29.0
8	388	93	1.00	240.0	29.2
9+	208	57	1.00	272.1	30.4
Immature	23311	379		16.2	10.9
Mature	8170	1501		183.7	27.0
Total	31481	1880	0.26	59.7	15.1

Table 2.3.1.3. Estimates of North Sea autumn spawners (millions) at age from acoustic surveys, 1986–2021. 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
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

Years / Age (rings)	1	2	3	4	5	6	7	8	9+	Total	SSB ('000t)
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
2021	5196	2803	1800	773	877	915	1021	388	208	31481	1501

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 numbers of larvae are expressed as mean number per ICES rectangle * 10^9.

	Orkney/Shetland		Buchan		Central North Sea			Southern North Sea		
Period/ Year	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

	Orkney/Shetland		Buchan		Central North Sea			Southern North Sea		
Period/ Year	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.
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
2009		7543		4629		4219		15295	14712	1689
2010		2362		1493		2317		7493	13230	8073
2011		3831		2839		17766		5461	6160	1215

	Orkney/Shetland		Buchan		Central North Sea			Southern North Sea		
Period/ Year	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.
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	
2021		6651		1413		3282		8899	8764	

Table 2.3.3.2. North Sea herring – International herring larvae surveys summary 2021/2022.

International Herring Larvae Surveys (IHLS)

Nation:	Vessel:	Dates
Germany	Dana #09-21	20 September – 01 October 2021
Netherlands	Tridens 2	20 September – 29 September 2021
Netherlands	Tridens 2	20 December – 23 December 2021
Germany	WH #452	05 January – 13 January 2022

Cruise	North Sea IHLS monitor the abundance and distribution of newly hatched herring larvae at the main spawning grounds of autumn spawning herring along the Scottish and English coast in September and on the Downs spawning ground in the English Channel in December and January.
Gear details:	Gulf-type high speed plankton sampler catches are taken during day and night time. Mesh size of the net is 280 microns. The sampler is equipped with a CTD for measurements of actual sampler depth, salinity and temperature profiles as well as internal and external flowmeters determining the filtered water volume. Samples are taken in a V-shape manner, e.g. from the sea surface down to near the seabed (5m above the bottom) and back to the surface.
Notes from survey (e.g. problems, additional work etc.):	All six survey areas could be sampled as scheduled. The survey around the Orkneys revealed higher quantities of newly hatched larvae, compared to relatively low numbers in the two preceding years. In the Buchan and the central North Sea, newly hatched larvae concentrated in two areas. There are some issues with larvae patchiness in the Downs area. One station yielded > 90% of the total catch in December. However, such a pattern has been seen also in the history of the survey time-series. Thus, all stations were included in further calculations.

	The estimated larvae abundance indices could be used in the assessment of North Sea autumn spawning herring.
Number of fish species recorded and notes on any rare species or unusual catches:	In total, 413 plankton samples were taken during the IHLS surveys between September 2021 and January 2022. They contained 118,968 herring larvae.

Stations fished

ICES Divisions	Strat.	Gear	Tows planned	Valid	Add.	Inv.	% stations fished	comments
4a,b	N/A	Gulf	274	274	0	0	100 %	Extra hauls taken when abundance was dense.
7d	N/A	Gulf	141	139	0	0	100 %	Extra hauls taken when abundance was dense.
total	N/A	Gulf	415	413	0	0	100 %	

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 2021 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 stored in the stock annex.

Area	North-west	North-east	Central west	Central east	South-west	South-east	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 10^9
1991	0.227	0.074	0.364	0.444	0.466	0.329	0.330	0.259	164.0
1992	0.191	0.037	0.576	0.387	0.638	0.300	0.359	0.871	195.8
1993	0.574	0.231	0.545	0.178	0.117	0.140	0.223	0.322	155.1
1994	0.131	0.023	0.438	0.359	0.360	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	107.0
1996	0.026	0.003	0.878	0.099	0.443	0.298	0.040	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	0.790	0.065	4.354	342.0
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	0.030	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	0.020	0.065	0.698	52.9
2007	0.013	0.009	0.185	0.031	0.084	0.058	0.019	0.320	39.5
2008	0.145	0.138	0.281	0.253	0.158	0.139	0.160	0.279	99.2
2009	0.073	0.074	0.194	0.052	0.390	0.291	0.000	0.042	73.5

Area	North-west	North-east	Central west	Central east	South-west	South-east	Division 3.a	South'Bight	IBTS-0 index
Area m^2 x 10^9	83	34	86	102	37	93	31	31	
Year class									no. in 10^9
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	0.240	0.253	0.389	0.313	0.037	0.213	113.8
2014	0.009	0.006	0.150	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	0.020	0.082	0.035	0.020	0.196	27.8
2017	0.111	0.001	0.395	0.181	0.397	0.260	0.031	0.019	102.1
2018	0.017	0.023	0.290	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
2021	0.010	0.002	0.109	0.050	0.251	0.102	0.031	0.412	47.8

Table 2.3.3.2. North Sea herring. Indices of 1-ringers from the IBTS 1st Quarter for the 1995 to 2020 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

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
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
2020	2022	806	401	0.50	396	0.49	0.08

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.

age	0		1		2		3		4		5		6		7		8	
Year	catch	HE-RAS	catch	HE-RAS	catch	HE-RAS	catch	HE-RAS	catch	HE-RAS	catch	HE-RAS	catch	HE-RAS	catch	HE-RAS	catch	HE-RAS
1996	0.015	0.006	0.018	0.054	0.112	0.130	0.156	0.199	0.188	0.227	0.204	0.234	0.212	0.274	0.261	0.301	0.281	0.327
1997	0.015	0.005	0.044	0.049	0.108	0.123	0.148	0.183	0.195	0.230	0.227	0.237	0.226	0.257	0.235	0.280	0.255	0.310
1998	0.021	0.006	0.051	0.047	0.114	0.116	0.145	0.187	0.183	0.241	0.219	0.264	0.238	0.284	0.247	0.287	0.288	0.308
1999	0.009	0.006	0.045	0.051	0.115	0.116	0.151	0.179	0.171	0.226	0.207	0.256	0.233	0.273	0.245	0.276	0.268	0.278
2000	0.015	0.006	0.033	0.051	0.113	0.116	0.157	0.184	0.179	0.221	0.201	0.248	0.216	0.279	0.246	0.286	0.273	0.284
2001	0.012	0.006	0.048	0.051	0.118	0.122	0.149	0.172	0.177	0.210	0.198	0.233	0.213	0.255	0.238	0.275	0.270	0.274
2002	0.012	0.006	0.037	0.047	0.118	0.128	0.153	0.172	0.170	0.205	0.199	0.228	0.214	0.248	0.228	0.270	0.250	0.287
2003	0.014	0.007	0.037	0.047	0.104	0.123	0.158	0.173	0.174	0.202	0.184	0.222	0.205	0.242	0.222	0.266	0.237	0.285
2004	0.014	0.007	0.036	0.042	0.100	0.119	0.138	0.165	0.183	0.203	0.201	0.223	0.216	0.248	0.228	0.268	0.255	0.280
2005	0.011	0.006	0.044	0.041	0.099	0.118	0.153	0.164	0.166	0.198	0.208	0.225	0.223	0.248	0.240	0.265	0.265	0.285
2006	0.010	0.007	0.049	0.041	0.117	0.126	0.144	0.155	0.172	0.191	0.181	0.216	0.220	0.242	0.237	0.252	0.246	0.270
2007	0.012	0.006	0.064	0.051	0.121	0.128	0.151	0.161	0.163	0.180	0.193	0.207	0.190	0.224	0.223	0.238	0.237	0.256
2008	0.008	0.008	0.054	0.058	0.129	0.130	0.180	0.164	0.181	0.181	0.183	0.195	0.216	0.218	0.216	0.226	0.262	0.256
2009	0.009	0.007	0.051	0.061	0.144	0.137	0.181	0.181	0.216	0.197	0.216	0.210	0.239	0.223	0.243	0.234	0.253	0.256
2010	0.008	0.007	0.057	0.052	0.129	0.142	0.167	0.190	0.191	0.216	0.220	0.224	0.219	0.234	0.216	0.240	0.238	0.261
2011	0.008	0.007	0.041	0.043	0.132	0.146	0.159	0.187	0.183	0.225	0.197	0.240	0.217	0.244	0.221	0.251	0.232	0.257
2012	0.011	0.006	0.046	0.040	0.124	0.138	0.171	0.182	0.185	0.211	0.206	0.233	0.222	0.241	0.239	0.243	0.243	0.253
2013	0.008	0.006	0.047	0.040	0.116	0.136	0.156	0.175	0.198	0.209	0.198	0.221	0.215	0.242	0.233	0.249	0.238	0.252

age	0		1		2		3		4		5		6		7		8	
Year	catch	HE-RAS	catch	HE-RAS	catch	HE-RAS	catch	HE-RAS	catch	HE-RAS	catch	HE-RAS	catch	HE-RAS	catch	HE-RAS	catch	HE-RAS
2014	0.008	0.006	0.052	0.043	0.124	0.129	0.172	0.177	0.186	0.204	0.215	0.216	0.212	0.229	0.226	0.241	0.243	0.247
2015	0.009	0.005	0.026	0.044	0.114	0.127	0.154	0.161	0.188	0.200	0.200	0.212	0.221	0.225	0.217	0.229	0.235	0.239
2016	0.007	0.005	0.027	0.043	0.127	0.121	0.155	0.160	0.180	0.189	0.206	0.216	0.215	0.224	0.231	0.224	0.230	0.234
2017	0.009	0.004	0.038	0.043	0.099	0.111	0.156	0.153	0.173	0.183	0.188	0.207	0.215	0.227	0.220	0.227	0.231	0.229
2018	0.005	0.005	0.039	0.040	0.109	0.101	0.145	0.153	0.184	0.186	0.191	0.215	0.215	0.229	0.234	0.239	0.246	0.247
2019	0.006	0.004	0.040	0.040	0.121	0.099	0.147	0.148	0.169	0.177	0.204	0.209	0.208	0.226	0.220	0.238	0.243	0.254
2020	0.004	0.004	0.071	0.041	0.130	0.107	0.155	0.150	0.171	0.182	0.189	0.217	0.214	0.229	0.219	0.242	0.243	0.264
2021	0.008	0.004	0.040	0.043	0.128	0.117	0.155	0.156	0.166	0.181	0.189	0.210	0.203	0.227	0.219	0.240	0.224	0.255

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 2021. 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

Year \ Ring	2	3	4	5	6	7+
2015	70.0	90.0	96.0	98.0	99.0	100
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
2021	75.0	99.0	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	1972–2021	1973–2021
IBTS 1st Quarter (Trawl survey)	1 wr	1971–2022	1984–2022
IBTS 3rd Quarter (Trawl survey)	0-5 wr	1991–2021	1998–2021
Acoustic (+trawl)	1 wr	1995–2021	1997–2021
	2-9+ wr	1984–2021	1989–2021
IBTS0	0wr	1977–2022	1992–2022

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
2021	0	0	0.74	0.99	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	0.712	0.497	0.303	0.273	0.252	0.232	0.222	0.216	0.216
1948	0.712	0.497	0.303	0.273	0.252	0.232	0.222	0.216	0.216
1949	0.712	0.497	0.303	0.273	0.252	0.232	0.222	0.216	0.216
1950	0.712	0.497	0.303	0.273	0.252	0.232	0.222	0.216	0.216
1951	0.712	0.497	0.303	0.273	0.252	0.232	0.222	0.216	0.216
1952	0.712	0.497	0.303	0.273	0.252	0.232	0.222	0.216	0.216
1953	0.712	0.497	0.303	0.273	0.252	0.232	0.222	0.216	0.216
1954	0.712	0.497	0.303	0.273	0.252	0.232	0.222	0.216	0.216
1955	0.712	0.497	0.303	0.273	0.252	0.232	0.222	0.216	0.216
1956	0.712	0.497	0.303	0.273	0.252	0.232	0.222	0.216	0.216
1957	0.712	0.497	0.303	0.273	0.252	0.232	0.222	0.216	0.216
1958	0.712	0.497	0.303	0.273	0.252	0.232	0.222	0.216	0.216
1959	0.712	0.497	0.303	0.273	0.252	0.232	0.222	0.216	0.216
1960	0.712	0.497	0.303	0.273	0.252	0.232	0.222	0.216	0.216

1961	0.712	0.497	0.303	0.273	0.252	0.232	0.222	0.216	0.216
1962	0.712	0.497	0.303	0.273	0.252	0.232	0.222	0.216	0.216
1963	0.712	0.498	0.303	0.273	0.252	0.232	0.222	0.216	0.216
1964	0.712	0.497	0.303	0.273	0.252	0.232	0.222	0.216	0.216
1965	0.712	0.497	0.303	0.273	0.252	0.232	0.222	0.216	0.216
1966	0.712	0.497	0.303	0.273	0.252	0.232	0.222	0.216	0.216
1967	0.712	0.498	0.303	0.273	0.252	0.232	0.222	0.216	0.216
1968	0.713	0.5	0.303	0.273	0.252	0.232	0.221	0.215	0.215
1969	0.712	0.495	0.302	0.272	0.252	0.232	0.222	0.216	0.216
1970	0.712	0.495	0.302	0.272	0.252	0.233	0.222	0.216	0.217
1971	0.712	0.498	0.303	0.273	0.252	0.232	0.222	0.216	0.216
1972	0.713	0.503	0.304	0.273	0.251	0.232	0.221	0.214	0.214
1973	0.715	0.509	0.305	0.274	0.25	0.231	0.219	0.213	0.212
1974	0.71	0.472	0.296	0.269	0.255	0.235	0.227	0.222	0.223
1975	0.71	0.493	0.302	0.273	0.253	0.233	0.223	0.217	0.218
1976	0.712	0.512	0.306	0.275	0.251	0.231	0.219	0.213	0.212
1977	0.718	0.527	0.31	0.276	0.248	0.228	0.216	0.208	0.207
1978	0.725	0.541	0.312	0.276	0.245	0.225	0.212	0.203	0.202
1979	0.734	0.551	0.314	0.276	0.242	0.222	0.208	0.199	0.197
1980	0.745	0.56	0.314	0.274	0.238	0.219	0.204	0.195	0.192
1981	0.758	0.565	0.313	0.272	0.234	0.215	0.201	0.191	0.187
1982	0.771	0.568	0.312	0.269	0.23	0.211	0.197	0.187	0.183
1983	0.791	0.569	0.309	0.264	0.225	0.207	0.193	0.184	0.178
1984	0.818	0.566	0.306	0.258	0.22	0.202	0.189	0.18	0.173
1985	0.839	0.562	0.301	0.252	0.215	0.198	0.185	0.176	0.169
1986	0.849	0.553	0.294	0.244	0.208	0.191	0.18	0.172	0.164
1987	0.856	0.541	0.284	0.233	0.201	0.184	0.174	0.168	0.159
1988	0.858	0.53	0.277	0.225	0.196	0.179	0.169	0.164	0.155
1989	0.853	0.522	0.274	0.222	0.195	0.178	0.167	0.162	0.152
1990	0.842	0.513	0.272	0.22	0.196	0.178	0.165	0.159	0.151
1991	0.832	0.506	0.271	0.219	0.197	0.178	0.163	0.158	0.15
1992	0.82	0.499	0.273	0.221	0.197	0.179	0.162	0.156	0.149
1993	0.803	0.493	0.277	0.225	0.198	0.18	0.162	0.156	0.15
1994	0.791	0.488	0.28	0.228	0.199	0.181	0.162	0.155	0.15
1995	0.78	0.483	0.282	0.228	0.197	0.18	0.161	0.154	0.149
1996	0.772	0.479	0.285	0.229	0.196	0.179	0.16	0.153	0.149
1997	0.773	0.485	0.289	0.232	0.197	0.179	0.16	0.153	0.15
1998	0.779	0.495	0.293	0.235	0.197	0.178	0.161	0.154	0.15
1999	0.787	0.506	0.299	0.239	0.2	0.179	0.163	0.155	0.152
2000	0.8	0.527	0.307	0.246	0.207	0.184	0.168	0.159	0.155
2001	0.818	0.556	0.318	0.256	0.216	0.19	0.174	0.164	0.16
2002	0.833	0.575	0.326	0.263	0.224	0.196	0.18	0.169	0.164
2003	0.846	0.585	0.332	0.27	0.234	0.205	0.188	0.177	0.17
2004	0.862	0.594	0.338	0.279	0.245	0.216	0.199	0.186	0.178
2005	0.875	0.598	0.342	0.284	0.253	0.224	0.207	0.194	0.184
2006	0.887	0.591	0.341	0.284	0.255	0.227	0.211	0.199	0.189
2007	0.9	0.578	0.337	0.281	0.254	0.23	0.215	0.204	0.193
2008	0.908	0.566	0.333	0.279	0.253	0.231	0.217	0.207	0.197
2009	0.91	0.555	0.327	0.275	0.25	0.23	0.217	0.209	0.198
2010	0.91	0.542	0.32	0.269	0.245	0.228	0.215	0.209	0.199
2011	0.905	0.531	0.315	0.265	0.241	0.227	0.215	0.209	0.2
2012	0.895	0.522	0.31	0.262	0.24	0.226	0.215	0.21	0.202
2013	0.881	0.512	0.306	0.26	0.238	0.225	0.214	0.211	0.203
2014	0.863	0.503	0.302	0.258	0.236	0.225	0.214	0.211	0.203
2015	0.84	0.495	0.298	0.257	0.235	0.224	0.213	0.211	0.204
2016	0.813	0.488	0.294	0.256	0.234	0.224	0.212	0.211	0.204
2017	0.781	0.481	0.291	0.256	0.233	0.223	0.212	0.21	0.204
2018	0.745	0.475	0.289	0.256	0.234	0.224	0.211	0.21	0.205
2019	0.704	0.469	0.286	0.258	0.235	0.224	0.211	0.209	0.205
2020	0.777	0.481	0.292	0.256	0.234	0.224	0.212	0.21	0.204
2021	0.761	0.478	0.29	0.256	0.234	0.224	0.212	0.21	0.205

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	0.0041	0.04073	0.1072	0.1495	0.1816	0.2168	0.2291	0.2424	0.2642
2021	0.003833	0.0432	0.1169	0.1563	0.1812	0.21	0.2267	0.2401	0.2551

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
2021	0.008	0.0398	0.1284	0.1547	0.1659	0.1892	0.2032	0.2187	0.2241

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
2021	534073	112447	407388	419770	179190	265946	118167	320792	291104

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
2021	5196000	2803000	1800000	773000	877000	915000	1021000	596000

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
2022	47.8

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	1052162
1985	1438636
1986	1654723
1987	3131778
1988	1487032
1989	1590320
1990	748258
1991	1072699
1992	1115786
1993	1818610
1994	2693135
1995	2102680
1996	1232257
1997	810884
1998	1446955
1999	704653
2000	2045844
2001	1567634
2002	1728823
2003	1327143
2004	762760
2005	905552
2006	725340
2007	859629
2008	713383
2009	705677
2010	856535
2011	1493897
2012	780486
2013	488298
2014	1620037
2015	1898773
2016	547781
2017	1340025
2018	667212
2019	958262
2020	1128416
2021	1210091
2022	630186

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	727669	463847	311107	92832	24483	11615
1999	4630197	296398	208814	124016	51023	18470
2000	1766609	771168	264562	119618	70400	18078
2001	1866630	321968	221010	95618	42999	26435
2002	2218582	1964691	441635	348862	82343	32929
2003	894458	478345	562350	150629	113711	19506
2004	2134639	393302	288331	424585	97809	51754
2005	1081092	387909	113423	83421	99818	31971
2006	1018646	292225	191814	78830	46527	53927
2007	2221506	137614	94241	101137	50850	31366
2008	567239	155700	114972	60800	36224	19573
2009	2799984	204902	95646	64972	27949	12674
2010	1333303	512783	176419	83611	37534	15920
2011	824623	324510	176616	100918	51010	22176
2012	769386	212991	91167	68462	39084	22588
2013	1803294	268269	142736	125246	86498	40667
2014	7408163	446599	195329	90049	81147	46104
2015	517000	734980	353384	128905	68406	46758
2016	1700293	176710	368183	214059	69038	43720
2017	855004	280153	76755	198683	129606	41777
2018	1918412	326201	113774	48347	86827	39799
2019	1441818	136877	65129	41782	23046	36679
2020	1013689	316659	263582	74298	65070	26556
2021	771966	279941	106525	71502	24587	17024

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 correspond 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
2021	8899	8764	-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 correspond 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
2021	-1	3282	-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
2021	-1	1413

Table 2.6.1.14 North Sea herring input data. LAI index from the IHLS larvae survey for the Orkney/Shetland component. The columns correspond 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
2021	-1	6651

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	0.426	0.1286	0.3311	0.5482
catch unique	1	0.426	0.1286	0.3311	0.5482
catch unique	2	0.1285	0.1601	0.09391	0.1759
catch unique	3	0.1285	0.1601	0.09391	0.1759
catch unique	4	0.1285	0.1601	0.09391	0.1759
catch unique	5	0.1285	0.1601	0.09391	0.1759
catch unique	6	0.1285	0.1601	0.09391	0.1759
catch unique	7	0.1911	0.1889	0.132	0.2768
catch unique	8	0.1911	0.1889	0.132	0.2768
HERAS	1	0.468	0.1516	0.3477	0.6299
HERAS	2	0.2597	0.1486	0.1941	0.3475
HERAS	3	0.1579	0.1908	0.1086	0.2294
HERAS	4	0.2202	0.1021	0.1803	0.269
HERAS	5	0.2202	0.1021	0.1803	0.269
HERAS	6	0.2202	0.1021	0.1803	0.269
HERAS	7	0.2925	0.126	0.2285	0.3745
HERAS	8	0.2925	0.126	0.2285	0.3745
IBTS-Q1	1	0.282	0.1482	0.2109	0.3771
IBTS0	0	0.348	0.163	0.2529	0.479
IBTS-Q3	0	0.477	0.1333	0.3673	0.6194
IBTS-Q3	1	0.477	0.1333	0.3673	0.6194
IBTS-Q3	2	0.3176	0.09655	0.2628	0.3837
IBTS-Q3	3	0.3176	0.09655	0.2628	0.3837
IBTS-Q3	4	0.3176	0.09655	0.2628	0.3837
IBTS-Q3	5	0.3176	0.09655	0.2628	0.3837
LAI-ORSH	0	1.183	0.04349	1.087	1.289
LAI-BUN	0	1.183	0.04349	1.087	1.289
LAI-CNS	0	1.183	0.04349	1.087	1.289
LAI-SNS	0	1.183	0.04349	1.087	1.289

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

fleet	age	value	CV	lbnd	ubnd
HERAS	1	0.968	0.0667	0.8494	1.103
HERAS	2	0.968	0.0667	0.8494	1.103
HERAS	3	1.09	0.05781	0.973	1.221
HERAS	4	1.09	0.05781	0.973	1.221
HERAS	5	1.09	0.05781	0.973	1.221
HERAS	6	1.09	0.05781	0.973	1.221
HERAS	7	1.09	0.05781	0.973	1.221
HERAS	8	1.09	0.05781	0.973	1.221
IBTS-Q1	1	0.1052	0.06811	0.09205	0.1202
IBTS0	0	3.346e-06	0.08816	2.815e-06	3.978e-06
IBTS-Q3	0	0.09625	0.1183	0.07633	0.1214
IBTS-Q3	1	0.04721	0.1143	0.03773	0.05907
IBTS-Q3	2	0.0414	0.08635	0.03496	0.04904
IBTS-Q3	3	0.03787	0.08574	0.03201	0.0448
IBTS-Q3	4	0.03189	0.08713	0.02688	0.03782
IBTS-Q3	5	0.02489	0.08829	0.02094	0.02959
LAI-ORSH	0	0.01649	0.1076	0.01335	0.02036
LAI-BUN	0	0.01649	0.1076	0.01335	0.02036
LAI-CNS	0	0.01649	0.1076	0.01335	0.02036
LAI-SNS	0	0.01649	0.1076	0.01335	0.02036

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	34933554	16750702	14490579	5423092	7277324	4453630	3915909	2071498	6319257
1948	33243309	16221925	9583273	8612213	3644469	5079250	2950462	2231630	4882860
1949	27876772	15566854	11550001	7235240	4210657	2289138	3244335	1873501	4263513
1950	39549436	12159066	9017771	9314252	5169144	2357593	1449141	1814152	3242114
1951	38332357	19029721	6535331	6047993	6786509	3608745	1480655	841990	2800243
1952	38183068	17622460	10442050	3886831	3575412	3786266	2160460	939413	2270950
1953	43326920	17336166	9210950	5728392	2630118	2112936	2222262	1229146	1767003
1954	40294149	20101839	8874450	5237374	3109415	1709393	1244009	1281118	1706085
1955	34319467	18105723	10545639	5104408	2668613	1789946	1051784	664431	1414205
1956	25365753	16053919	8587718	6056072	2879033	1469658	1046068	582345	1384933
1957	57941798	10815015	8076891	3760931	3530365	1678679	930799	649820	1173638
1958	24823836	32665560	4749523	4527459	1889153	2234186	926352	543526	1012704
1959	28315691	11029413	19137104	2172396	2336678	1102504	1162459	566145	1187421
1960	12460158	14293760	4969153	10525480	1063269	1151505	605307	617544	1084114
1961	53119421	4197022	7218722	2370104	7072617	669446	792869	344630	872784
1962	28426460	27202408	1610898	3178407	1367899	4356276	424565	512571	711428
1963	34277972	13050781	15943248	1008114	1256825	678448	2248744	203730	693138
1964	34446126	14839182	6538573	9334804	661347	736150	505280	1537733	546836
1965	17177153	16506154	6210836	3394472	5376256	388814	425117	319560	1376045
1966	18451668	7917792	7492025	2149051	1365889	2314821	168803	188424	841350
1967	25572686	7834922	3595817	3142321	847396	651335	866841	100650	465112
1968	21982231	11614820	3112561	1849306	1149058	290821	246354	277898	164702
1969	12706227	9868176	4251836	662988	302903	348942	78391	65203	95485
1970	21921266	5810635	4121588	1518130	209414	99023	108736	16351	42947
1971	17176447	10086083	2333942	1211179	372826	51578	31454	29903	17516
1972	12632049	7668466	3279469	755936	312756	95410	14044	1056	6522
1973	6847350	5392983	2660773	1126502	291222	121030	47185	7453	4447
1974	10823529	2755727	1556355	732910	263104	97399	40041	11395	5254
1975	2561527	5313981	921729	433685	231737	80650	26982	11712	5868
1976	3325786	841432	1789769	210720	92591	61321	13656	6294	2474
1977	4383451	1394653	286928	607670	50001	24770	18488	4576	2127
1978	4276395	1863273	702705	222359	247617	30688	11498	10051	3186
1979	7834683	1685761	903650	406122	175791	122141	20605	7054	7302
1980	12618730	3220679	750215	474825	227801	154155	62976	16853	8134
1981	27336674	4677829	1600157	326454	220273	137949	119000	54332	20137
1982	46487835	8063380	1849834	1023545	199109	120952	76776	70552	39221
1983	46119251	14951591	3224090	1055868	502295	125543	102301	52378	82393
1984	46255876	13367152	6138490	1794983	669672	272040	79384	66932	80800
1985	55006798	14820009	5716973	3572935	993563	357757	124464	46848	74909

1986	66844177	19860582	5445445	2984789	1550815	428735	169200	54518	60829
1987	57661607	26274204	8706425	2609121	1547580	778002	222942	76810	50548
1988	37652038	18959787	10050459	4592095	1338574	807741	390630	112390	67102
1989	29611643	12888931	6934775	5554904	2664252	698459	404046	194334	90504
1990	27465205	9857242	4495247	3943422	3642063	1561336	376025	219009	163601
1991	29856193	10530441	4149228	2343879	2321844	2162410	885567	216041	199571
1992	5.2e+07	10282115	4504702	1795850	1337450	1343835	1302252	525554	246915
1993	54689598	16674800	3745112	2016635	945253	735740	744835	642274	408663
1994	42327104	16811767	5838155	1447165	864484	406880	347474	341570	471698
1995	43745924	13817403	6051275	2613477	728336	372122	200980	174118	378548
1996	35378362	13970262	5184166	3071063	1102238	344960	153321	98300	269320
1997	28927930	13509114	6405793	2978269	1670211	670610	212569	89827	226471
1998	18436245	12011287	8839724	3213652	1484205	898754	438271	131883	176761
1999	56283952	8122439	5546603	5401270	1692304	760061	439214	228270	152671
2000	39546582	22457135	5420257	2934597	3177196	1040824	476998	272387	197853
2001	68068660	15777978	11250149	3542535	1718236	1782524	557881	281973	227785
2002	35673589	29125325	7893451	8118569	1923596	934392	1089603	325320	313193
2003	20127944	13920998	17218059	4501413	4963506	1076005	574388	658836	341733
2004	23308892	7642338	6213499	10915475	2999148	2997472	552164	369260	502317
2005	20454449	9705310	3813917	3854986	6490639	1774794	1614331	271667	408701
2006	20763428	7220553	4941222	2461745	2399797	4119341	865663	725118	284594
2007	24591328	7487152	3213040	2900682	1556714	1374907	2312071	447827	466839
2008	21498765	8681156	4325035	2108169	1708632	1e+06	872024	1481509	569530
2009	35475263	8563576	5311325	2615811	1422456	1132023	679065	634139	1623528
2010	27173952	12845581	5483190	3880858	1923674	1055304	994431	521361	1758939
2011	24406725	11239901	6649073	3550780	2462286	1241626	720823	650681	1490209
2012	22665108	9037588	5847068	4984827	2625737	1718247	804125	469699	1192615
2013	30689037	8435583	4534053	4083282	3438190	1967384	1190979	505407	1029528
2014	48616427	13605561	5331309	3145942	3325471	2302585	1245089	699224	756156
2015	13098673	19159546	9563115	2988164	1955459	2069393	1374982	718480	809788
2016	23503414	5086683	11693633	6896740	1848987	1238975	1168489	694860	715163
2017	14150971	8698012	2511203	8319615	4812222	1230894	638039	551515	592739
2018	24124008	5763090	4172696	1916534	5932524	3400924	808623	427695	691501
2019	21552500	9393374	2451477	2687129	1430825	3721252	2062891	436141	575063
2020	23368085	8800232	5640556	1583206	1819341	1043994	2261921	1064712	512158
2021	18346146	9669912	4556242	2793510	1035442	1208272	711464	1233519	851830
2022	16619677	7202844	5519567	2894602	1683718	618927	712826	430366	1067022

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	0.0001206	0.001042	0.03891	0.09561	0.1111	0.1482	0.2434	0.2704	0.2704
1948	9.736e-05	0.0008166	0.03313	0.08715	0.1057	0.1398	0.2099	0.2397	0.2397
1949	0.0002424	0.002305	0.04996	0.1097	0.1258	0.1592	0.2562	0.3052	0.3052
1950	0.0005909	0.006347	0.07413	0.1365	0.1486	0.1642	0.2185	0.2374	0.2374
1951	0.001797	0.02248	0.1299	0.2017	0.2129	0.2094	0.2351	0.2272	0.2272
1952	0.003093	0.04168	0.1607	0.211	0.2196	0.2257	0.2829	0.3073	0.3073
1953	0.004633	0.06601	0.1906	0.2331	0.2279	0.2338	0.2827	0.2987	0.2987
1954	0.006567	0.1009	0.2341	0.2751	0.2575	0.272	0.3645	0.3791	0.3791
1955	0.007049	0.1204	0.2509	0.2664	0.2351	0.24	0.2699	0.2344	0.2344
1956	0.007242	0.1352	0.2753	0.2687	0.2291	0.2312	0.2458	0.2389	0.2389
1957	0.008021	0.1485	0.286	0.2765	0.2419	0.2609	0.2859	0.2725	0.2725
1958	0.008706	0.1502	0.2943	0.2765	0.2306	0.2369	0.204	0.173	0.173
1959	0.01471	0.2124	0.3497	0.3145	0.27	0.2705	0.291	0.2882	0.2882
1960	0.01674	0.191	0.3089	0.2577	0.215	0.2119	0.2385	0.2688	0.2688
1961	0.01917	0.1963	0.3272	0.294	0.2545	0.2406	0.2528	0.2375	0.2375
1962	0.01236	0.131	0.2748	0.3155	0.3005	0.306	0.3768	0.3493	0.3493
1963	0.01233	0.1166	0.2353	0.2256	0.1804	0.1694	0.131	0.144	0.144
1964	0.01852	0.1941	0.3409	0.3404	0.288	0.2733	0.2255	0.2171	0.2171
1965	0.02425	0.2885	0.5223	0.5824	0.5233	0.5198	0.5044	0.5123	0.5123
1966	0.0245	0.2534	0.4919	0.5609	0.4967	0.5119	0.4133	0.5122	0.5122
1967	0.02927	0.2897	0.5693	0.7359	0.6712	0.7091	0.7666	0.9543	0.9543
1968	0.04943	0.535	0.9886	1.287	1.002	0.9658	1.153	1.216	1.216
1969	0.02798	0.2983	0.6933	0.8832	0.8042	0.8527	1.191	1.068	1.068
1970	0.04683	0.4224	0.8143	1.019	0.9319	0.8556	1.178	0.9108	0.9108
1971	0.06892	0.5655	0.8859	1.088	1.073	1.133	2.916	1.722	1.722
1972	0.0689	0.4572	0.6979	0.7291	0.6012	0.5316	0.5386	0.318	0.318

1973	0.102	0.634	0.9082	1.021	0.8637	0.8636	1.074	0.705	0.705
1974	0.1149	0.5446	0.8413	0.9424	0.8429	0.939	0.9563	0.8424	0.8424
1975	0.1758	0.6789	1.008	1.244	1.116	1.287	1.289	1.615	1.615
1976	0.1487	0.4447	0.7274	1.009	0.8765	0.9483	0.8077	1.148	1.148
1977	0.06804	0.1275	0.2636	0.3893	0.3323	0.4025	0.2734	0.4571	0.4571
1978	0.07747	0.1131	0.2157	0.2815	0.2358	0.266	0.1404	0.2526	0.2526
1979	0.1094	0.1297	0.2106	0.2492	0.1947	0.2008	0.08303	0.1526	0.1526
1980	0.1619	0.1564	0.2146	0.2345	0.1734	0.1571	0.05095	0.09138	0.09138
1981	0.3278	0.2681	0.2517	0.2814	0.2507	0.2652	0.2128	0.3782	0.3782
1982	0.2976	0.2368	0.2211	0.2511	0.2051	0.1756	0.1071	0.1543	0.1543
1983	0.3035	0.2713	0.2433	0.2904	0.2865	0.2778	0.2569	0.3388	0.3388
1984	0.2206	0.2624	0.2618	0.3443	0.3878	0.3863	0.3908	0.4949	0.4949
1985	0.1899	0.3271	0.3237	0.4356	0.4972	0.4795	0.5223	0.5882	0.5882
1986	0.1469	0.3027	0.3093	0.3803	0.4361	0.4428	0.5168	0.582	0.582
1987	0.1805	0.3814	0.3262	0.3586	0.415	0.4261	0.4549	0.4571	0.4571
1988	0.1677	0.387	0.3134	0.328	0.3956	0.421	0.4543	0.4684	0.4684
1989	0.1638	0.3852	0.3211	0.324	0.3892	0.4031	0.4154	0.4228	0.4228
1990	0.1193	0.2798	0.2796	0.2654	0.3049	0.312	0.2855	0.303	0.303
1991	0.1595	0.3376	0.3436	0.3081	0.3213	0.3075	0.2838	0.2578	0.2578
1992	0.2302	0.4137	0.3947	0.3598	0.3777	0.3562	0.3757	0.3548	0.3548
1993	0.267	0.4537	0.4457	0.4448	0.465	0.4034	0.4243	0.4061	0.4061
1994	0.217	0.3597	0.4158	0.4775	0.5035	0.3994	0.3712	0.323	0.323
1995	0.1897	0.2924	0.343	0.4286	0.447	0.402	0.393	0.3152	0.3152
1996	0.07065	0.1069	0.1735	0.2183	0.2198	0.2122	0.1676	0.1144	0.1144
1997	0.03404	0.06005	0.138	0.1923	0.2087	0.2103	0.1851	0.1344	0.1344
1998	0.03851	0.07578	0.1617	0.2294	0.2464	0.2512	0.241	0.1475	0.1475
1999	0.03838	0.06594	0.145	0.2219	0.2332	0.232	0.1976	0.1216	0.1216
2000	0.04355	0.06866	0.1382	0.2141	0.2482	0.2529	0.2165	0.1339	0.1339
2001	0.03537	0.04866	0.1029	0.1679	0.2077	0.2259	0.1987	0.1387	0.1387
2002	0.03217	0.04144	0.09098	0.1471	0.191	0.2157	0.1996	0.1685	0.1685
2003	0.0361	0.04457	0.0916	0.1498	0.2132	0.266	0.2512	0.2089	0.2089
2004	0.04401	0.04823	0.09543	0.1565	0.2382	0.3241	0.3979	0.3396	0.3396
2005	0.06811	0.06996	0.1154	0.1757	0.2701	0.3671	0.5241	0.5645	0.5645
2006	0.05753	0.05426	0.1035	0.1621	0.2455	0.3186	0.417	0.5017	0.5017
2007	0.05101	0.0474	0.09877	0.1578	0.229	0.287	0.3607	0.4423	0.4423
2008	0.04935	0.04138	0.08777	0.11	0.1454	0.1735	0.1664	0.2112	0.2112
2009	0.02909	0.02194	0.05631	0.06073	0.07814	0.09458	0.06872	0.09505	0.09505
2010	0.03404	0.02524	0.06305	0.0724	0.08433	0.09876	0.07062	0.07959	0.07959
2011	0.03788	0.02709	0.06925	0.09256	0.1101	0.1289	0.1026	0.1052	0.1052
2012	0.05501	0.04408	0.09791	0.1519	0.1904	0.2255	0.2445	0.2556	0.2556
2013	0.04613	0.03823	0.09039	0.1509	0.212	0.2714	0.3489	0.3942	0.3942
2014	0.05236	0.03568	0.08533	0.1476	0.2148	0.2702	0.3184	0.3866	0.3866
2015	0.05409	0.02759	0.06802	0.1214	0.192	0.2786	0.41	0.5617	0.5617
2016	0.06936	0.02927	0.06881	0.1415	0.2143	0.295	0.4437	0.6762	0.6762
2017	0.05827	0.02239	0.06036	0.139	0.2064	0.2517	0.3096	0.4733	0.4733
2018	0.06073	0.02057	0.06287	0.1431	0.2268	0.2905	0.3782	0.5479	0.5479
2019	0.05178	0.01706	0.06238	0.1344	0.1867	0.2402	0.3191	0.4773	0.4773
2020	0.08256	0.02711	0.09941	0.1764	0.2043	0.2238	0.2779	0.4597	0.4597
2021	0.06317	0.02274	0.1035	0.1899	0.2208	0.2441	0.2312	0.4023	0.4023
2022	0.06327	0.02278	0.1036	0.1901	0.221	0.2442	0.2313	0.4026	0.4026

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

year	ssb	fbar	rec
2011	12.91	-14.32	14.82
2012	22.71	-29.56	26.8
2013	20.77	-27.18	18.02
2014	13.21	-16.09	5.518
2015	11.72	-12.95	3.548
2016	10.13	-10.44	-20.31
2017	18.29	-25.61	-4.868
2018	11.12	-13.43	-13.14
2019	4.783	-7.027	-12.93
2020	-0.4952	-0.4827	-10.37
2021	0	0	0
av_5y	7.305	-9.498	-10.27

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	34933554	19714707	61900650	8576788	6512605	11295219	5285579	3810441	7331788	851394	730285	992587	0.1275	0.08932	0.1819	581760	1.461
1948	33243309	19786422	55852320	7388921	5652180	9659309	4498149	3272582	6182684	660189	575156	757795	0.1151	0.08188	0.1619	502100	1.333
1949	27876772	16764967	46353471	6810234	5282618	8779603	4068639	2993728	5529503	724543	631895	830775	0.1402	0.1008	0.1949	508500	1.45
1950	39549436	24255781	64485983	6431334	5067687	8161919	3813584	2861275	5082848	648230	576651	728695	0.1484	0.1095	0.2012	491700	1.307
1951	38332357	23699211	6.2e+07	6287798	5037726	7848067	3376462	2565481	4443804	775407	694440	865815	0.1978	0.1497	0.2613	600400	1.324
1952	38183068	23776916	61317735	6040922	4875702	7484612	3193191	2444769	4170729	835136	750997	928701	0.22	0.1673	0.2893	664400	1.272
1953	43326920	27815630	67488027	5816252	4715276	7174296	2960946	2271310	3859977	836261	751752	930269	0.2336	0.1785	0.3059	698500	1.198
1954	40294149	25958593	62546474	5670449	4611746	6972194	2705410	2062689	3548400	948972	847912	1062077	0.2806	0.213	0.3697	762900	1.251
1955	34319467	22244721	52948552	5414280	4398895	6664042	2715493	2080562	3544188	844032	747356	953214	0.2525	0.1922	0.3316	806400	1.06
1956	25365753	16429985	39161412	5052878	4117322	6201015	2622714	2013775	3415790	832719	737944	939667	0.25	0.1914	0.3266	675200	1.271
1957	57941798	37216611	90208427	4947768	4044996	6052021	2376734	1824592	3095960	785195	700322	880352	0.2702	0.2065	0.3536	682900	1.158
1958	24823836	16214946	3.8e+07	4951743	4030397	6083707	2017862	1550502	2626096	733374	623420	862722	0.2485	0.1916	0.3223	670500	1.167
1959	28315691	18005602	44529385	5522135	4541749	6714148	2920802	2258668	3777042	1166274	1002624	1356635	0.2991	0.2311	0.3872	784500	1.519
1960	12460158	8003503	19398450	4625901	3806254	5622052	2513467	1949591	3240432	807088	702204	927636	0.2464	0.1919	0.3164	696200	1.183
1961	53119421	34234520	82421861	4782644	3971940	5758819	2527008	1988151	3211914	765899	677009	866459	0.2738	0.2168	0.3459	696700	1.135
1962	28426460	18682408	43252649	4467036	3710703	5377529	1768353	1374072	2275770	727198	629814	839640	0.3147	0.2482	0.3991	627800	1.171
1963	34277972	22650190	51875033	5164800	4320178	6174551	2784064	2229825	3476064	595439	509533	695828	0.1884	0.1521	0.2333	716000	0.8602
1964	34446126	22907288	51797295	5109984	4419237	5908697	2515254	2081115	3039959	902315	783335	1039368	0.2936	0.2443	0.3529	871200	1.066
1965	17177153	11414094	25850024	4607510	4067501	5219213	1989648	1675745	2362351	1299992	1140647	1481596	0.5304	0.4485	0.6274	1168800	1.15
1966	18451668	12338825	27592908	3457613	3065711	3899615	1592304	1351658	1875794	933131	828545	1050920	0.4949	0.4219	0.5806	895500	1.071
1967	25572686	17013798	38437171	2678503	2387164	3005398	957998	822337	1116038	836664	742667	942559	0.6904	0.5973	0.7981	695500	1.176
1968	21982231	14748061	32764882	2266832	1989204	2583208	523533	448185	611548	906941	774428	1062128	1.079	0.9505	1.225	717800	1.255
1969	12706227	8408837	19199824	1688584	1457715	1956018	478525	392552	583327	503434	427093	593421	0.8848	0.7722	1.014	546700	0.9674
1970	21921266	14512163	33113043	1660625	1440182	1914810	455974	373764	556266	548051	468827	640661	0.9598	0.8427	1.093	563100	0.9657
1971	17176447	11500502	25653692	1468756	1248833	1727408	286537	236666	346916	525590	424540	650693	1.419	1.256	1.604	520100	1.075
1972	12632049	8396307	1.9e+07	1321327	1133850	1539802	328789	271220	398579	392358	317543	484799	0.6197	0.5359	0.7166	497500	0.9197
1973	6847350	4564992	10270819	1105924	966310	1265710	279135	232988	334422	444151	371972	530336	0.9461	0.8306	1.078	484000	0.9575
1974	10823529	7100393	16498915	776456	674870	893334	191486	160775	228064	271535	232284	317417	0.9044	0.7914	1.034	275100	0.968
1975	2561527	1667370	3935192	611797	511176	732223	105622	87307	127779	269111	213655	338960	1.189	1.025	1.379	312800	0.9343
1976	3325786	2097481	5273397	450493	375936	539836	143885	109186	189611	158173	133100	187968	0.8738	0.6841	1.116	174800	0.953
1977	4383451	2700203	7116001	317785	250486	403165	109516	79724	150441	51938	43857	61509	0.3322	0.2424	0.4553	46000	1.198
1978	4276395	2606804	7015316	377528	289078	493041	136468	100197	185870	45596	26303	79039	0.2279	0.143	0.3632	11000	.
1979	7834683	4951098	12397706	496249	394135	624820	186007	142742	242387	59108	33509	104261	0.1877	0.1165	0.3023	25100	.
1980	12618730	8456379	18829852	667953	548659	813183	209548	167415	262285	80070	62695	102261	0.1661	0.1317	0.2096	70764	1.094
1981	27336674	18395329	40624103	1090375	891211	1334047	269982	216354	336903	147151	113020	191589	0.2524	0.2014	0.3161	174879	1.008
1982	46487835	31348781	68937891	1706265	1384933	2102151	383091	310940	471984	238674	173599	328141	0.192	0.1558	0.2366	275079	0.9786
1983	46119251	31793569	66899860	2347934	1949408	2827931	547774	447921	669888	383898	285267	516632	0.271	0.2234	0.3287	387202	1.077
1984	46255876	31962845	66940414	3114638	2648438	3662903	901656	736690	1103562	477340	386744	589158	0.3542	0.2949	0.4253	428631	1.054
1985	55006798	37917617	79797942	3548570	3047802	4131616	989672	817413	1198233	636843	541921	748392	0.4517	0.3769	0.5412	613780	1.042
1986	66844177	45922405	97297692	3955160	3376781	4632604	1029021	855136	1238263	716702	577083	890100	0.4171	0.3477	0.5003	671488	1.137
1987	57661607	39673313	83805981	3942296	3392562	4581111	1207748	1004741	1451771	764493	627288	931709	0.3962	0.3319	0.4728	792058	1.017

1988	37652038	25974716	54579076	3826700	3332815	4393772	1541445	1287040	1846136	879558	723253	1069643	0.3824	0.3223	0.4539	887686	1.164
1989	29611643	20436111	42906861	3469840	3077328	3912418	1598124	1370868	1863053	808260	697083	937170	0.3706	0.3157	0.435	787899	1.034
1990	27465205	18894393	39923881	3469308	3075697	3913292	1748337	1503453	2033109	632743	550472	727310	0.2895	0.2454	0.3414	645229	1.052
1991	29856193	20572305	43329721	3332392	2958663	3753331	1551746	1339736	1797306	683584	587303	795650	0.3129	0.2658	0.3683	658008	1.02
1992	5.2e+07	37359725	72383331	3303140	2925184	3729931	1180619	1016213	1371624	707534	603801	829089	0.3728	0.3164	0.4393	716799	0.995
1993	54689598	39114535	76466515	3070263	2684876	3510969	839871	715566	985770	708460	596273	841754	0.4367	0.3692	0.5164	671397	1.023
1994	42327104	30161861	59398980	2962976	2559298	3430326	892915	759487	1049783	713172	574512	885298	0.4335	0.3663	0.513	568234	1.05
1995	43745924	31080084	61573383	2787853	2413852	3219801	924912	780587	1095922	612227	518744	722558	0.4027	0.3372	0.4811	579371	1.008
1996	35378362	25205039	49657868	2742054	2357713	3189049	1085584	917372	1284639	267798	233000	307791	0.1983	0.1646	0.2388	275098	0.9987
1997	28927930	20553933	40713625	2831966	2452377	3270310	1252705	1063560	1475489	275865	243199	312919	0.1869	0.1555	0.2245	264313	1.001
1998	18436245	13370771	25420760	3112829	2716010	3567625	1432476	1227208	1672079	377052	333100	426804	0.2259	0.1886	0.2707	391628	1.002
1999	56283952	40815555	77614606	3164390	2774768	3608721	1530535	1311863	1785656	353352	312772	399197	0.2059	0.1728	0.2454	363163	1
2000	39546582	28860529	54189309	3771568	3283155	4332639	1552473	1331880	1809602	381332	337657	430657	0.214	0.1793	0.2553	388157	1
2001	68068660	49065310	94432143	4242716	3693984	4872962	1947136	1671744	2267896	372273	330833	418902	0.1806	0.1512	0.2158	374065	0.9901
2002	35673589	25885695	49162478	5065178	4397274	5834531	2406200	2065151	2803571	395188	350972	444973	0.1689	0.1415	0.2016	394709	0.9974
2003	20127944	14666299	27623474	5339794	4653374	6127469	2368340	2045541	2742078	484773	434072	541395	0.1944	0.1634	0.2312	482281	1.015
2004	23308892	16944697	32063390	4675290	4120377	5304936	2334587	2021031	2696790	588510	528307	655574	0.2424	0.2034	0.2889	587698	0.9985
2005	20454449	14975215	27938463	3873255	3432543	4370551	2108713	1814999	2449957	663286	595140	739236	0.2905	0.2444	0.3452	663813	1.003
2006	20763428	15148108	28460316	3255288	2883237	3675348	1722082	1484514	1997668	511608	459065	570166	0.2493	0.2095	0.2968	514597	0.995
2007	24591328	17798533	33976587	2716905	2398548	3077517	1369887	1177015	1594364	398270	357308	443928	0.2266	0.1897	0.2708	406482	1.006
2008	21498765	15520784	29779223	2757036	2412019	3151406	1461007	1257237	1697803	257392	230133	287880	0.1366	0.1144	0.1631	257870	1.004
2009	35475263	25650484	49063180	3220317	2802121	3700926	1808626	1553415	2105767	165536	147955	185207	0.0717	0.05979	0.08597	168443	1.002
2010	27173952	19735017	37416926	3854517	3357642	4424921	1920666	1645128	2242352	186468	166989	208219	0.07783	0.06506	0.09311	187611	1.003
2011	24406725	17795559	33473982	3853478	3382970	4389425	2257511	1958276	2602471	228763	205830	254252	0.1007	0.08471	0.1197	226478	0.9938
2012	22665108	16510193	31114543	3778821	3339167	4276361	2303866	2e+06	2654129	431402	388561	478966	0.182	0.1534	0.216	434710	1.011
2013	30689037	22211446	42402328	3679047	3265025	4145569	2112765	1836572	2430494	498634	449764	552815	0.2147	0.1811	0.2547	511416	1.001
2014	48616427	34867440	67786939	3920594	3470073	4429607	2083311	1809165	2398999	507606	457758	562884	0.2073	0.1747	0.2459	517356	1.003
2015	13098673	9423319	18207517	4102674	3596183	4680501	1936797	1678528	2234804	486387	437680	540513	0.214	0.1794	0.2553	494099	1.002
2016	23503414	17105641	32294052	4060267	3554844	4637551	2232275	1923541	2590560	550065	495669	610431	0.2327	0.1949	0.2777	563610	1
2017	14150971	10235594	19564080	3525551	3093115	4018444	2064512	1770303	2407617	466630	416208	523162	0.1934	0.1624	0.2303	498437	1.001
2018	24124008	17514666	33227453	3347823	2947549	3802453	1852687	1584320	2166513	550382	488579	620001	0.2203	0.1849	0.2625	603536	1.001
2019	21552500	15552764	29866735	2853541	2514411	3238412	1589952	1361873	1856230	427794	381970	479115	0.1886	0.1575	0.2258	442138	1.002
2020	23368085	16636212	32824021	2764224	2419085	3158605	1499912	1280028	1757567	415594	371484	464941	0.1964	0.1636	0.2357	426900	1.003
2021	18346146	12542176	26835940	2573507	2205925	3002340	1352809	1129011	1620970	360261	319730	405931	0.1979	0.1608	0.2436	365356	1
2022	16619677	9095169	30369274	2444795	1943895	3074767	1334034	1009913	1762178	330994	181739	602826	0.198	0.1027	0.3817	.	.

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 ).  Mon May 02 09:53:59 2022"

Slot "range":
    min     max plusgroup   minyear   maxyear   minfbar   maxfbar
      0       8       8      1947      2022         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	1.223	0.1772	0.864	1.73
catch A	2	0.1679	0.1157	0.1338	0.2106
catch A	3	0.1679	0.1157	0.1338	0.2106
catch A	4	0.1679	0.1157	0.1338	0.2106
catch A	5	0.1679	0.1157	0.1338	0.2106
catch A	6	0.1679	0.1157	0.1338	0.2106
catch A	7	0.1764	0.2219	0.1142	0.2724
catch A	8	0.1764	0.2219	0.1142	0.2724
catch BD	0	0.4282	0.1837	0.2987	0.6137
catch BD	1	0.3473	0.2759	0.2022	0.5964
catch BD	2	1.428	0.09082	1.195	1.706
catch BD	3	1.428	0.09082	1.195	1.706
catch BD	4	1.428	0.09082	1.195	1.706
catch BD	5	1.428	0.09082	1.195	1.706
catch C	1	0.762	0.1897	0.5254	1.105
catch C	2	0.5315	0.1606	0.388	0.7282
catch C	3	0.6717	0.09392	0.5588	0.8075
catch C	4	0.6717	0.09392	0.5588	0.8075
catch C	5	0.6717	0.09392	0.5588	0.8075
catch C	6	0.6717	0.09392	0.5588	0.8075
HERAS	1	0.4709	0.151	0.3502	0.6331
HERAS	2	0.2505	0.1518	0.186	0.3372
HERAS	3	0.1541	0.1976	0.1046	0.227
HERAS	4	0.2267	0.102	0.1856	0.2769
HERAS	5	0.2267	0.102	0.1856	0.2769
HERAS	6	0.2267	0.102	0.1856	0.2769
HERAS	7	0.3102	0.1215	0.2445	0.3935
HERAS	8	0.3102	0.1215	0.2445	0.3935
IBTS-Q1	1	0.2893	0.1443	0.2181	0.3838
IBTS0	0	0.3499	0.1616	0.2549	0.4803
IBTS-Q3	0	0.4802	0.1318	0.3709	0.6217

IBTS-Q3	1	0.4802	0.1318	0.3709	0.6217
IBTS-Q3	2	0.3123	0.09664	0.2584	0.3774
IBTS-Q3	3	0.3123	0.09664	0.2584	0.3774
IBTS-Q3	4	0.3123	0.09664	0.2584	0.3774
IBTS-Q3	5	0.3123	0.09664	0.2584	0.3774
LAI-ORSH	0	1.185	0.04353	1.088	1.291
LAI-BUN	0	1.185	0.04353	1.088	1.291
LAI-CNS	0	1.185	0.04353	1.088	1.291
LAI-SNS	0	1.185	0.04353	1.088	1.291

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

fleet	age	value	CV	lbnd	ubnd
HERAS	1	0.974	0.06472	0.858	1.106
HERAS	2	0.974	0.06472	0.858	1.106
HERAS	3	1.096	0.05653	0.981	1.224
HERAS	4	1.096	0.05653	0.981	1.224
HERAS	5	1.096	0.05653	0.981	1.224
HERAS	6	1.096	0.05653	0.981	1.224
HERAS	7	1.096	0.05653	0.981	1.224
HERAS	8	1.096	0.05653	0.981	1.224
IBTS-Q1	1	0.1061	0.06743	0.093	0.1211
IBTS0	0	3.4e-06	0.08689	2.867e-06	4.031e-06
IBTS-Q3	0	0.09727	0.1175	0.07725	0.1225
IBTS-Q3	1	0.04763	0.1139	0.0381	0.05955
IBTS-Q3	2	0.04176	0.08427	0.0354	0.04926
IBTS-Q3	3	0.03804	0.0838	0.03228	0.04483
IBTS-Q3	4	0.03183	0.08528	0.02693	0.03762
IBTS-Q3	5	0.02509	0.08652	0.02118	0.02973
LAI-ORSH	0	0.01648	0.1074	0.01335	0.02034
LAI-BUN	0	0.01648	0.1074	0.01335	0.02034
LAI-CNS	0	0.01648	0.1074	0.01335	0.02034
LAI-SNS	0	0.01648	0.1074	0.01335	0.02034

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	36093932	13591337	11395641	4908659	6777687	4281618	3787658	2027407	6166295
1948	33922411	16752169	7752809	7084872	3233361	4628207	2818194	2145713	4714114
1949	29597819	15763209	10851381	6319931	3828679	2079292	2976617	1773298	4059964
1950	40627635	13074607	9033028	8791989	4719749	2238395	1317643	1659497	3031759
1951	39440118	19345219	7081018	6115954	6427695	3347964	1417880	766015	2593261
1952	39202102	18112677	10821930	4179763	3606880	3701136	2042192	888887	2113747
1953	43036414	17856733	9661115	5984202	2698213	2115634	2176856	1161805	1661387
1954	4e+07	20315640	9292090	5398021	3233641	1714175	1243424	1247435	1625343
1955	34619911	17932899	10913570	5264622	2767472	1839013	1040662	661174	1369763
1956	25968979	16111660	8445230	6172460	2917568	1529044	1074515	579813	1367085
1957	62093137	10988363	8089546	3827082	3537414	1694566	947070	661837	1169426
1958	26115891	34116757	4770550	4441642	1928697	2181839	946780	553022	1018277
1959	28657528	11569021	19492580	2222328	2332883	1107674	1171629	575195	1200850
1960	12186191	14312061	5247995	10791132	1096748	1201637	608142	623417	1101960
1961	55563221	4231482	7032921	2517921	7040539	677632	814066	348424	887227
1962	28262748	28263813	1722745	3126909	1386615	4306990	422336	528385	724653
1963	32170955	1.3e+07	16514904	1032285	1308222	707785	2298998	207437	713749
1964	34142629	14283094	6632125	9634320	668880	759170	510074	1570891	562289
1965	17859019	16422385	5928575	3427110	5315554	393020	428820	323572	1397370
1966	17969166	8123565	7531218	2142467	1384520	2265497	176603	190049	850704
1967	23777353	7705972	3635946	3202601	840670	657642	877591	102969	468618
1968	23298271	10652581	3019696	1703701	1164918	291128	253371	275757	166455
1969	12696599	10354073	4296609	676195	306856	347754	78215	64905	95111
1970	23081631	5754218	4157793	1475367	204378	96889	113035	16236	42981
1971	18967092	10535473	2390802	1240220	377970	55176	29722	30400	17448
1972	12824572	8546123	3327981	756248	307919	95343	14444	1057	6489
1973	6901059	5492126	2628245	1153130	294057	123269	45461	7653	4444

1974	10626801	2775191	1545086	752559	267336	97046	40158	11357	5336
1975	2595192	5059081	903094	438887	229808	79604	28455	11867	5933
1976	3292902	880028	1766813	211617	90143	60425	14692	6454	2527
1977	4042815	1371839	340732	591155	53620	25430	18687	4906	2283
1978	4535163	1714301	671194	246346	252203	32794	11975	10263	3565
1979	8428613	1724651	834975	393659	183959	128376	22152	7379	7831
1980	13137089	3299201	774788	468326	226857	151110	68695	18070	8698
1981	27450227	4886313	1682681	356634	229257	138319	114842	57962	21465
1982	46179507	8006515	2018527	1032261	207138	128644	78383	70529	41850
1983	45190849	14309825	3299279	1128107	518755	129835	103002	53646	84703
1984	45580424	12820462	6010621	1820908	677128	274300	81431	67946	82659
1985	56719079	14511193	5564990	3446713	985011	357650	127032	47734	75823
1986	69322285	20573763	5333129	2889673	1544397	435509	168613	55044	61441
1987	60793072	26940860	8769729	2599526	1519937	773014	222983	76567	50915
1988	38026105	20370553	10222666	4633033	1344343	799214	391989	112821	67306
1989	30342238	12957247	6934689	5561702	2640442	698753	403776	195454	90599
1990	27295514	10224493	4464887	3938244	3588363	1534310	374933	217499	162029
1991	29157687	10377183	4003870	2317560	2308353	2136860	873027	212489	199141
1992	50157281	10021545	4492528	1803150	1324970	1323148	1271884	522898	244181
1993	52043143	15915540	3742534	2016902	941601	721785	726571	628101	405593
1994	41472045	15825546	5851877	1447285	838583	411246	341241	328396	463493
1995	42144693	13734935	6273150	2603126	720603	364235	201727	168233	371736
1996	33388610	13561510	5549514	3060271	1115802	342822	156343	98241	259507
1997	28057040	12799161	6004862	3086726	1601461	655322	206763	96514	211751
1998	18544104	11718955	8411975	3151426	1505249	862461	433443	133136	174976
1999	57325166	8156944	5509842	5184407	1686532	777231	433239	235239	155952
2000	37429320	23385625	5369332	2976281	3029250	980879	480432	265422	219525
2001	69204784	14296436	11616089	3553038	1709986	1655709	505698	273267	285010
2002	35081327	29902550	7611166	8035545	1933771	949655	1017145	305267	312130
2003	19127720	13651690	17372256	4464005	5011228	1073689	587083	631754	328812
2004	23203294	7174352	6041317	10769701	3001723	3023204	569924	371540	485166
2005	20310298	9834511	3661965	3919014	6449787	1779337	1643769	284944	414800
2006	20874443	7178287	4976327	2462757	2436192	4062207	876600	738159	296709
2007	25178929	7574760	3235952	2813243	1535664	1391711	2218910	449686	479237
2008	21984090	8983101	4376722	2123298	1670102	972559	851972	1408050	572281
2009	34450991	8771121	5268406	2667886	1412544	1095018	661329	622572	1542317
2010	27158438	12676152	5536618	3810141	1938466	1055592	908716	501809	1666071
2011	24342085	11082069	6666382	3568876	2450547	1245040	723495	611245	1424802
2012	23086179	9132739	5909094	4887641	2660066	1704182	810710	479497	1158651
2013	31571200	8546778	4487891	4092999	3412174	1952820	1171666	505382	1021916
2014	48305720	13723189	5361500	3155122	3257603	2293909	1236784	689425	759765
2015	12656662	18828828	9498180	3067648	1974414	2066491	1373933	718136	818192
2016	22792622	4882009	11635360	6892883	1922687	1228474	1168492	704490	732921
2017	13604031	8501195	2496961	7980134	4833325	1288961	628341	557159	612391
2018	23215739	5512549	4203423	1921539	5737006	3323673	819068	413273	708399
2019	19791826	9130981	2375612	2708081	1448638	3538641	2001803	439935	578116
2020	23548414	8042883	5398558	1597030	1850789	1072051	2137581	1059337	510839
2021	18229682	9877931	4298044	2719718	1053321	1172985	712748	1176763	845096
2022	16404915	7196801	5653978	2714118	1626468	629993	691110	424975	1025744

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	0.002569	0.04853	0.1061	0.1216	0.1566	0.247	0.2767	0.2767
1948	0	0.002492	0.0461	0.1036	0.1205	0.1526	0.222	0.2507	0.2507
1949	0	0.002841	0.05685	0.1204	0.1404	0.1755	0.2779	0.3255	0.3255
1950	0	0.003362	0.07389	0.1399	0.1569	0.1779	0.2389	0.2586	0.2586
1951	0	0.004443	0.1135	0.1894	0.2045	0.2122	0.2509	0.2476	0.2476
1952	0	0.005123	0.1412	0.205	0.2161	0.231	0.3026	0.3308	0.3308
1953	0	0.005725	0.1672	0.2222	0.2197	0.2322	0.2922	0.3154	0.3154
1954	0	0.006715	0.2137	0.2662	0.2518	0.2689	0.371	0.3959	0.3959
1955	0	0.006943	0.2245	0.2524	0.224	0.2295	0.2587	0.2362	0.2362
1956	0	0.007618	0.2588	0.2661	0.2266	0.2281	0.2458	0.2421	0.2421
1957	0	0.007962	0.2766	0.2796	0.2415	0.2527	0.28	0.2703	0.2703
1958	0	0.00809	0.2832	0.2744	0.226	0.2254	0.1989	0.1709	0.1709
1959	0	0.008829	0.3241	0.3107	0.2644	0.2654	0.2922	0.2868	0.2868
1960	0	0.007879	0.2714	0.2524	0.2142	0.2162	0.2389	0.2647	0.2647

1961	0	0.008322	0.2955	0.284	0.2433	0.2361	0.2417	0.2321	0.2321
1962	0	0.008239	0.2906	0.3226	0.2936	0.2994	0.3565	0.341	0.341
1963	0	0.006642	0.2075	0.2134	0.1776	0.1723	0.1301	0.1403	0.1403
1964	0	0.008528	0.3053	0.3227	0.275	0.264	0.2139	0.2093	0.2093
1965	0	0.01223	0.5336	0.592	0.516	0.5002	0.5024	0.5103	0.5103
1966	0	0.01142	0.4796	0.5567	0.4882	0.4891	0.4262	0.5062	0.5062
1967	0	0.01291	0.5796	0.7334	0.6653	0.6865	0.7911	0.9434	0.9434
1968	0	0.01833	0.9982	1.235	0.9927	0.9472	1.195	1.223	1.223
1969	0	0.01517	0.7433	0.9231	0.8246	0.8471	1.197	1.063	1.063
1970	0	0.01589	0.7992	0.992	0.8901	0.8532	1.194	0.9142	0.9142
1971	0	0.01705	0.8909	1.129	1.092	1.177	2.858	1.749	1.749
1972	0	0.01321	0.5989	0.68	0.571	0.5324	0.52	0.314	0.314
1973	0	0.01675	0.8665	1.018	0.8613	0.86	1.044	0.7047	0.7047
1974	0	0.01612	0.8171	0.9599	0.8434	0.8976	0.9374	0.83	0.83
1975	0	0.01858	1.019	1.272	1.114	1.215	1.323	1.603	1.603
1976	0	0.01496	0.7284	0.9886	0.8545	0.9013	0.823	1.113	1.113
1977	0	0.007451	0.2469	0.3678	0.3266	0.3818	0.2597	0.4116	0.4116
1978	0	0.006319	0.1912	0.2636	0.2288	0.2508	0.1317	0.2202	0.2202
1979	0	0.005988	0.176	0.227	0.1858	0.1882	0.07856	0.1332	0.1332
1980	0	0.006018	0.1775	0.2156	0.167	0.1517	0.0516	0.08511	0.08511
1981	0	0.006784	0.2138	0.2751	0.2516	0.2638	0.206	0.355	0.355
1982	0	0.005911	0.1726	0.2204	0.1916	0.1747	0.1027	0.1476	0.1476
1983	0	0.006661	0.2079	0.2739	0.2747	0.2723	0.2397	0.326	0.326
1984	0	0.007494	0.2497	0.3407	0.3729	0.375	0.3795	0.4874	0.4874
1985	0	0.008715	0.3158	0.4291	0.4773	0.4671	0.5182	0.5876	0.5876
1986	0	0.00844	0.3007	0.3861	0.4383	0.4441	0.5175	0.5819	0.5819
1987	0	0.008108	0.2828	0.3447	0.4014	0.4116	0.4415	0.4536	0.4536
1988	0	0.007817	0.2674	0.3162	0.3825	0.4052	0.4455	0.4676	0.4676
1989	0	0.007921	0.2734	0.3097	0.3708	0.3848	0.4074	0.4227	0.4227
1990	0	0.007351	0.2438	0.2604	0.2991	0.305	0.2865	0.3063	0.3063
1991	0	0.008273	0.2935	0.2984	0.3158	0.3009	0.2748	0.258	0.258
1992	0	0.008992	0.3347	0.3523	0.3745	0.3526	0.3714	0.3567	0.3567
1993	0	0.009888	0.3887	0.4384	0.4597	0.4051	0.4381	0.4162	0.4162
1994	0	0.009624	0.3737	0.465	0.4847	0.3983	0.3875	0.3365	0.3365
1995	0	0.008131	0.2881	0.4032	0.4299	0.3869	0.3946	0.3285	0.3285
1996	0	0.004871	0.1302	0.1941	0.2063	0.1965	0.1478	0.1119	0.1119
1997	0	0.004309	0.1079	0.173	0.1873	0.1817	0.1412	0.109	0.109
1998	0	0.004968	0.1341	0.222	0.238	0.2356	0.2134	0.1385	0.1385
1999	0	0.004626	0.119	0.2125	0.2272	0.223	0.1844	0.114	0.114
2000	0	0.004374	0.1082	0.203	0.2312	0.2323	0.1911	0.1234	0.1234
2001	0	0.003642	0.08092	0.1614	0.1998	0.2193	0.1942	0.1644	0.1644
2002	0	0.003279	0.06828	0.1388	0.1823	0.2089	0.1901	0.1693	0.1693
2003	0	0.00325	0.06694	0.1433	0.203	0.2505	0.2431	0.21	0.21
2004	0	0.003116	0.06262	0.1434	0.2211	0.2965	0.3622	0.3206	0.3206
2005	0	0.003458	0.07254	0.1625	0.2583	0.3524	0.5146	0.5452	0.5452
2006	0	0.003652	0.07814	0.1643	0.2484	0.3225	0.4386	0.5055	0.5055
2007	0	0.003563	0.07423	0.1523	0.222	0.281	0.3633	0.4352	0.4352
2008	0	0.003307	0.06533	0.1099	0.1464	0.1768	0.172	0.2165	0.2165
2009	0	0.002628	0.04558	0.06686	0.08475	0.1025	0.07577	0.1037	0.1037
2010	0	0.002709	0.04774	0.07154	0.08484	0.09952	0.07032	0.08362	0.08362
2011	0	0.002986	0.05573	0.09158	0.1104	0.1289	0.1008	0.1092	0.1092
2012	0	0.003786	0.08042	0.1482	0.1869	0.2216	0.2378	0.2549	0.2549
2013	0	0.003498	0.07121	0.1465	0.2065	0.2642	0.34	0.3929	0.3929
2014	0	0.003317	0.06679	0.1425	0.2064	0.2625	0.32	0.3877	0.3877
2015	0	0.002876	0.05502	0.1242	0.1929	0.2727	0.3985	0.5475	0.5475
2016	0	0.002864	0.05596	0.14	0.2134	0.2944	0.4489	0.6665	0.6665
2017	0	0.002517	0.04631	0.1278	0.1929	0.2468	0.3127	0.4641	0.4641
2018	0	0.002702	0.05216	0.1412	0.218	0.2842	0.3806	0.5539	0.5539
2019	0	0.002572	0.04865	0.1256	0.1804	0.2406	0.3196	0.4864	0.4864
2020	0	0.003617	0.08261	0.1731	0.205	0.2361	0.2884	0.4635	0.4635
2021	0	0.00398	0.09663	0.1948	0.219	0.2442	0.2448	0.4109	0.4109
2022	0	0.00398	0.09663	0.1948	0.219	0.2442	0.2448	0.4109	0.4109

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	0.001131	0.001155	0.000438	0.0007473	0.0007473	0.0007473	0	0	0
1948	0.001096	0.001063	0.0004183	0.000732	0.000732	0.000732	0	0	0
1949	0.001696	0.003307	0.0007567	0.0009864	0.0009864	0.0009864	0	0	0
1950	0.00251	0.009171	0.001303	0.001298	0.001298	0.001298	0	0	0
1951	0.00358	0.02307	0.002149	0.001673	0.001673	0.001673	0	0	0
1952	0.004573	0.04357	0.003022	0.001942	0.001942	0.001942	0	0	0
1953	0.0054	0.06714	0.003796	0.00215	0.00215	0.00215	0	0	0
1954	0.006461	0.09436	0.004532	0.002317	0.002317	0.002317	0	0	0
1955	0.006854	0.1356	0.005516	0.00252	0.00252	0.00252	0	0	0
1956	0.006419	0.1397	0.005653	0.002497	0.002497	0.002497	0	0	0
1957	0.007176	0.1673	0.00616	0.002578	0.002578	0.002578	0	0	0
1958	0.007762	0.1523	0.005891	0.002495	0.002495	0.002495	0	0	0
1959	0.01187	0.1836	0.006426	0.00254	0.00254	0.00254	0	0	0
1960	0.01744	0.1966	0.006569	0.002481	0.002481	0.002481	0	0	0
1961	0.01789	0.1394	0.00547	0.002255	0.002255	0.002255	0	0	0
1962	0.01261	0.1015	0.004484	0.002037	0.002037	0.002037	0	0	0
1963	0.01637	0.1429	0.005321	0.002189	0.002189	0.002189	0	0	0
1964	0.02021	0.2457	0.007047	0.002572	0.002572	0.002572	0	0	0
1965	0.01965	0.2403	0.006982	0.002602	0.002602	0.002602	0	0	0
1966	0.02615	0.2575	0.007158	0.002662	0.002662	0.002662	0	0	0
1967	0.03342	0.3209	0.007892	0.002812	0.002812	0.002812	0	0	0
1968	0.03595	0.3376	0.008162	0.002867	0.002867	0.002867	0	0	0
1969	0.02888	0.3116	0.007783	0.00279	0.00279	0.00279	0	0	0
1970	0.04222	0.353	0.008308	0.002891	0.002891	0.002891	0	0	0
1971	0.0584	0.5584	0.01046	0.003235	0.003235	0.003235	0	0	0
1972	0.07545	0.6194	0.01117	0.003358	0.003358	0.003358	0	0	0
1973	0.08743	0.6501	0.01137	0.003394	0.003394	0.003394	0	0	0
1974	0.113	0.5534	0.01037	0.003239	0.003239	0.003239	0	0	0
1975	0.1415	0.5178	0.009877	0.003164	0.003164	0.003164	0	0	0
1976	0.1162	0.2442	0.006521	0.002546	0.002546	0.002546	0	0	0
1977	0.11	0.1482	0.004843	0.002162	0.002162	0.002162	0	0	0
1978	0.134	0.134	0.004674	0.002104	0.002104	0.002104	0	0	0
1979	0.1611	0.1257	0.004627	0.00208	0.00208	0.00208	0	0	0
1980	0.1935	0.1143	0.004534	0.002049	0.002049	0.002049	0	0	0
1981	0.3584	0.2159	0.006175	0.002327	0.002327	0.002327	0	0	0
1982	0.3599	0.2117	0.006176	0.002307	0.002307	0.002307	0	0	0
1983	0.3491	0.2367	0.006673	0.002387	0.002387	0.002387	0	0	0
1984	0.2342	0.2176	0.006597	0.002386	0.002386	0.002386	0	0	0
1985	0.1649	0.2782	0.007861	0.002611	0.002611	0.002611	0	0	0
1986	0.133	0.2836	0.008388	0.002665	0.002665	0.002665	0	0	0
1987	0.1617	0.3673	0.01019	0.002921	0.002921	0.002921	0	0	0
1988	0.159	0.4611	0.01215	0.003159	0.003159	0.003159	0	0	0
1989	0.1483	0.3947	0.01223	0.003132	0.003132	0.003132	0	0	0
1990	0.1286	0.3404	0.01258	0.00312	0.00312	0.00312	0	0	0
1991	0.1569	0.2846	0.01319	0.00316	0.00316	0.00316	0	0	0
1992	0.2388	0.3333	0.01573	0.003438	0.003438	0.003438	0	0	0
1993	0.2626	0.3104	0.0167	0.003561	0.003561	0.003561	0	0	0
1994	0.195	0.1725	0.01346	0.003207	0.003207	0.003207	0	0	0
1995	0.1749	0.1481	0.01342	0.003202	0.003202	0.003202	0	0	0
1996	0.09644	0.093	0.01154	0.002921	0.002921	0.002921	0	0	0
1997	0.04043	0.03453	0.00814	0.002431	0.002431	0.002431	0	0	0
1998	0.03333	0.03114	0.008275	0.002395	0.002395	0.002395	0	0	0
1999	0.03528	0.02247	0.007659	0.002316	0.002316	0.002316	0	0	0
2000	0.03997	0.02351	0.007895	0.002098	0.002098	0.002098	0	0	0
2001	0.03036	0.009731	0.005271	0.001581	0.001581	0.001581	0	0	0
2002	0.03735	0.02208	0.008123	0.001537	0.001537	0.001537	0	0	0
2003	0.04082	0.03278	0.009029	0.001142	0.001142	0.001142	0	0	0
2004	0.04949	0.0383	0.009689	0.0009545	0.0009545	0.0009545	0	0	0
2005	0.06584	0.04952	0.009561	0.0006437	0.0006437	0.0006437	0	0	0
2006	0.05464	0.02588	0.006404	0.0004516	0.0004516	0.0004516	0	0	0
2007	0.04085	0.01425	0.003372	0.0001712	0.0001712	0.0001712	0	0	0
2008	0.04152	0.01432	0.002531	9.77e-05	9.77e-05	9.77e-05	0	0	0
2009	0.03639	0.01422	0.002467	0.0001255	0.0001255	0.0001255	0	0	0
2010	0.03767	0.01371	0.00274	0.0002387	0.0002387	0.0002387	0	0	0
2011	0.04255	0.01602	0.00253	0.0002305	0.0002305	0.0002305	0	0	0
2012	0.04579	0.02216	0.00343	0.0003164	0.0003164	0.0003164	0	0	0
2013	0.03747	0.01931	0.003357	0.0003041	0.0003041	0.0003041	0	0	0

2014	0.04587	0.01996	0.003135	0.000277	0.000277	0.000277	0	0	0
2015	0.06133	0.02184	0.002402	0.0001595	0.0001595	0.0001595	0	0	0
2016	0.07802	0.02451	0.002315	0.0001579	0.0001579	0.0001579	0	0	0
2017	0.0671	0.01677	0.00139	8.47e-05	8.47e-05	8.47e-05	0	0	0
2018	0.06789	0.01135	0.001016	9.063e-05	9.063e-05	9.063e-05	0	0	0
2019	0.05849	0.007761	0.0009039	0.0001416	0.0001416	0.0001416	0	0	0
2020	0.06512	0.005598	0.00106	0.0002877	0.0002877	0.0002877	0	0	0
2021	0.06306	0.009093	0.001533	0.0004647	0.0004647	0.0004647	0	0	0
2022	0.0631	0.0091	0.001533	0.0004648	0.0004648	0.0004648	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	0.0002746	0.0008232	3.348e-07	2.512e-07	2.512e-07	2.512e-07	0	0
1948	0	0.0002708	0.0008147	3.243e-07	2.436e-07	2.436e-07	2.436e-07	0	0
1949	0	0.0003121	0.0009048	4.472e-07	3.322e-07	3.322e-07	3.322e-07	0	0
1950	0	0.0003591	0.001004	6.147e-07	4.515e-07	4.515e-07	4.515e-07	0	0
1951	0	0.0004122	0.001111	8.404e-07	6.105e-07	6.105e-07	6.105e-07	0	0
1952	0	0.0004707	0.001226	1.136e-06	8.167e-07	8.167e-07	8.167e-07	0	0
1953	0	0.0005346	0.001347	1.516e-06	1.079e-06	1.079e-06	1.079e-06	0	0
1954	0	0.0006054	0.001477	2.008e-06	1.415e-06	1.415e-06	1.415e-06	0	0
1955	0	0.0006854	0.001618	2.66e-06	1.856e-06	1.856e-06	1.856e-06	0	0
1956	0	0.0007744	0.001771	3.506e-06	2.423e-06	2.423e-06	2.423e-06	0	0
1957	0	0.0008711	0.001931	4.573e-06	3.132e-06	3.132e-06	3.132e-06	0	0
1958	0	0.0009788	0.002104	5.951e-06	4.038e-06	4.038e-06	4.038e-06	0	0
1959	0	0.001097	0.002289	7.7e-06	5.178e-06	5.178e-06	5.178e-06	0	0
1960	0	0.001228	0.002486	9.918e-06	6.611e-06	6.611e-06	6.611e-06	0	0
1961	0	0.001368	0.002691	1.265e-05	8.36e-06	8.36e-06	8.36e-06	0	0
1962	0	0.001517	0.002902	1.594e-05	1.045e-05	1.045e-05	1.045e-05	0	0
1963	0	0.001706	0.003165	2.081e-05	1.352e-05	1.352e-05	1.352e-05	0	0
1964	0	0.001912	0.003442	2.69e-05	1.732e-05	1.732e-05	1.732e-05	0	0
1965	0	0.002134	0.003731	3.445e-05	2.199e-05	2.199e-05	2.199e-05	0	0
1966	0	0.00237	0.00403	4.362e-05	2.761e-05	2.761e-05	2.761e-05	0	0
1967	0	0.002629	0.004347	5.504e-05	3.456e-05	3.456e-05	3.456e-05	0	0
1968	0	0.00293	0.004708	7.031e-05	4.377e-05	4.377e-05	4.377e-05	0	0
1969	0	0.003253	0.005084	8.898e-05	5.493e-05	5.493e-05	5.493e-05	0	0
1970	0	0.003606	0.005484	0.0001122	6.872e-05	6.872e-05	6.872e-05	0	0
1971	0	0.003997	0.005914	0.0001414	8.591e-05	8.591e-05	8.591e-05	0	0
1972	0	0.004435	0.006384	0.0001789	0.0001078	0.0001078	0.0001078	0	0
1973	0	0.00489	0.006858	0.0002227	0.0001331	0.0001331	0.0001331	0	0
1974	0	0.005372	0.007346	0.000275	0.0001632	0.0001632	0.0001632	0	0
1975	0	0.005885	0.007852	0.0003372	0.0001987	0.0001987	0.0001987	0	0
1976	0	0.006407	0.008352	0.0004076	0.0002386	0.0002386	0.0002386	0	0
1977	0	0.006937	0.008847	0.0004861	0.0002827	0.0002827	0.0002827	0	0
1978	0	0.008	0.009846	0.0006745	0.0003879	0.0003879	0.0003879	0	0
1979	0	0.009175	0.01091	0.0009243	0.0005254	0.0005254	0.0005254	0	0
1980	0	0.0104	0.01199	0.001232	0.0006929	0.0006929	0.0006929	0	0
1981	0	0.01188	0.01324	0.001676	0.0009387	0.0009387	0.0009387	0	0
1982	0	0.01373	0.01476	0.002356	0.001311	0.001311	0.001311	0	0
1983	0	0.01567	0.0163	0.003204	0.001779	0.001779	0.001779	0	0
1984	0	0.01784	0.01796	0.004343	0.002404	0.002404	0.002404	0	0
1985	0	0.02076	0.02013	0.006183	0.0034	0.0034	0.0034	0	0
1986	0	0.0231	0.0218	0.007889	0.004314	0.004314	0.004314	0	0
1987	0	0.02542	0.02341	0.00981	0.005344	0.005344	0.005344	0	0
1988	0	0.02712	0.02454	0.01128	0.006116	0.006116	0.006116	0	0
1989	0	0.02886	0.02569	0.01294	0.006962	0.006962	0.006962	0	0
1990	0	0.02999	0.0264	0.01395	0.007428	0.007428	0.007428	0	0
1991	0	0.03267	0.02819	0.0171	0.008971	0.008971	0.008971	0	0
1992	0	0.0338	0.02889	0.01844	0.00957	0.00957	0.00957	0	0
1993	0	0.03575	0.03014	0.02118	0.01084	0.01084	0.01084	0	0
1994	0	0.03688	0.03087	0.0231	0.0117	0.0117	0.0117	0	0
1995	0	0.03814	0.0316	0.02506	0.01254	0.01254	0.01254	0	0
1996	0	0.03727	0.03092	0.02338	0.01155	0.01155	0.01155	0	0
1997	0	0.03588	0.03003	0.02128	0.01036	0.01036	0.01036	0	0
1998	0	0.03237	0.02756	0.01593	0.007825	0.007825	0.007825	0	0
1999	0	0.0304	0.0264	0.01399	0.006747	0.006747	0.006747	0	0
2000	0	0.02854	0.02525	0.01228	0.005768	0.005768	0.005768	0	0

2001	0	0.01532	0.01554	0.002516	0.001052	0.001052	0.001052	0 0
2002	0	0.009766	0.01106	0.0008565	0.0003715	0.0003715	0.0003715	0 0
2003	0	0.01693	0.0173	0.003825	0.001835	0.001835	0.001835	0 0
2004	0	0.01685	0.01748	0.00392	0.001888	0.001888	0.001888	0 0
2005	0	0.0171	0.01759	0.003803	0.001555	0.001555	0.001555	0 0
2006	0	0.01432	0.01528	0.002428	0.0008904	0.0008904	0.0008904	0 0
2007	0	0.01054	0.01203	0.001109	0.0003766	0.0003766	0.0003766	0 0
2008	0	0.007676	0.0095	0.000553	0.0001817	0.0001817	0.0001817	0 0
2009	0	0.00525	0.007154	0.0002441	8.59e-05	8.59e-05	8.59e-05	0 0
2010	0	0.004677	0.006669	0.0001998	6.709e-05	6.709e-05	6.709e-05	0 0
2011	0	0.00634	0.008766	0.0005363	0.0001714	0.0001714	0.0001714	0 0
2012	0	0.006805	0.009463	0.0007347	0.0002318	0.0002318	0.0002318	0 0
2013	0	0.006421	0.009278	0.0007343	0.0002139	0.0002139	0.0002139	0 0
2014	0	0.006815	0.01004	0.001079	0.0003103	0.0003103	0.0003103	0 0
2015	0	0.008908	0.01274	0.002698	0.0008476	0.0008476	0.0008476	0 0
2016	0	0.00579	0.009205	0.001004	0.0003068	0.0003068	0.0003068	0 0
2017	0	0.006693	0.01039	0.001505	0.0004417	0.0004417	0.0004417	0 0
2018	0	0.005684	0.009259	0.001076	0.0002932	0.0002932	0.0002932	0 0
2019	0	0.004511	0.007794	0.0006261	0.0001467	0.0001467	0.0001467	0 0
2020	0	0.006705	0.01092	0.002064	0.0005449	0.0005449	0.0005449	0 0
2021	0	0.006896	0.01135	0.002483	0.000754	0.000754	0.000754	0 0
2022	0	0.006897	0.01135	0.002484	0.0007542	0.0007542	0.0007542	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	36093932	20750964	62781272	7806700	6115230	9966031	4783956	3561853	6425373	852843	731764	993954	0.1367	0.09944	0.1878	581760
1948	33922411	20543216	56015083	6761523	5333341	8572150	3961873	2975042	5276038	666626	579015	767493	0.1297	0.09565	0.1758	502100
1949	29597819	18081727	48448407	6409820	5111458	8037979	3712925	2822158	4884849	730549	634505	841131	0.1551	0.1153	0.2088	508500
1950	40627635	25311507	65211634	6214591	5012141	7705519	3587598	2771509	4643989	648487	570728	736839	0.1587	0.12	0.21	491700
1951	39440118	24747664	62855343	6211033	5069713	7609292	3301723	2578337	4228065	751339	660716	854391	0.1958	0.1501	0.2553	600400
1952	39202102	24781685	62013731	6090145	4985950	7438877	3199364	2502030	4091049	837855	742819	945049	0.2212	0.17	0.2877	664400
1953	43036414	27909105	66363036	5900935	4838324	7196920	3013831	2349901	3865345	835273	739918	942916	0.229	0.1759	0.2982	698500
1954	4e+07	26126913	61254368	5755651	4724400	7012004	2765201	2135657	3580321	953183	842371	1078571	0.2769	0.2109	0.3636	762900
1955	34619911	22763194	52652463	5501984	4503231	6722246	2798729	2163949	3619717	841968	733879	965976	0.2408	0.1834	0.3161	806400
1956	25968979	17059605	39531269	5085817	4176056	6193772	2641803	2044607	3413431	837557	731539	958939	0.2481	0.1897	0.3243	675200
1957	62093137	40422899	95380532	5042123	4154980	6118682	2392825	1851678	3092120	800448	702187	912459	0.2693	0.2059	0.3521	682900
1958	26115891	17252338	39533178	5036873	4129668	6143372	2017832	1563482	2604218	745782	628547	884884	0.2447	0.1881	0.3182	670500
1959	28657528	18538553	44299784	5621867	4616942	6845526	2984292	2310032	3855356	1148571	963972	1368520	0.2946	0.2275	0.3815	784500
1960	12186191	7886906	18829087	4736854	3906133	5744247	2601400	2026196	3339894	820539	702398	958551	0.2419	0.1875	0.3121	696200
1961	55563221	36047405	85644764	4826076	4021122	5792166	2552188	2017234	3229007	733169	633660	848305	0.2631	0.2074	0.3338	696700
1962	28262748	18770736	42554695	4525951	3780100	5418967	1773922	1390483	2263098	713231	616139	825622	0.3153	0.2487	0.3997	627800
1963	32170955	21649861	47804940	5263581	4396523	6301636	2899811	2315315	3631862	600576	503602	716223	0.1832	0.1468	0.2286	716000
1964	34142629	2.3e+07	50674338	5171348	4473157	5978515	2603409	2153249	3147679	911783	776372	1070811	0.2799	0.2308	0.3393	871200
1965	17859019	12037346	26496252	4572139	4034166	5181853	1959759	1650930	2326360	1278052	1109727	1471909	0.5326	0.4471	0.6344	1168800
1966	17969166	12186880	26494963	3463416	3059421	3920758	1600123	1353461	1891738	931170	812184	1067588	0.4918	0.4155	0.5822	895500
1967	23777353	16145329	35017094	2667372	2376179	2994251	964368	824310	1128223	860297	751767	984494	0.6954	0.5962	0.8109	695500
1968	23298271	15784272	34389261	2202290	1935132	2506330	511241	436339	599001	819977	707699	950069	1.078	0.9426	1.233	717800
1969	12696599	8509512	18943933	1722488	1480694	2003766	467714	379942	575762	538552	450039	644474	0.9113	0.7905	1.051	546700
1970	23081631	15495273	34382206	1672354	1440617	1941369	457474	370264	565224	534022	449851	633942	0.9502	0.8271	1.092	563100
1971	18967092	12805037	28094460	1533986	1303646	1805024	287656	235431	351466	549383	442878	681502	1.435	1.267	1.624	520100
1972	12824572	8651831	19009807	1374682	1170496	1614487	345782	281208	425183	425157	335495	538781	0.5861	0.4998	0.6873	497500
1973	6901059	4669081	10199997	1112375	965289	1281873	282030	233238	341028	447492	371216	539439	0.9359	0.8138	1.076	484000
1974	10626801	7074419	15962994	777312	674640	895609	192645	160441	231313	275134	233389	324346	0.8967	0.7775	1.034	275100
1975	2595192	1718950	3918101	597433	501848	711225	103686	85384	125911	248600	199937	309107	1.194	1.027	1.389	312800
1976	3292902	2111802	5134575	448129	369375	543675	141736	106349	188897	152782	125376	186179	0.8639	0.676	1.104	174800
1977	4042815	2535823	6445384	317952	254294	397546	113902	82658	156957	54202	45074	65178	0.3209	0.2334	0.4411	46000
1978	4535163	2788080	7377014	375401	294295	478860	138961	103508	186557	48860	31926	74776	0.2177	0.1336	0.3548	11000
1979	8428613	5402990	13148557	498125	400762	619143	183352	142155	236487	60571	39662	92503	0.176	0.1078	0.2873	25100
1980	13137089	8936495	19312170	683425	564546	827337	213538	171016	266632	79982	62708	102015	0.1579	0.1236	0.2016	70764
1981	27450227	18640594	40423334	1123375	924057	1365684	284251	228112	354205	147857	114971	190150	0.2482	0.1975	0.312	174879
1982	46179507	31548502	67595822	1731447	1419892	2111364	408065	331007	503061	247305	180797	338277	0.1792	0.1444	0.2225	275079
1983	45190849	31391200	65056859	2333065	1954868	2784429	571394	467064	699029	379442	289046	498107	0.2614	0.2142	0.3191	387202
1984	45580424	31914549	65098053	3061456	2614637	3584633	893442	729572	1094120	469514	388575	567313	0.3522	0.292	0.4249	428631
1985	56719079	39554113	81332982	3512723	3023449	4081174	962028	796377	1162135	620070	529873	725620	0.4519	0.3759	0.5434	613780
1986	69322285	48270038	99556150	4001766	3427586	4672132	1000966	833509	1202067	741974	600663	916531	0.4291	0.3565	0.5166	671488
1987	60793072	42314279	87341618	4003144	3453628	4640095	1211476	1007591	1456618	768372	636025	928259	0.39	0.3248	0.4684	792058

1988	38026105	26617608	54324366	3925626	3419273	4506963	1561678	1305377	1868301	958261	777056	1181723	0.3785	0.317	0.452	887686
1989	30342238	21222837	43380223	3475715	3088307	3911720	1600704	1377271	1860384	811312	699123	941504	0.3655	0.3086	0.4328	787899
1990	27295514	19059205	39091090	3462435	3078666	3894043	1724868	1487289	2e+06	675060	580688	784770	0.2959	0.2486	0.3522	645229
1991	29157687	20417792	41638720	3276983	2916766	3681687	1525114	1319749	1762435	670407	581244	773247	0.3156	0.2652	0.3756	658008
1992	50157281	36361750	69186790	3250500	2884590	3662825	1166146	1005388	1352610	691748	596592	802081	0.3775	0.3172	0.4493	716799
1993	52043143	37443145	72336039	2995019	2628535	3412599	824909	702943	968037	671620	576809	782015	0.4483	0.375	0.5358	671397
1994	41472045	29776970	57760428	2886604	2498625	3334826	880451	749793	1033877	626099	532560	736068	0.4443	0.3717	0.5311	568234
1995	42144693	30152157	58907069	2793145	2415751	3229497	931536	786521	1103288	573780	494810	665353	0.404	0.3345	0.4879	579371
1996	33388610	24072349	46310364	2753448	2376702	3189914	1104248	934102	1305386	284224	244091	330956	0.1969	0.1613	0.2402	275098
1997	28057040	20097033	39169836	2739853	2383987	3148842	1227831	1044893	1442797	264169	230710	302480	0.1778	0.1462	0.2162	248023
1998	18544104	13548403	25381869	3032252	2654084	3464303	1395001	1198220	1624098	363151	318196	414457	0.2251	0.1862	0.2721	385577
1999	57325166	41809047	78599607	3133522	2755437	3563486	1502576	1291213	1748537	351407	306974	402270	0.2083	0.1731	0.2505	370877
2000	37429320	27453528	51030017	3766491	3281901	4322632	1530044	1315958	1778958	364028	320238	413807	0.207	0.1718	0.2493	382794
2001	69204784	50171172	95459243	4189548	3658685	4797437	1952112	1678835	2269873	349723	307959	397151	0.1774	0.1468	0.2143	358657
2002	35081327	25677026	47929986	5029686	4380141	5775554	2367734	2038580	2750034	374505	328987	426321	0.1628	0.1349	0.1965	371955
2003	19127720	14039542	26059944	5334304	4658571	6108054	2375503	2057385	2742808	477853	421173	542162	0.1892	0.1576	0.2271	480107
2004	23203294	1.7e+07	31676550	4616741	4076342	5228779	2338856	2031217	2693089	562971	496012	638968	0.2251	0.1869	0.2711	570865
2005	20310298	14962250	27569931	3875858	3439402	4367700	2124185	1835073	2458847	647947	570412	736020	0.2796	0.2329	0.3356	666404
2006	20874443	15323186	28436800	3262684	2894901	3677193	1720898	1487726	1990615	515942	455186	584807	0.256	0.2131	0.3075	524366
2007	25178929	18329712	34587476	2696293	2386090	3046823	1354354	1168274	1570071	381440	336365	432556	0.2222	0.1843	0.2679	408528
2008	21984090	15952790	30295654	2754883	2416814	3140243	1443327	1245725	1672273	246991	219533	277883	0.1368	0.1134	0.165	259031
2009	34450991	25110514	47265889	3191925	2787145	3655491	1776606	1529237	2063989	172196	152960	193851	0.07719	0.06363	0.09363	172685
2010	27158438	19871035	37118386	3794013	3315856	4341122	1877237	1611156	2187262	177592	157888	199755	0.0769	0.06355	0.09305	187508
2011	24342085	17880524	33138688	3824287	3368957	4341157	2239366	1948964	2573038	227127	201891	255518	0.1001	0.08334	0.1202	224148
2012	23086179	16918487	31502325	3775423	3346466	4259364	2301383	2005261	2641232	416621	369392	469890	0.1781	0.1485	0.2135	437236
2013	31571200	22987715	43359712	3669010	3264597	4123523	2106892	1837927	2415217	484998	430478	546423	0.2087	0.1743	0.2498	511733
2014	48305720	34924132	66814618	3910370	3471007	4405347	2079890	1812586	2386614	489338	435072	550373	0.2028	0.1693	0.2431	517593
2015	12656662	9192676	17425948	4095304	3603970	4653623	1946063	1692792	2237228	489486	435179	550570	0.2128	0.177	0.2559	494072
2016	22792622	16712055	31085562	4058123	3561287	4624272	2240807	1937000	2592265	550756	489030	620274	0.2333	0.1938	0.2809	564880
2017	13604031	9911096	18672976	3480735	3061887	3956878	2052594	1767702	2383402	447546	392381	510467	0.1883	0.1566	0.2264	499145
2018	23215739	16959447	31779961	3287728	2897787	3730141	1825019	1565915	2126996	533923	465103	612925	0.2177	0.181	0.2619	604449
2019	19791826	14334239	27327323	2784406	2457601	3154669	1557280	1338373	1811991	421732	369244	481681	0.185	0.1529	0.2238	451542
2020	23548414	16746655	33112750	2691893	2361023	3069131	1471011	1257982	1720114	406600	358551	461089	0.2003	0.165	0.2433	434000
2021	18229682	12459331	26672482	2521102	2166633	2933564	1310003	1094101	1568510	367132	324083	415899	0.2037	0.1634	0.2539	373167
2022	16404915	8957164	30045363	2406412	1925598	3007285	1300630	987661	1712774	340192	183379	631098	0.2037	0.1018	0.4075	.

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 ).  Mon May 02 09:53:59 2022"

Slot "range":
    min     max plusgroup   minyear   maxyear   minfbar   maxfbar
      0       8       8      1947      2022         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

Slot "obs.vars":
        age
fleet      0  1  2  3  4  5  6  7  8
 catch A  -1  0  1  1  1  1  1  2  2
 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

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 2 2

Slot "cor.obs":
        age
fleet     0-1 1-2 2-3 3-4 4-5 5-6 6-7 7-8
 catch A   NA  NA  NA  NA  NA  NA  NA  NA
 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
```

```
Slot "cor.obs.Flag":
 [1] ID  ID  ID  ID  ID  ID  AR  ID  ID  ID  ID  <NA>
Levels: ID AR US

Slot "biomassTreat":
 [1] -1 -1 -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 LN LN LN
Levels: LN ALN

Slot "fixVarToWeight":
[1] FALSE

Slot "simulate":
[1] FALSE

Slot "residuals":
[1] TRUE

Slot "sumFleets":
[1] "A"  "BD" "C"
```

Table 2.7.1. North Sea herring. Intermediate year (2022) assumptions for the stock.

Variable	Value	Notes
Fages (wr) 2–6 (2022)	0.278	Based on estimated catch 2021
SSB (2022)	1 233 347	Calculated based on catch constraint (in tonnes)
Rage (wr) 0 (2022)	16 619 677	Estimated by assessment model (in thousands)
Rage (wr) 0 (2023)	22 556 738	Weighted mean over 2011–2020 (in thousands)
Total catch (2022)	451 651	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 by-catch quota (for B and D fleets).

Table 2.7.2. North Sea herring. Intermediate year (2021), fleet wise assumptions for the catches and the fishing mortality. Weights are in tonnes

	Field	Value	Note
TACs	A-fleet TAC	427 628	
	B-fleet TAC	8 174	
	C-fleet TAC	25 021	Total TAC in IIIa (including WBSS and NSAS)
	D-fleet TAC	6 659	Total TAC in IIIa (including WBSS and NSAS)
TACs to catches variables	C-fleet transfer FcY	0.9546	Taken from ImY as % of C-fleet TAC
	C-fleet transfer ImY	23 885	Value for the Intermediate year in tonnes
	D-fleet transfer	0.5	Value for the Intermediate year in %
	WBSS/NSAS split in the North Sea	0.0136	Value from terminal year
	B-fleet uptake	0.78	Average over the last 3 years (2018-2020)
	C-fleet NSAS/WBSS split	0.3551	Average over the last 3 years (2018-2020)
	D-fleet NSAS/WBSS split	0.7	Average over the last 3 years (2018-2020)
	D-fleet uptake	0.0707	Average over the last 3 years (2018-2020)
F by fleet and total	$F_{(wr)\ 2–6}$ A-fleet	0.269	
	$F_{(wr)\ 0–1}$ B-fleet	0.048	
	$F_{(wr)\ 1–3}$ C-fleet	0	
	$F_{(wr)\ 0–1}$ D-fleet	0	
	$F_{(wr)\ 2–6}$	0.27	
	$F_{(wr)\ 0–1}$	0.051	
NSAS catches by fleet	Catches A-fleet	445371	Fleet TAC (427628 t) + what is transferred from the C fleet in 3a to the North sea (23885 t) scaled by the 3 year average proportion of NSAS in A fleet catch (98.6%, 2019-2021)
	Catches B-fleet	7099	Fleet TAC (8174 t) + a 50% transfer from the F fleet TAC (6659 t) in 3a to the North Sea scaled with the fleet uptake in 2021 (78%).
	Catches C-fleet	403	Catches corresponding to 1136 t catch in 3a scaled by the 3 year average proportion of NSAS in the C fleet catch (35.5%, 2019-2021)
	Catches D-fleet	0	Total catch set at 0 t because considered negligible

value	description	basis
0.9546	C-fleet transfer FcY (%)	Taken from ImY as % of C-fleet TAC
23885	C-fleet transfer ImY (tonnes)	Value for the Intermediate year
0.5	D-fleet transfer ImY (tonnes)	Value for the Intermediate year
0.3551	C-fleet NSAS/WBSS split	Average over the last 3 years
0.7	D-fleet NSAS/WBSS split	Average over the last 3 years
0.0136	WBSS/NSAS split in the north sea	Value from terminal year
0.78	B-fleet uptake	Average over the last 3 years
0.0707	D-fleet uptake	Average over the last 3 years

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.

TACs to catches variables.

value	description	basis
0.9546	C-fleet transfer FcY (%)	Taken from ImY as % of C-fleet TAC
23885	C-fleet transfer ImY (tonnes)	Value for the Intermediate year
0.5	D-fleet transfer ImY (tonnes)	Value for the Intermediate year
0.3551	C-fleet NSAS/WBSS split	Average over the last 3 years
0.7	D-fleet NSAS/WBSS split	Average over the last 3 years
0.0136	WBSS/NSAS split in the north sea	Value from terminal year
0.78	B-fleet uptake	Average over the last 3 years
0.0707	D-fleet uptake	Average over the last 3 years

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
mpA	0.2173	0.03454	0.003509	0.001735	0.2191	0.04004	378230	7613	3615	301	1367895	1445014
mpAC	0.2173	0.03454	0.003509	0.001735	0.2191	0.04004	378230	7613	3615	301	1367895	1445014
mpAD	0.2173	0.03454	0.003509	0.001735	0.2191	0.04004	378230	7613	3615	301	1367895	1445014
mpB	0.2219	0.03693	0.003509	0.001734	0.2236	0.04247	385226	8128	3613	300.5	1363333	1436118
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 2.7.5. North Sea herring. All scenarios with status quo in C-D fleet catches.

Basis	Fbar26A	Fbar01B	Fbar13C	Fbar01D	Fbar26	Fbar01	CatchA	CatchB	CatchC	CatchD	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 2.7.6. 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	0.279	0.031	0	0	0.28	0.034	391050	8700	0	0	399750	1113013	1012309	-9.8	-8.6	-25.3
fmsy	0.309	0.034	0	0	0.31	0.038	426243	9610	0	0	435853	1089257	969866	-11.7	-0.3	-18.6
nf	0	0	0	0	0	0	0	0	0	0	0	1365644	1551302	10.7	-100	-100
tacro	0.311	0.035	0.011	0.001	0.317	0.045	427628	9650	8885	330	446493	1083444	954653	-12.2	0	-18.3
fsq	0.278	0.031	0	0	0.278	0.034	388860	8644	0	0	397504	1114485	1014983	-9.6	-9.1	-25.7
fpa	0.309	0.034	0	0	0.31	0.038	426243	9610	0	0	435853	1089257	969866	-11.7	-0.3	-18.6
flim	0.399	0.044	0	0	0.4	0.048	524742	12297	0	0	537039	1021782	856285	-17.2	22.7	0.2
bpa	0.493	0.055	0	0	0.494	0.06	618010	15059	0	0	633069	956483	755742	-22.4	44.5	18.1
blim	0.623	0.069	0	0	0.624	0.075	732695	18799	0	0	751494	874198	641331	-29.1	71.3	40
MSYBtrigger	0.138	0.015	0	0	0.139	0.017	209423	4369	0	0	213792	1232828	1247135	0	-51	-60
fmsyAR_no_transfer_Btarget	0.279	0.047	0	0	0.28	0.05	390696	13096	0	0	403792	1113016	1011268	-9.8	-8.6	-25.4
fmsyAR_transfer_sq TAC C&D	0.295	0.03	0	0.001	0.295	0.035	408945	8522	0	330	417797	1100972	990705	-10.7	-4.4	-21.9
fmsyAR_no_transfer_sq C&D	0.274	0.03	0.011	0.001	0.28	0.04	383924	8522	8885	330	401661	1112962	1007229	-9.8	-10.2	-26.7

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)

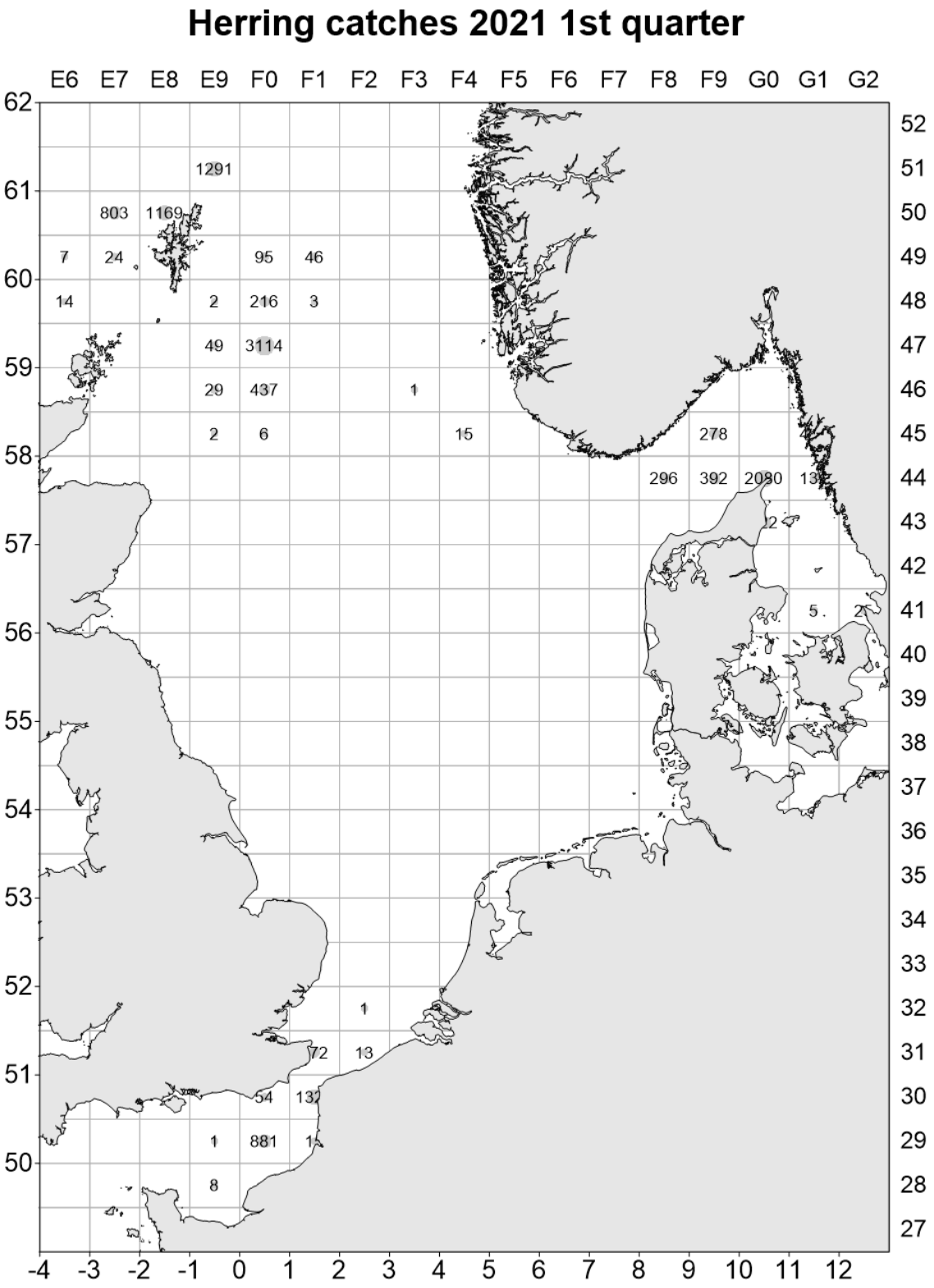

Figure 2.1.1a. Herring catches in the North Sea in the 1st quarter of 2021 (in tonnes) by statistical rectangle.

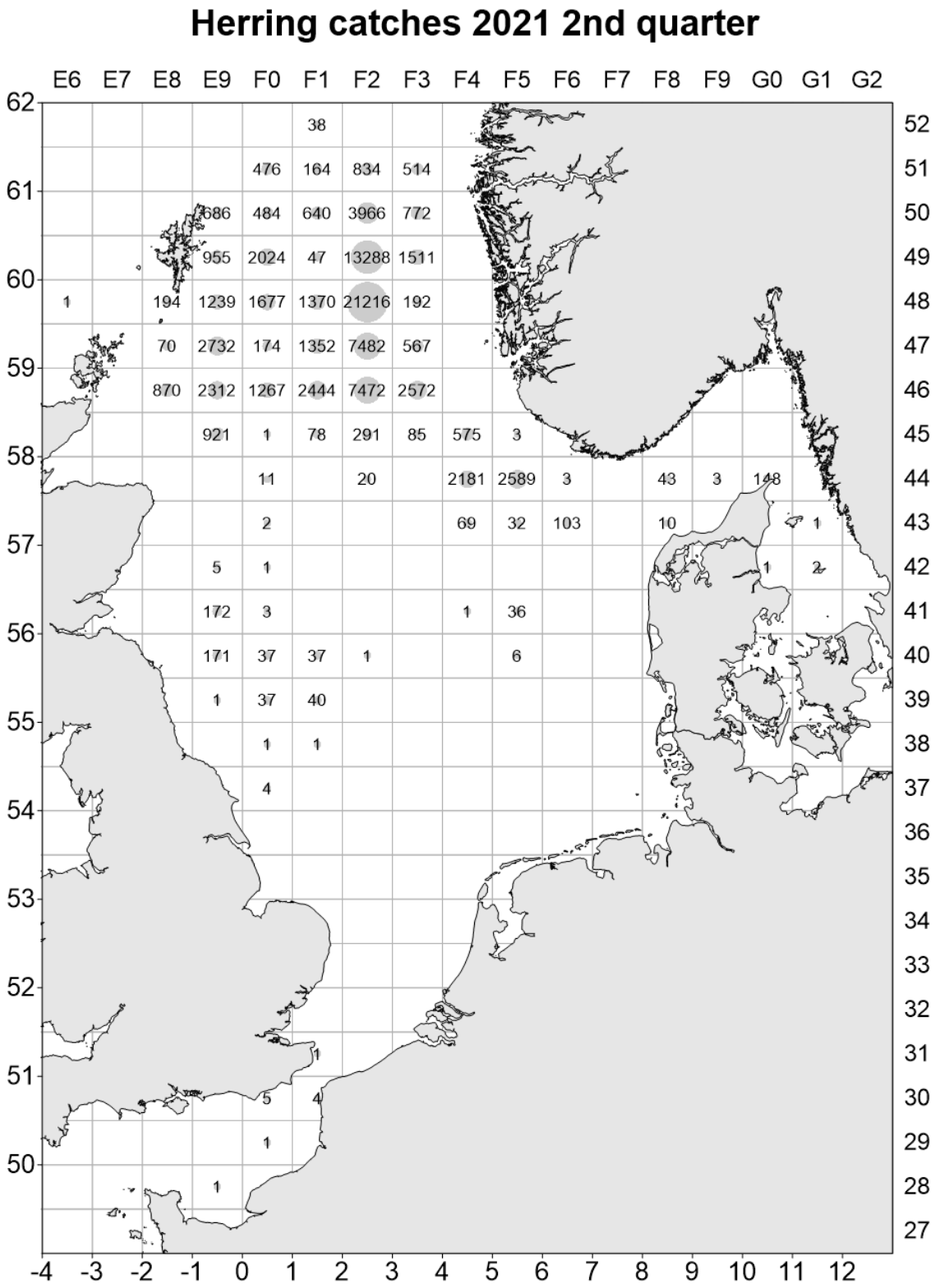

Figure 2.1.1b. Herring catches in the North Sea in the second quarter of 2021 (in tonnes) by statistical rectangle.

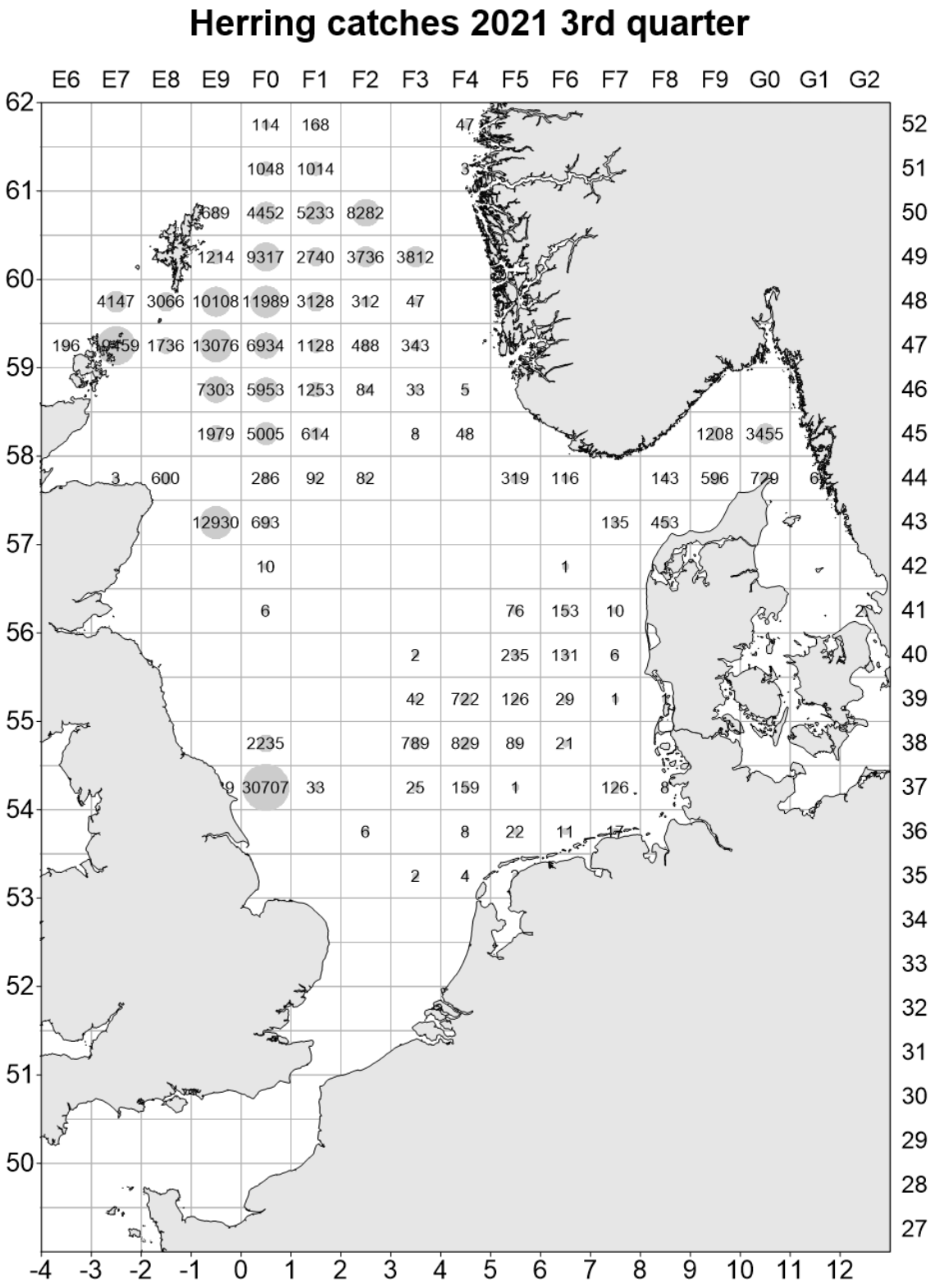

Figure 2.1.1c. Herring catches in the North Sea in the 3rd quarter of 2021 (in tonnes) by statistical rectangle.

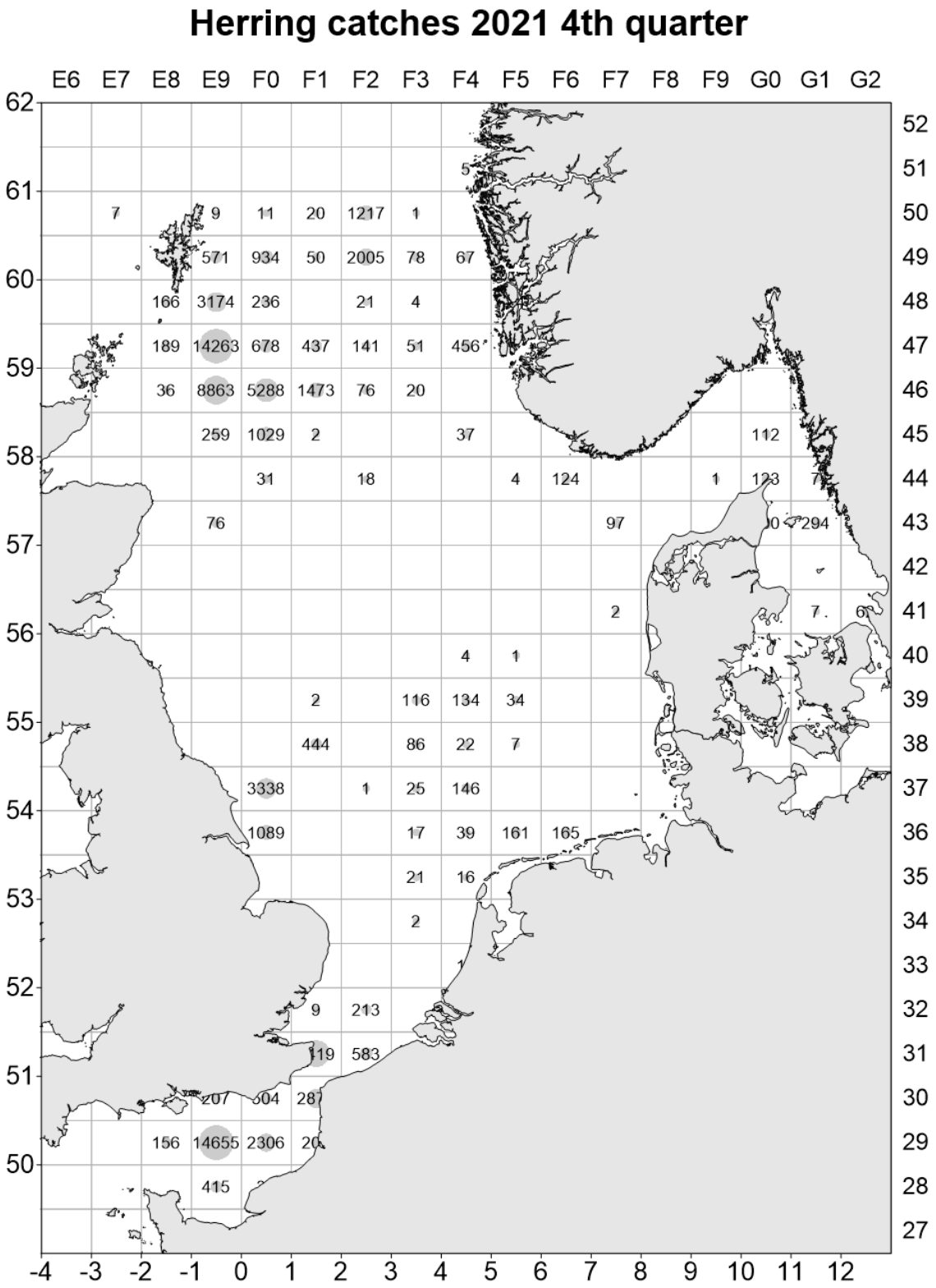

Figure 2.1.1d. Herring catches in the North Sea in the 4th quarter of 2021 (in tonnes) by statistical rectangle.

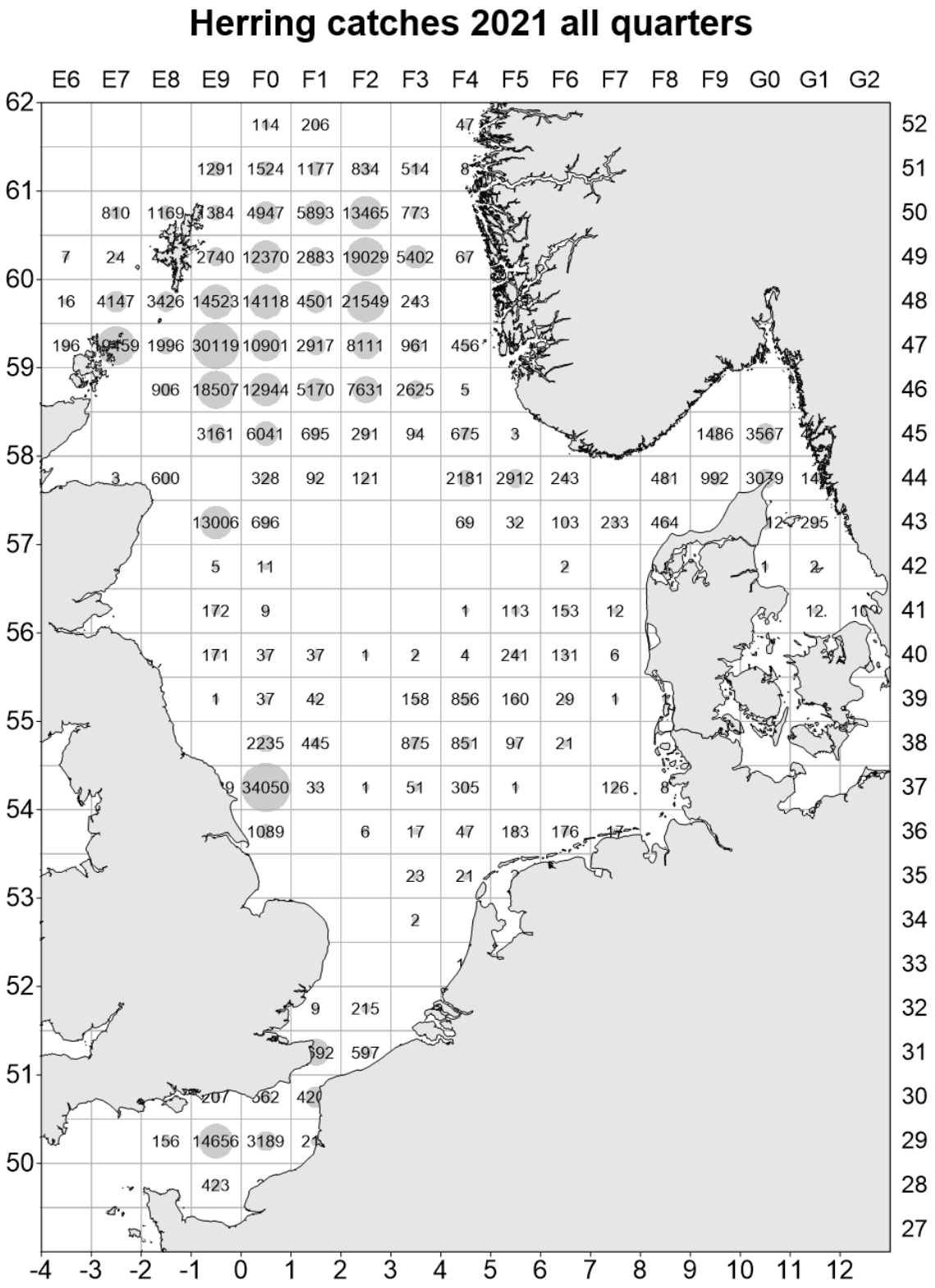

Figure 2.1.1e. Herring catches in the North Sea in all quarters of 2021 (in tonnes) by statistical rectangle.

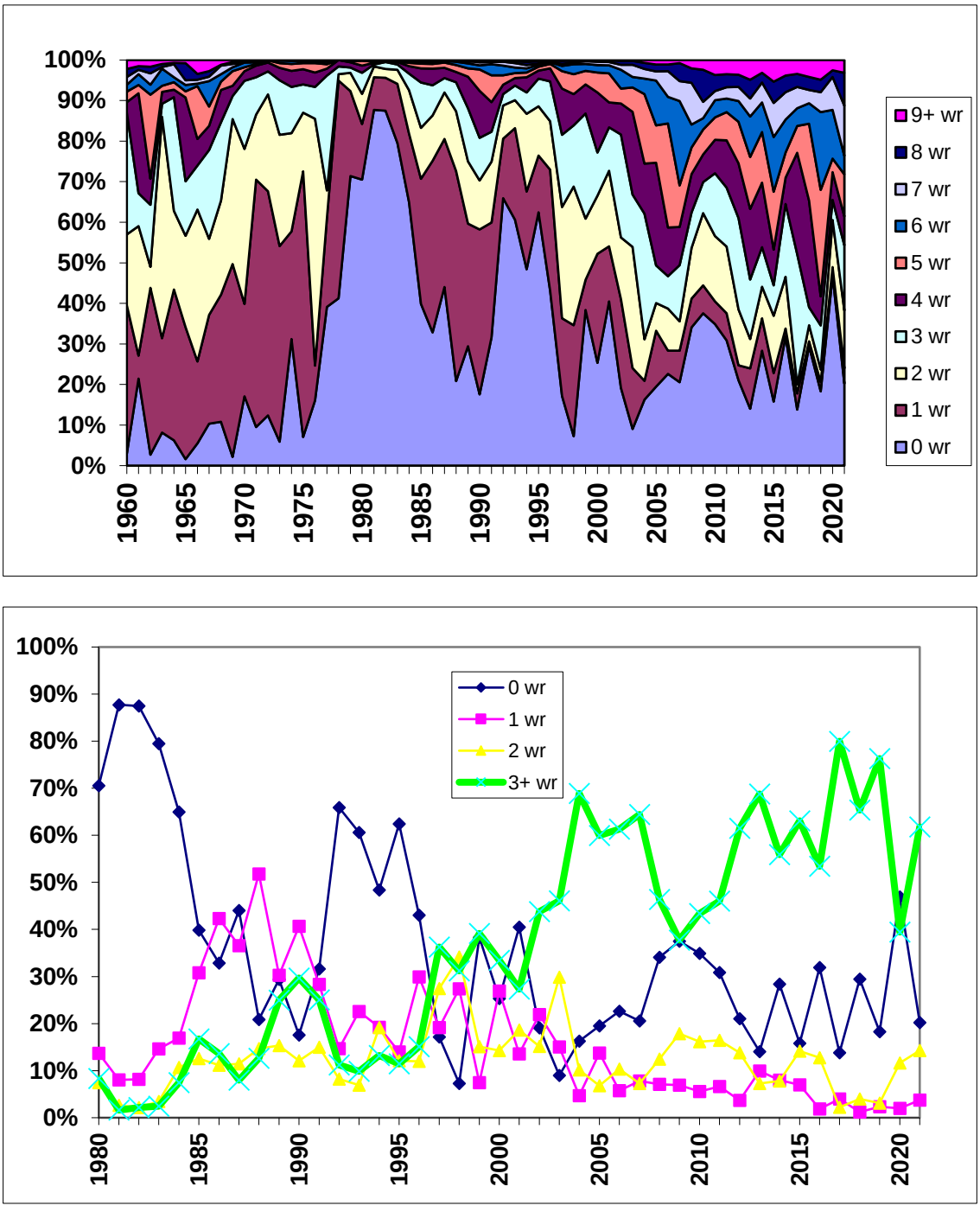

Figure 2.2.1. Proportions of age groups (numbers) in the total catch of herring caught in the North Sea (upper, 1960–2021, and lower panel, 1980–2021).

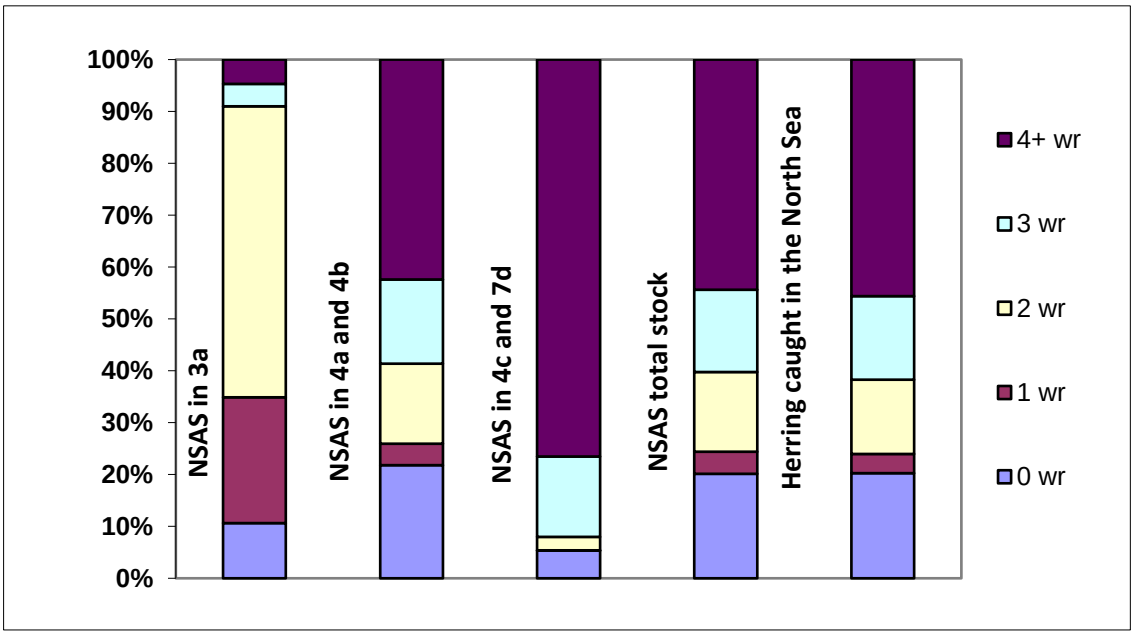

Figure 2.2.2. Proportion of age groups (numbers) in the total catch of NSAS and herring caught in the North Sea in 2021.

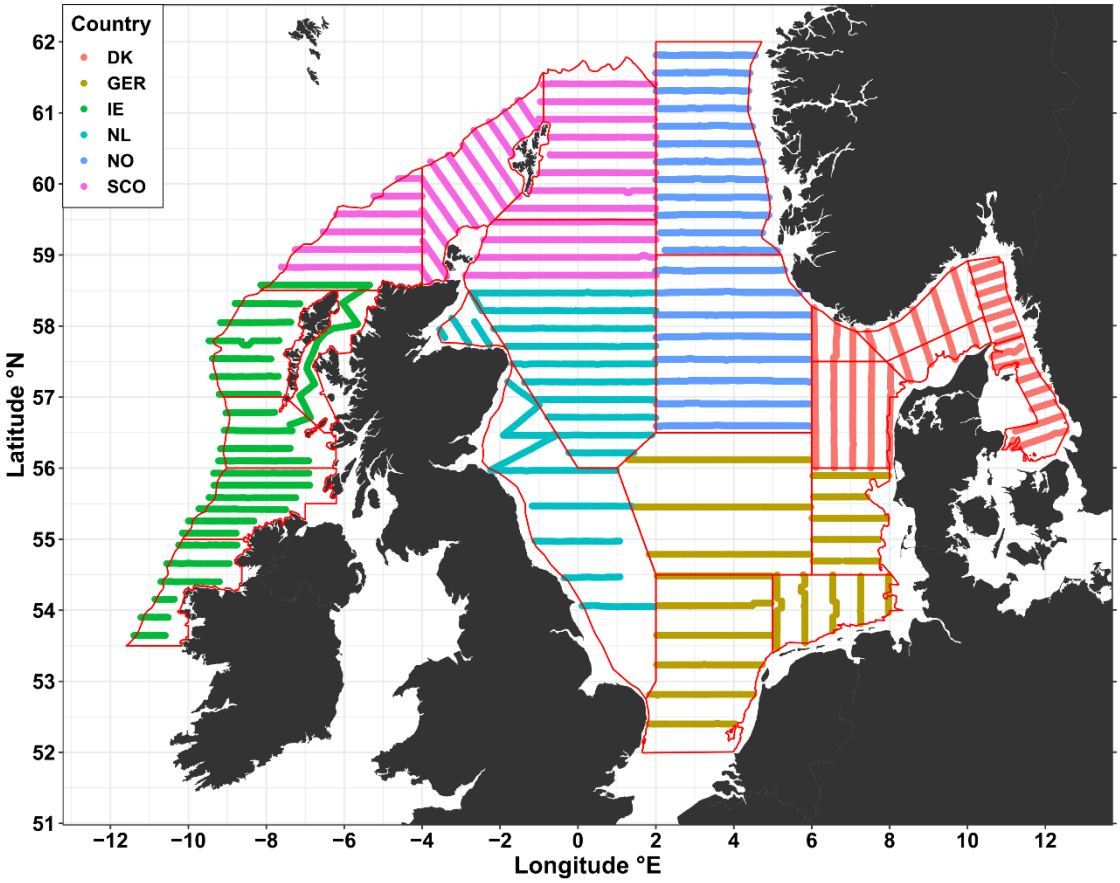

Figure 2.3.1.1. Cruise tracks and survey area coverage in the HERAS acoustic surveys in 2021 by nation.

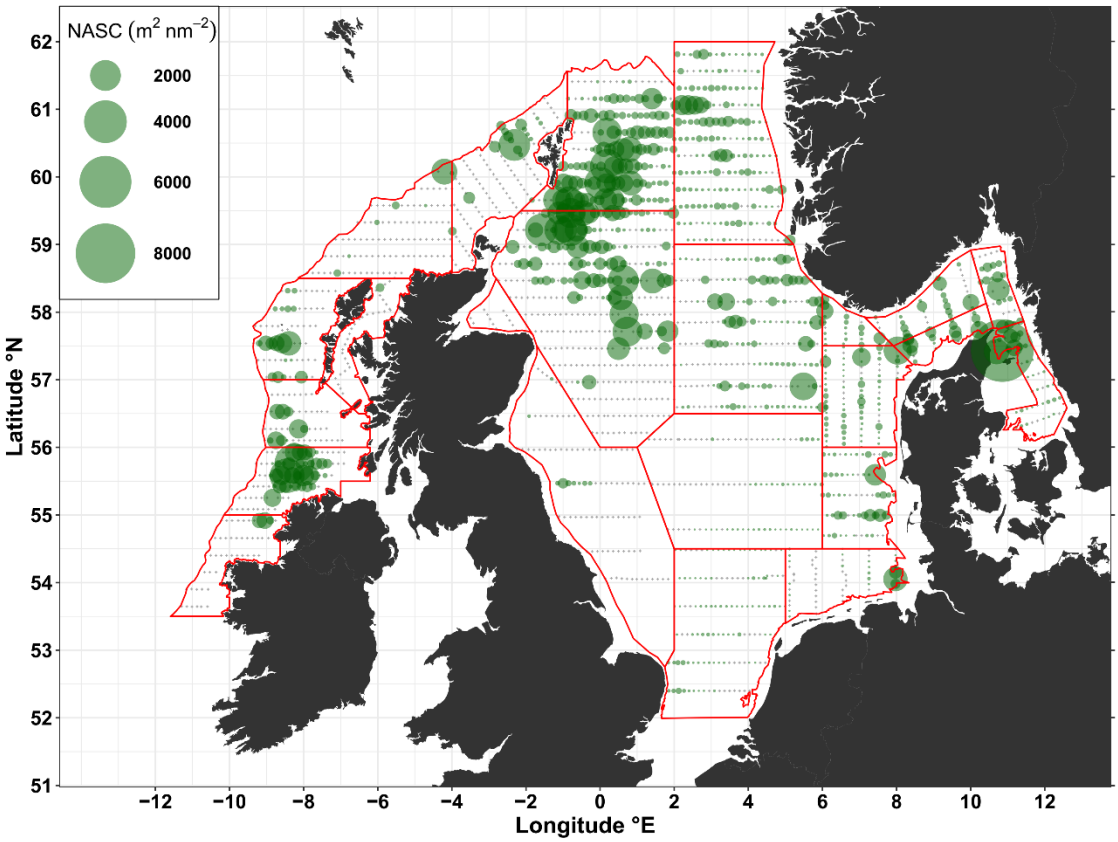

Figure 2.3.1.2. Distribution of NASC attributed to herring in HERAS in 2021. Acoustic intervals represented by light grey dot with green circles representing size and location of herring aggregations. NASC values are resampled at 5 nmi intervals along the cruise track. The red lines show the strata system.

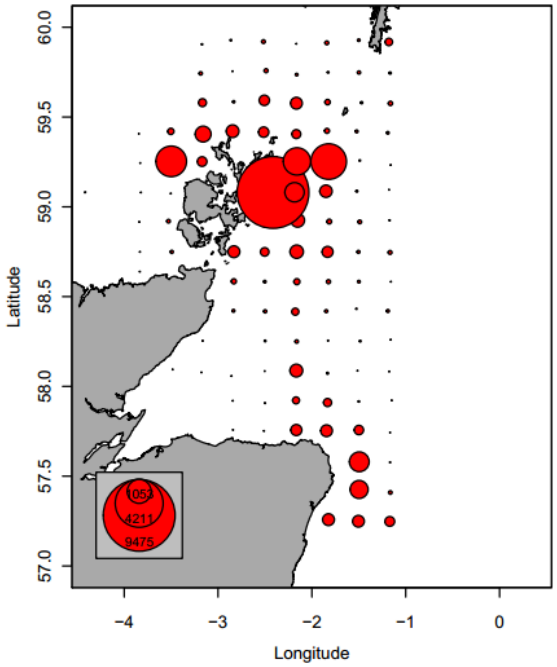

Figure 2.3.2.1. North Sea herring - Abundance of larvae < 10 mm (n/m²) in the Orkney/Shetlands and northern Buchan area, second half of September 2021 (maximum circle size = 9 475 n/m²).

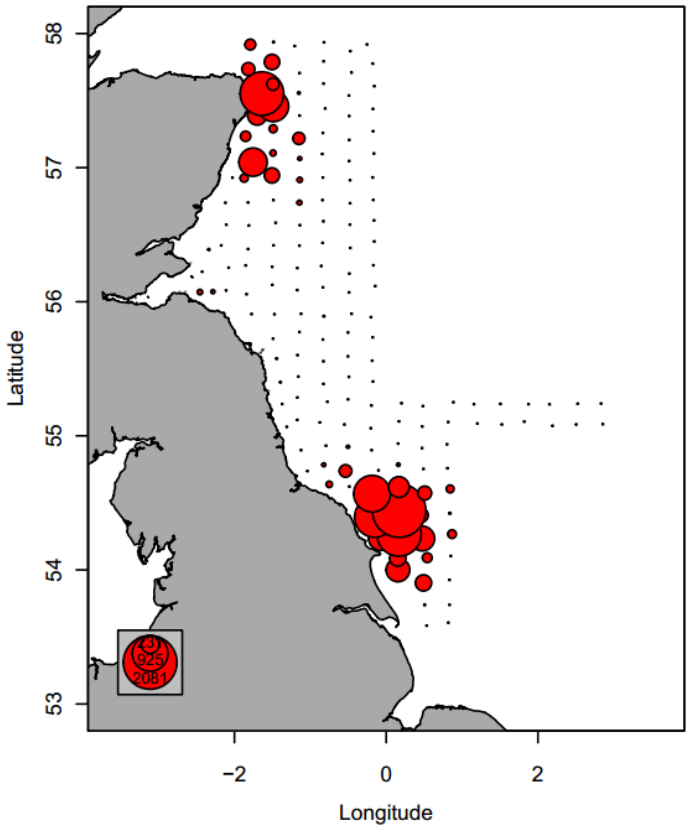

Figure 2.3.2.1. North Sea herring - Abundance of larvae < 10 mm (n/m²) in the Buchan area and the central North Sea, second half of September 2021 (maximum circle size = 2 081 n/m²).

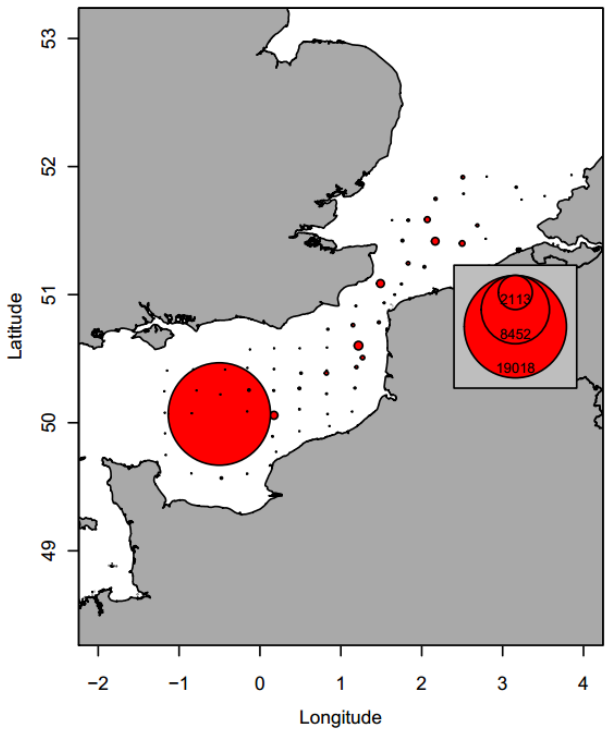

Figure 2.3.2.3. North Sea herring - Abundance of larvae <11 mm (n/m²) in the Southern North Sea and English Channel, second half of December 2021 (maximum circle size = 19 018 n/m²).

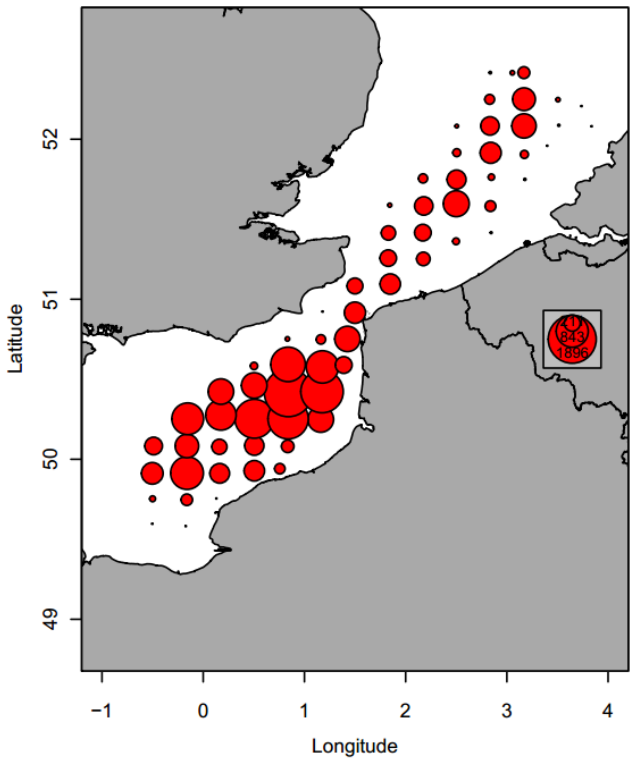

Figure 2.3.2.4. North Sea herring - Abundance of larvae <11 mm (n/m²) in the Southern North Sea and English Channel, first half of January 2022 (maximum circle size = 1 900n/m²).

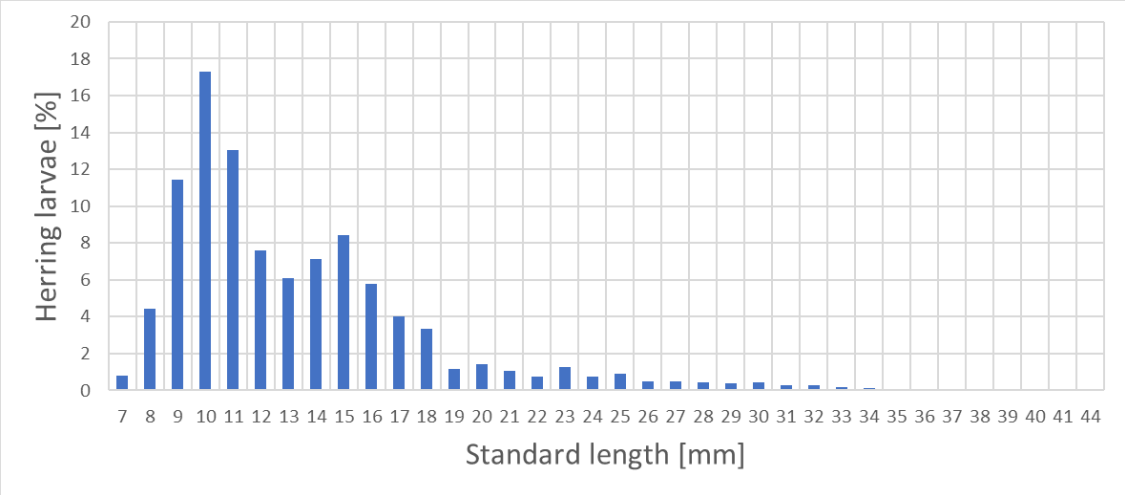

Figure 2.3.3.1.1 North Sea herring. Length distribution of all herring larvae caught in the MIK during the 2022 Q1 IBTS.

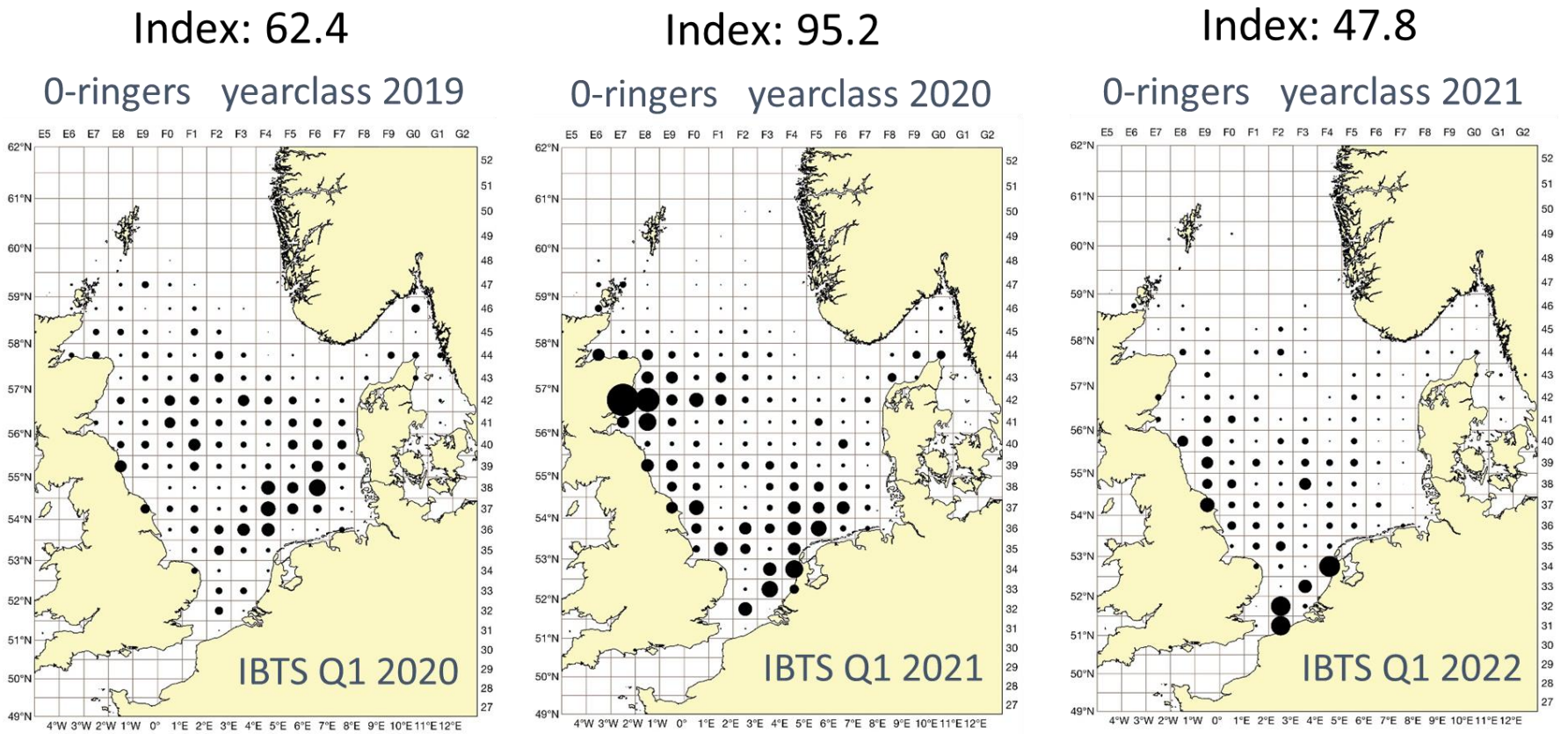

Figure 2.3.3.1.2 North Sea herring. Distribution of 0-ringer herring, year classes 2019–2021. Density estimates of 0-ringers within each statistical rectangle are based on MIK catches during IBTS in January/February 2020–2022. Areas of filled circles illustrate densities in no m-2, the area of the largest circle represents a density of 3.82 m-2. All circles are scaled to the same order of magnitude of the square root transformed densities.

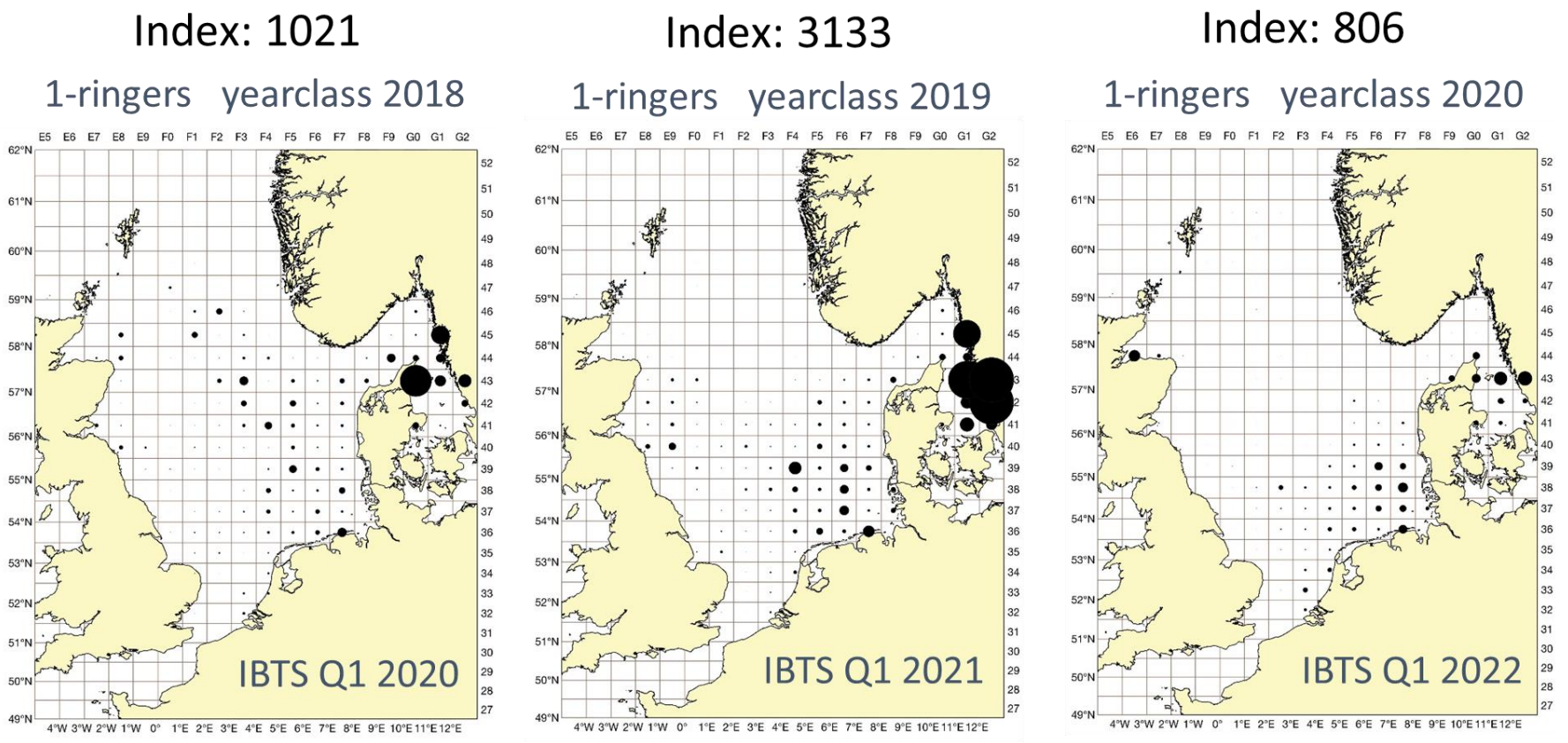

Figure 2.3.3.2.1 North Sea herring. Distribution of 1-ringer herring, year classes 2018–2020. Density estimates of 1-ringers within each statistical rectangle are based on GOV catches during IBTS in January/February 2020–2022. Areas of filled circles illustrate numbers per hour, scaled proportionally 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.

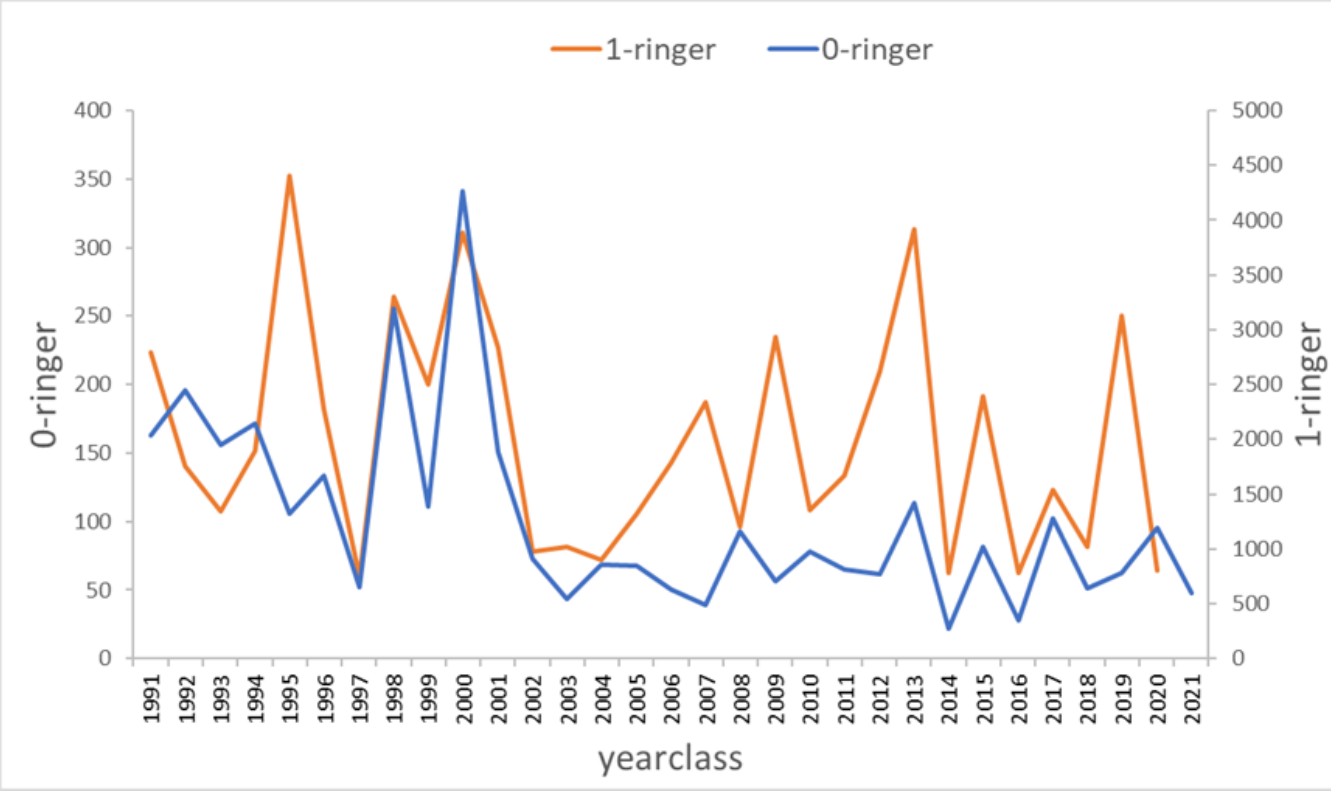

Figure 2.3.3.2.2 North Sea herring. Time series of 0-ringer (blue) and 1-ringer indices (orange). Year-classes 1991 to 2021 for 0-ringers, year-classes 1991–2020 for 1-ringers.

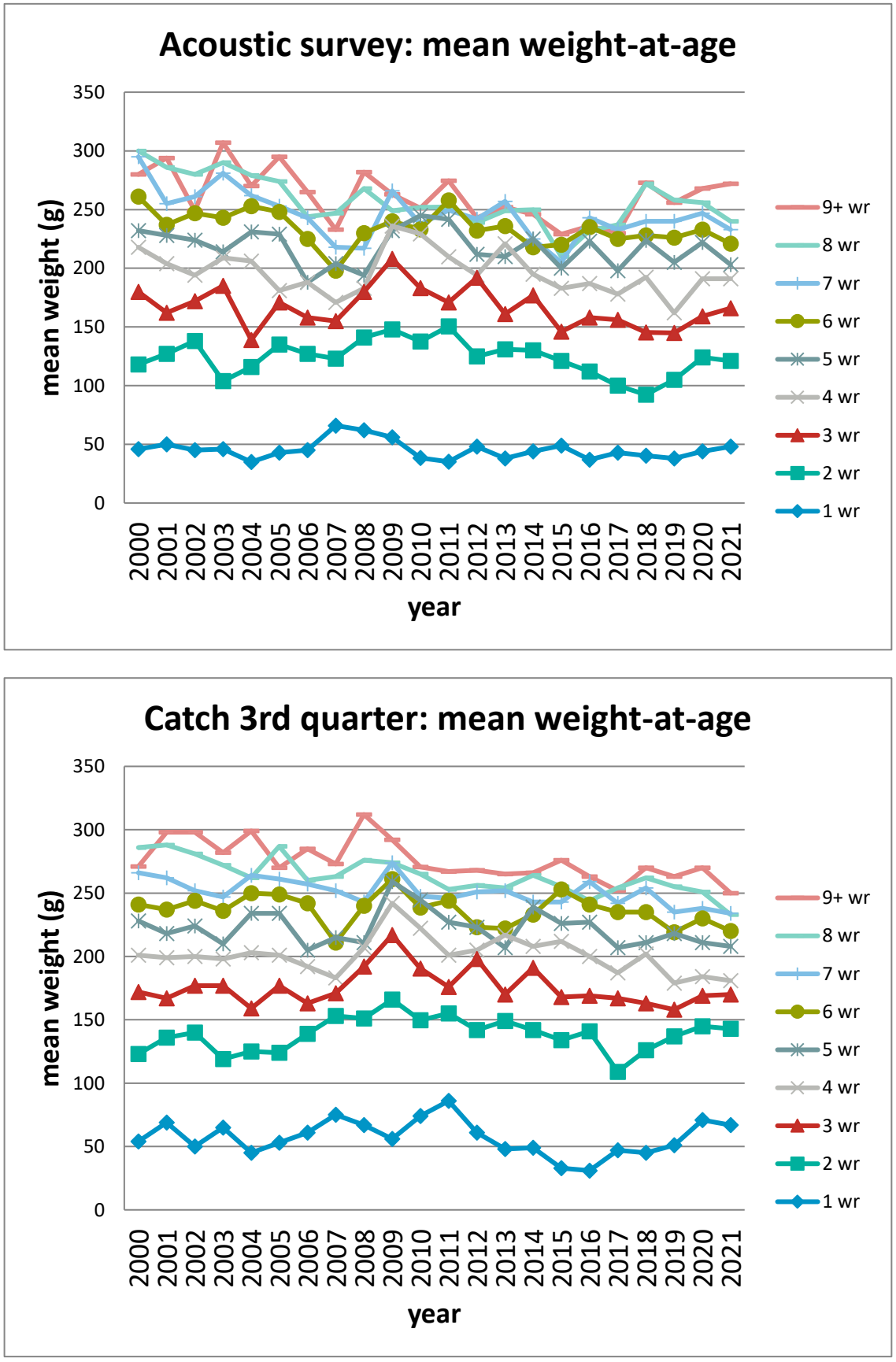

Figure 2.4.1.1. North Sea Herring. Mean weights-at-age for the 3rd quarter in Divisions 4 and 3.a from the acoustic survey (upper panel) and mean weights-in-the-catch (lower panel) for comparison.

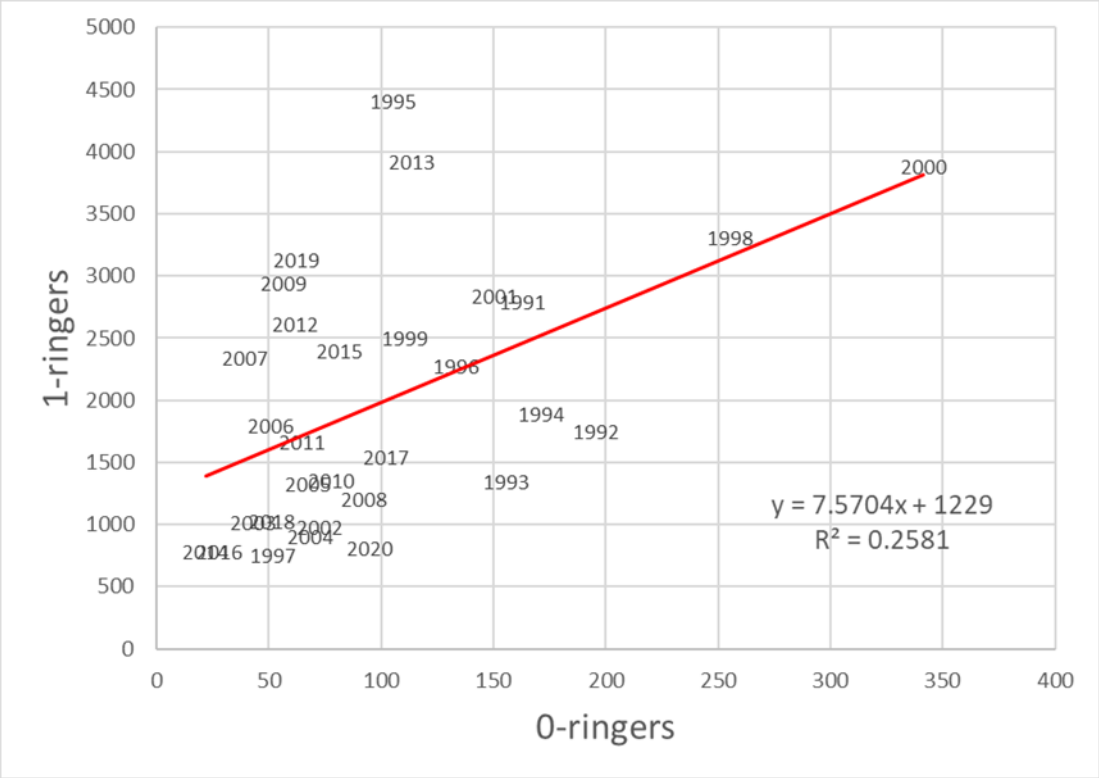

Figure 2.5.1.1 North Sea herring. Relationship between indices of 0-ringers, calculated with the new algorithm, and 1-ringers for year-classes 1991 to 2020.

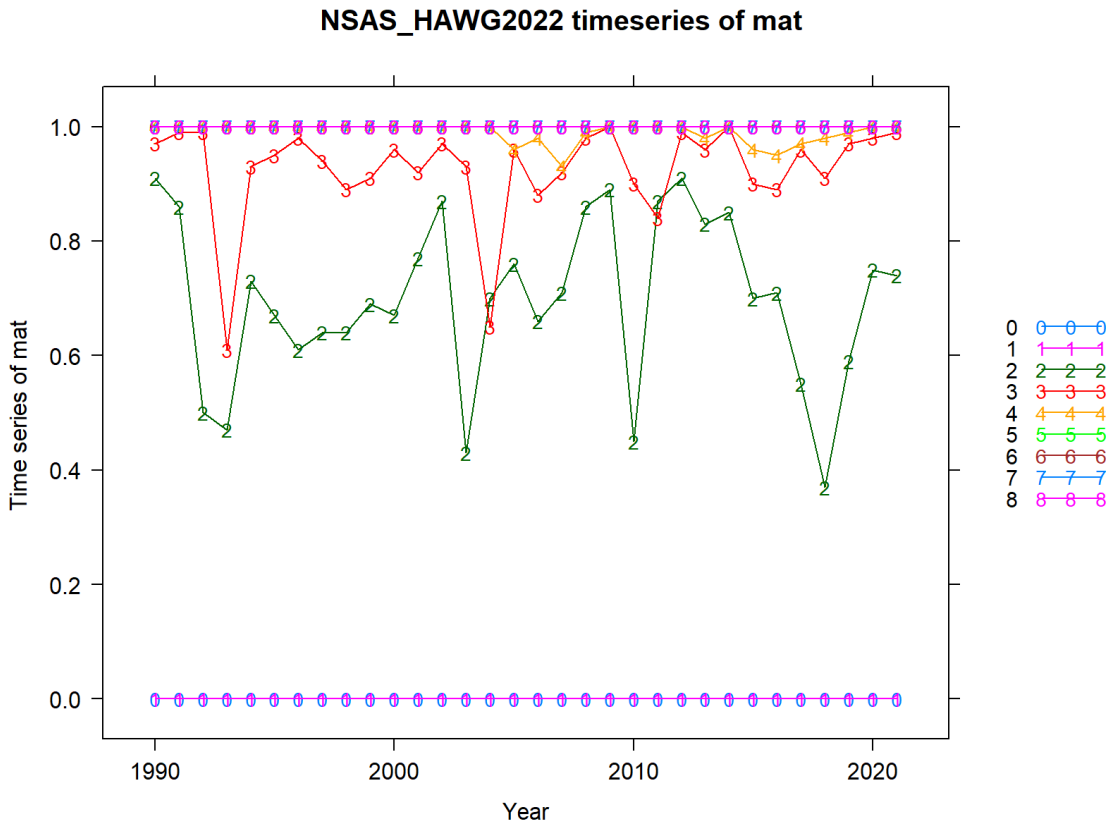

Figure 2.6.1.1. North Sea Herring. Time-series of proportion mature at ages 0 to 8+ as used in the North Sea herring assessment.

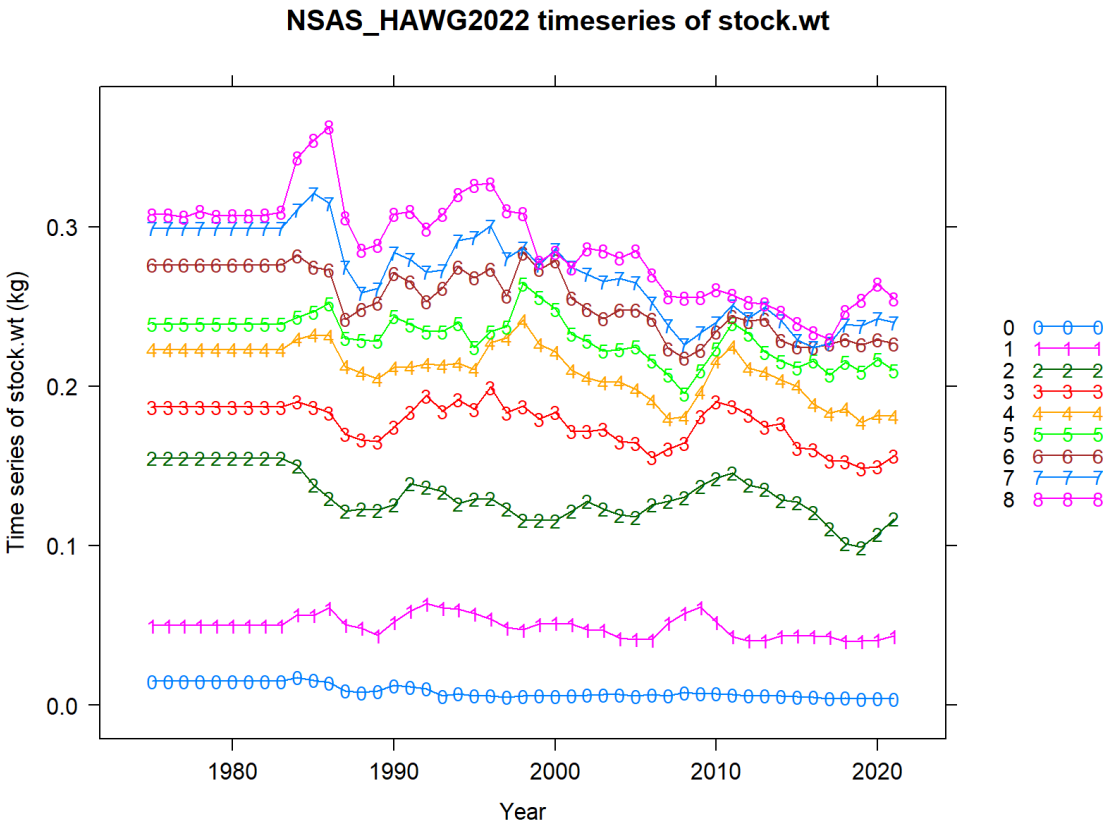

Figure 2.6.1.2. North Sea Herring. Time-series of stock weight at ages 0 to 8+ as used in the North Sea herring assessment.

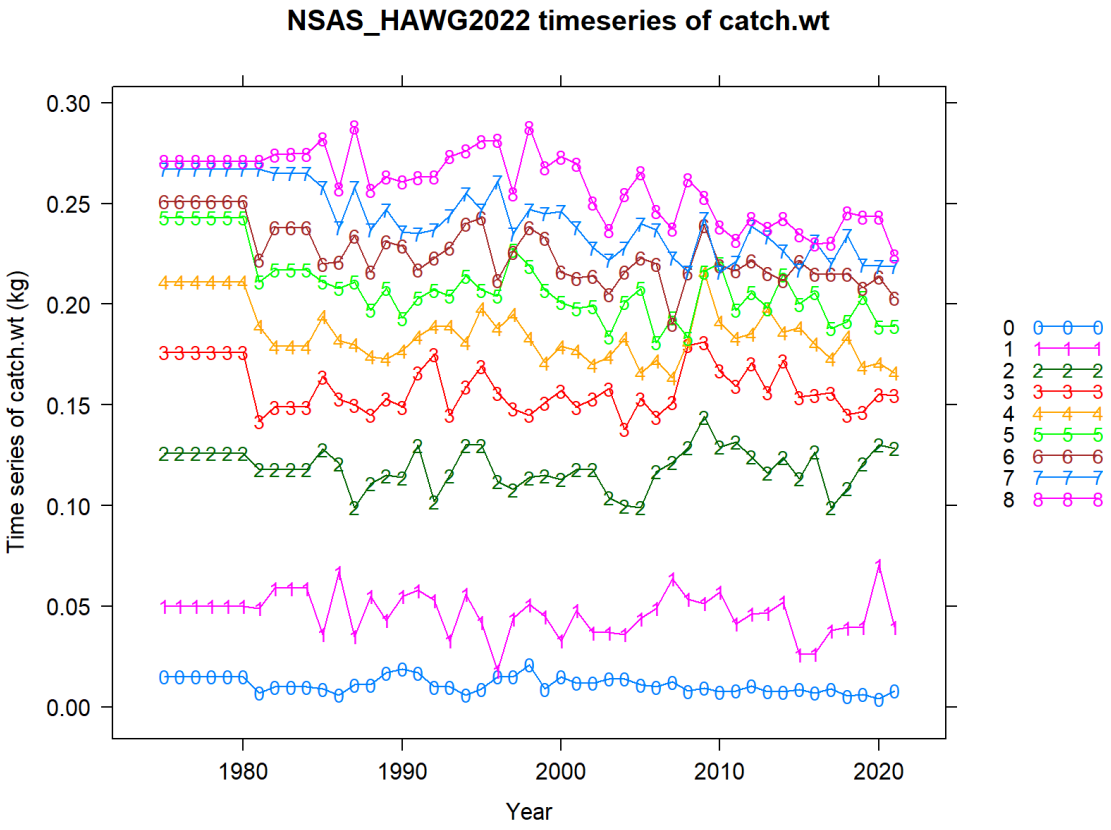

Figure 2.6.1.3. North Sea Herring. Time-series of catch weight at ages 0 to 8+ as used in the North Sea herring assessment.

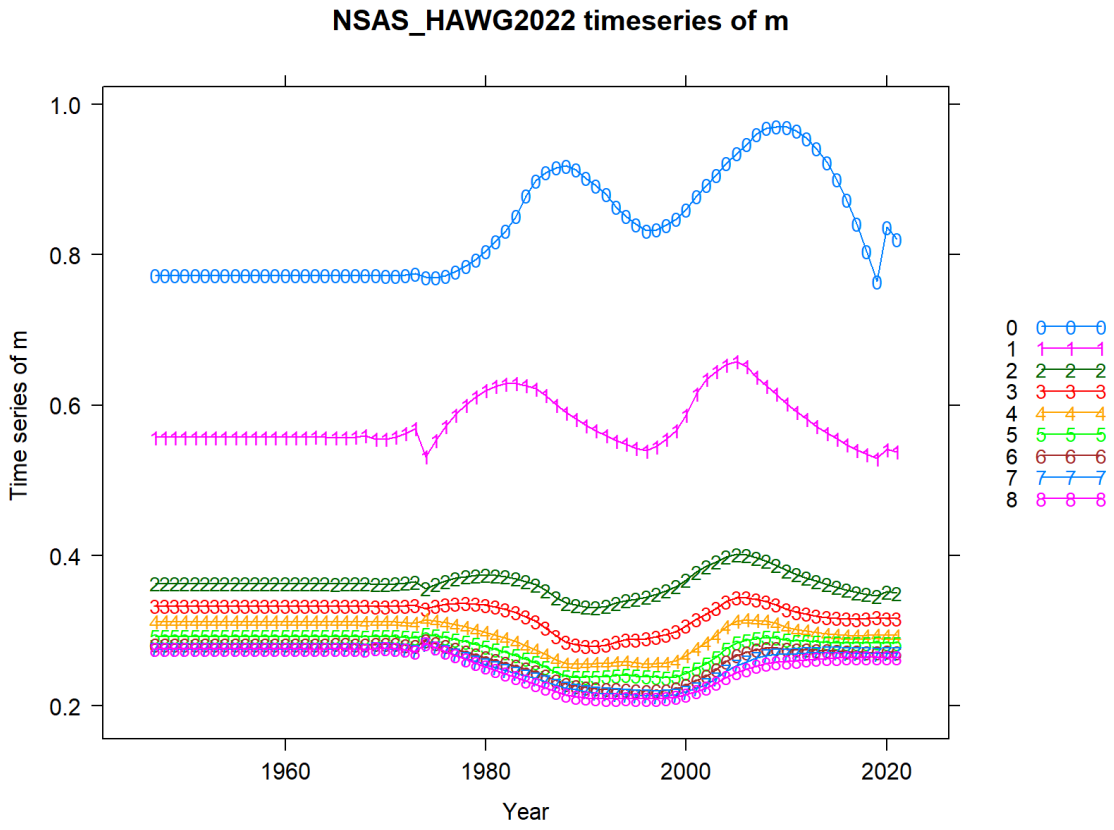

Figure 2.6.1.4. North Sea Herring. Time-series of absolute natural mortality values at age 0–8+ as used in the North Sea herring assessment. Natural mortality values are based on the 2019 North Sea key-run (ICES WGSAM, 2021)

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.

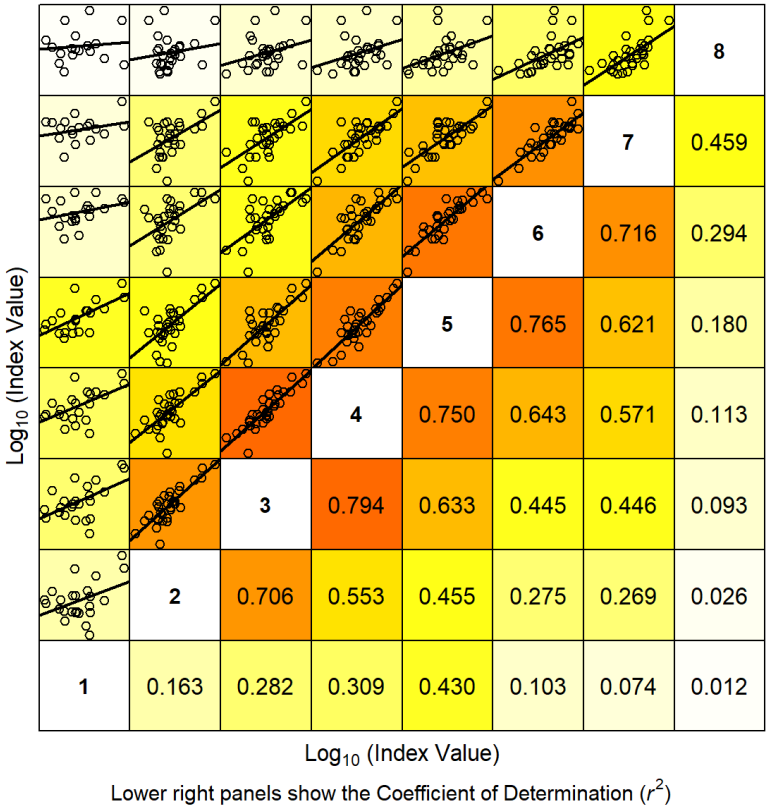

Figure 2.6.1.7. North Sea herring. Internal consistency plot of the acoustic survey (HERAS). Above the diagonal the linear regression is shown including the observations (in points) while under the diagonal the r^2 value that is associated with the linear regression is given.

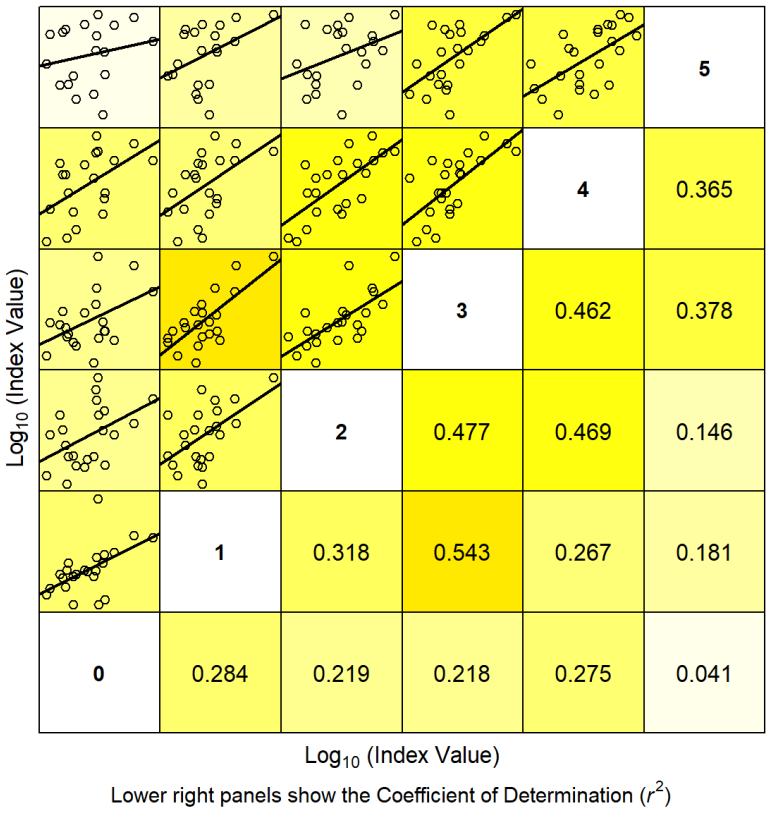

Figure 2.6.1.8. North Sea herring. Internal consistency plot of the IBTS in quarter 3. Above the diagonal the linear regression is shown including the observations (in points) while under the diagonal the r^2 value that is associated with the linear regression is given.

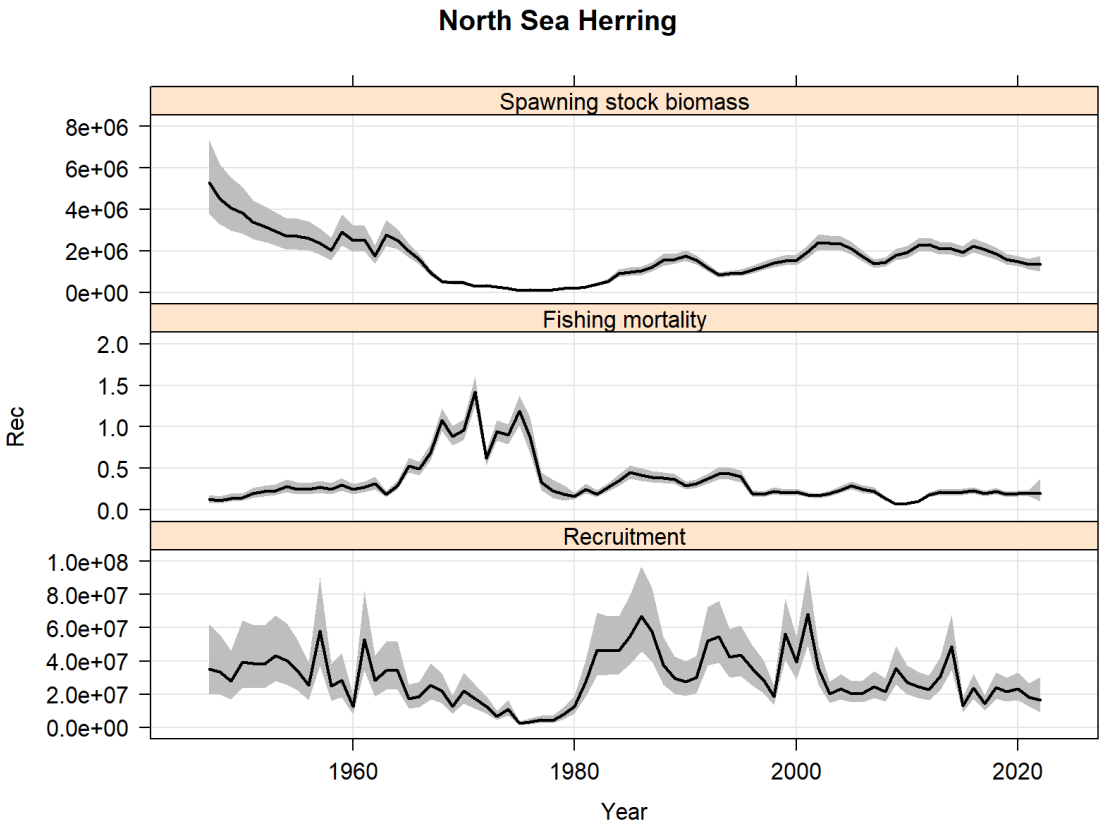

Figure 2.6.2.1. North Sea herring. Stock summary plot of North Sea herring with associated uncertainty for SSB (top panel), F ages 2–6 (middle panel) and recruitment (bottom panel).

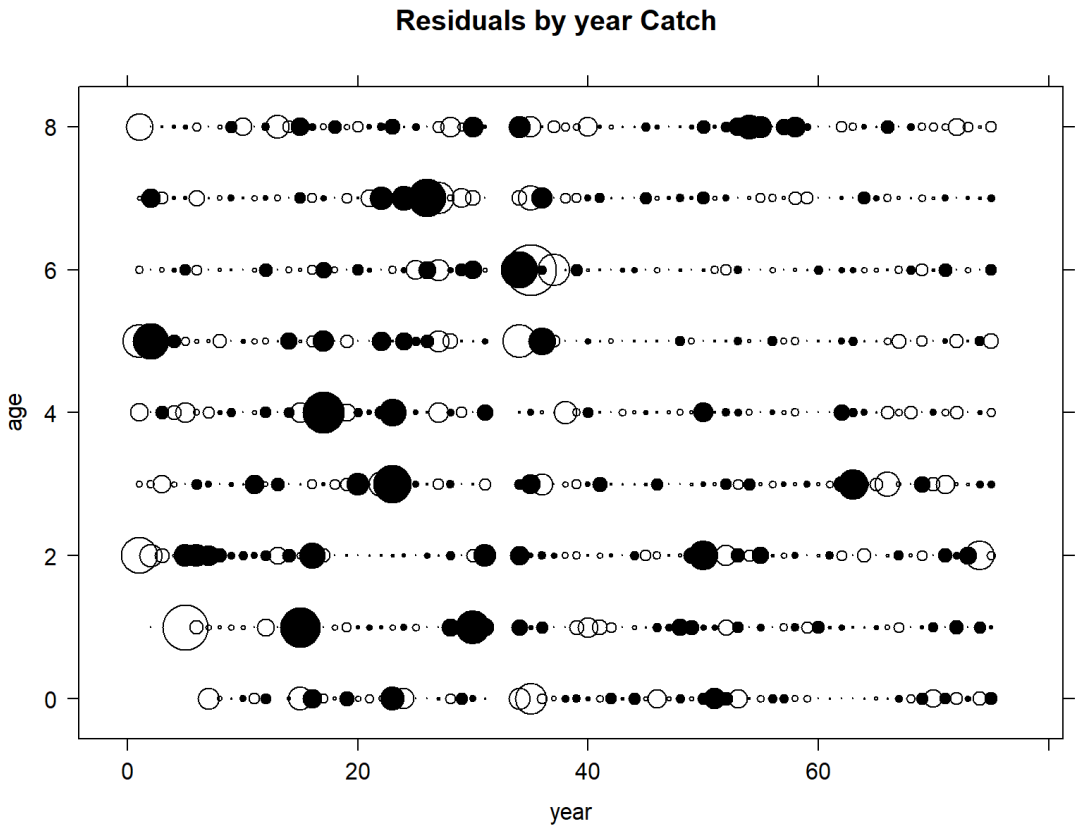

Figure 2.6.2.2. North Sea herring. Bubble plot of standardized catch residual at age.

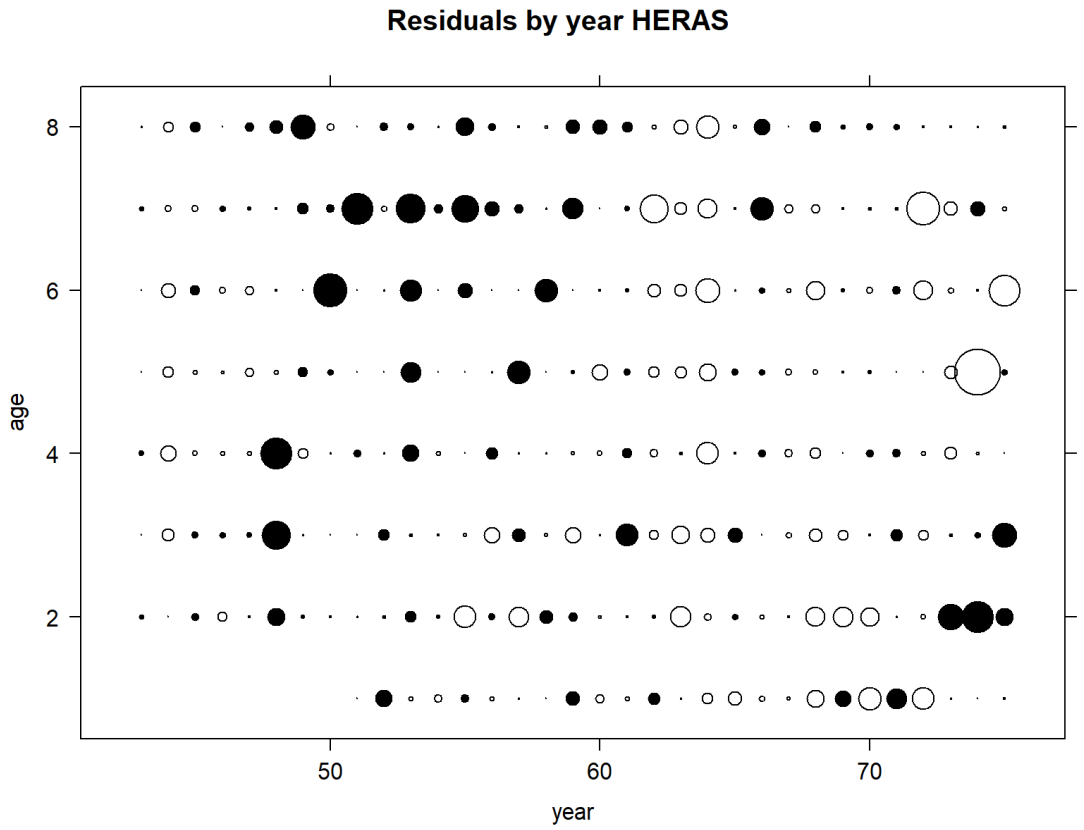

Figure 2.6.2.3. North Sea herring. Bubble plot of standardized acoustic survey residuals at age.

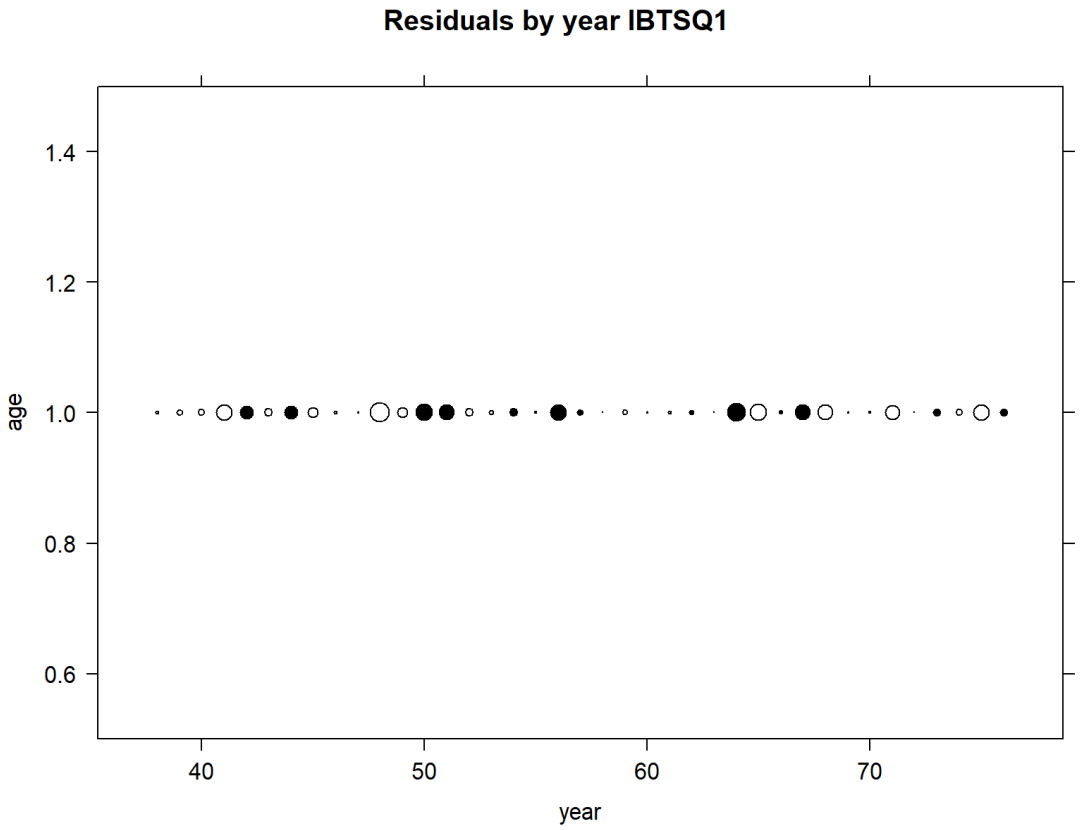

Figure 2.6.2.4. North Sea herring. Bubble plot of standardized IBTSQ1 residuals at age.

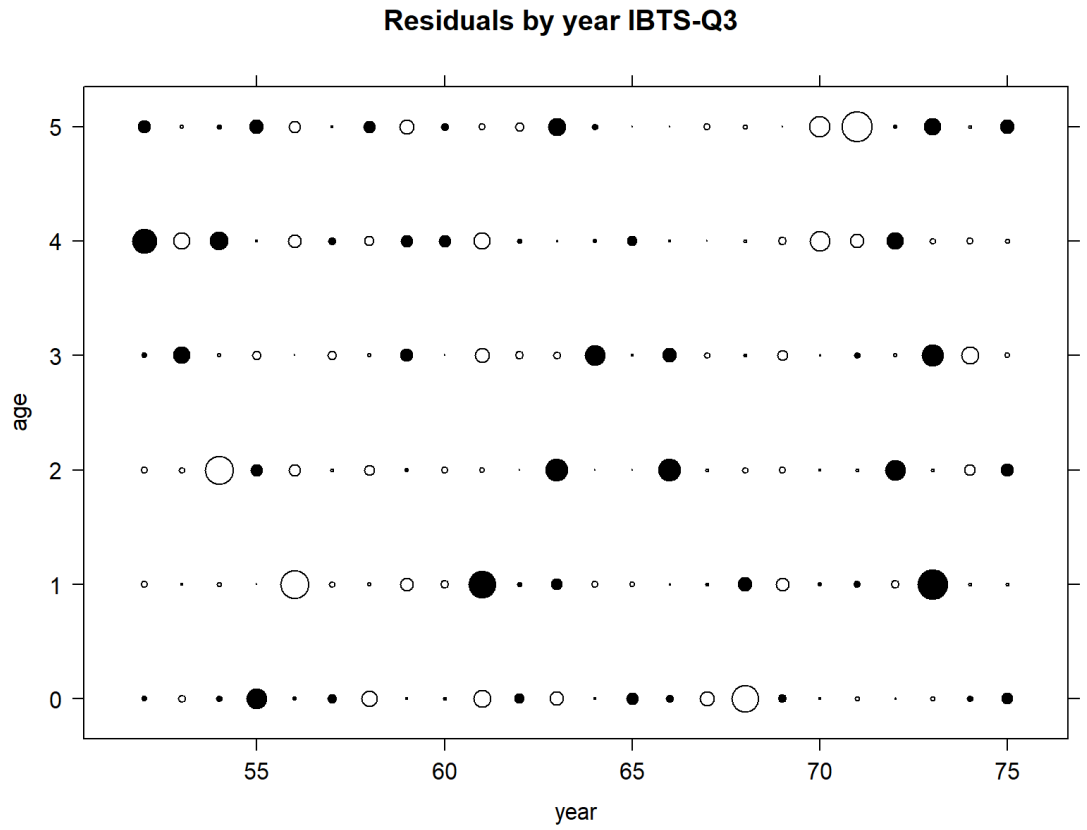

Figure 2.6.2.5. North Sea herring. Bubble plot of standardized IBTSQ3 residuals at age.

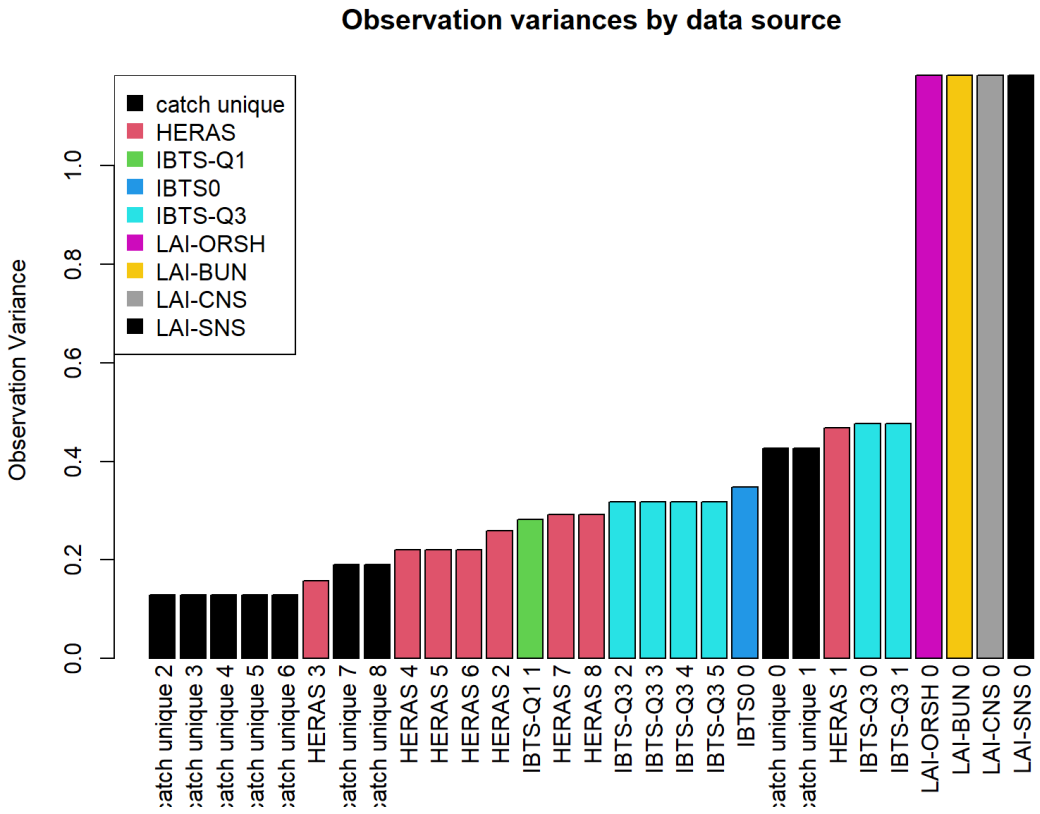

Figure 2.6.2.6. North Sea herring. Observation variance by data source as estimated by the assessment model. Observation variance is ordered from least (left) to most (right). Colours indicate the different data sources. Observation variance is not individually estimated for each data source thereby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

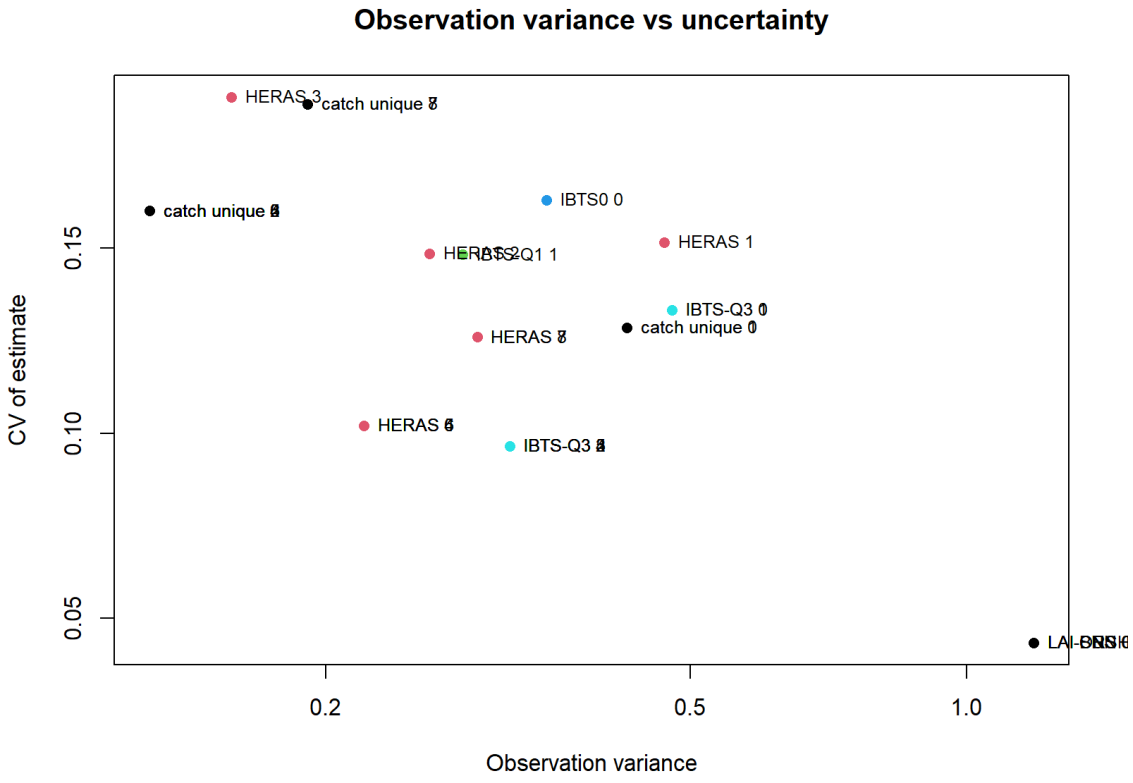

Figure 2.6.2.7. North Sea herring. Observation variance by data source as estimated by the assessment model plotted against the CV estimate of the observation variance parameter.

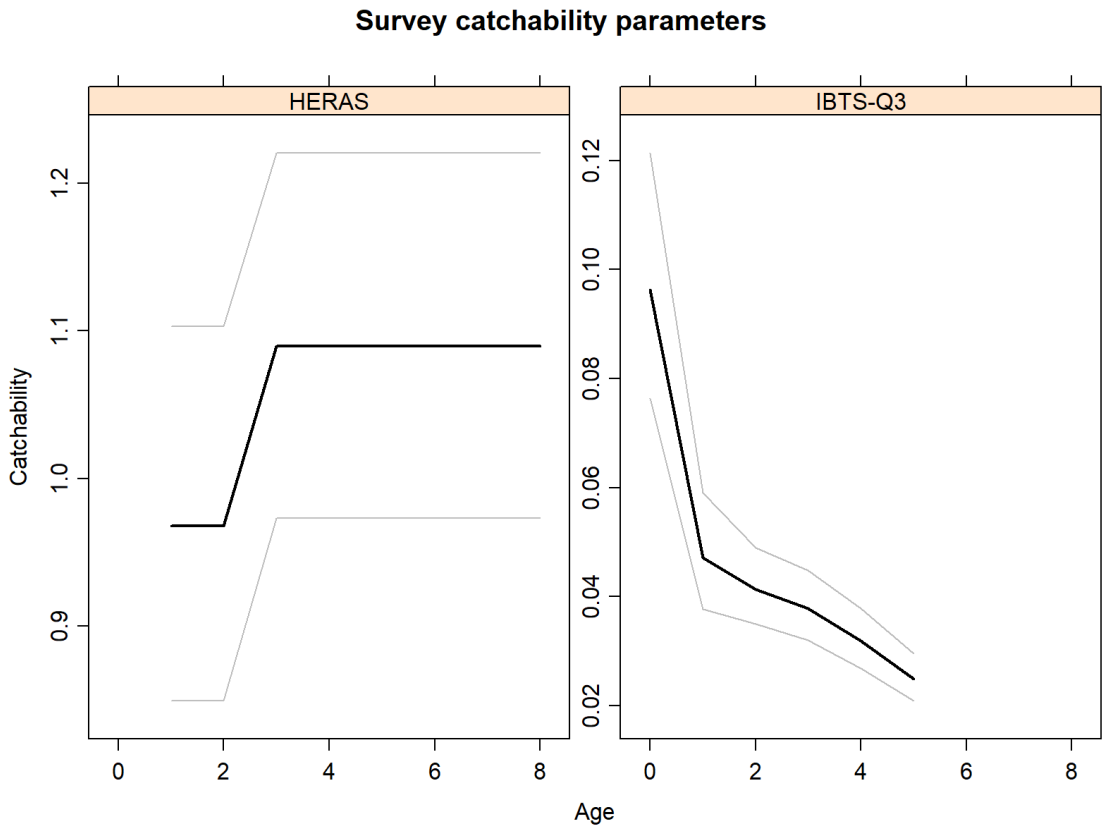

Figure 2.6.2.8. North Sea herring. Catchability at age for the HERAS and IBTSQ3 surveys.

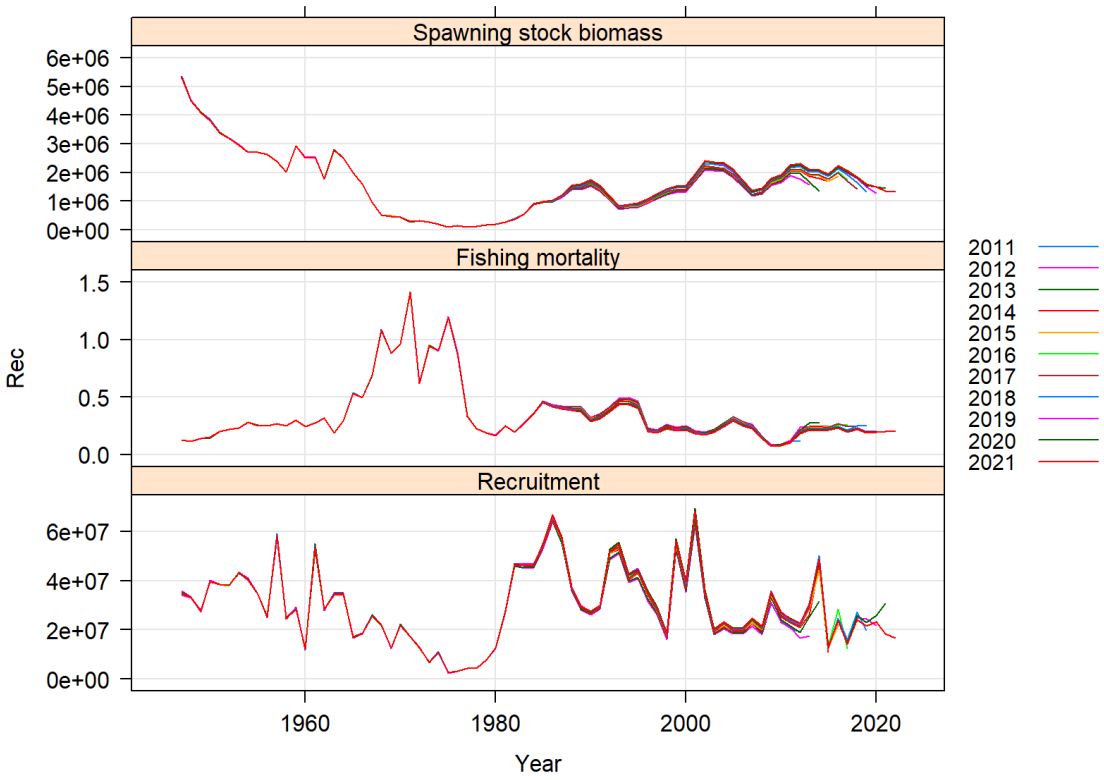

Figure 2.6.2.9. North Sea herring. Assessments retrospective pattern of SSB (top panel) F (middle panel) and recruitment (bottom panel).

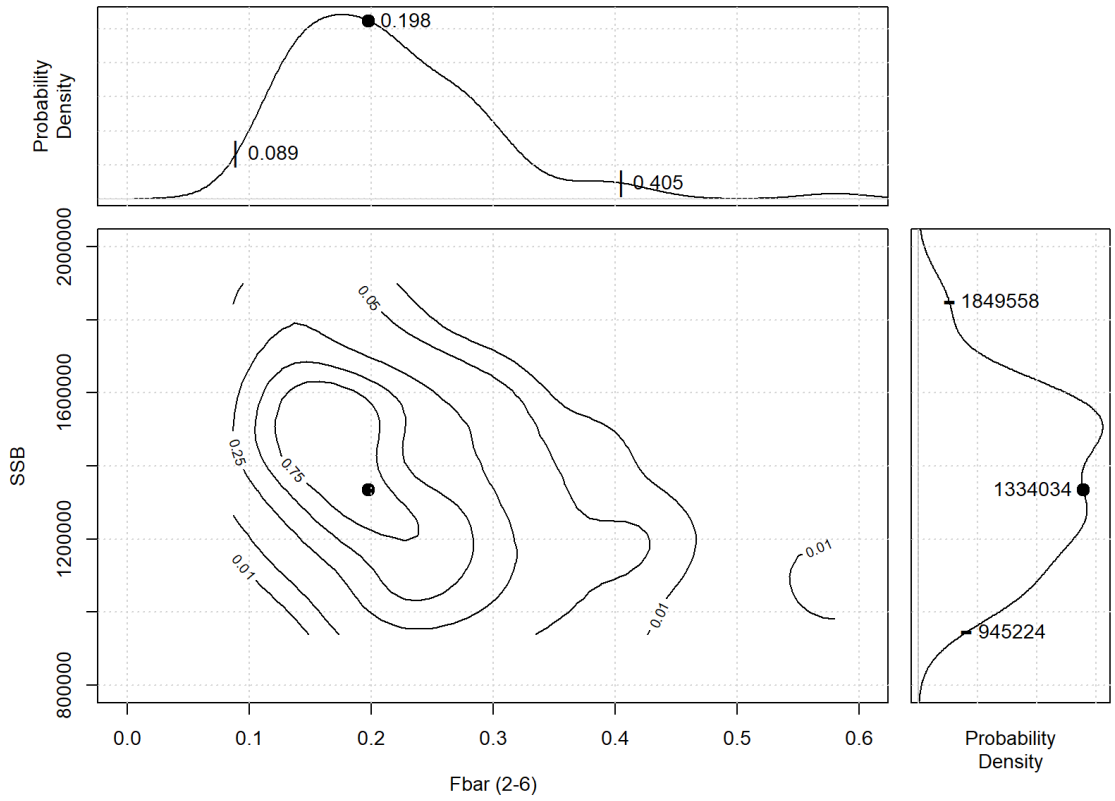

Figure 2.6.2.10. North Sea herring. Model uncertainty; distribution and quantiles of estimated SSB and F2-6 in the terminal year of the assessment. Estimates of precision are based on a parametric bootstrap from the FLSAM estimated variance/covariance estimates from the model.

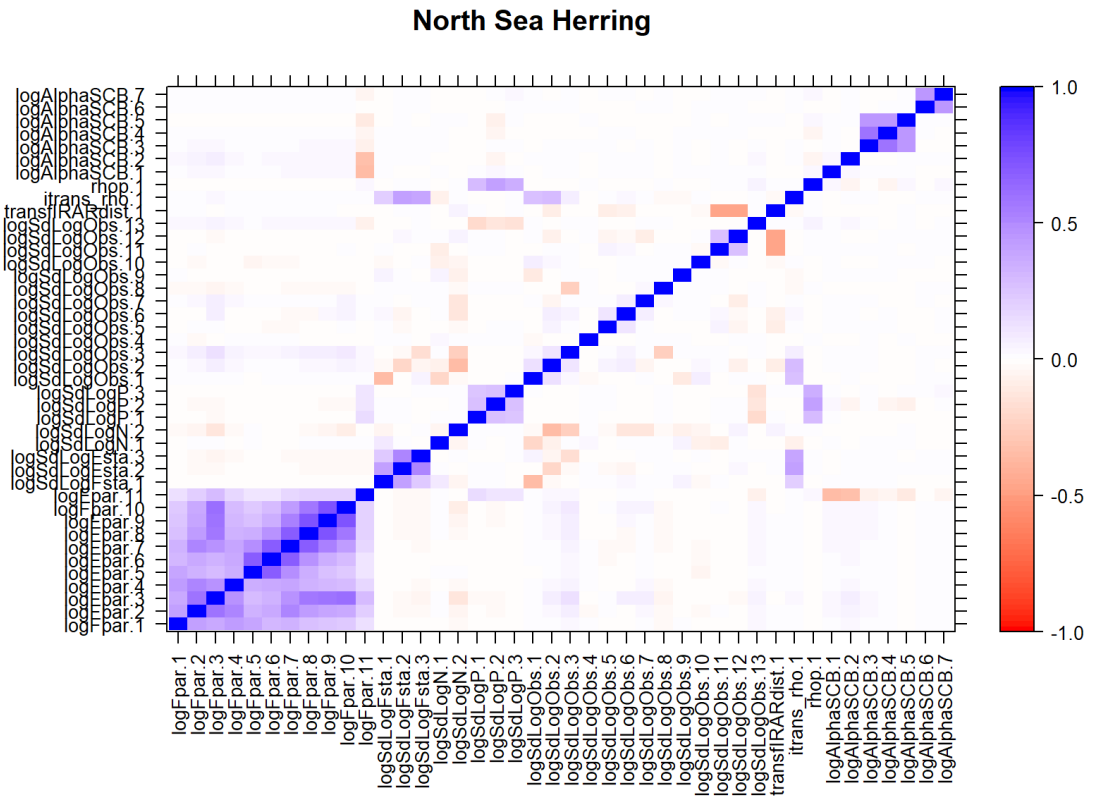

Figure 2.6.2.11. North Sea herring. Correlation plot of the FLSAM assessment model with the final set of parameters estimated in the model. The diagonal represents the correlation with the data source itself.

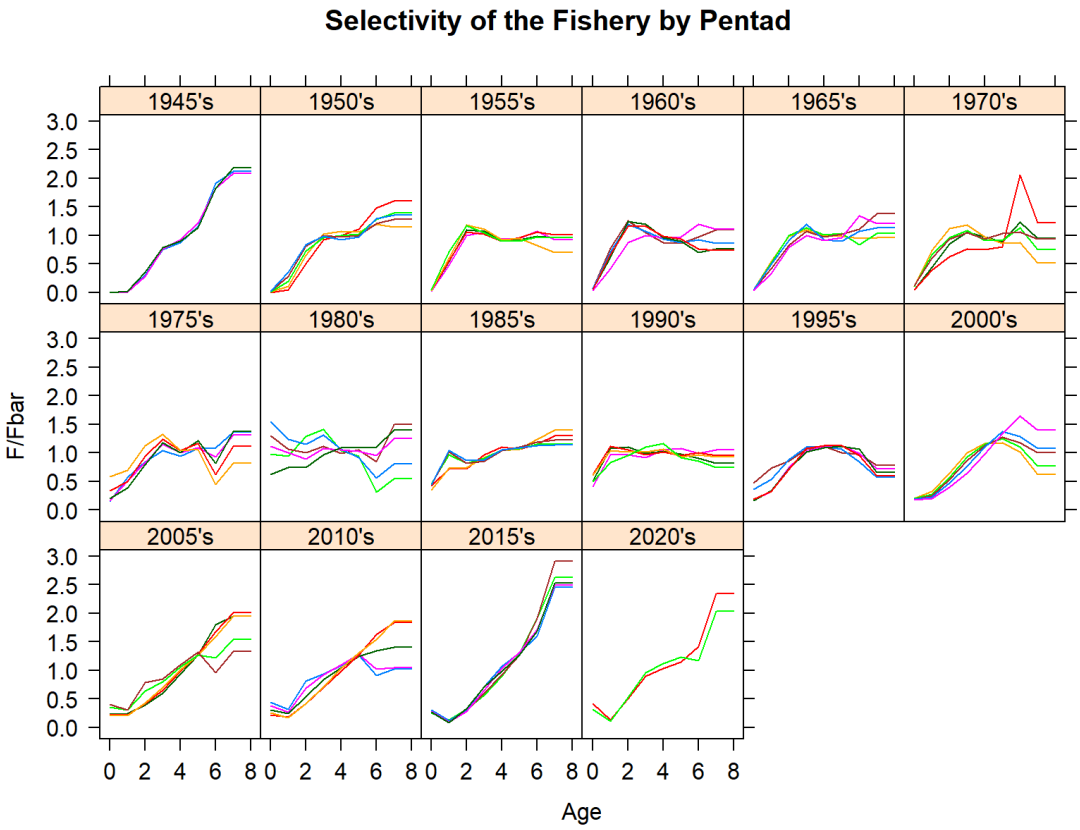

Figure 2.6.2.12. North Sea herring. Fishing selectivity by pentad.

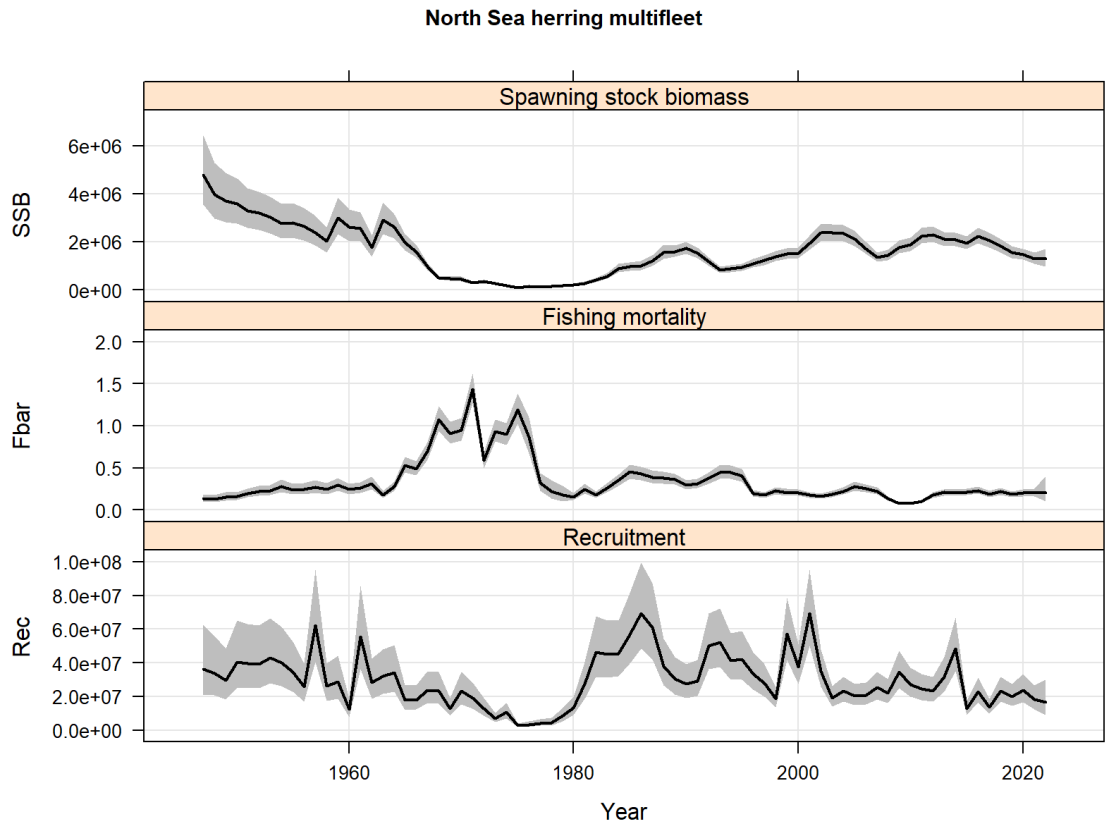

Figure 2.6.3.1 North Sea herring multi-fleet model. Stock summary plot with associated uncertainty for SSB (top panel), F ages 2–6 (middle panel) and recruitment (bottom panel).

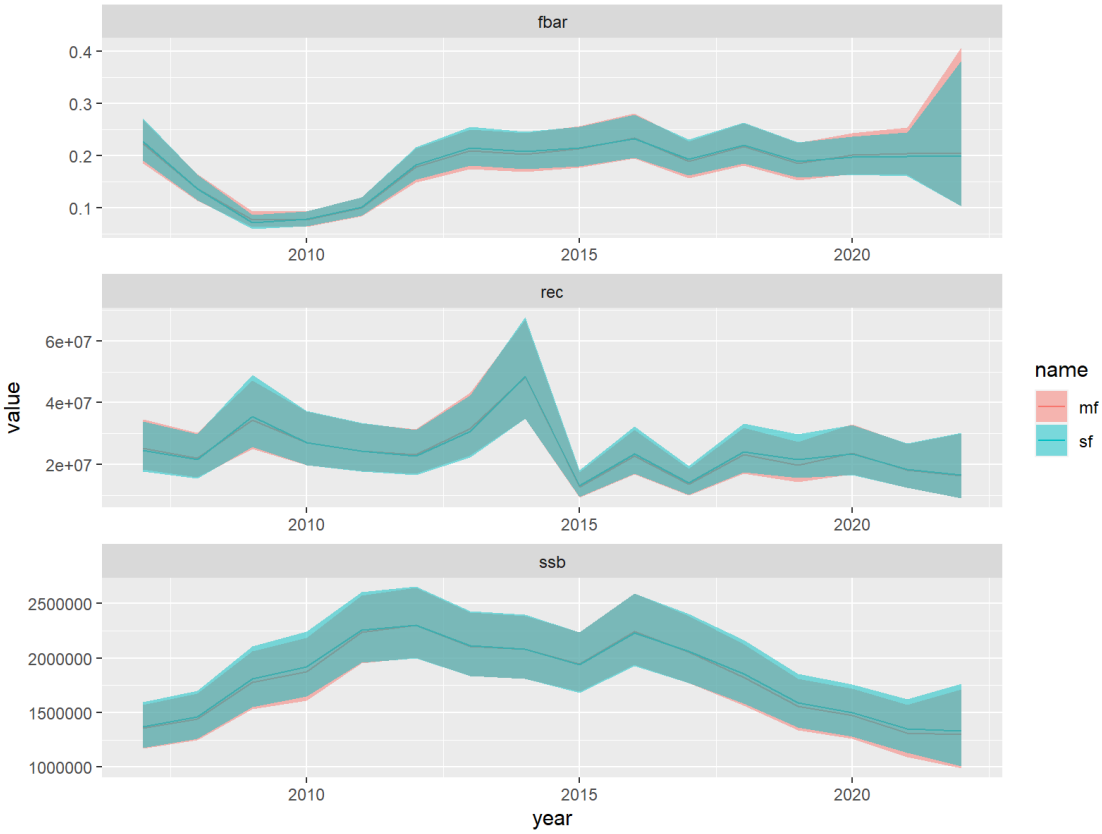

Figure 2.6.3.2 North Sea herring multi-fleet model. Comparison between single fleet and multi-fleet assessment models for SSB (top panel), F ages 2–6 (middle panel) and recruitment (bottom panel).

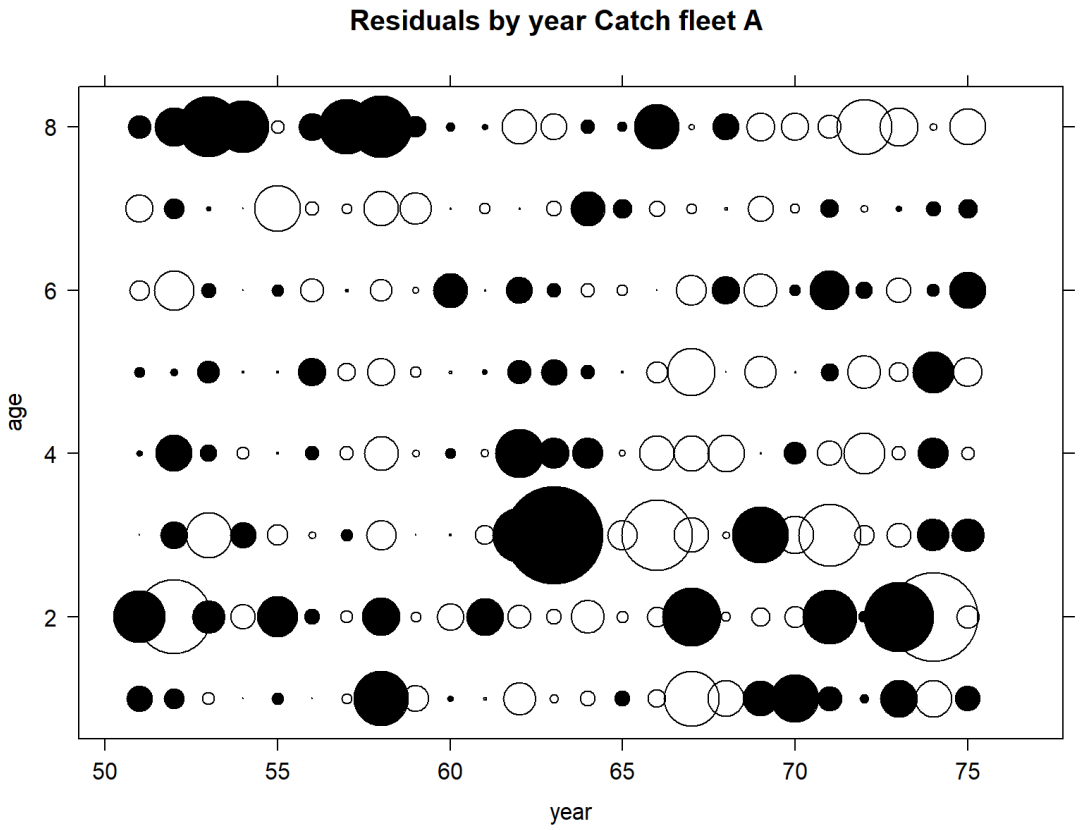

Figure 2.6.3.3. North Sea herring multifleet assessment model. Bubble plot of standardized residuals for catches of fleet A.

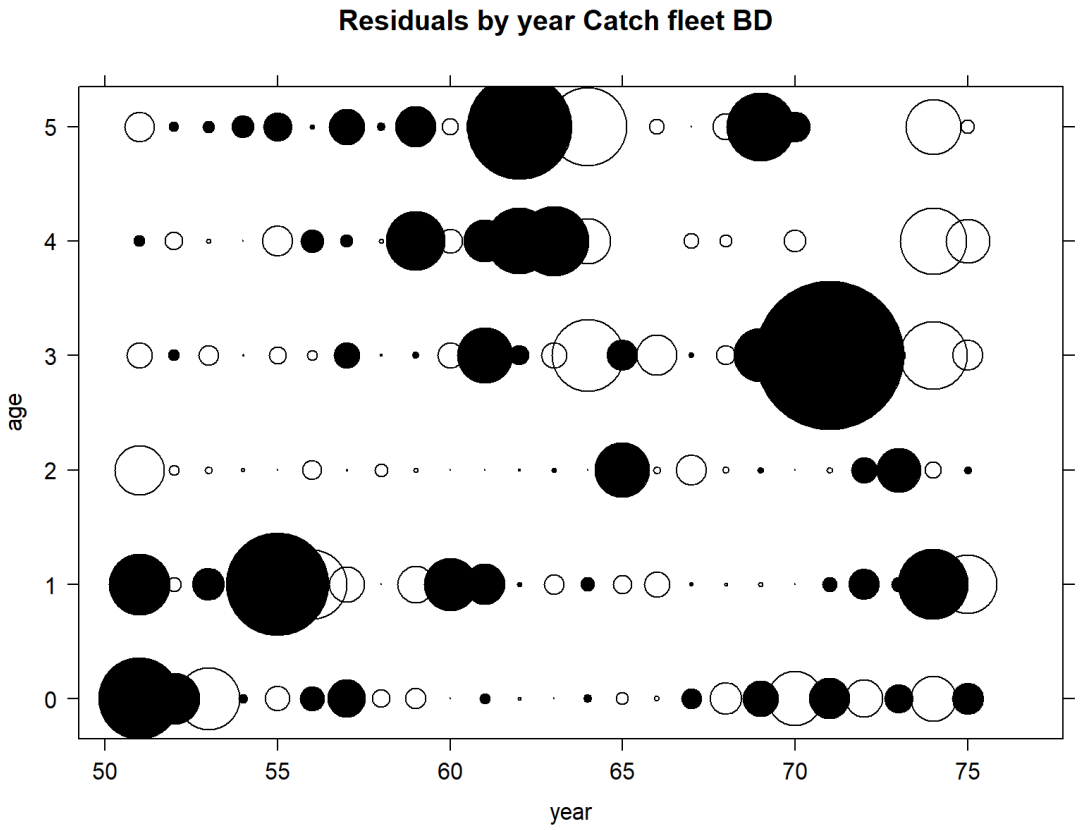

Figure 2.6.3.4. North Sea herring multifleet assessment model. Bubble plot of standardized residuals for catches of fleet B&D.

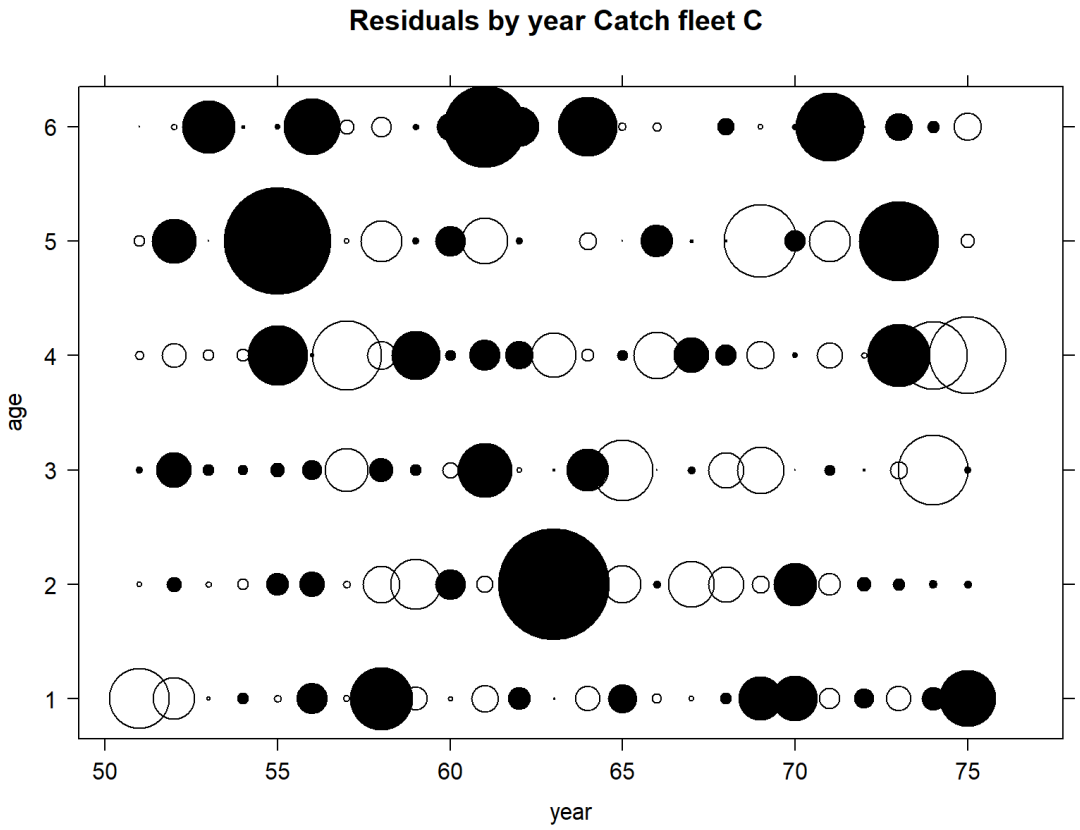

Figure 2.6.3.5. North Sea herring multifleet assessment model. Bubble plot of standardized residuals for catches of fleet C.

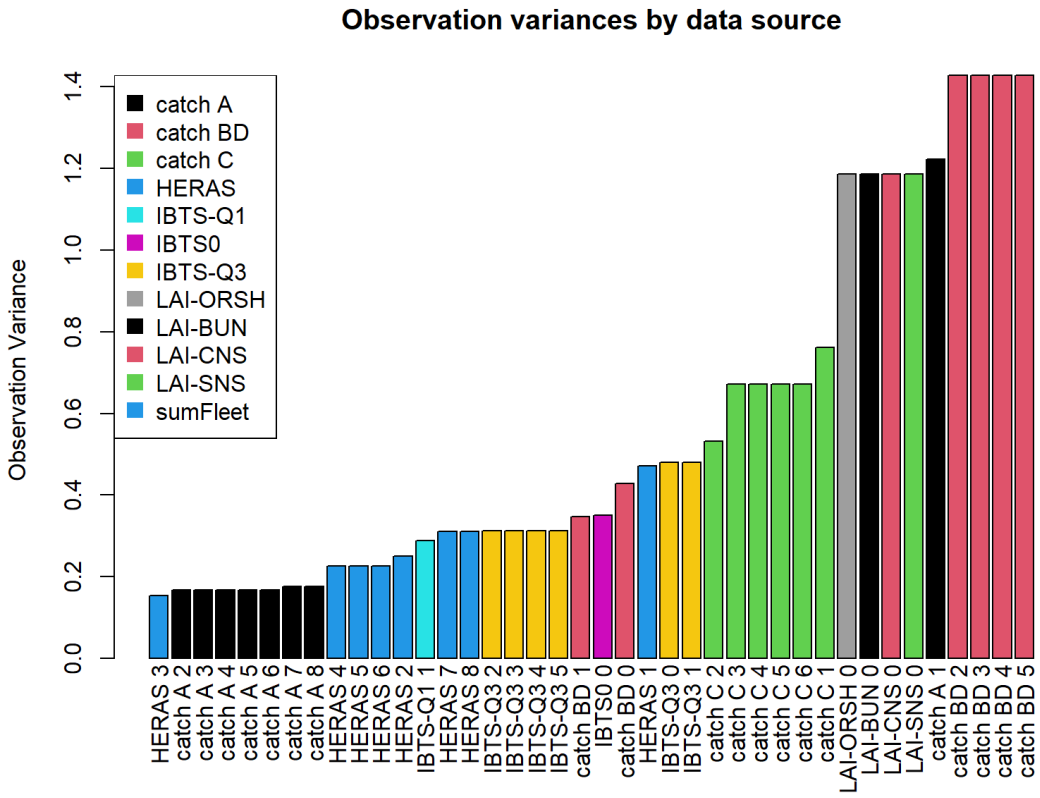

Figure 2.6.3.6. North Sea herring multifleet assessment model. Observation variance by data source as estimated by the assessment model. Observation variance is ordered from least (left) to most (right). Colours indicate the different data sources. Observation variance is not individually estimated for 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.

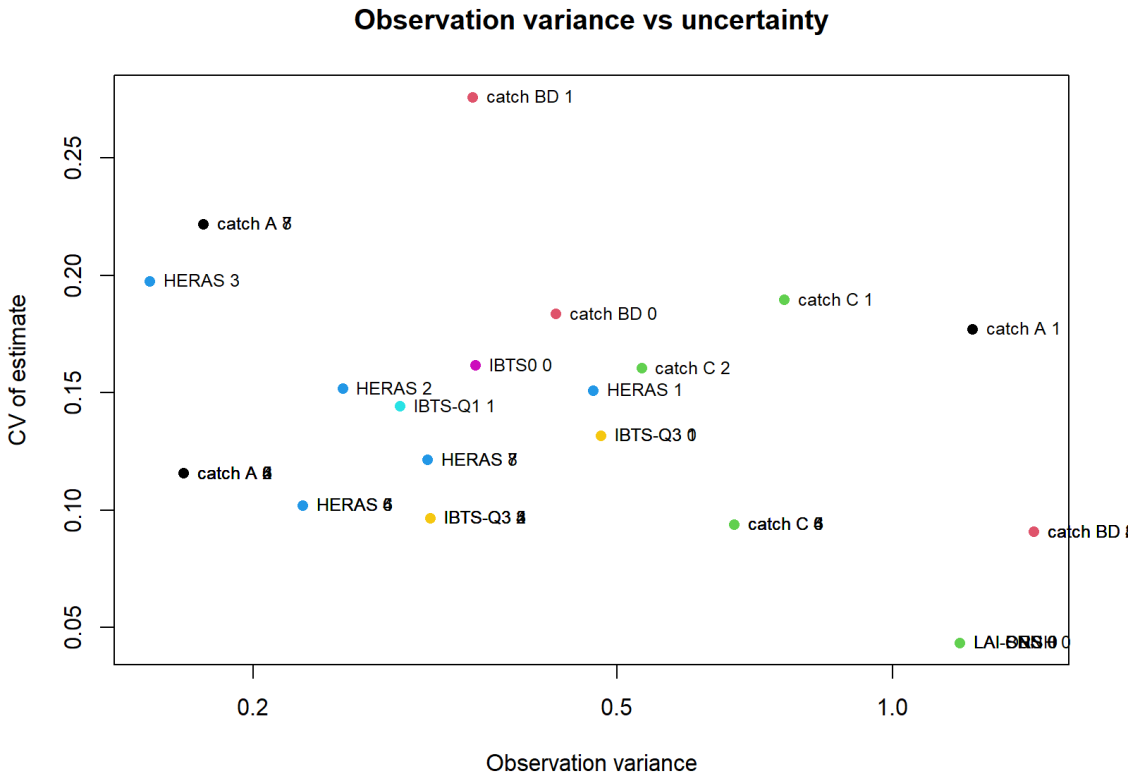

Figure 2.6.3.7. North Sea herring multifleet assessment model. Observation variance by data source as estimated by the assessment model plotted against the CV estimate of the observation variance parameter.

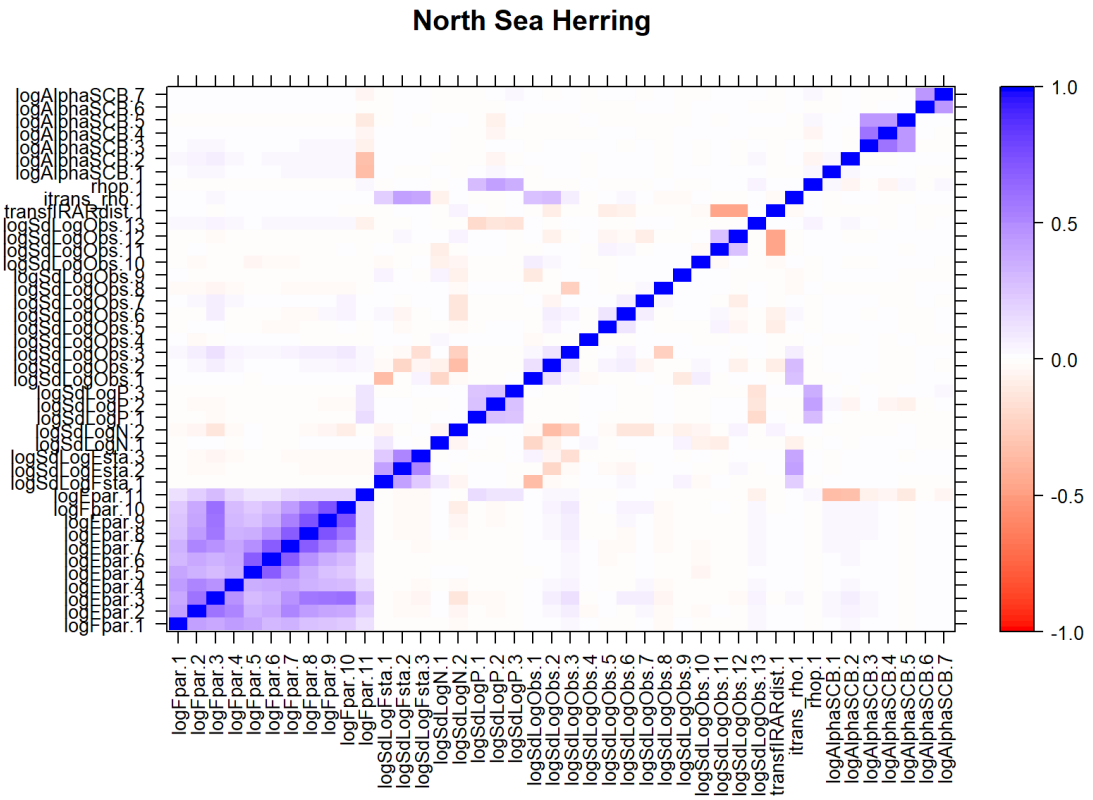

Figure 2.6.3.8. North Sea multifleet assessment model. Correlation plot of the FLSAM assessment model with the final set of parameters estimated in the model. The diagonal represents the correlation with the data source itself.

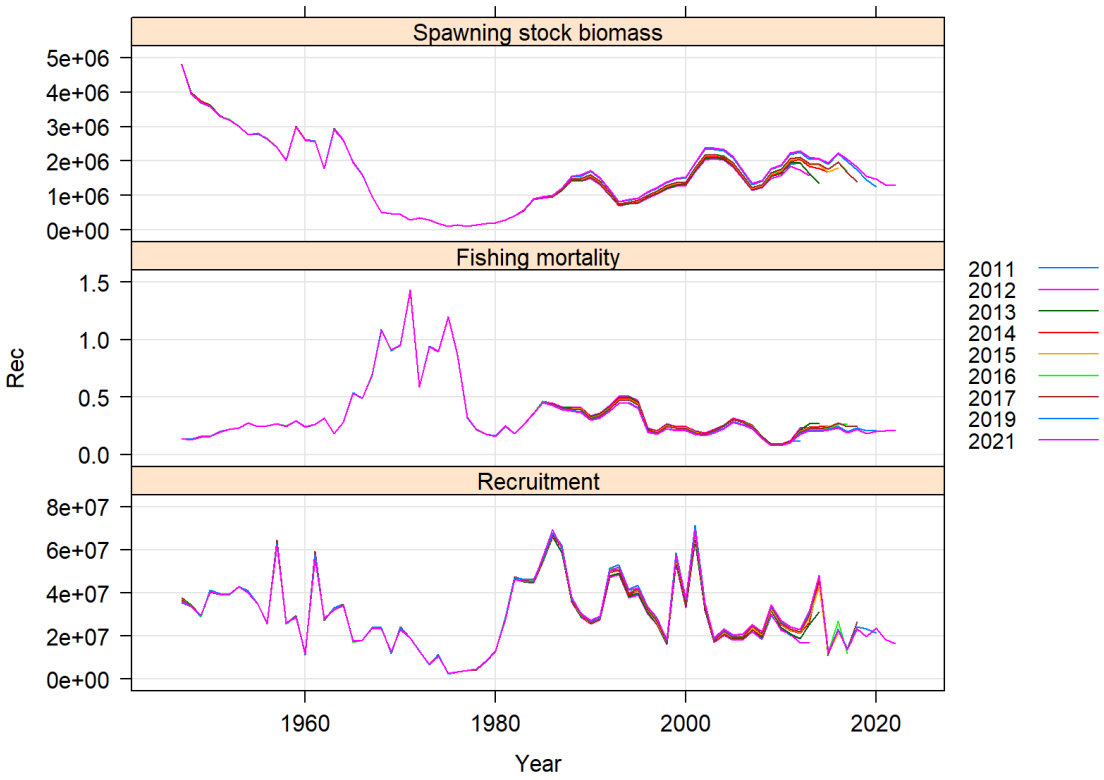

Figure 2.6.3.9. North Sea herring multifleet assessment model. Assessments retrospective pattern of SSB (top panel) F (middle panel) and recruitment (bottom panel).

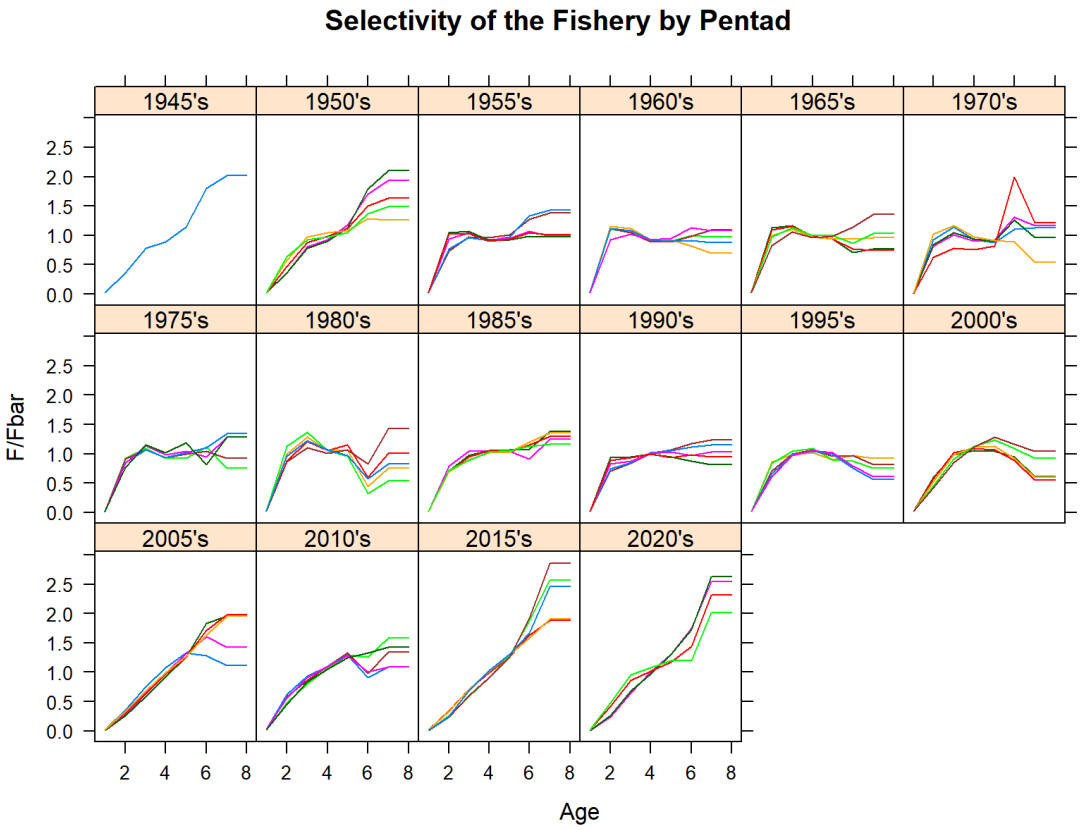

Figure 2.6.3.10. North Sea herring multifleet assessment model. Fishing selectivity fleet A.

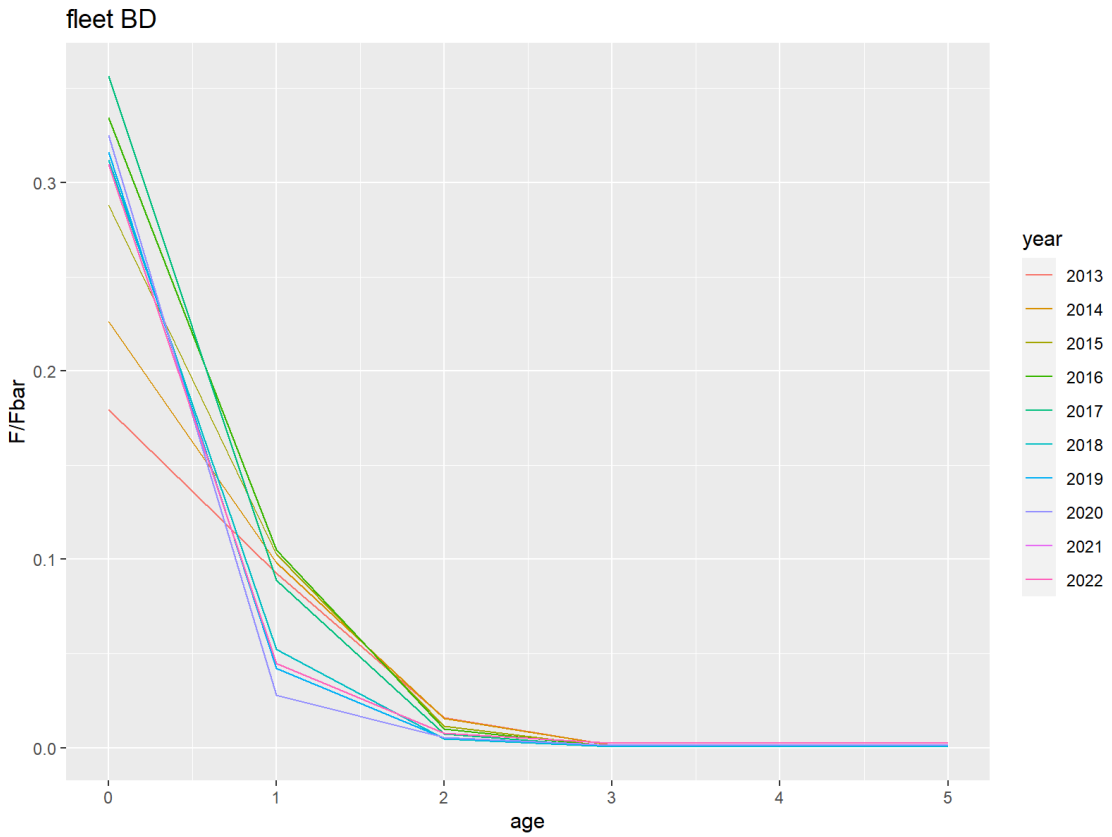

Figure 2.6.3.11. North Sea herring multifleet assessment model. Fishing selectivity fleet B and D combined.

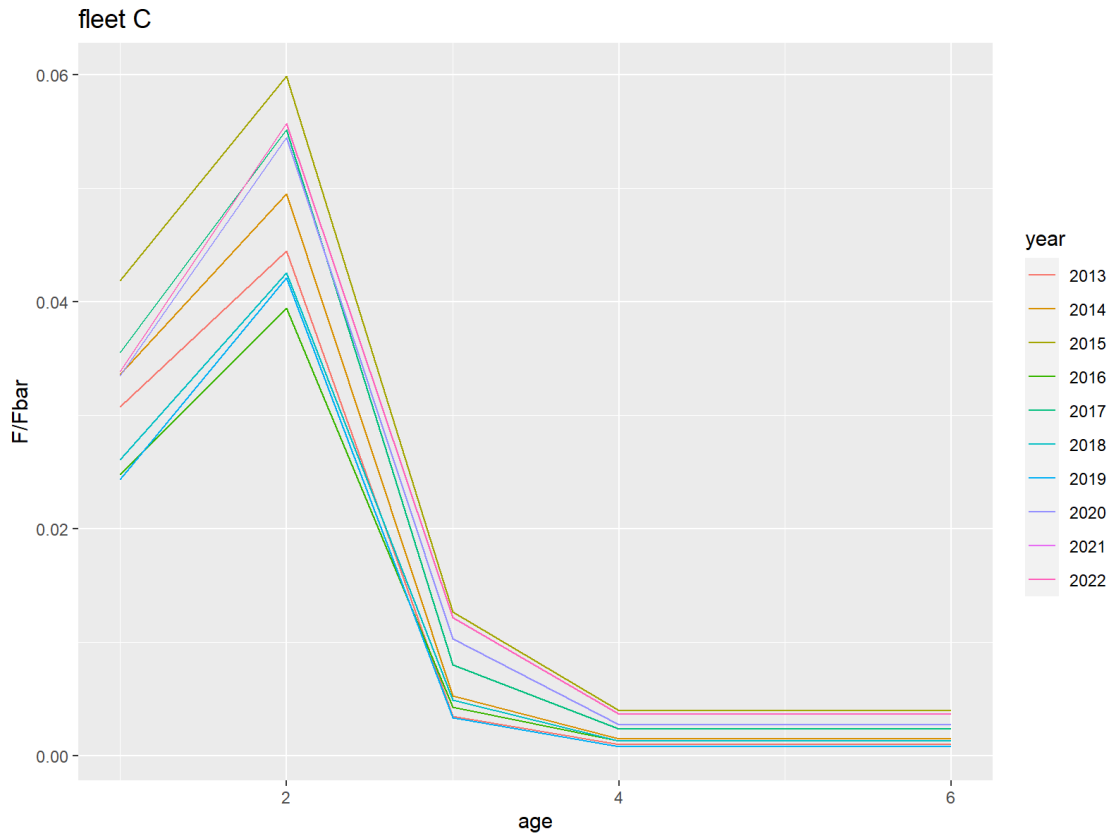

Figure 2.6.3.12. North Sea herring multifleet assessment model. Fishing selectivity fleet C.

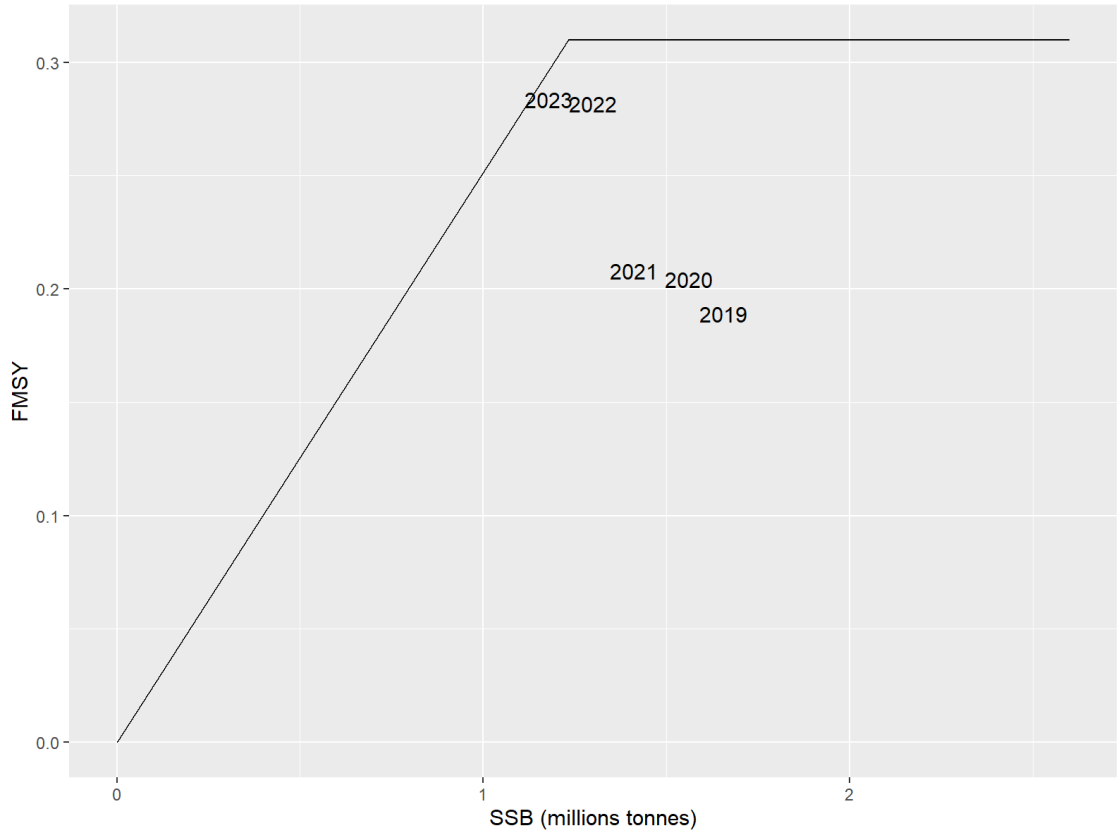

Figure 2.7.1.1. North Sea herring. FMSY advice rule and SSB/Fbar data point since 2019.

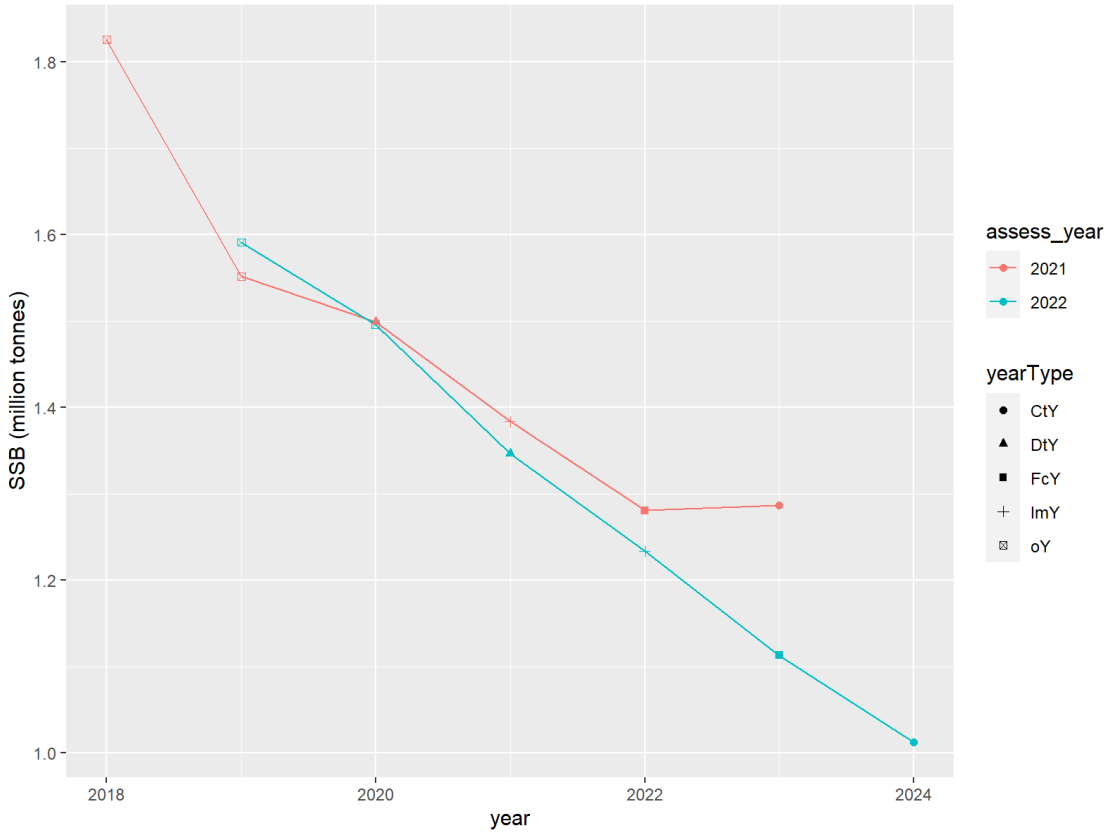

Figure 2.7.2.1. North Sea herring. comparison of SSB trajectory between short term forecasts applied to HAWG2021 and HAWG2022 data. oY: old years (prior to data year). DtY: data year. ImY: intermadiate year. FcY: forecast year. CtY: continuation year.

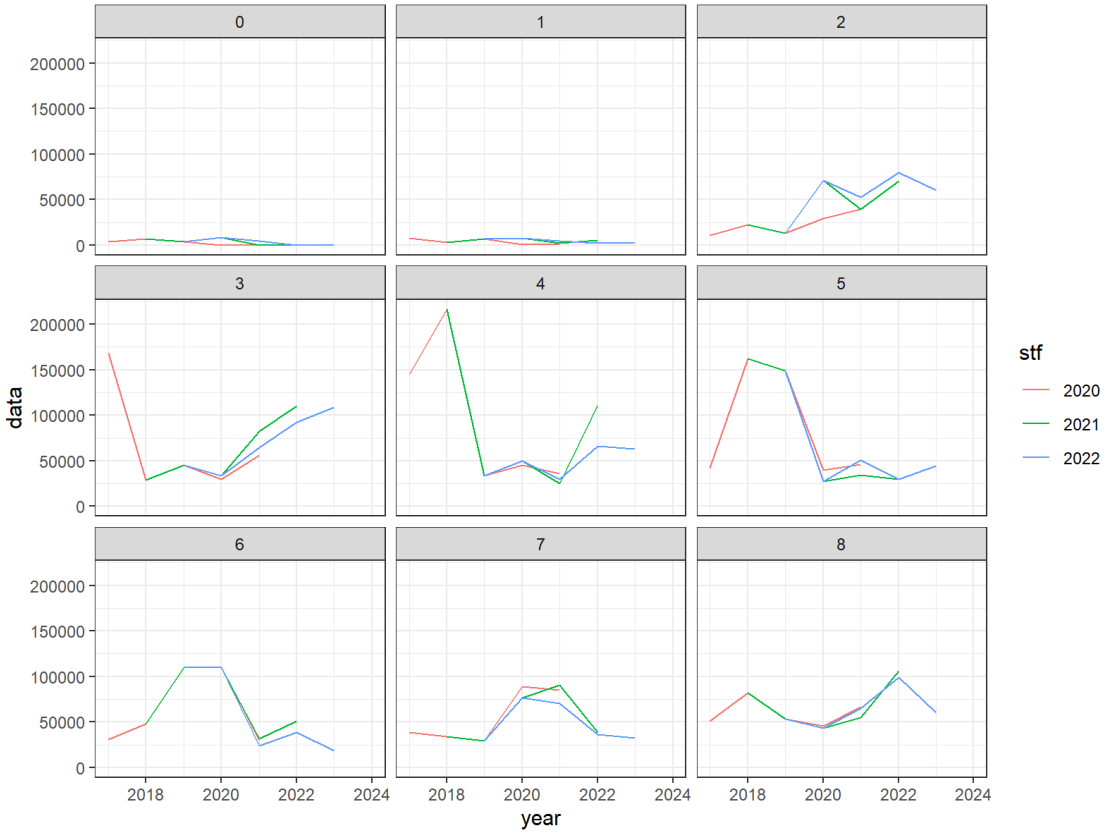

Figure 2.7.2.2. North Sea Herring. Realized and projected catch (in weight) by age (wr) between 2020 assessment (2021 as forecast year), 2021 assessment (2022 as forecast year) and 2022 assessment (2023 as forecast year).

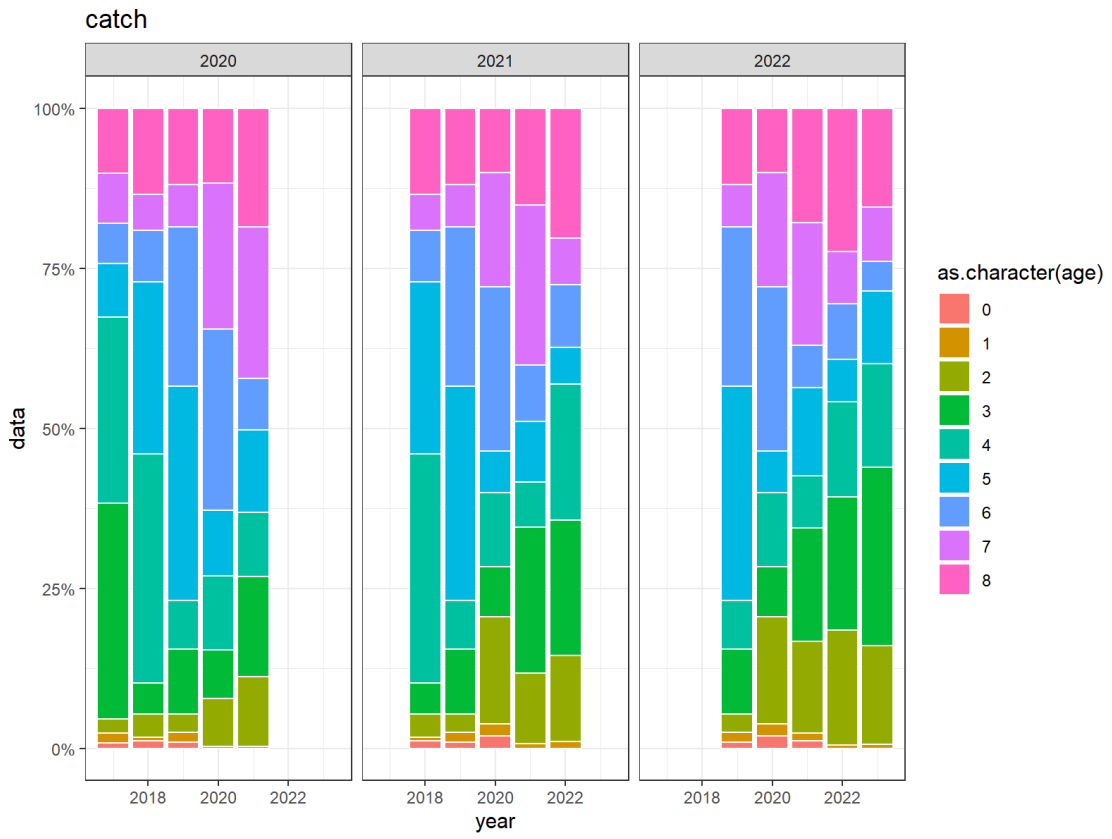

Figure 2.7.2.3. North Sea Herring. Catch proportions for the different ages between the 2020 short-term forecast (2021 as forecast year), 2021 short-term forecast (2022 as forecast year) and 2022 short term forecast (2023 as forecast year).

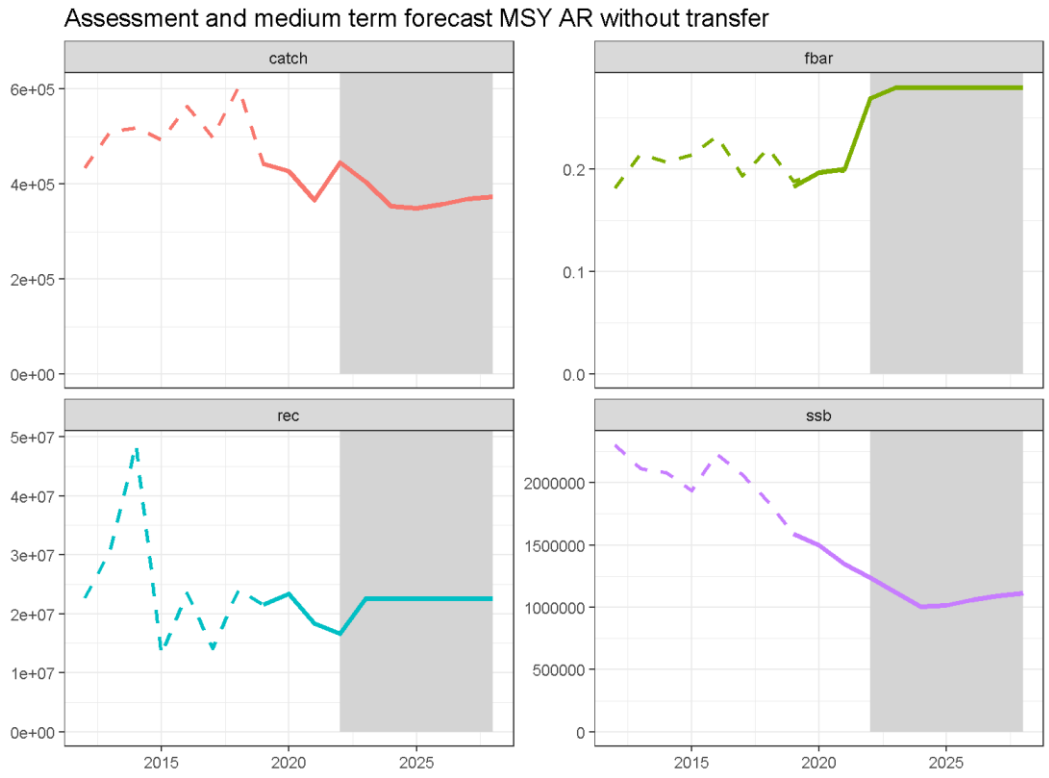

Figure 2.7.2.4. North Sea Herring. Short-term projections using an F status quo from TAC year (i.e. advice year). Intermediate year is in 2022 and the TAC year is 2023.

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.

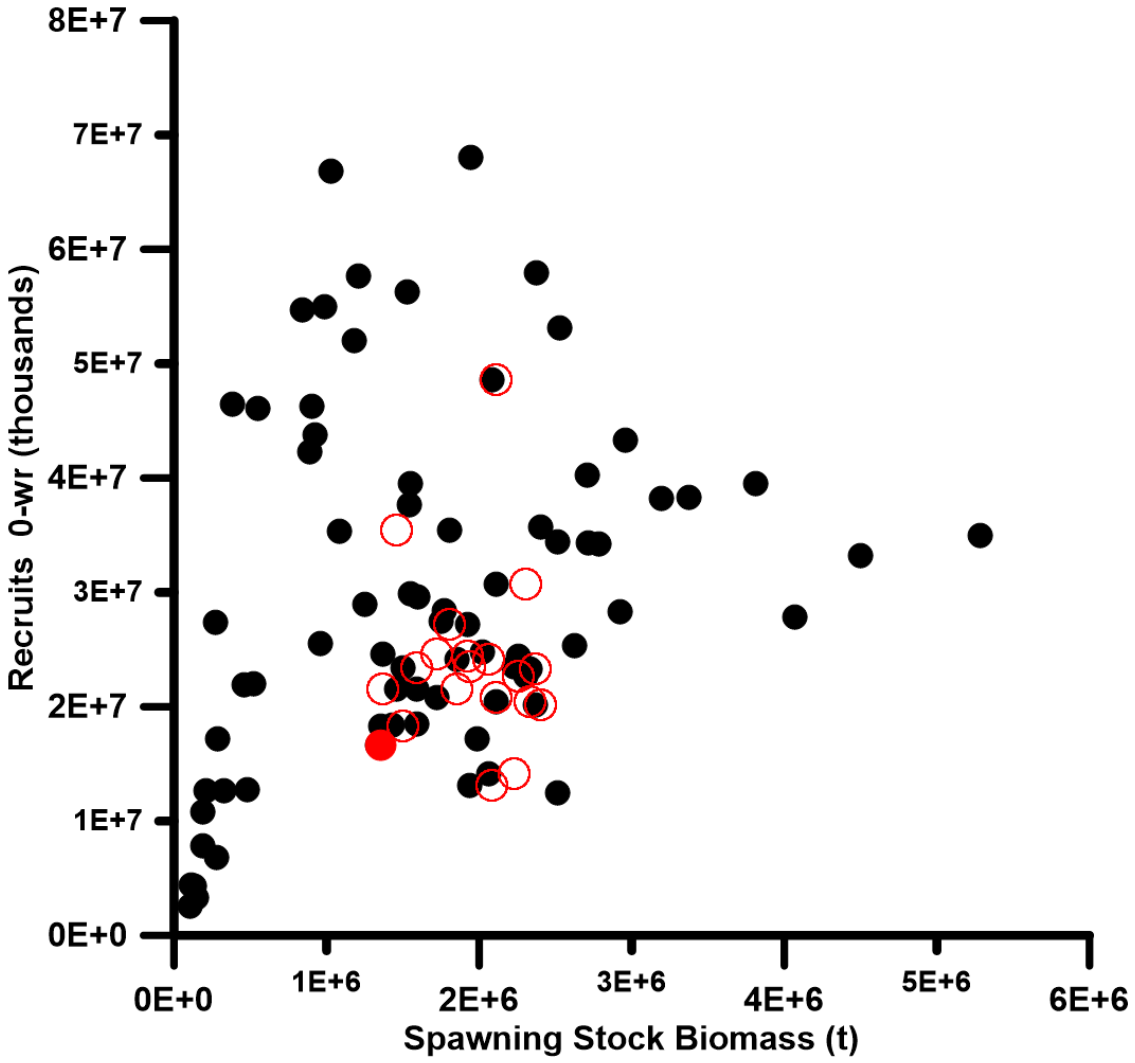

Figure 2.13.1. North Sea Autumn Spawning Herring stock recruitment curve, plotting estimated spawning-stock biomass against the resulting recruitment. Year classes spawned after 2001 are plotted with open red circles, to highlight the years of recent low recruitment. The most recent year class is plotted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

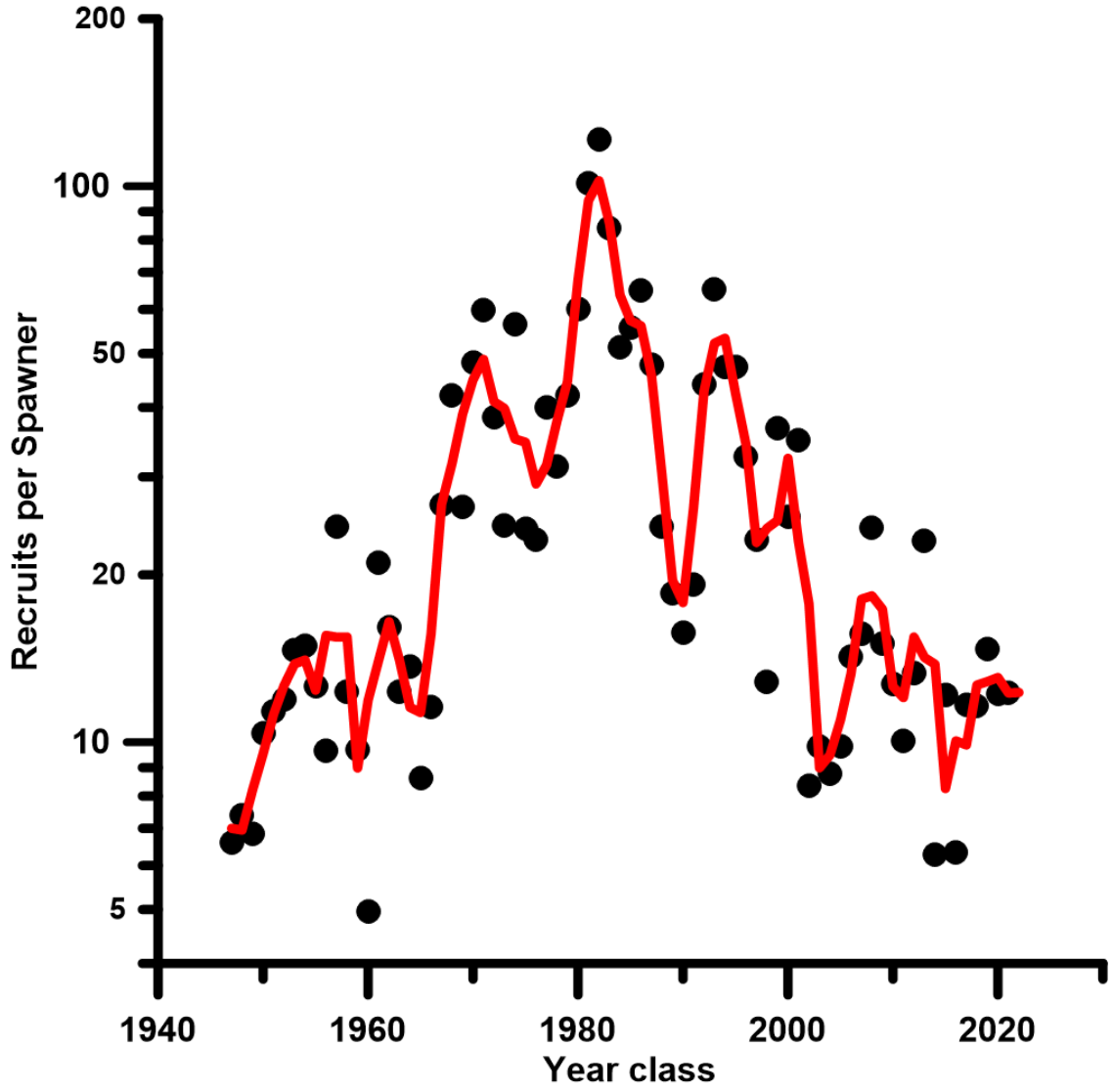

Figure 2.13.2. North Sea Autumn Spawning Herring time-series of recruits per spawner (RPS). RPS is calculated as the estimated number of recruits from the assessment divided by the estimated number of mature fish at the time of spawning and is plotted against the year in which spawning occurred. Black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

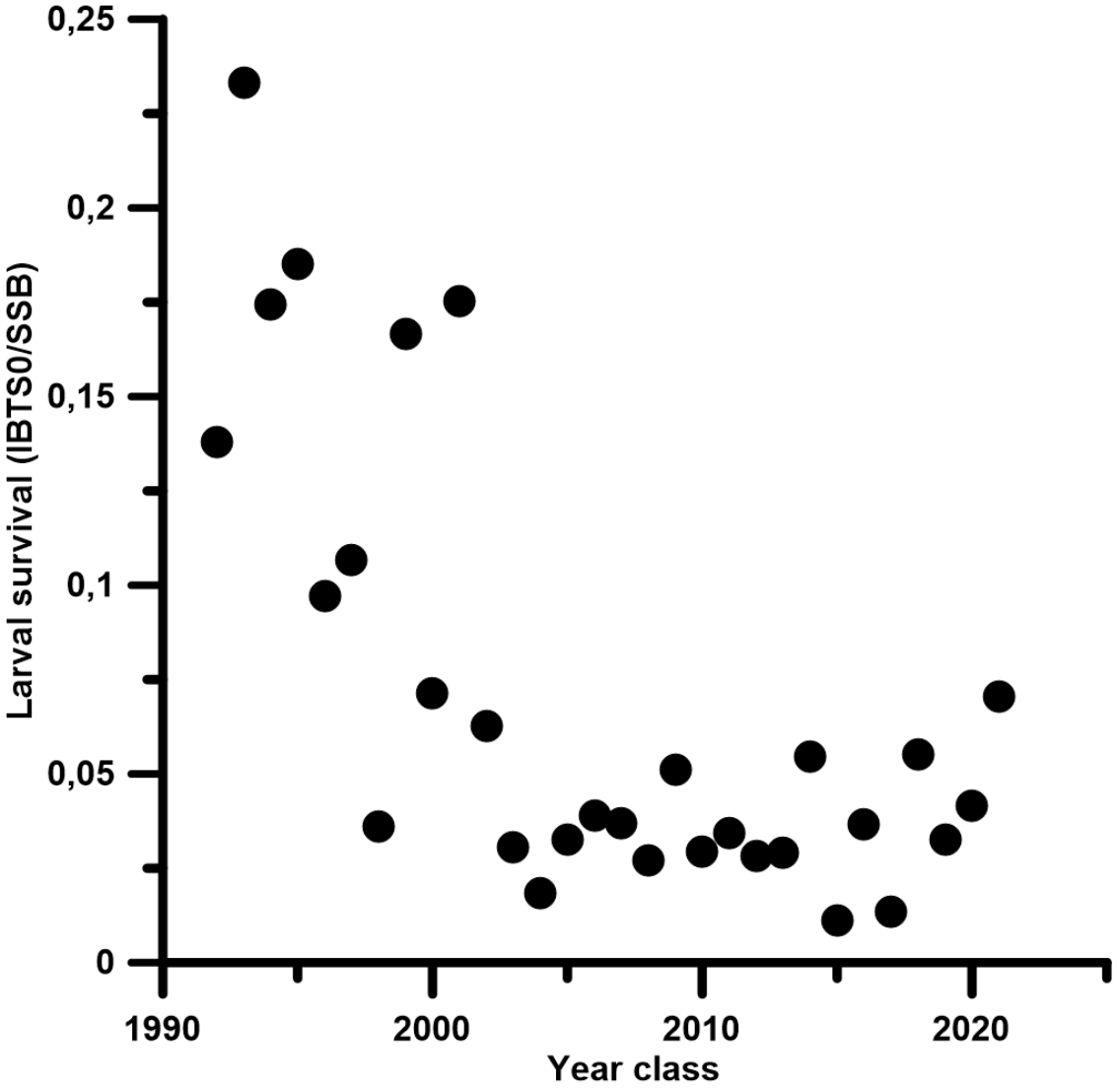

Figure 2.13.3. North Sea Autumn Spawning Herring time-series of larval survival ratio (Dickey-Collas & Nash, 2005; Payne *et al.,* 2009), defined as the ratio of the SSB larval index (representing larvae less than 10–11 mm) and the IBTS0 index (representing the late larvae, > 18 mm). Survival ratio is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

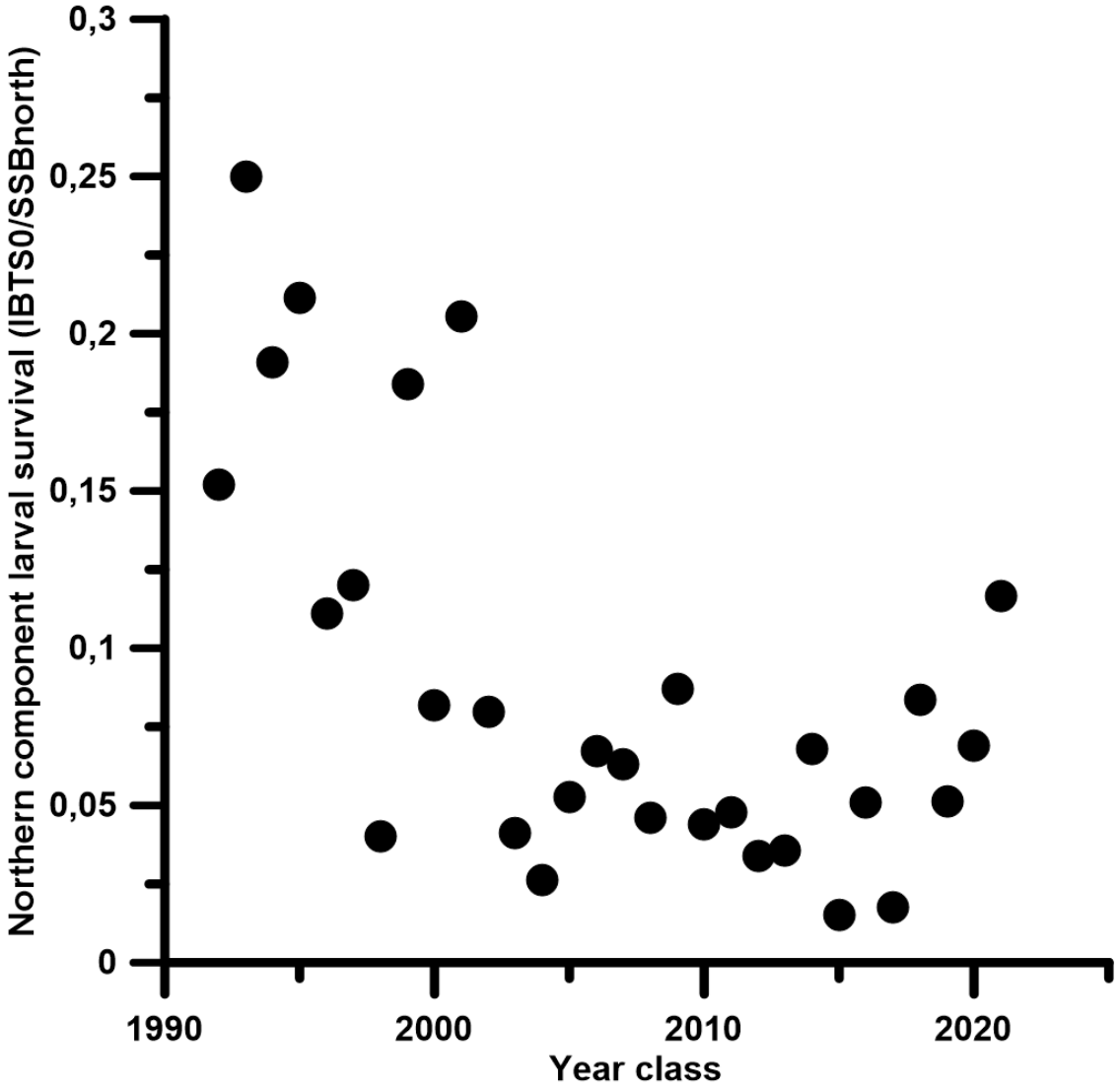

Figure 2.13.4. North Sea Autumn Spawning Herring time-series of larval survival ratio (Dickey-Collas & Nash, 2005; Payne *et al.,* 2009) for the northern-most spawning components (Banks, Buchan, Orkney-Shetland), defined as the ratio of the sum of the larvae indices for these components (representing 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.