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 2019 and 2020

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

There is currently no agreed EU-Norway management plan (Anon, 2019) although a Working Group has been set up by Norway and the European Union to recommend an a way of optimally and sustainably utilizing the North Sea autumn spawning herring stock. This working group needs to report by September 2020. 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 2019 was 398 198 tonnes for Area 4 and Division 7.d, where no more than 42 351 t should be caught in Division 4.c and 7.d. For 2020, the TAC for the A-fleet is the same amount (385 008 t for the A-Fleet), including a TAC of 42 351 t for Division 4.c and 7.d.

The bycatch TAC for the B-Fleet in the North Sea (and Division 2.a) was 13 190 t in 2019 and has decreased by 32% to 8954 t in 2020. As North Sea autumn spawners are also caught in Division 3.a, regulations for the fleets operating in this area have to be taken into account for the management of the WBSS stock (see Section 3). Catches of spring-spawning herring in the Thames estuary are in general low and not included in the TAC. For a definition of the different fleets harvesting North Sea herring see the Stock Annex and Section 2.7.2.

2.1.2 Catches in 2019

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

The total WG catch of all herring caught in the North Sea amounted to 445 631 t in 2019. Official catches by the human consumption fishery were 440 470 t, corresponding to a substantial overshoot of 14% of the TAC for the human consumption fishery (385 008 t).

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 39 754 t. The separate TAC for this area was 42 351 t, so 8% of the TAC remains in Division 4.c and 7.d (but due to catch regulations, 50% of the TAC could have been taken in Division 4.b).

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

Landings of herring taken as bycatch in the small-meshed fishery were 5161 tonnes in 2019. The bycatch ceiling for the B-Fleet was 13 190 t. Since the introduction of yearly bycatch ceilings in 1996, these ceilings have only fully been taken in 2014 and 2016.

The total North Sea TAC and catch estimates for the years 2014 to 2019 are shown in the table below (adapted from Table 2.1.6).

Year	2014	2015	2016	2017	2018	2019
TAC HC ('000 t)	470	445	518	482	601	385
"Official" landings HC ('000 t) *	490	472	545	485	594	439
Working Group catch HC ('000 t)	493	474	545	485	594	440
Excess of landings over TAC HC ('000 t)	23	28	27	3	-7	55
Bycatch ceiling ('000 t) **	13	16	13	11	10	13
Reported bycatches ('000 t) ***	14	8	15	7	8	5
Working Group catch North Sea ('000 t)	507	482	560	492	602	442

HC = human consumption fishery

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

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

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

2.1.3 Regulations and their effects

In 2019, the following quota had been set initially and modified through swaps and banking and borrowing (source: FIDES + Norway). This is compared with the officially reported catches and the calculated percentage uptake. Note that the officially reported catches of herring are not necessarily identical to the WG estimates of catches.

year	Fleet	Area	Init Quota	Final Quota	Official catch	% Uptake
2019	A-fleet	4AB.	342 657	377 389	374,753	99%
		4CXB7D	42 351	45 378	43 963	97%
	A-fleet Total		385 008	422 767	418 717	99%
	B-fleet	2A47DX	13 190	14 281	5365	38%
	B-fleet Total		13 190	14 281	5365	38%
2019 Total			398 198	437 048	424 082	97%

In 2020, half of the EU quota for Division 3.a (HER/03A.) can be taken in the North Sea (HER/*04-C.). Based on correspondence with the Pelagic AC, HAWG notes that this transfer is expected to be 50%. Norway can take up to 50% of its quota for Division 3.a in the North Sea (Subarea 4).

In the North Sea, Norway can take up to 50 000 tonnes of its quota in EU-waters in divisions 4.a and 4.b (HER/*4AB-C). 50 000 tonnes of the EU-quota can be taken within Norwegian waters south of 62°N (HER/*04N-).

Half of the EU quota for divisions 4.c and 7.d can be taken in Division 4.b (HER/*04B.). In 2019 the quota transfer from 4.c and 7.d to 4.b has been around 54% (source: FIDES).

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% coud be borrowed. Subsequent year, the quota flexibility has been set to 10% again.

HAWG 2020 had access to the EU FIDES data for 2015-2019 and some national statistics on quota and catches. Unfortunately there is, however, still no complete coverage of whether countries have applied the annual quota flexibility.

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

2.1.4 Changes in fishing technology and fishing patterns.

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

The fishery concentrated in the northwestern part of the North Sea, around the Fladen Ground area (figures 2.1.1 a–e). In line with the TAC, catches in 2019 decreased. The majority of catches

is taken in Subdivision 4.aW, in the order of 57% of the total. Subdivision 4.aE provided 15% of the catches in 2019 and catches in Division 4.b contributed 19%.

The utilization of catches in divisions 4.c and 7.d has decreased since 2010. Since 2014, catches in the southern North Sea contributed less than 10% to the total catch, while they were in the range of 15% for the period before 2010. The TAC in this Division is not fully taken since 2012. Catches in Division 4.c were only 2583 t in 2019 (<1%).

As in former years, most of the catches in the B-Fleet are taken in Division 4.b (70%). The bycatch ceiling for this fleet has not fully been taken 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 2.2 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 2003–2018 (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 2009–2018.

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 2.83 billion fish and NSAS amounts to 2.87 billion fish in 2019. The proportion of 0- and 1-ringers of herring taken in the North Sea is 21% of the total catch in numbers in 2019 (Table 2.2.5), compared to 31% in 2018. Most of these young herring are still taken in the B-Fleet in Division 4.b. Here, 0- and 1-ringers amount to 53% of the total catch in numbers.

The proportion of 3+ winter ring herring is 76% of the total catch in numbers taken in the North Sea (compared to 65% in 2018). The 5 and 6 winter ring herring contributed most to the catches in 2019, both in terms of numbers and in biomass.

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 2.2.2). 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 2004–2019. After splitting the herring caught in the North Sea and 3.a between stocks, the total catch of North Sea Autumn spawners amounts to 442 886 tonnes.

Area	Allocated	Unallocated	BMS/Discard	Total
4.a West	254 860			254 860
4.a East	64 692			64 692
4.b	85 525		800	86 325
4.c/7.d	38 924		830	39 754
	Total catch in the North Sea			445 631
	Autumn spawners caught in Division 3.a (SOP)			6087
	Baltic spring spawners caught in the North Sea (SOP)			-8832
	Total catch NSAS used for the assessment			442 886

2.2.2 Other Spring-spawning herring in the North Sea

Norwegian spring spawners and local fjord-type spring-spawning herring are taken in Division 4.a (East) close to the Norwegian coast under a separate TAC. These catches are not included in the Norwegian North Sea catch figures given in tables 2.1.1–2.1.6, but are listed separately in the respective catch tables. Along with the reduction in biomass of these spring-spawning herring in recent years, the catches have decreased in recent years and amount to only 5 t in 2019.

Blackwater herring are caught in the Thames estuary under a separate quota and included in the catch figure for England and Wales. In recent years, these catches have been relatively small. At the time of HAWG, no catch figure for 2019 was available.

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

2.2.3 Data revisions

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

2.2.4 Quality of catch and biological data

Annual misreporting and unallocation of catches are meanwhile regarded as a minor issue in the North Sea herring fishery. In 2019, 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 800 tonnes in 2019. 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 2019 North Sea herring fishery. However, discards occurred in demersal fisheries not targeting on herring. These discards sum to 830 tonnes in 2019.

The sampling of commercial landings covers 83% 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 104 different reported métiers, 293 were sampled in 2019. The sampling level of more than 1 sample per 1000 t catch has been met for only 11 métiers. With regards to age readings, 8 métiers appear to be sampled sufficiently (>25 fish aged per 1000 t catch).

However, some of the métiers yielded very little catch. In 59 métiers the catch is below 1000 t. The total catch in these métiers sums to 9938 t, so the remaining 45 métiers represent 435 694 t of the working group catch (98%). Of these 45 métiers, 27 were sampled. Only 8 métiers have more than 1 sample per 1000 t catch and only 5 more than 25 age readings per 1000 t catch.

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

The WG recommends that all métiers with substantial catch should be sampled (including by-catches in the industrial fisheries), and that catches landed abroad should be sampled based on criteria provided above, and information on these samples should 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 2018

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 CM 2020/EOSG:14). 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.

The estimate of North Sea autumn spawning herring SSB (spawning-stock biomass) is estimated to be lower than in 2018, at 1.9 million tonnes (2018: 2.3) and at similar level to 2017. This is due to a decrease in the number of fish (2018: 12,315 mill. fish, 2019: 10,295). The mean weight of mature fish is similar to last year at 186.4 g and the decrease in biomass follows directly from a decrease in numbers. The spawning stock is dominated by fish of age 3 and 5 wr, which is in accordance with the strongest year classes in the 2018 survey.

The time-series of abundance of North Sea autumn spawning herring is given in Table 2.3.1.3.

Distribution of herring in the North Sea area is similar to that seen in 2017 and 2018 though it did not extend as far south as in the years prior to 2017. Abundance of NSAS herring was slightly lower compared to recent surveys in the North Sea area. Particularly the abundance of age 2 winter ring herring was very low this year and the maturity level of this age class is still low although it is higher than in 2018.

The abundance of immature fish in the stock has decreased by 25% since last year from 20 290 million in 2018 to 15 265 million this year. This is influenced by the small number of 2 wr fish.

Maturity of 2 winter ringers was at an all-time low at 37% in 2018. This year the proportion mature at 2 winter rings were higher at 59%, but still low when compared to the long-term picture. Maturities for ages 3 and above were comparable to the long-term average, with 97% of 3 winter ringers and 99% or higher maturity for all ages 4 and above. 100% maturity was achieved by age 5.

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 2019-2020. 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 2019 and January 2020 (Figure 2.3.2.1).

The survey around the Orkneys revealed relatively small numbers of newly hatched larvae, while in the Buchan area and the central North Sea, quantities were much higher, in the same order of magnitude as in preceding years.

The two surveys in the southern North Sea showed a peak in abundance in December. The abundance of newly hatched larvae in the southern North Sea is strikingly high in the first survey of the most recent sampling period. Newly hatched larvae occurred only in the western part of the survey area. However, the overall distribution of larvae and thus the main spawning area used by herring is not obviously different from preceding years. The abundance of young larvae is high when hatching started in December, but their spatial distribution is limited. With progressing spawning season also the spatial distribution gets broader.

No survey was planned for the second half of January 2020. Instead, an additional MIK sampling was undertaken in March-April 2020 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. Results of this survey are described in section 2.11.

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

2.3.3 International Bottom Trawl Survey (IBTS-Q1)

The total abundance of 0-ringers in the survey area is used as a recruitment index for the stock. This year, 576 depth-integrated hauls were completed with the MIK-net, which is 61 MIK hauls less than in 2019. Several issues hampered MIK sampling during the Q1 IBTS: in particular the permit to work in UK waters was not issued for the German participation and other nations had to step in. Their sampling, however, was severely affected by prevailing bad weather with strong winds and high waves. The coverage of the survey area was, however, still good with at least 2 hauls in most of ICES rectangles in the North Sea as well as in Kattegat and Skagerrak.

Index values are calculated as described in detail in the Stock Annex

Larvae measured between 5 and 38 mm standard length (SL). Again, and as in most years, the smallest larvae <10 mm were the most numerous. Larger larvae >18 mm SL were rarer and were caught in slightly higher densities than last year (Figure 2.3.3.1). 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 western and eastern parts of the North Sea. In the southeastern and eastern part of the North Sea, the potential nurseries, abundance of large herring larvae was much higher than last year.

The newly proposed rule was applied to the MIK herring larvae data time-series from 1992 onwards, where because of data quality issues all French data before 2008 were excluded. The results of the calculation can be found in Table 2.3.3.1.2. The 2020 index is 62.4.

2.3.4 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 2018 is shown in Table 2.3.3.2. The index from the 2020 survey is 1021 which is below the long-term average of the time-series. Figure 2.3.3.3 illustrates the spatial distribution of 1-ringers as estimated by trawling in January-February 2018, 2019 and 2020. For the 2018 year class, the majority of the 1-ringers were found in the Kattegat/Skagerrak area, while in the North Sea, the 1-ringer abundance was low and more dispersed than in previous years. The few rectangles in the Kattegat/Skagerrak area contributing the most to the index for this year. It appears noteworthy, that the trajectories for six recent 1-ringer abundances (year classes 2013–2018) correspond very well to the trajectories of their 6 respective 0-ringer indices (Figure 2.3.3.4).

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 2019 for comparison. The data for 2019 were sourced from tables 2.3.1.2. and 2.2.2. In the third quarter most fish are approaching their peak weights just prior to spawning.

The mean weights in the acoustic survey in 2019 were lighter for groups 1 to 5-wr and 9+ wr compared to those in the catch (Table 2.4.1.1).

However, the general trend towards smaller mean weight at age observed in recent years in the acoustic survey and, but less pronounced, in the catch in the 3rd quarter (Figure 2.4.1.1), seems to be continued in 2019. Only 2-wr in the acoustic survey had higher mean weight at age compared to 2018, while all other ages had the same or lower mean weight. In the 3rd quarter catch, all aged were lighter expect of 1, 2 and 5-wr.

The mean weight-at-age of the 9+ wr are almost the same weight than the 8-wr in the survey. The 2007 year class (part of the plus group) seems to have been growing slower throughout the years and was also the year class exhibiting greatly reduced maturity as 2-wr in 2010 and 3-wr in 2011.

2.4.2 Maturity ogive

The percentages at age of North Sea autumn spawning herring that were considered mature in 2019 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. Maturities for winter

ringers 3 (97%) and 4 (99%) are comparable to the long-term average. 100% maturity was achieved by age 5.

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).

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. The optimal offset obtained is of 0.11.

Because no update from SMS model key run was available, the 2020 assessment used the natural mortality from the 2017 SMS model key run (ICES WGSAM, 2018) which provides M at age from 1974 to 2016. Natural mortality 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 autumn spawning components. Hence, once the contribution of winter spawning Downs component to the total North Sea stock increased, the relationship between the two indices started to erode. This was particularly true in recent years (the 2009 and the 2006–2007 year classes), but also already for the 1995 year class, when the predicted levels of recruitment have deviated between the two indices.

Since 2017, the MIK index time-series is calculated with the new algorithm, which only dates back to 1992 and excludes larvae of Downs origin more rigorously. The correlation between 0- and 1-ringer indices utilizing the newly calculated MIK index time-series is much weaker, explaining only 31 % recruitment variability (Figure 2.5.1.1). However, starting with the 2013 year class there was once again good agreement between the trends of the two indices. In 2014 it was recorded as the largest 0-ringer abundance since 2002, and the strength of this year class was confirmed in 2015 with one of the largest 1-ringer abundances. This was the first strong year class observed since 2002. Since then, the IBTS 1-ringer index followed the ups and downs of the MIK 0-ringer index for the respective year class (Figure 2.3.3.4).

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), 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. As for the 2019 assessment, a somewhat high and one-directional retrospective was observed. This was further explored and results are presented in 2.10.1

The proportion mature of 2, 3 and 4-wr individuals are 59%, 97%, and 99% respectively. The historical proportion mature at age are given in Table 2.6.3.5 and plotted in Figure 2.6.1.1. The maturity for age has substantially increased compared to 2018 (37%). This is following a consistent decrease of proportion mature at this age since 2015. The tracking of each cohort can be observed in the catch-at-age presented Figure 2.6.1.2. The 2013 year class is particular high in the catches. Time-series of natural mortality-at-age built from the 2017 SMS key run (ICES WGSAM, 2018) is shown in Figure 2.6.1.3.

The numbers-at-age over all ages in the acoustic survey can still be considered relatively high in the recent time period (see Figure 2.6.1.4), especially for age 5 and 6. The internal consistency of the acoustic survey remains high, as it has been for a long period (Figure 2.6.1.5). Though, an exploration of the assessment results revealed that the consistency is variable in time with a significant drop in the last years for age 6-7 (see Section 2.10.1). Following the revision of the index generation during the 2018 benchmark (ICES, WKPELA 2018), the internal consistency for the IBTS-Q3 is also at a considerable high levels (Figure 2.6.1.6).

The SAM model fits the catch and the surveys well and residuals are random and small for all ages (figures 2.6.1.7–2.6.1.42). 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 (figures 2.6.1.32–2.6.1.42). 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. All other surveys fit well inside the model. Further visualization of residuals for the catch data and the survey indices can be observed in figures 2.6.1.43–2.6.1.46.

A feature of the assessment model is the estimation of an observation variance parameter for each dataset (see Figure 2.6.1.47). 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 somewhat high (Figure 2.6.1.48). However, the CV quantities do not indicate a lack of convergence of the assessment model.

The analytical retrospective pattern is similar to the 2019 assessment. The SSB has been revised upward with very similar perception in F and recruits (Figure 2.6.1.49). The mean mohn's rho with a 5-year period for the peel is similar to those from 2019: -12.2% (F_{bar}), 2.9% (rec), and 11.5% (SSB). A specific analysis of the analytical retrospective is presented in Section 2.10.1.

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 2.6.1.50-51).

2.6.2 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. It is important to note that fleet B and D are combined because of their similarity. More details on the model configuration exploration is provided in the 2018 benchmark report (ICES WKPELA, 2018). Tables for the multifleet assessment and results (including fleet wise fishing mortalities) are given in Table 2.6.2.2 to 2.6.2.41.

Of particular relevance when running the SAM model using a multifleet configuration is the fishing mortality-at-age that is outputted for each fleet. The subsequent catch residuals for each fleet is shown in Figure 2.6.2.1 to Figure 2.6.2.3. The observation variance is shown in Figure 2.6.2.4, with high levels for fleet B and D. Expectedly, the model is driven by catch data from fleet A which represents most of the overall catches. The model uncertainty and the correlation coefficients between the estimated parameters are shown in Figure 2.6.2.5 and 2.6.2.6 respectively.

As for the single fleet assessment, the analytical retrospective for SSB, F_{bar} and the recruitment is shown in Figure 2.6.2.7. Similar pattern to the single fleet can be observed, i.e. one directional bias with increased peels. With respect to SSB, F_{bar} and recruitment, the multifleet assessment yields very similar results to the single fleet assessment (figures 2.6.2.8-10).

2.6.3 Final Assessment for NS herring

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 and model settings are shown in tables 2.6.3.1–2.6.3.11, the SAM output is presented in tables 2.6.3.13–2.6.3.35, the stock summary in Table 2.6.3.12. Figure 2.6.3.1 shows the stock time-series for SSB, F_{bar} and recruitment.

The spawning stock at spawning time in 2019 is estimated at approximately 1.68 million tonnes, which is a decrease of 18% compared with 2018.

The abundance of 0-wr fish in 2020 (2019 year class) is estimated to be at approximately 29 billion, which is 10% below the 10-year weighted mean (33 billion, see Table 2.6.3.14).

Mean F_{2-6} in 2019 is estimated at approximately 0.18.

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} (0.26).

The SSB in autumn 2019 was estimated at 1.68 million tonnes, which is above B_{pa} (0.9 million t) and MSY $B_{trigger}$(1.4 million t).

The recruitment for the stock in recent years (since 2013) is low and the further aging of the 2013 and 2012 year classes is driving the decrease in SSB. In line with the recruitment level since 2014, the recruitment in 2020 remains low (23 billion, 10% lower than the 10-years weighted mean).

Similarly to recent years' assessments, fishing mortality on older ages remains high in recent years. As for the 2019 assessment, the fishing mortality-at-age 7 is estimated around 0.42 in 2019, which is substantially higher than F_{bar2-6} (0.21). In the 2017 assessment (ICES HAWG, 2017), comparison of the only acoustic survey and catch data gave the same impression that the catches at the older ages are relatively high compared to the estimated number of fish in those ages.

2.7 Short-term predictions

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

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

In the short-term predictions, recruitment is assumed constant at 33 billion for the years 2021 and 2022 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 2019 year class, obtained from the assessment served as the estimate for 2020.

For the intermediate year (2020), no overshoot for the A fleet was assumed. Previous negotiations between the EU and Norway resulted in the allowance of 50% of the C-fleet TAC in the Kattegat-Skagerrak area to be taken in the North Sea. Because a TAC for the C-fleet had been agreed for 2020, despite the zero advice for WBSS herring, the pelagic AC was requested to estimate the

percentage of the 3.a herring TAC that would be taken in the North Sea. The pelagic AC estimated it at 50% in 2020. The same proportion has been used in this projection for the scenarios where the C-fleet catch was not set to zero.

The expected catches of Western Baltic Spring-spawning herring caught under the North Sea TAC are deducted from the expected A fleet catches (amounting to 6071 t) in the intermediate year. In the projected year 2021, 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 2020.

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.

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. The MSY AR stipulates a fishing mortality of $F_{MSY} = 0.26$ when the stock is above MSY $B_{trigger}$ (1 400 000 tonnes) and a linear decline in F when the stock is below MSY $B_{trigger}$.

There is no specific allowance in the ICES MSY AR for multiple fishing mortality targets, such as the F for 0 and 1 WR herring, which were previously integral part of the management plans for NSAS herring. In HAWG 2019, a fixed fishing mortality was assumed across all scenarios. In HAWG 2020, this assumption has been changed. In the new forecast, the combined selection pattern for the A and B fleets are scaled together to achieve the different targets of the forecast scenarios. Therefore the fishing mortalities of the A and B fleets are both variable across the scenarios. In addition, three scenarios are presented in which 1) a fixed target fishing mortality for the B-fleet is used and 2) and 3) the TACs of the C and D fleet are the same as in 2020 (with and without transfer of the C fleet to the North Sea).

All predictions are for North Sea autumn spawning herring only.

2.7.1 Comments on the short-term projections

Although the SSB is expected to decrease between 2020 and 2022, due to a series of weak year-classes recruiting to the fishery, the projection still estimates a higher catch compared to the projection that was carried out in HAWG 2018 and HAWG 2019. The main reasons for the higher predicted catch were:

8. a higher estimate of stock size due to a retrospective bias in the assessment (see Section 2.10),
9. a relatively large contribution of older fish in the population (year classes 2012 and 2013, age 7 and 8 wr in 2020), and
10. a high selection on the oldest ages in the population.

The large proportion of age 7 and 8 in the forecast year (2021) is shown in figures 2.7.2.1 and 2.7.2.2. This leads to a projection where the estimated catch (in tonnes) in 2021 consists for around 42% of fish that are age 7 (WR) and older, and that the average fishing mortality on ages 7 and 8 (WR) is around 0.58.

The predicted total catch of NSAS herring according to the MSY Advice Rule for 2021 is 365.792 tonnes which implies a 15% decrease compared to the advice for 2020. The calculated catch for the A fleet in 2020 is based on a number of assumption about the distribution of fishing mortalities and catches between fleets. Using these assumption, the estimated catch of the A fleet in 2021 would be 359 367 tonnes which represents a 14% decrease compared to the calculated A fleet catch in HAWG 2019 (418 649 tonnes).

2.7.2 Exploratory short-term projections

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 2020 again carried out and extended short-term projection using the MSY AR projection, using the same (low) recruitment and the same fishing patterns by fleet for the years 2022–2026 (Figure 2.7.2.3). This resulted in a further decline in the total catch of autumn spawning herring to around 300 000 tonnes in 2022 and catches slowly increasing to 320 000 tonnes by 2026 while SSBs would be between 1 200 000 and 1 300 000 tonnes in all years. It should be noted that this does not constitute a real evaluation of the MSY AR rule because the fishing mortality was not adapted according to the rule, but simply kept constant during the years of the projection.

2.8 Medium term predictions and HCR simulations

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

2.9 Precautionary and Limit Reference Points and FMSY targets

The precautionary reference points for this stock were originally adopted in 1998.

New reference points were calculated during the 2018 benchmark meeting (ICES WKPELA, 2018) and did not change the perception of the stock assessment. Reference points prior to 2018 and out of the 2018 benchmark are presented in tables 2.9.1 and 2.9.2 respectively. Overall, in light of the 2020 assessment, the fishing pressure remains below F_{MSY} while the SSB is below MSY $B_{Trigger}$. For 2020, the F_{MSY} advice rule is applied. This management procedure consists of applying a fishing mortality F_{bar} (over ages 2-6) of F_{MSY} if the SSB in the forecast year is above MSY $B_{Trigger}$ and conversely decrease F_{bar} linearly. This is exemplified in Figure 2.9.1.1 with the current estimation of SSB in the intermediate and forecast years. Following the linear decrease of F_{bar} due to having SSB_{2021} below MSY $B_{Trigger}$, the applicable F_{bar} in the forecast year is of 0.22. The derivation of reference points and the history of the reference points for North Sea herring are further described in the Stock Annex.

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 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 2020 assessment was classified as an update assessment and was carried out following these procedures and settings.

The natural mortality is very impactful for the assessment of North Sea herring. The time-series are those from the latest SMS key run from 2017 (ICES WGSAM, 2018). However, the assessment model is sensitive to the absolute level of these time-series and previous changes have caused

[2] EU–Norway. 2018. Agreed record of consultations of long-term management strategies on joint stocks between Norway and the European Union, London, 7 June 2018. 5 pp.

the perception of the stock to change (ICES HAWG, 2016). During the benchmark in 2018 (ICES WKPELA, 2018), a methodology was developed to use an optimal offset (time and age independent) based on the assessment performance. This resulted in improved consistency between different assessments.

The 2020 assessment has decreased the estimates of the 2017–2019 recruitments by 1.5% compared to the 2019 assessment. The SSB has been increased by 10.1% over the 2017-2019 period and the fishing mortality is estimated to be lower by around 12.1% (see text table below and discussion in Section 2.6.4 and 2.7).

	2019 Assessment				2020 Assessment				% change 2020/2011			
Year	Rec	SSB	Catch	$F_{2–6}$	Rec	SSB	Catch	$F_{2–6}$	Rec	SSB	Catch	$F_{2–6}$
2017	22	2.2	495	0.22	20	2.3	492	0.21	-13.9	5.9	-0.4	-6.3
2018	36	1.8	567	0.27	33	2.1	556	0.24	-8.7	10.6	-2.0	-11.0
2019	26	1.5	432	0.34	32	1.7	437	0.23	18.1	13.7	1.1	-18.9

2.10.1 Analysing the retrospective pattern

Given the continuous one-directional retrospective pattern in the assessment, the following extra analyses were undertaken to find the source and potential solution for the retrospective pattern:

11. Leave-one-out analyses including retrospective analyses. If the retrospective pattern was due to substantial pattern in any of the surveys, a leave-one-out analyses would have resulted in a model lacking a retrospective as the cause of the problem would have been eliminated. The results however did not indicate it was only one of the surveys causing the problem, suggesting the catch data plays an important role as well.
12. Changing settings and parameter bindings of the assessment model. In some occasions, not allowing for enough free parameters results in retrospective patterns. For that reason, all settings were carefully screened. Results indicate that no setting could be found that solved the problem or substantially reduced the retrospective pattern.
13. Change in plus-group. An analyses was undertaken increasing the plus-group to age 9+ to investigate the effect on the retrospective pattern. Updating the model settings and parameter bindings was part of this analyses. Increasing the plus-group did however not result in a reduced retrospective pattern.
14. Analyse the change in internal consistency of the data used in the assessment. A 10-year moving window was used to estimate the internal consistency of the catch and survey data. In this analyses, a window of 10 years was used to estimate the linear relationship between e.g. age-pairs 4-5 within a cohort. The results showed that in the catch-at-age data the internal consistency in the age-pairs 7-8+ was very low around 2010 and increased since (Figure 2.10.1.1). The results furthermore showed that the internal consistency in the HERAS-at-age data for age-pairs 6-7 has declined substantially and is now close to 0 (random noise) (Figure 2.10.1.2). The improved consistency at older ages in the catch together with the reduced consistency at older ages in the HERAS data results in a change in weight of the catch and HERAS data (observation variance for catch down, for HERAS up (Figure 2.10.1.3). This ultimately results in the change in perception from year to year.

2.11 North Sea herring spawning components

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

2.11.1 International Herring Larval Survey

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

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

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

2.11.2 IBTS0 Larval Index

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

2.11.3 Component considerations

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

2.12 Ecosystem considerations

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

2.13 Changes in the environment

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

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

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

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

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

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

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

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

Table 2.1.1. Herring caught in the North Sea. Total catch (tonnes) by country, 2015–2019. These figures do not in all cases correspond to the official statistics and cannot be used for legal purposes.

Country	2015	2016	2017	2018	2019
Belgium	18	26	13	32	60
Denmark *	113 481	133 962	110 318	132 231	91 680
Faroe Islands	981	833	442	497	614
France	30 269	35 177	28 801	31 505	25 288
Germany	44 377	44 231	43 707	51 636	37 699
Netherlands	70 076	98 859	84 914	111 302	79 465
Norway	134 349	150 183	134 132	162 594	128 614
Sweden	13 184	16 625	18 518	19 408	13 184
Ireland	183	127	868	515	3
UK (England)	18 897	20 485	16 997	19591	12 685
UK (Scotland)	48 332	59 240	49 514	66005	50 771
UK (N.Ireland)	5948	-	3469	6916	3938
Unallocated landings	1516	8	0	0	0
Total landings	481 611	559 756	491 693	602 232	444 001
Discards/BMS	-	170	-	96	1630
Total catch	481 611	559 926	491 693	602 328	445 631
Estimates of the parts of the catches which have been allocated to spring-spawning stocks					
WBSS	2204	1839	632	2164	8832
Thames estuary **	10	1	0	0	-
Norw. Spring Spawners ***	2191	216	83	310	5

*** 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	2015	2016	2017	2018	2019
Denmark *	68017	81080	76277	90763	54820
Faroe Islands	981	811	405	496	611
France	13401	15073	11064	14745	13344
Germany	32253	27926	32736	35884	19851
Netherlands	44309	66740	55832	56990	44071
Norway	47010	57056	57744	78647	53254
Sweden	10388	9933	12447	14132	8557
Ireland	183	127	868	515	3
UK (England)	12249	13010	12072	12313	5640
UK (Scotland)	46931	58557	49012	64424	50771
UK (N. Ireland)	4878	-	3469	5582	3938
Unallocated landings **	1939	0	0	0	0
Total Landings	282539	330313	311926	374491	254860
Discards/BMS	-	100	-	-	-
Total catch	282539	330413	311926	374491	254860

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

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

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	2015	2016	2017	2018	2019
Denmark *	16739	16305	3928	751	-
Faroe Islands	-	-	-	-	-
France	-	-	-	-	-
Germany	-	-	-	-	-
Netherlands	-	-	-	-	100
Norway	67254	78125	74216	73452	64592
UK (Scotland)	1369	-	-	-	-
Sweden	570	3985	705	377	-
Unallocated landings**	-423	0	0	0	0
Total landings	85509	98415	78849	74580	64692
Discards/BMS	-	-	-	-	-
Total catch	85509	98415	78849	74580	64692
Norw. Spring Spawners ***	2191	216	85	310	5

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

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

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

Table 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	2015	2016	2017	2018	2019
Denmark*	28551	36149	30045	4067	36750
Faroe Islands	-	22	37	1	3
France	6342	6225	7423	6090	1359
Germany	107	3419	2048	4964	8568
Netherlands	10606	17233	15739	34491	20700
UK (N. Ireland)	1070	-	-	1334	-
Norway	20077	15002	2172	10495	10768
Sweden*	2226	2705	5366	4899	4627
UK (England)	3484	3820	2435	3262	2750
UK (Scotland)	32	683	502	1581	-
Unallocated landings	0	0	0	0	0
Total landings	72495	85258	65767	107794	85525
Discards	-	-	-	1	800
Total catch	72495	85258	65767	107795	86325

*** 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	2015	2016	2017	2018	2019
Belgium	18	26	13	32	60
Denmark*	174	428	68	40	110
France	10526	13879	10314	10670	10585
Germany	12017	12886	8923	10788	9280
Netherlands	15161	14886	13343	19821	14594
Norway	8	-	-	-	-
Sweden	-	2	-	-	-
UK (England)	3164	3655	2490	4016	4295
UK (Scotland)	-	-	-	-	-
Unallocated landings	0	8	0	0	0
Total landings	41068	45770	35151	45367	38924
Discards/BMS	-	70	-	95	830
Total catch	41068	45840	35151	45462	39754
Coastal spring spawners included above**	10	1	-	10	-

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

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

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

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

Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Subarea 4 and Division 7.d: TAC (4 and 7.d)												
Agreed Divisions 4.a,b	147.4	149.0	173.5	360.4	427.7	418.3	396.3	461.2	428.7	534.5	342.7	342.7
Agreed Div. 4.c, 7.d	23.6	15.3	26.5	44.6	50.3	51.7	49.0	57.0	53.0	66.0	42.4	42.4
Bycatch ceiling in the small mesh fishery *	16.0	13.6	16.5	17.9	14.4	13.1	15.7	13.4	11.4	9.7	13.2	9.0
CATCH (4 and 7.d)												
National catch Divisions 4.a,b **	145.0	148.1	191.7	387.2	453.8	465.9	439	514.0	456.5	556.9	405.1	
Unallocated catch Divisions 4.a,b	-1.1	0.0	0.0	-3.0	0.0	3.3	1.5	0.0	0.0	0.0	0.0	
Discard/slipping Divisions 4.a,b ***	0.1	0.0	-	-	-	0.0	-	0.1	-	0.0	0.8	
Total catch Divisions 4.a,b #	143.9	148.1	191.7	384.2	453.9	469.2	440.5	514.1	456.5	556.9	405.9	
National catch Divisions 4.c, 7.d **	21.5	26.5	26.7	37.1	44.7	38.2	41.1	45.8	35.2	45.4	38.9	
Unallocated catch Divisions 4.c,7.d	0.4	0.0	0.0	3.3	0.0	0.0	0.0	0.0	0.0	0.0	0	
Discard/slipping Divisions 4.c, 7.d ***	-	-	-	-	-	-	-	0.1	-	0.1	0.8	
Total catch Divisions 4.c, 7.d	21.9	26.5	26.7	40.4	44.7	38.2	41.1	45.8	35.2	45.5	39.8	
Total catch 4 and 7.d as used by ICES #	165.8	174.6	218.4	424.6	498.5	507.5	481.6	559.9	491.7	602.3	445.6	
CATCH BY FLEET/STOCK (4 and 7.d) ##												
North Sea autumn spawners directed fisheries (Fleet A)	152.1	164.8	209.2	411.8	489.9	490.5	471.5	543.6	484.1	591.7	440.5	
North Sea autumn spawners industrial (Fleet B)	9.8	9.1	8.9	10.6	8.1	14.0	7.9	14.5	7.0	8.5	5.2	

Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
North Sea autumn spawners in 4 and 7.d total	161.9	173.9	218.1	422.5	498.1	504.5	479.4	558.1	491.1	600.2	436.8	
Baltic-3.a-type spring spawners in 4	3.9	0.8	0.3	2.1	0.5	3.0	2.2	1.8	0.6	2.2	8.8	
Coastal-type spring spawners	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Norw. Spring Spawners caught under a separate quota in 4 ###	44.6	56.9	12.2	9.6	3.2	2.3	2.2	0.2	0.1	0.3	0.0	
Division 3.a: TAC (3.a)												
Agreed herring TAC	37.7	33.9	30.0	45.0	55.0	46.8	43.6	51.1	50.7	48.4	29.3	24.5
Bycatch ceiling in the small mesh fishery	8.4	7.5	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7
CATCH (3.a)												
National catch	38.8	37.3	20.0	27.7	31.2	28.9	27.8	29.9	26.8	23.3	14.9	
Catch as used by ICES	38.8	37.3	20.0	27.7	31.2	28.9	27.8	29.9	26.8	23.3	14.9	
CATCH BY FLEET/STOCK (3.a) ##												
Autumn spawners human consumption (Fleet C)	5.1	12.0	6.6	7.8	11.8	9.5	10.2	4.1	7.4	3.2	5.8	
Autumn spawners mixed clupeoid (Fleet D)	1.5	1.8	1.8	4.4	1.6	3.3	4.4	1.4	0.2	0.2	0.3	
Autumn spawners in 3.a total	6.5	13.8	8.4	12.2	13.4	12.8	14.7	5.5	7.6	3.4	6.1	
Spring spawners human consumption (Fleet C)	29.4	23.0	10.8	14.5	16.6	15.4	11.3	23.3	19.0	19.7	8.8	
Spring spawners mixed clupeoid (Fleet D)	2.9	0.5	0.8	1.0	1.3	0.6	1.8	1.1	0.2	0.2	0.0	
Spring spawners in 3.a total	32.3	23.5	11.6	15.5	17.9	16.1	13.1	24.4	19.2	19.9	8.8	
North Sea autumn spawners Total as used by ICES	168.4	187.6	226.5	434.6	511.4	517.3	494.1	563.6	498.7	603.5	442.9	

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 2019. 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	**23.7**	**0.0**	**5.3**	**0.0**	**100.7**	**403.2**	**14.2**	**0.0**	**503.9**	**14.2**	**541.8**	**518.1**
1	**101.3**	**2.4**	**30.6**	**0.0**	**20.2**	**42.2**	**1.2**	**0.0**	**62.5**	**1.2**	**164.9**	**66.0**
2	**19.8**	**21.2**	**53.0**	**0.0**	**40.7**	**17.5**	**0.4**	**7.3**	**58.2**	**7.7**	**85.7**	**87.1**
3	**4.6**	**36.3**	**16.2**	**20.1**	**168.6**	**39.3**	**8.2**	**55.5**	**228.0**	**63.7**	**296.3**	**307.9**
4	**0.1**	**17.9**	**5.5**	**12.4**	**115.3**	**26.7**	**2.3**	**40.2**	**154.4**	**42.5**	**197.0**	**202.4**
5	**0.1**	**97.5**	**2.5**	**95.0**	**454.9**	**119.9**	**5.5**	**64.9**	**669.8**	**70.5**	**740.4**	**742.7**
6	**0.1**	**81.1**	**1.4**	**79.7**	**311.6**	**115.6**	**2.2**	**33.1**	**506.9**	**35.3**	**542.3**	**543.6**
7	**0.0**	**25.8**	**0.3**	**25.4**	**67.6**	**38.3**	**0.2**	**8.1**	**131.3**	**8.3**	**139.6**	**140.0**
8	**0.0**	**20.1**	**0.1**	**20.0**	**47.4**	**11.2**	**0.3**	**6.5**	**78.6**	**6.8**	**85.4**	**85.4**
9+	**0.0**	**23.7**	**0.0**	**23.7**	**75.1**	**25.7**	**0.9**	**12.8**	**124.6**	**13.7**	**138.3**	**138.3**
Sum	**149.8**	**325.9**	**114.9**	**276.4**	**1402.2**	**839.6**	**35.3**	**228.5**	**2518.2**	**263.9**	**2931.8**	**2831.5**
Quarter: 1												
0	0.0	0.0	0.0	0.0	3.6	2.9	12.4	0.0	6.5	12.4	**18.9**	**18.9**
1	38.4	0.0	2.3	0.0	0.3	0.2	1.0	0.0	0.5	1.0	**40.0**	**1.6**
2	17.9	0.0	22.0	0.0	0.6	0.5	0.0	0.0	1.1	0.0	**19.0**	**1.1**
3	3.4	0.0	5.8	0.0	3.8	0.8	0.8	11.0	4.6	11.9	**19.8**	**16.5**
4	0.1	0.0	1.4	0.0	2.7	0.3	0.2	3.5	3.1	3.7	**6.9**	**6.8**
5	0.0	0.0	0.5	0.0	16.3	1.3	0.4	6.7	17.6	7.1	**24.8**	**24.7**
6	0.0	0.0	0.3	0.0	13.1	1.3	0.1	1.6	14.4	1.7	**16.1**	**16.1**
7	0.0	0.0	0.0	0.0	2.8	0.5	0.0	0.9	3.3	0.9	**4.2**	**4.2**
8	0.0	0.0	0.0	0.0	1.1	0.3	0.0	0.0	1.4	0.0	**1.4**	**1.4**
9+	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.3	1.4	0.3	**1.7**	**1.7**
Sum	**59.8**	**0.0**	**32.3**	**0.0**	**45.8**	**8.2**	**15.0**	**24.0**	**54.1**	**39.0**	**152.9**	**93.1**
Quarter: 2												
0	0.0	0.0	0.0	0.7	6.5	165.0	1.8	0.0	0.2	0.1	**174.1**	**173.4**
1	9.6	2.4	0.7	1.7	0.6	13.8	0.2	0.0	16.1	0.2	**25.9**	**17.0**
2	0.2	21.2	0.9	20.3	18.6	0.2	0.0	0.0	39.1	0.0	**39.3**	**40.0**
3	0.1	31.6	0.5	31.1	39.7	0.2	0.0	0.1	70.9	0.1	**71.1**	**71.6**
4	0.0	13.7	0.3	13.4	15.2	0.0	0.0	0.0	28.7	0.0	**28.7**	**29.0**
5	0.0	51.1	0.3	50.9	58.8	0.7	0.0	0.0	110.3	0.1	**110.4**	**110.7**
6	0.0	51.3	0.2	51.1	52.1	0.5	0.0	0.0	103.7	0.0	**103.7**	**103.9**
7	0.0	18.2	0.1	18.0	13.8	0.2	0.0	0.0	32.0	0.0	**32.0**	**32.2**
8	0.0	13.4	0.0	13.4	10.7	0.1	0.0	0.0	24.2	0.0	**24.2**	**24.2**
9+	0.0	2.4	0.0	2.4	0.6	0.2	0.0	0.0	3.3	0.0	**3.3**	**3.3**
Sum	**9.8**	**205.4**	**3.1**	**203.0**	**216.7**	**180.9**	**2.1**	**0.2**	**428.6**	**0.5**	**612.7**	**605.2**
Quarter: 3												
0	16.0	0.0	0.0	0.0	14.2	132.7	0.0	0.0	146.9	0.0	**163.0**	**146.9**
1	36.1	0.0	7.9	0.0	1.5	9.5	0.0	0.0	11.1	0.0	**47.2**	**11.1**
2	0.6	0.0	22.0	0.0	15.8	15.9	0.0	0.0	31.7	0.0	**32.3**	**31.7**
3	0.8	4.4	7.9	0.0	108.1	25.0	0.0	0.0	133.1	0.0	**133.8**	**137.5**
4	0.0	3.7	2.9	0.0	86.6	18.0	0.0	0.0	104.6	0.0	**104.6**	**108.3**
5	0.1	39.6	1.2	0.0	334.4	92.5	0.0	0.0	426.9	0.0	**427.0**	**466.6**
6	0.0	24.1	0.9	0.0	199.6	85.1	0.0	0.0	284.7	0.0	**284.8**	**308.8**
7	0.0	5.9	0.2	0.0	42.6	27.5	0.0	0.0	70.1	0.0	**70.1**	**76.0**
8	0.0	4.4	0.0	0.0	31.9	8.6	0.0	0.0	40.5	0.0	**40.5**	**44.9**
9+	0.0	19.6	0.0	0.0	40.7	19.2	0.0	0.0	59.9	0.0	**59.9**	**79.5**
Sum	**53.6**	**101.9**	**43.0**	**0.0**	**875.4**	**434.1**	**0.0**	**0.0**	**1309.4**	**0.0**	**1363.1**	**1411.3**
Quarter: 4												
0	7.7	0.0	5.3	0.0	76.3	102.6	0.0	0.0	178.9	0.0	**186.6**	**178.9**
1	17.2	0.0	19.7	0.0	17.7	18.6	0.0	0.0	36.4	0.0	**53.6**	**36.4**
2	1.2	0.0	8.1	0.0	5.8	0.8	0.4	7.3	6.6	7.7	**15.5**	**14.3**
3	0.4	0.2	2.0	0.0	17.1	13.3	7.3	44.4	30.4	51.7	**82.5**	**82.3**
4	0.0	0.4	0.8	0.0	10.7	8.3	2.1	36.7	19.1	38.8	**57.8**	**58.2**
5	0.0	6.8	0.5	6.3	45.3	25.4	5.1	58.2	76.9	63.3	**140.3**	**140.7**
6	0.0	5.7	0.1	5.7	46.8	28.7	2.1	31.5	81.2	33.6	**114.8**	**114.8**
7	0.0	1.7	0.0	1.7	8.3	10.1	0.2	7.2	20.1	7.4	**27.6**	**27.6**
8	0.0	2.2	0.0	2.2	3.7	2.2	0.3	6.5	8.1	6.8	**14.8**	**14.9**
9+	0.0	1.7	0.0	1.7	32.5	6.3	0.9	12.5	40.5	13.4	**53.9**	**53.9**
Sum	**26.5**	**18.7**	**36.5**	**17.5**	**264.3**	**216.3**	**18.3**	**204.4**	**498.1**	**222.6**	**747.2**	**721.9**

Table 2.2.2. North Sea autumn spawning herring (NSAS), and western Baltic spring spawners (WBSS) caught in the North Sea and Division 3.a in 2019. 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	**0.012**	**0.000**	**0.020**	**0.009**	**0.006**	**0.003**	**0.000**	**0.006**	**0.003**	**0.006**	**0.006**
1	**0.041**	**0.071**	**0.048**	**0.047**	**0.034**	**0.027**	**0.000**	**0.039**	**0.027**	**0.038**	**0.039**
2	**0.062**	**0.134**	**0.080**	**0.134**	**0.144**	**0.118**	**0.119**	**0.136**	**0.118**	**0.162**	**0.135**
3	**0.085**	**0.155**	**0.107**	**0.154**	**0.149**	**0.098**	**0.130**	**0.153**	**0.126**	**0.149**	**0.148**
4	**0.116**	**0.173**	**0.128**	**0.174**	**0.171**	**0.116**	**0.155**	**0.173**	**0.153**	**0.170**	**0.169**
5	**0.118**	**0.212**	**0.128**	**0.205**	**0.215**	**0.136**	**0.168**	**0.208**	**0.165**	**0.204**	**0.204**
6	**0.164**	**0.204**	**0.156**	**0.206**	**0.222**	**0.166**	**0.186**	**0.210**	**0.185**	**0.208**	**0.208**
7	**0.202**	**0.209**	**0.178**	**0.220**	**0.229**	**0.196**	**0.196**	**0.220**	**0.196**	**0.219**	**0.219**
8	**0.159**	**0.220**	**0.162**	**0.246**	**0.242**	**0.203**	**0.203**	**0.239**	**0.203**	**0.236**	**0.236**
9+	**0.000**	**0.250**	**0.000**	**0.248**	**0.259**	**0.211**	**0.223**	**0.251**	**0.223**	**0.248**	**0.248**
Quarter: 1											
0	0.000	0.000	0.000	0.003	0.003	0.003	0.000	0.000	0.000	**0.003**	**0.003**
1	0.027	0.071	0.027	0.027	0.027	0.027	0.000	0.027	0.027	**0.027**	**0.027**
2	0.060	0.134	0.061	0.142	0.150	0.000	0.000	0.146	0.000	**0.034**	**0.146**
3	0.072	0.149	0.078	0.119	0.146	0.088	0.090	0.123	0.000	**0.102**	**0.100**
4	0.122	0.164	0.111	0.125	0.155	0.103	0.107	0.129	0.107	**0.118**	**0.117**
5	0.087	0.180	0.097	0.144	0.173	0.113	0.125	0.146	0.125	**0.141**	**0.140**
6	0.137	0.188	0.101	0.163	0.186	0.130	0.162	0.165	0.161	**0.165**	**0.164**
7	0.000	0.202	0.000	0.172	0.186	0.172	0.172	0.174	0.000	**0.173**	**0.173**
8	0.000	0.209	0.000	0.185	0.212	0.000	0.000	0.191	0.000	**0.191**	**0.191**
9+	0.000	0.213	0.000	0.185	0.222	0.169	0.169	0.186	0.169	**0.182**	**0.182**
Quarter: 2											
0	0.000	0.000	0.000	0.003	0.003	0.003	0.000	0.000	0.000	**0.003**	**0.003**
1	0.032	0.071	0.032	0.035	0.027	0.027	0.000	0.034	0.000	**0.033**	**0.034**
2	0.060	0.134	0.061	0.142	0.148	0.000	0.000	0.138	0.000	**0.139**	**0.138**
3	0.079	0.149	0.078	0.145	0.163	0.088	0.088	0.147	0.088	**0.147**	**0.146**
4	0.090	0.164	0.101	0.155	0.163	0.103	0.103	0.159	0.103	**0.160**	**0.159**
5	0.049	0.180	0.118	0.174	0.210	0.113	0.113	0.177	0.113	**0.177**	**0.177**
6	0.000	0.188	0.138	0.188	0.229	0.129	0.129	0.188	0.129	**0.188**	**0.188**
7	0.000	0.202	0.149	0.184	0.251	0.000	0.000	0.194	0.000	**0.195**	**0.194**
8	0.000	0.209	0.166	0.210	0.244	0.000	0.000	0.209	0.000	**0.209**	**0.209**
9+	0.000	0.213	0.000	0.234	0.253	0.169	0.169	0.219	0.169	**0.219**	**0.219**
Quarter: 3											
0	0.009	0.000	0.000	0.006	0.006	0.000	0.000	0.006	0.000	**0.006**	**0.006**
1	0.054	0.000	0.053	0.050	0.038	0.000	0.000	0.040	0.000	**0.050**	**0.040**
2	0.095	0.000	0.097	0.130	0.145	0.000	0.000	0.138	0.000	**0.222**	**0.138**
3	0.135	0.196	0.134	0.159	0.148	0.000	0.000	0.158	0.000	**0.160**	**0.158**
4	0.097	0.201	0.143	0.179	0.174	0.000	0.000	0.179	0.000	**0.180**	**0.179**
5	0.155	0.253	0.153	0.213	0.221	0.000	0.000	0.218	0.000	**0.218**	**0.218**
6	0.180	0.233	0.180	0.214	0.228	0.000	0.000	0.219	0.000	**0.220**	**0.219**
7	0.202	0.225	0.202	0.237	0.235	0.000	0.000	0.235	0.000	**0.235**	**0.235**
8	0.000	0.250	0.159	0.259	0.244	0.000	0.000	0.255	0.000	**0.255**	**0.255**
9+	0.000	0.255	0.000	0.266	0.264	0.000	0.000	0.263	0.000	**0.263**	**0.263**
Quarter: 4											
0	0.018	0.000	0.020	0.010	0.010	0.000	0.000	0.010	0.000	**0.010**	**0.010**
1	0.049	0.000	0.049	0.048	0.037	0.000	0.000	0.042	0.000	**0.042**	**0.042**
2	0.078	0.078	0.083	0.115	0.120	0.118	0.119	0.116	0.118	**0.148**	**0.117**
3	0.095	0.217	0.096	0.148	0.150	0.099	0.140	0.149	0.135	**0.141**	**0.140**
4	0.097	0.211	0.112	0.166	0.165	0.118	0.160	0.166	0.158	**0.161**	**0.161**
5	0.078	0.217	0.101	0.209	0.194	0.138	0.173	0.205	0.170	**0.190**	**0.189**
6	0.093	0.221	0.093	0.205	0.209	0.168	0.188	0.207	0.186	**0.201**	**0.201**
7	0.000	0.229	0.000	0.210	0.215	0.196	0.199	0.214	0.199	**0.210**	**0.210**
8	0.159	0.230	0.159	0.252	0.238	0.203	0.203	0.242	0.203	**0.224**	**0.224**
9+	0.000	0.249	0.000	0.230	0.244	0.212	0.225	0.233	0.224	**0.231**	**0.231**

Table 2.2.3. North Sea autumn spawning herring (NSAS), and western Baltic spring spawners (WBSS) caught in the North Sea in 2019. 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.**	**10.7**	**9.2**	**7.7**	**0.0**	**9.5**	**7.7**	**9.5**
1	**n.d.**	**19.2**	**n.d.**	**17.8**	**16.2**	**15.0**	**0.0**	**16.8**	**15.0**	**16.8**
2	**n.d.**	**22.8**	**n.d.**	**24.1**	**24.2**	**23.6**	**23.7**	**23.8**	**23.7**	**23.8**
3	**n.d.**	**24.4**	**n.d.**	**25.3**	**25.3**	**23.8**	**24.9**	**25.2**	**24.8**	**25.1**
4	**n.d.**	**25.6**	**n.d.**	**26.6**	**26.8**	**25.2**	**26.5**	**26.5**	**26.4**	**26.5**
5	**n.d.**	**27.4**	**n.d.**	**28.0**	**28.3**	**26.0**	**26.8**	**28.0**	**26.8**	**27.8**
6	**n.d.**	**27.3**	**n.d.**	**27.9**	**28.8**	**27.4**	**27.6**	**28.0**	**27.6**	**28.0**
7	**n.d.**	**27.5**	**n.d.**	**28.6**	**29.3**	**28.0**	**28.5**	**28.6**	**28.5**	**28.6**
8	**n.d.**	**28.5**	**n.d.**	**29.5**	**29.7**	**28.2**	**28.8**	**29.3**	**28.7**	**29.2**
9+	**n.d.**	**29.5**	**n.d.**	**30.6**	**30.5**	**29.4**	**29.4**	**30.4**	**29.4**	**30.3**
Quarter: 1										
0	n.d.	0.0	n.d.	7.7	7.7	7.7	0.0	0.0	0.0	**7.7**
1	n.d.	19.2	n.d.	15.0	15.0	15.0	0.0	15.0	15.0	**15.0**
2	n.d.	22.8	n.d.	23.7	23.9	0.0	0.0	23.8	0.0	**23.8**
3	n.d.	24.1	n.d.	24.5	24.2	23.5	23.6	24.5	0.0	**23.8**
4	n.d.	25.2	n.d.	25.2	25.1	24.9	24.9	25.2	24.9	**25.0**
5	n.d.	26.0	n.d.	26.7	25.7	25.5	25.8	26.6	25.8	**26.4**
6	n.d.	26.6	n.d.	27.8	26.4	27.1	28.0	27.7	28.0	**27.7**
7	n.d.	27.2	n.d.	28.1	26.8	28.3	28.3	28.0	0.0	**28.0**
8	n.d.	28.0	n.d.	28.6	27.7	0.0	0.0	28.4	0.0	**28.4**
9+	n.d.	28.5	n.d.	29.6	28.6	29.5	29.5	29.6	29.5	**29.6**
Quarter: 2										
0	n.d.	0.0	n.d.	7.7	7.7	7.7	0.0	0.0	0.0	**7.7**
1	n.d.	19.2	n.d.	15.9	15.0	15.0	0.0	15.6	0.0	**15.6**
2	n.d.	22.8	n.d.	23.9	24.3	0.0	0.0	23.3	0.0	**23.3**
3	n.d.	24.1	n.d.	24.6	25.6	23.5	23.5	24.4	23.5	**24.4**
4	n.d.	25.2	n.d.	25.3	25.6	24.9	24.9	25.3	24.9	**25.3**
5	n.d.	26.0	n.d.	26.1	28.2	25.5	25.5	26.1	25.5	**26.1**
6	n.d.	26.6	n.d.	26.7	29.0	27.1	27.1	26.7	27.1	**26.7**
7	n.d.	27.2	n.d.	26.8	29.9	0.0	0.0	27.0	0.0	**27.0**
8	n.d.	28.0	n.d.	27.7	30.0	0.0	0.0	27.9	0.0	**27.9**
9+	n.d.	28.5	n.d.	29.1	30.5	29.5	29.5	28.7	29.5	**28.7**
Quarter: 3										
0	n.d.	0.0	n.d.	9.5	9.5	0.0	0.0	9.5	0.0	**9.5**
1	n.d.	0.0	n.d.	18.0	16.3	0.0	0.0	16.6	0.0	**16.6**
2	n.d.	0.0	n.d.	24.6	24.3	0.0	0.0	24.4	0.0	**24.4**
3	n.d.	26.4	n.d.	25.6	25.4	0.0	0.0	25.6	0.0	**25.6**
4	n.d.	26.7	n.d.	26.9	27.2	0.0	0.0	27.0	0.0	**27.0**
5	n.d.	28.9	n.d.	28.3	28.7	0.0	0.0	28.4	0.0	**28.4**
6	n.d.	28.2	n.d.	28.1	29.2	0.0	0.0	28.4	0.0	**28.4**
7	n.d.	28.0	n.d.	29.2	29.8	0.0	0.0	29.3	0.0	**29.3**
8	n.d.	29.0	n.d.	30.1	29.9	0.0	0.0	29.9	0.0	**29.9**
9+	n.d.	29.4	n.d.	30.5	30.8	0.0	0.0	30.3	0.0	**30.3**
Quarter: 4										
0	n.d.	0.0	n.d.	11.3	11.3	0.0	0.0	11.3	0.0	**11.3**
1	n.d.	0.0	n.d.	17.9	17.0	0.0	0.0	17.5	0.0	**17.5**
2	n.d.	21.0	n.d.	23.4	23.3	23.6	23.7	23.3	23.7	**23.6**
3	n.d.	27.7	n.d.	25.3	25.2	23.8	25.2	25.2	25.0	**25.1**
4	n.d.	27.6	n.d.	26.4	26.0	25.2	26.7	26.2	26.6	**26.5**
5	n.d.	29.2	n.d.	28.4	27.1	26.0	26.9	28.0	26.9	**27.5**
6	n.d.	29.7	n.d.	28.4	27.7	27.4	27.6	28.3	27.6	**28.1**
7	n.d.	29.7	n.d.	28.7	28.0	27.9	28.5	28.5	28.5	**28.5**
8	n.d.	30.5	n.d.	29.9	28.8	28.2	28.8	29.8	28.7	**29.3**
9+	n.d.	31.6	n.d.	30.8	29.5	29.4	29.4	30.6	29.4	**30.3**

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 2019. 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	**0.3**	**0.0**	**0.1**	**0.0**	**0.9**	**2.3**	**0.0**	**0.0**	**3.2**	**0.0**	**3.4**	**3.3**
1	**4.1**	**0.2**	**1.5**	**0.0**	**0.9**	**1.4**	**0.0**	**0.0**	**2.4**	**0.0**	**5.2**	**2.6**
2	**1.2**	**2.8**	**4.2**	**0.0**	**5.5**	**2.5**	**0.0**	**0.9**	**8.0**	**0.9**	**8.7**	**11.7**
3	**0.4**	**5.6**	**1.7**	**3.9**	**25.9**	**5.8**	**0.8**	**7.2**	**35.7**	**8.0**	**44.1**	**45.4**
4	**0.0**	**3.1**	**0.7**	**2.4**	**20.0**	**4.6**	**0.3**	**6.2**	**27.0**	**6.5**	**33.5**	**34.2**
5	**0.0**	**20.7**	**0.3**	**20.4**	**93.3**	**25.7**	**0.8**	**10.9**	**139.4**	**11.7**	**151.1**	**151.4**
6	**0.0**	**16.5**	**0.2**	**16.3**	**64.3**	**25.7**	**0.4**	**6.2**	**106.3**	**6.5**	**112.9**	**113.1**
7	**0.0**	**5.4**	**0.1**	**5.3**	**14.8**	**8.8**	**0.0**	**1.6**	**28.9**	**1.6**	**30.6**	**30.6**
8	**0.0**	**4.4**	**0.0**	**4.4**	**11.6**	**2.7**	**0.1**	**1.3**	**18.8**	**1.4**	**20.1**	**20.1**
9+	**0.0**	**5.9**	**0.0**	**5.9**	**18.7**	**6.7**	**0.2**	**2.9**	**31.3**	**3.1**	**34.3**	**34.3**
Sum	**6.1**	**64.7**	**8.8**	**58.7**	**256.0**	**86.3**	**2.6**	**37.2**	**400.9**	**39.8**	**444.0**	**446.8**
Quarter: 1												
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**
1	1.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**1.0**	**0.0**
2	1.1	0.0	1.4	0.0	0.1	0.1	0.0	0.0	0.2	0.0	**0.0**	**0.2**
3	0.2	0.0	0.5	0.0	0.5	0.1	0.1	1.0	0.6	1.1	**1.4**	**1.6**
4	0.0	0.0	0.2	0.0	0.3	0.1	0.0	0.4	0.4	0.4	**0.6**	**0.8**
5	0.0	0.0	0.1	0.0	2.3	0.2	0.0	0.8	2.6	0.9	**3.4**	**3.5**
6	0.0	0.0	0.0	0.0	2.1	0.2	0.0	0.3	2.3	0.3	**2.6**	**2.6**
7	0.0	0.0	0.0	0.0	0.5	0.1	0.0	0.2	0.6	0.2	**0.7**	**0.7**
8	0.0	0.0	0.0	0.0	0.2	0.1	0.0	0.0	0.3	0.0	**0.3**	**0.3**
9+	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.1	0.3	0.1	**0.3**	**0.3**
Sum	**2.4**	**0.0**	**2.1**	**0.0**	**6.3**	**0.9**	**0.2**	**2.7**	**7.2**	**2.9**	**10.5**	**10.1**
Quarter: 2												
0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.5	0.0	**0.5**	**0.5**
1	0.3	0.2	0.0	0.1	0.0	0.4	0.0	0.0	0.5	0.0	**0.9**	**0.6**
2	0.0	2.8	0.1	2.8	2.6	0.0	0.0	0.0	5.5	0.0	**5.5**	**5.5**
3	0.0	4.7	0.0	4.7	5.7	0.0	0.0	0.0	10.4	0.0	**10.4**	**10.5**
4	0.0	2.3	0.0	2.2	2.4	0.0	0.0	0.0	4.6	0.0	**4.6**	**4.6**
5	0.0	9.2	0.0	9.2	10.2	0.2	0.0	0.0	19.6	0.0	**19.6**	**19.6**
6	0.0	9.6	0.0	9.6	9.8	0.1	0.0	0.0	19.5	0.0	**19.5**	**19.6**
7	0.0	3.7	0.0	3.6	2.5	0.0	0.0	0.0	6.2	0.0	**6.2**	**6.3**
8	0.0	2.8	0.0	2.8	2.2	0.0	0.0	0.0	5.1	0.0	**5.1**	**5.1**
9+	0.0	0.5	0.0	0.5	0.2	0.0	0.0	0.0	0.7	0.0	**0.7**	**0.7**
Sum	**0.3**	**35.8**	**0.2**	**35.6**	**35.8**	**1.3**	**0.0**	**0.0**	**72.7**	**0.0**	**73.0**	**72.9**
Quarter: 3												
0	0.1	0.0	0.0	0.0	0.1	0.8	0.0	0.0	0.9	0.0	**1.0**	**0.9**
1	1.9	0.0	0.4	0.0	0.1	0.4	0.0	0.0	0.4	0.0	**2.0**	**0.4**
2	0.1	0.0	2.1	0.0	2.1	2.3	0.0	0.0	4.4	0.0	**2.3**	**4.4**
3	0.1	0.9	1.1	0.0	17.2	3.7	0.0	0.0	20.9	0.0	**20.8**	**21.8**
4	0.0	0.7	0.4	0.0	15.5	3.1	0.0	0.0	18.7	0.0	**19.0**	**19.4**
5	0.0	10.0	0.2	9.8	71.3	20.4	0.0	0.0	101.5	0.0	**101.5**	**101.7**
6	0.0	5.6	0.2	0.0	42.8	19.4	0.0	0.0	62.1	0.0	**67.6**	**67.7**
7	0.0	1.3	0.0	1.3	10.1	6.5	0.0	0.0	17.8	0.0	**17.8**	**17.9**
8	0.0	1.1	0.0	1.1	8.3	2.1	0.0	0.0	11.5	0.0	**11.5**	**11.5**
9+	0.0	5.0	0.0	5.0	10.8	5.1	0.0	0.0	20.9	0.0	**20.9**	**20.9**
Sum	**2.3**	**24.7**	**4.4**	**17.3**	**178.1**	**63.7**	**0.0**	**0.0**	**259.1**	**0.0**	**264.4**	**266.5**
Quarter: 4												
0	0.1	0.0	0.1	0.0	0.8	1.0	0.0	0.0	1.8	0.0	**1.8**	**1.8**
1	0.8	0.0	1.0	0.0	0.8	0.7	0.0	0.0	1.5	0.0	**1.4**	**1.5**
2	0.1	0.0	0.7	0.0	0.7	0.1	0.0	0.9	0.8	0.9	**1.1**	**1.7**
3	0.0	0.0	0.2	0.0	2.5	2.0	0.7	6.2	4.5	7.0	**11.4**	**11.5**
4	0.0	0.1	0.1	0.0	1.8	1.4	0.2	5.9	3.1	6.1	**9.3**	**9.4**
5	0.0	1.5	0.0	1.4	9.5	4.9	0.7	10.1	15.8	10.8	**26.6**	**26.6**
6	0.0	1.3	0.0	1.3	9.6	6.0	0.3	5.9	16.8	6.3	**23.1**	**23.1**
7	0.0	0.4	0.0	0.4	1.7	2.2	0.0	1.4	4.3	1.5	**5.8**	**5.8**
8	0.0	0.5	0.0	0.5	0.9	0.5	0.1	1.3	2.0	1.4	**3.3**	**3.3**
9+	0.0	0.4	0.0	0.4	7.5	1.5	0.2	2.8	9.4	3.0	**12.4**	**12.4**
Sum	**1.1**	**4.2**	**2.1**	**4.0**	**35.8**	**20.3**	**2.3**	**34.5**	**60.1**	**36.9**	**96.2**	**97.2**

Table 2.2.5. North Sea autumn spawning herring (NSAS), and western Baltic spring spawners (WBSS) caught in the North Sea in 2019. 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	**15.8%**	**0.0%**	**4.6%**	**0.0%**	**7.2%**	**48.0%**	**40.2%**	**0.0%**	**20.0%**	**5.4%**	**18.5%**	**18.3%**
1	**67.7%**	**0.7%**	**26.7%**	**0.0%**	**1.4%**	**5.0%**	**3.3%**	**0.0%**	**2.5%**	**0.4%**	**5.6%**	**2.3%**
2	**13.2%**	**6.5%**	**46.1%**	**0.0%**	**2.9%**	**2.1%**	**1.0%**	**3.2%**	**2.3%**	**2.9%**	**2.9%**	**3.1%**
3	**3.0%**	**11.1%**	**14.1%**	**7.3%**	**12.0%**	**4.7%**	**23.2%**	**24.3%**	**9.1%**	**24.2%**	**10.1%**	**10.9%**
4	**0.1%**	**5.5%**	**4.8%**	**4.5%**	**8.2%**	**3.2%**	**6.5%**	**17.6%**	**6.1%**	**16.1%**	**6.7%**	**7.1%**
5	**0.1%**	**29.9%**	**2.2%**	**34.4%**	**32.4%**	**14.3%**	**15.7%**	**28.4%**	**26.6%**	**26.7%**	**25.3%**	**26.2%**
6	**0.0%**	**24.9%**	**1.2%**	**28.8%**	**22.2%**	**13.8%**	**6.1%**	**14.5%**	**20.1%**	**13.4%**	**18.5%**	**19.2%**
7	**0.0%**	**7.9%**	**0.3%**	**9.2%**	**4.8%**	**4.6%**	**0.7%**	**3.5%**	**5.2%**	**3.2%**	**4.8%**	**4.9%**
8	**0.0%**	**6.2%**	**0.0%**	**7.2%**	**3.4%**	**1.3%**	**0.7%**	**2.9%**	**3.1%**	**2.6%**	**2.9%**	**3.0%**
9+	**0.0%**	**7.3%**	**0.0%**	**8.6%**	**5.4%**	**3.1%**	**2.6%**	**5.6%**	**4.9%**	**5.2%**	**4.7%**	**4.9%**
Sum 3+	**3.3%**	**92.8%**	**22.6%**	**100.0%**	**88.5%**	**44.9%**	**55.4%**	**96.8%**	**75.2%**	**91.3%**	**73.0%**	**76.3%**
Quarter: 1												
0	0.0%	0.0%	0.0%	0.0%	7.9%	35.3%	82.5%	0.0%	12.1%	31.7%	**12.4%**	**20.3%**
1	64.3%	1.2%	7.0%	0.0%	0.7%	2.9%	6.9%	0.0%	1.0%	2.6%	**26.2%**	**1.7%**
2	29.9%	10.3%	68.0%	0.0%	1.3%	6.5%	0.0%	0.0%	2.1%	0.0%	**12.4%**	**1.2%**
3	5.6%	15.4%	18.0%	0.0%	8.3%	9.7%	5.6%	46.0%	8.5%	30.5%	**13.0%**	**17.7%**
4	0.1%	6.7%	4.4%	0.0%	6.0%	4.2%	1.5%	14.5%	5.7%	9.5%	**4.5%**	**7.3%**
5	0.1%	24.9%	1.6%	0.0%	35.7%	15.7%	2.8%	27.8%	32.6%	18.2%	**16.2%**	**26.6%**
6	0.0%	25.0%	0.9%	0.0%	28.7%	15.8%	0.6%	6.5%	26.7%	4.3%	**10.5%**	**17.3%**
7	0.0%	8.8%	0.0%	53.3%	6.2%	5.6%	0.0%	3.8%	6.1%	2.3%	**2.8%**	**4.5%**
8	0.0%	6.6%	0.0%	39.6%	2.4%	4.1%	0.0%	0.0%	2.7%	0.0%	**0.9%**	**1.6%**
9+	0.0%	1.2%	0.0%	7.0%	2.9%	0.2%	0.2%	1.3%	2.5%	0.9%	**1.1%**	**1.8%**
Sum 3+	**5.8%**	**88.5%**	**24.9%**	**100.0%**	**90.1%**	**55.2%**	**10.6%**	**100.0%**	**84.8%**	**65.6%**	**49.0%**	**76.8%**
Quarter: 2												
0	0.0%	0.0%	0.0%	0.3%	3.0%	91.2%	88.7%	0.0%	0.0%	27.0%	**28.4%**	**28.6%**
1	97.6%	1.2%	22.9%	0.8%	0.3%	7.6%	7.4%	0.0%	3.8%	28.3%	**4.2%**	**2.8%**
2	1.8%	10.3%	30.1%	10.0%	8.6%	0.1%	0.0%	0.0%	9.1%	0.0%	**6.4%**	**6.6%**
3	0.6%	15.4%	17.2%	15.3%	18.3%	0.1%	2.0%	52.5%	16.6%	23.5%	**11.6%**	**11.8%**
4	0.0%	6.7%	10.1%	6.6%	7.0%	0.0%	0.5%	13.9%	6.7%	6.2%	**4.7%**	**4.8%**
5	0.0%	24.9%	8.5%	25.1%	27.1%	0.4%	1.0%	25.9%	25.7%	11.6%	**18.0%**	**18.3%**
6	0.0%	25.0%	5.7%	25.2%	24.1%	0.3%	0.2%	5.9%	24.2%	2.6%	**16.9%**	**17.2%**
7	0.0%	8.8%	4.7%	8.9%	6.4%	0.1%	0.0%	0.0%	7.5%	0.0%	**5.2%**	**5.3%**
8	0.0%	6.5%	0.7%	6.6%	4.9%	0.1%	0.0%	0.0%	5.6%	0.0%	**3.9%**	**4.0%**
9+	0.0%	1.2%	0.0%	1.2%	0.3%	0.1%	0.1%	1.9%	0.8%	0.8%	**0.5%**	**0.5%**
Sum 3+	**0.6%**	**88.5%**	**47.0%**	**88.8%**	**88.1%**	**1.0%**	**3.9%**	**100.0%**	**87.1%**	**44.7%**	**61.0%**	**61.9%**
Quarter: 3												
0	29.9%	0.0%	0.0%	0.0%	1.6%	30.6%	#DIV/0!	0.0%	11.2%	#DIV/0!	**12.0%**	**10.4%**
1	67.3%	0.0%	18.4%	0.0%	0.2%	2.2%	#DIV/0!	0.0%	0.8%	#DIV/0!	**3.5%**	**0.8%**
2	1.1%	0.0%	51.1%	0.0%	1.8%	3.7%	#DIV/0!	0.0%	2.4%	#DIV/0!	**2.4%**	**2.2%**
3	1.4%	4.4%	18.3%	0.0%	12.3%	5.8%	#DIV/0!	0.0%	10.2%	#DIV/0!	**9.8%**	**9.7%**
4	0.0%	3.6%	6.7%	0.0%	9.9%	4.2%	#DIV/0!	0.0%	8.0%	#DIV/0!	**7.7%**	**7.7%**
5	0.1%	38.9%	2.8%	0.0%	38.2%	21.3%	#DIV/0!	0.0%	32.6%	#DIV/0!	**31.3%**	**33.1%**
6	0.1%	23.6%	2.1%	0.0%	22.8%	19.6%	#DIV/0!	0.0%	21.7%	#DIV/0!	**20.9%**	**21.9%**
7	0.0%	5.8%	0.4%	0.0%	4.9%	6.3%	#DIV/0!	0.0%	5.4%	#DIV/0!	**5.1%**	**5.4%**
8	0.0%	4.4%	0.0%	0.0%	3.6%	2.0%	#DIV/0!	0.0%	3.1%	#DIV/0!	**3.0%**	**3.2%**
9+	0.0%	19.3%	0.0%	0.0%	4.6%	4.4%	#DIV/0!	0.0%	4.6%	#DIV/0!	**4.4%**	**5.6%**
Sum 3+	**1.7%**	**100.0%**	**30.4%**	**0.0%**	**96.4%**	**63.6%**	**#DIV/0!**	**0.0%**	**85.5%**	**#DIV/0!**	**82.2%**	**86.6%**
Quarter: 4												
0	29.0%	0.0%	14.6%	0.0%	28.9%	47.4%	0.0%	0.0%	35.9%	0.0%	**25.0%**	**24.8%**
1	64.9%	0.0%	54.1%	0.0%	6.7%	8.6%	0.0%	0.0%	7.3%	0.0%	**7.2%**	**5.0%**
2	4.5%	0.0%	22.1%	0.0%	2.2%	0.4%	2.0%	3.6%	1.3%	3.4%	**2.1%**	**2.0%**
3	1.4%	1.1%	5.4%	0.0%	6.5%	6.2%	40.0%	21.7%	6.1%	23.2%	**11.0%**	**11.4%**
4	0.1%	2.3%	2.3%	0.0%	4.1%	3.8%	11.3%	18.0%	3.8%	17.4%	**7.7%**	**8.1%**
5	0.1%	36.1%	1.3%	35.9%	17.1%	11.7%	27.9%	28.5%	15.4%	28.4%	**18.8%**	**19.5%**
6	0.0%	30.7%	0.1%	32.5%	17.7%	13.3%	11.3%	15.4%	16.3%	15.1%	**15.4%**	**15.9%**
7	0.0%	8.9%	0.0%	9.6%	3.2%	4.7%	1.3%	3.5%	4.0%	3.3%	**3.7%**	**3.8%**
8	0.0%	11.9%	0.1%	12.5%	1.4%	1.0%	1.4%	3.2%	1.6%	3.0%	**2.0%**	**2.1%**
9+	0.0%	8.9%	0.0%	9.5%	12.3%	2.9%	4.8%	6.1%	8.1%	6.0%	**7.2%**	**7.5%**
Sum 3+	**1.6%**	**100.0%**	**9.2%**	**100.0%**	**62.2%**	**43.6%**	**98.0%**	**96.4%**	**55.5%**	**96.6%**	**65.8%**	**68.2%**

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.

2018	**Fleet A**		**Fleet B**		**Fleet C**		**Fleet D**		**TOTAL**	
Winter rings	Numbers	Mean Weight	Numbers	Mean Weight	Numbers	Mean Weight	Numbers	Mean Weight	Numbers	Mean Weight
0	0.0	0.000	1322.9	0.005	0.1	0.022	14.4	0.010	1'337.4	0.005
1	8.6	0.089	45.5	0.026	17.6	0.050	1.6	0.036	73.3	0.039
2	175.9	0.118	1.9	0.027	28.2	0.057	0.3	0.044	206.2	0.108
3	199.4	0.145	0.0	0.000	1.1	0.105	0.0	0.048	200.5	0.145
4	1176.8	0.184	0.0	0.000	1.8	0.158	0.0	0.000	1'178.6	0.184
5	847.9	0.191	0.0	0.000	1.0	0.181	0.0	0.000	849.0	0.191
6	223.5	0.215	0.0	0.000	0.2	0.189	0.0	0.000	223.6	0.215
7	144.9	0.234	0.0	0.000	0.1	0.187	0.0	0.000	145.0	0.234
8	144.1	0.242	0.0	0.000	0.1	0.202	0.0	0.000	144.2	0.241
9+	188.3	0.249	0.0	0.000	0.0	0.000	0.0	0.000	188.3	0.249
TOTAL	3'109.3		1'370.3		50.2		16.3		4'546.1	
SOP catch		592.7		8.4		3.1		0.2		604.5
Figures for A fleet include unsampled bycatch in the industrial fishery										

2019	**Fleet A**		**Fleet B**		**Fleet C**		**Fleet D**		**TOTAL**	
Winter rings	Numbers	Mean Weight	Numbers	Mean Weight	Numbers	Mean Weight	Numbers	Mean Weight	Numbers	Mean Weight
0	0.0	0.000	526.2	0.006	6.2	0.022	17.5	0.008	550.0	0.007
1	6.7	0.057	57.0	0.032	95.4	0.042	5.9	0.027	165.0	0.039
2	66.1	0.192	0.0	0.000	19.5	0.062	0.3	0.039	85.9	0.162
3	292.5	0.150	0.0	0.000	4.5	0.085	0.1	0.065	297.1	0.149
4	197.5	0.170	0.0	0.000	0.1	0.116	0.0	0.000	197.6	0.170
5	742.4	0.204	0.0	0.000	0.1	0.118	0.0	0.000	742.5	0.204
6	543.8	0.208	0.0	0.000	0.1	0.165	0.0	0.000	543.8	0.208
7	140.0	0.219	0.0	0.000	0.0	0.202	0.0	0.000	140.0	0.219
8	85.6	0.236	0.0	0.000	0.0	0.159	0.0	0.000	85.6	0.236

2019	Fleet A		Fleet B		Fleet C		Fleet D		TOTAL	
Winter rings	Numbers	Mean Weight	Numbers	Mean Weight	Numbers	Mean Weight	Numbers	Mean Weight	Numbers	Mean Weight
9+	138.7	0.248	0.0	0.000	0.0	0.000	0.0	0.000	138.7	0.248
TOTAL	2'213.3		583.2		125.9		23.8		2'946.2	
SOP catch		440.5		5.2		5.8		0.3		451.7
Figures for A fleet include unsampled bycatch in the industrial fishery										

Table 2.2.7. Catch-at-age (numbers in millions) of North Sea herring, 2004–2019.

Year/rings	0	1	2	3	4	5	6	7	8	9+	Total
2004	627	136	274	1333	517	721	170	100	70	22	3970
2005	919	408	203	487	1326	480	577	116	108	39	4664
2006	844	72	354	309	475	1017	257	252	65	44	3689
2007	553	46	142	413	284	307	628	147	133	23	2677
2008	713	148	260	183	199	137	118	215	74	43	2090
2009	533	98	253	108	96	88	40	58	112	34	1421
2010	526	84	243	234	124	84	63	34	59	56	1508
2011	575	124	306	271	218	130	63	52	60	66	1865
2012	627	110	412	671	403	306	151	104	89	109	2982
2013	461	327	239	482	571	422	327	145	153	160	3287
2014	1104	309	303	380	616	487	284	192	92	123	3890
2015	508	225	454	241	282	456	431	270	167	170	3204
2016	1450	86	578	813	293	280	368	307	186	173	4534
2017	462	133	74	1075	836	222	146	176	107	115	3345
2018	1323	54	178	200	1179	852	225	146	144	189	4491
2019	513	35	34	292	197	740	542	140	85	138	2717

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, 2004–2019.

Year/rings	0	1	2	3	4	5	6	7	8	9+	Total
2004	0.0	0.0	15.1	27.9	3.5	4.1	1.0	0.5	0.1	0.0	52.3
2005	0.0	0.0	6.6	17.4	12.7	2.6	3.8	1.1	0.4	0.3	44.8
2006	0.0	0.1	3.5	8.8	14.0	22.4	5.1	5.3	2.1	1.0	62.2
2007	0.0	0.0	0.1	2.6	1.3	0.6	0.8	0.4	0.5	0.2	6.3
2008	0.0	0.0	0.1	0.1	0.2	0.1	0.1	0.2	0.0	0.0	0.7
2009	0.0	0.0	1.0	2.1	3.4	1.4	1.7	4.5	1.8	1.4	17.2
2010	0.0	0.0	0.0	0.5	1.0	0.4	0.5	0.3	0.3	0.7	3.8
2011	0.0	0.0	0.1	0.4	0.4	0.2	0.1	0.1	0.1	0.2	1.6
2012	0.0	0.0	0.0	0.2	0.4	0.0	1.4	0.0	1.1	6.3	9.4
2013	0.0	0.0	0.1	0.4	0.2	0.5	0.3	0.1	0.2	0.5	2.2
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

Table 2.2.9. Catch-at-age (numbers in millions) of NSAS taken in 3.a, and transferred to the assessment of NSAS, 2004–2019.

Year/rings	0	1	2	3	4	5	6	7	8+	Total
2004	88.4	70.9	179.9	20.7	6.0	9.7	1.8	2.0	0.9	380.4
2005	96.4	307.5	159.2	16.2	5.4	2.4	2.3	0.5	0.2	589.9
2006	35.1	150.1	50.2	10.2	3.3	3.3	0.6	0.4	0.2	253.3
2007	67.7	189.3	76.9	2.1	0.4	1.4	0.3	0.6	0.0	338.7
2008	85.7	86.6	72.0	1.9	0.3	0.1	0.1	0.3	0.1	247.0
2009	116.8	77.5	7.0	0.4	0.2	0.0	0.0	0.0	0.1	202.0
2010	48.6	197.0	43.3	0.3	0.1	0.1	0.0	0.1	0.0	289.6
2011	203.8	35.4	61.5	3.2	0.3	0.2	0.1	0.1	0.0	304.6
2012	145.8	174.9	43.7	1.9	1.2	0.2	0.2	0.1	0.0	368.0

Year/rings	0	1	2	3	4	5	6	7	8+	Total
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	0.0

Table 2.2.10. Catch-at-age (numbers in millions) of the total NSAS stock 2004–2019.

Year/rings	0	1	2	3	4	5	6	7	8	9+	Total
2004	716	207	439	1326	520	726	171	101	71	22	4298
2005	1016	716	355	486	1318	480	576	115	108	39	5209
2006	879	222	401	311	465	999	253	249	63	44	3885
2007	621	236	219	412	283	308	628	147	132	23	3009
2008	798	235	332	185	199	137	118	215	74	43	2336
2009	650	176	259	107	93	86	38	53	110	33	1606
2010	575	281	287	233	123	83	63	34	59	55	1794
2011	779	160	368	274	218	130	63	52	60	65	2168
2012	773	285	455	673	404	306	150	104	88	102	3341
2013	462	413	325	484	571	422	327	145	152	160	3461
2014	1389	371	383	386	617	488	285	192	92	123	4323
2015	538	395	552	248	283	461	432	271	168	170	3517
2016	1584	109	625	819	293	280	368	307	186	173	4745
2017	462	209	109	1080	838	223	146	176	107	115	3463
2018	1337	73	206	201	1179	849	224	145	144	188	4546
2019	537	137	54	296	197	740	542	140	85	138	2866

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 2009–2019

		Age (Rings)							
Division	Year	2	3	4	5	6	7	8	9+
3.a	2009	0.101	0.082	0.206	0.000	0.000	0.000	0.269	-
	2010	0.077	0.122	0.149	0.191	0.221	0.216	0.205	-
	2011	0.084	0.114	0.134	0.191	0.193	0.234	0.248	-
	2012	0.067	0.124	0.169	0.175	0.200	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	-
4.a(E)	2009	0.139	0.167	0.208	0.219	0.232	0.245	0.253	0.288
	2010	0.131	0.154	0.201	0.201	0.210	0.223	0.248	0.235
	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
	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
4.a(W)	2009	0.152	0.180	0.211	0.223	0.266	0.251	0.252	0.278
	2010	0.137	0.166	0.195	0.223	0.220	0.216	0.236	0.252
	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

		Age (Rings)							
Division	Year	2	3	4	5	6	7	8	9+
	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
4.b	2009	0.140	0.188	0.228	0.219	0.223	0.243	0.255	0.255
	2010	0.134	0.176	0.182	0.229	0.237	0.235	0.232	0.265
	2011	0.145	0.162	0.187	0.206	0.235	0.234	0.240	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

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 2009–2019.

		Age (Rings)							
Division	Year	2	3	4	5	6	7	8	9+
4.a & 4.b	2009	0.142	0.183	0.217	0.221	0.248	0.248	0.253	0.277
	2010	0.136	0.167	0.192	0.224	0.222	0.220	0.236	0.250
	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

		Age (Rings)							
Division	Year	2	3	4	5	6	7	8	9+
	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
4.c & 7.d	2009	0.156	0.162	0.197	0.197	0.211	0.192	0.219	0.244
	2010	0.145	0.167	0.187	0.204	0.207	0.207	0.223	0.216
	2011	0.122	0.154	0.179	0.189	0.195	0.205	0.209	0.217
	2012	0.119	0.165	0.186	0.202	0.212	0.234	0.209	0.226
	2013	0.126	0.144	0.180	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
Total	2009	0.145	0.181	0.216	0.216	0.239	0.243	0.248	0.273
North Sea	2010	0.138	0.167	0.192	0.222	0.219	0.217	0.234	0.245
Catch	2011	0.141	0.160	0.183	0.197	0.217	0.221	0.223	0.240
	2012	0.130	0.171	0.185	0.206	0.222	0.239	0.239	0.247
	2013	0.131	0.156	0.198	0.198	0.215	0.233	0.234	0.241
	2014	0.137	0.173	0.186	0.215	0.212	0.226	0.244	0.241
	2015	0.123	0.154	0.188	0.200	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
	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

Table 2.2.12. Sampling of commercial landings of North Sea herring (Division 4 and 7.d) in 2019 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 measured	>1 sample per 1 kt catch
Belgium	1	2	0	0%	7	0	0	0	n
	2	1	0	0%	0	0	0	0	n
	3	1	0	0%	0	0	0	0	n
	4	2	0	0%	52	0	0	0	n
total		**6**	**0**	**0%**	**60**	**0**	**0**	**0**	**n**
Denmark (A)	1	3	1	99%	5450	3	81	360	y
	2	2	1	94%	4819	1	29	112	y
	3	2	2	100%	58076	37	1036	4217	y
	4	2	2	100%	18268	9	252	948	y
total		**9**	**6**	**100%**	**86612**	**50**	**1398**	**5637**	**y**
Denmark (B)	1	3	0	0%	104	0	0	0	n
	2	3	1	95%	938	3	23	47	y
	3	3	1	90%	1023	42	382	798	y
	4	2	1	57%	3004	16	92	99	y
total		**11**	**3**	**70%**	**5069**	**61**	**497**	**944**	**y**
UK(E&W)	1	3	1	81%	483	4	100	339	y
	2	4	1	100%	1061	24	599	4553	y
	3	4	1	62%	7177	21	524	2387	y
	4	4	0	0%	3964	0	0	0	n
total		**15**	**3**	**46%**	**12686**	**49**	**1223**	**7279**	**y**
France	1	2	0	0%	1285	0	0	0	n
	2	5	0	0%	1596	0	0	0	n
	3	4	0	0%	10496	0	0	0	n
	4	5	0	0%	12741	0	0	0	n
total		**16**	**0**	**0%**	**26119**	**0**	**0**	**0**	**n**
Germany	2	2	1	100%	5045	25	118	7913	y

Country (fleet)	Q	Métiers (n)	Métiers sampled	Sam. Catch (%)	Official Catch	Samples	Fish aged	Fish measured	>1 sample per 1 kt catch
	3	2	1	71%	20341	19	155	7214	y
	4	3	1	75%	12313	44	176	14282	y
total		**7**	**3**	**76%**	**37700**	**88**	**449**	**29409**	**y**
Ireland	1	1	0	0%	3	0	0	0	n
total		**1**	**0**	**0%**	**3**	**0**	**0**	**0**	**n**
Netherlands	1	1	1	100%	1021	1	25	289	y
	3	2	2	100%	56315	55	1372	6774	y
	4	4	1	61%	22128	4	100	598	y
total		**7**	**4**	**89%**	**79464**	**60**	**1497**	**7661**	**y**
Norway	1	2	0	0%	848	0	0	0	n
	2	3	2	100%	56633	22	944	1342	y
	3	3	3	100%	51641	15	544	868	y
	4	3	3	100%	19492	5	190	257	y
total		**11**	**8**	**99%**	**128613**	**42**	**1678**	**2467**	**y**
UK(Scotland)	1	1	0	0%	13	0	0	0	n
	2	1	1	100%	1473	5	199	744	y
	3	1	1	100%	46692	21	840	3057	y
	4	1	0	0%	2593	0	0	0	n
total		**4**	**2**	**95%**	**50771**	**26**	**1039**	**3801**	**y**
Sweden	1	1	0	0%	876	0	0	0	n
	2	1	0	0%	1371	0	0	0	n
	3	3	0	0%	9660	0	0	0	n
	4	2	0	0%	1985	0	0	0	n
total		**7**	**0**	**0%**	**13892**	**0**	**0**	**0**	**n**
Sweden (B)	2	1	0	0%	15	0	0	0	n
	3	1	0	0%	72	0	0	0	n
	4	2	0	0%	5	0	0	0	n

Country (fleet)	Q	Métiers (n)	Métiers sampled	Sam. Catch (%)	Official Catch	Samples	Fish aged	Fish measured	>1 sample per 1 kt catch
total		**4**	**0**	**0%**	**92**	**0**	**0**	**0**	**n**
Faroese	1	1	0	0%	6	0	0	0	n
	3	2	0	0%	251	0	0	0	n
	4	1	0	0%	357	0	0	0	n
total		**4**	**0**	**0%**	**613**	**0**	**0**	**0**	**n**
UK(NI)	3	1	0	0%	3777	0	0	0	n
	4	1	0	0%	161	0	0	0	n
total		**2**	**0**	**0%**	**3939**	**0**	**0**	**0**	**n**
grand total		**104**	**29**	**83%**	**445633**	**376**	**7781**	**57198**	**n**
Period total	**1**	18	5	68%	10095	8	206	988	n
Period total	**2**	23	6	95%	72951	80	1912	14711	y
Period total	**3**	32	13	88%	265522	210	4853	25315	n
Period total	**4**	30	9	64%	97064	78	810	16184	n
Total 2019		**104**	**29**	**83%**	**445633**	**376**	**7781**	**57198**	**n**
Human Cons. only		92	28	83%	440471	315	7284	56254	n
Total 2017		100	27	84%	491694	326	7783	58280	n
Total 2018		103	33	83%	602328	394	8868	63991	n
Human Cons. only		92	28	84%	593851	326	8354	63030	n

2.3.1.1. North Sea herring. Acoustic Surveys in the North Sea (HERAS) in June–July 2019. Vessels, areas and cruise dates.

Vessel	Period	Contributing to Stocks	Strata
Celtic Explorer (IRL) EIGB	4 – 24 July	MSHAS, WoS	2, 3, 4, 5, 6
Scotia (SCO) MXHR6	27 June – 19 July	MSHAS,WoS, NSAS, Sprat NS	1, 91 (north of 58°30'N), 111, 121
Johan Hjort (NOR) LDGJ	29 June – 16 July	NSAS, WBSS, Sprat NS	11, 141
Tridens (NED) PBVO	1 – 18 July	NSAS, Sprat NS	81, 91 (south of 58°30'N), 101
Solea (GER) DBFH	28 June – 18 July	NSAS, Sprat NS	51, 61, 71, 131
Dana (DEN) OXBH	25 June – 09 July	NSAS, WBSS, Sprat NS, Sprat 3.a	21, 31, 41, 42, 151, 152

Table 2.3.1.2. North Sea herring. Acoustic Surveys in the North Sea (HERAS) in June–July 2019. 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	4,573	15	0.00	3.3	7.7
1	10,146	384	0.01	37.8	16.6
2	1,303	137	0.59	105.1	22.8
3	2,345	339	0.97	144.5	25.2
4	1,212	196	0.99	161.8	26.1
5	3,506	718	1.00	204.8	27.8
6	1,657	374	1.00	225.8	28.6
7	395	95	1.00	240.3	29.3
8	252	65	1.00	258.0	30.1
9+	172	44	1.00	255.8	30.1
Immature	15,265	448		29.3	14.1
Mature	10,295	1,919		186.4	27.0
Total	25,560	2,366	0.40	92.6	19.3

Table 2.3.1.3. Estimates of North Sea autumn spawners (millions) at age from acoustic surveys, 1986–2019. 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

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

	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
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

	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.
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
2012		19552		5856		517		22768	11103	3285
2013		21282		8618		7354		5	9314	2957
2014		6604		5033		1149				1851

	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.
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	

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 2019 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 1994, calculated with the old algorithm, are recorded in the stock annex.

Area	Northwest	Northeast	Central west	Central east	Southwest	Southeast	Division 3.a	South'Bight	IBTS-0 index
Area m^2 x 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

Area	Northwest	Northeast	Central west	Central east	Southwest	Southeast	Division 3.a	South'Bight	IBTS-0 index
Area $m^2 \times 10^9$	83	34	86	102	37	93	31	31	
Year class									no. in 10^9
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
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

Table 2.3.3.2. North Sea herring. Indices of 1-ringers from the IBTS 1st Quarter for the 1995 to 2018 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

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
2001	2003	2837	664	0.23	180	0.06	0.75
2002	2004	979	665	0.68	710	0.73	0.01
2003	2005	1015	341	0.34	357	0.35	0.02
2004	2006	900	115	0.13	121	0.13	0.02
2005	2007	1322	303	0.23	304	0.23	0.07
2006	2008	1792	417	0.23	444	0.25	0.01
2007	2009	2339	734	0.31	623	0.27	0.21
2008	2010	1206	279	0.23	286	0.24	0.05
2009	2011	2939	1331	0.45	1407	0.48	0.02
2010	2012	1353	279	0.21	288	0.21	0.04
2011	2013	1665	747	0.45	796	0.48	0.01
2012	2014	2615	1297	0.5	1245	0.48	0.11
2013	2015	3918	1808	0.46	1105	0.28	0.43
2014	2016	783	368	0.47	364	0.47	0.08
2015	2017	2396	1306	0.54	1008	0.42	0.28
2016	2018	778	406	0.52	424	0.55	0.03
2017	2019	1543	432	0.28	397	0.26	0.15
2018	2020	1021	168	0.16	150	0.15	0.17

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

W. rings	1		2		3		4		5		6		7		8		9+	
Year	AS	3Q	AS	3Q	AS	3Q	AS	3Q	AS	3Q	AS	3Q	AS	3Q	AS	3Q	AS	3Q
1996	45	75	119	135	196	186	253	224	262	229	299	253	306	292	325	300	335	302
1997	45	43	120	129	168	175	233	220	256	247	245	255	265	278	269	295	329	295
1998	52	54	109	131	198	172	238	209	275	237	307	263	289	269	308	313	363	298
1999	52	62	118	128	171	163	207	193	236	228	267	252	272	263	230	275	260	306
2000	46	54	118	123	180	172	218	201	232	228	261	241	295	266	300	286	280	271
2001	50	69	127	136	162	167	204	199	228	218	237	237	255	262	286	288	294	298

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

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 2019. 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

Year \ Ring	2	3	4	5	6	7+
1995	72.6	95.4	100	100	100	100
1996	60.5	97.5	100	100	100	100
1997	64.0	94.2	100	100	100	100
1998	64.0	89.0	100	100	100	100
1999	81.0	91.0	100	100	100	100
2000	66.0	96.0	100	100	100	100
2001	77.0	92.0	100	100	100	100
2002	86.0	97.0	100	100	100	100
2003	43.0	93.0	100	100	100	100
2004	69.8	64.9	100	100	100	100
2005	76.0	97.0	96.0	100	100	100
2006	66.0	88.0	98.0	100	100	100
2007	71.0	92.0	93.0	100	100	100
2008	86.0	98.0	99.0	100	100	100
2009	89.0	100	100	100	100	100
2010	45.0	90.0	100	100	100	100
2011	87.0	84.0	99.0	100	100	100
2012	91.0	99.0	100	100	100	100
2013	83.0	96.0	98.0	100	100	100
2014	85.0	100	100	100	100	100
2015	70.0	90.0	96.0	98.0	99.0	100
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

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	1972–2019	1973–2019
IBTS 1st Quarter (Trawl survey)	1 wr	1971–2020	1984–2020
IBTS 3rd Quarter (Trawl survey)	0-5 wr	1991–2019	1998–2019
Acoustic (+trawl)	1 wr	1995–2019	1997–2019
	2-9+ wr	1984–2019	1989–2019
IBTS0	0wr	1977–2020	1992–2020

Table 2.6.2.1. North Sea Herring multifleet assessment. CATCH IN NUMBER

```
Units  :  thousands
, , area = A

   year
age   1997    1998    1999   2000   2001   2002   2003       2004
  0      0       0     900  14300      0      0   1700       0.00
  1  18400   19200   36900  93500  35600  77500  59200    2742.34
  2 445900 1024600  479700 486700 682400 427200 952900  252943.50
  3 419500  497300 1004700 470400 469200 874300 502000 1298647.98
  4 245600  252700  280700 587200 258200 281500 799100  510566.17
  5  85900  157300  130900 183000 293000 131400 240500  714620.51
  6  22800   81500   66600  77700  70200 159700 104700  168564.45
  7  10800   15100   25800  27800  39700  46000 118800   99086.33
  8  17900   18900   11800  18700  41000  40400  45100   91784.49
   year
age       2005        2006      2007      2008      2009      2010
  0     370.83    7626.329  20518.61  66326.54  39555.07      0.00
  1   42294.69   14317.025  21000.11  78367.74  20895.89  49098.41
  2  196263.51  334087.797 142145.56 259696.77 240765.77 237386.41
  3  469506.01  308175.624 412754.88 182805.52 108033.06 229567.90
  4 1313016.96  471796.256 284048.94 198652.09  96475.11 123132.74
  5  477572.01 1012566.583 307418.28 137305.38  87559.66  79783.41
  6  573577.13  257502.800 628121.13 118211.91  39482.25  57479.29
  7  114689.37  253325.080 146819.94 215029.23  57601.93  34204.88
  8  146939.01  109356.448 156120.28 117158.05 146172.09 115361.78
   year
age      2011      2012     2013      2014      2015      2016       2017
  0      0.01    964.83      0.0  51827.64      0.00      0.00       0.03
  1  10953.93  42583.90 220314.1 123489.43  22069.38   2266.73   11429.50
  2 306229.46 404364.31 218399.5 301326.88 454232.46 556167.33   74276.48
  3 270916.44 667132.00 481777.5 377968.23 240596.59 807104.45 1072939.39
  4 217634.40 402719.28 569285.6 612183.09 281558.31 292667.90  834803.34
  5 129485.21 305311.44 421526.1 482925.60 456147.89 281288.52  221588.33
  6  62683.39 149493.78 326237.7 282534.63 430922.75 368010.60  145439.64
  7  51767.93 104341.73 144913.5 190210.26 270074.10 308001.17  175489.28
  8 125119.00 197582.57 312128.9 212506.33 337460.94 360221.01  221268.20
   year
```

```
age       2018      2019
  0       0.04      0.00
  1    8556.77   6686.63
  2  175851.85  66073.41
  3  199400.70 292527.33
  4 1176811.03 197463.35
  5  847919.28 742358.54
  6  223453.20 543779.12
  7  144881.43 140033.26
  8  332397.32 224359.57

, , area = BD

   year
age   1997   1998    1999    2000    2001   2002   2003       2004
  0 448300 242990 1522300 1031400 1816600 787100 365500 702371.337
  1 259500 337250  112500  589900   47000 574500 390300 185134.240
  2  78300  54910   38400   28800   31000  83000 109400  71603.232
  3   9000   2980   22400    5400    9100  24000   2600  15440.534
  4   1100   5610    4700    6000   10700   1800   4600   4504.390
  5   2800   1120    1200     800    1100   1600    400   2897.281
  6    200    600     800     300    4800   1400    500    977.078
  7      0    100     300     300     500    200    500    299.094
  8      0    200       0    1300     100    200    100    512.507
   year
age        2005       2006       2007       2008       2009       2010
  0 1003835.615 864978.971 586298.647 727620.103 609519.988 643205.527
  1  498688.950 114605.971  64277.477  97442.846 105416.413 111048.081
  2   43321.434  28405.157  17371.465  19427.299  13252.754  10588.055
  3    3737.874   3859.262    209.353    194.806    435.122   3799.599
  4     620.600   4620.192     99.051     15.738      4.254   1093.668
  5     234.316   5962.889     79.327      0.893      0.000   3626.372
  6     327.427    147.662    102.353      0.402    201.157   5612.243
  7     198.327     87.525     12.457      0.356      0.000      0.000
  8       0.000    522.397      2.512      1.507      0.052      0.000
   year
age       2011       2012      2013        2014     2015        2016
  0 776665.373 771659.094 460672.00 1336408.279 536231.8 1583567.508
  1 129136.779 171619.280 128349.36  196353.428 322104.5   96041.970
  2   1747.186  14766.265  37946.21   20507.573  19630.0   28404.041
  3    157.498   4258.114    715.72    1816.481     90.0    9714.031
  4      0.000      0.000   1476.07    1632.259      0.0    1204.270
  5      0.000    732.084    466.07    2421.874     20.0      86.382
  6      0.000   1449.227    663.62     837.241      0.0     793.000
  7      0.000      0.000    349.61     808.671      0.0       0.000
  8      0.000    418.334    863.24    1187.871      0.0       0.000
   year
age      2017       2018   2019
  0 462000.31 1337301.27 543700
  1 122289.22   47122.62  62900
  2   7683.74    2180.96    300
  3      2.04      10.15    100
  4      0.00       0.00      0
```

```
  5      0.00       0.00      0
  6      0.00       0.00      0
  7      0.00       0.00      0
  8      0.00       0.00      0

, , area = C

   year
age   1997   1998   1999   2000   2001   2002   2003       2004       2005
  0   8900  18800  42000  63100  16100  10200   1900  13224.659  11348.035
  1 249000 649500 180600 485400 344000 201000 167500  18781.670 174563.971
  2 156000 141200 129300 105800 140900  51500 142100 114216.281 115852.028
  3  67300  25600  50200  21400  16600   5100  12400  12034.393  12432.805
  4  11800  18200  13000  19800   1400    700  16000   4433.049   4734.859
  5   5500   2700   6000   7500    300    200   1800   8716.986   2142.120
  6   1700   3100   1200   2900    500    100   1100   1608.338   1946.357
  7    700   1200    400    300      0      0   1200   1857.617    276.878
  8    900    500    400    100      0      0    200    848.599    160.680
   year
age      2006       2007      2008      2009       2010      2011
  0  6031.506  14188.186  4338.255   967.532     63.893  2261.893
  1 93313.152 150276.724 59212.038 49610.797 120464.527 19413.633
  2 42052.087  59524.312 52575.827  6432.312  39362.171 59715.483
  3  7329.826   1862.450  1683.228   343.800    284.818  3058.037
  4  2417.487    346.167   234.935   217.338    144.577   277.768
  5  2109.206   1362.359   146.281     0.000     99.120   171.243
  6   416.577    158.925    56.015     0.000     16.488   117.299
  7   290.241    620.013   330.892     0.000     59.490    93.709
  8   129.495     16.100    63.793   102.543     13.971    18.963
   year
age      2012  2013      2014  2015      2016     2017     2018  2019
  0   617.894   900   261.842  2000     0.000   148.46   102.51  6200
  1 70566.848 64340 50303.335 50700 10846.292 75638.58 17581.87 95400
  2 35450.808 68520 60071.599 77940 42121.171 26745.53 28198.77 19500
  3  1822.980  2280  4985.472  6870  5877.935  6912.92  1115.21  4500
  4  1140.440   340   544.423  1250   531.712  2967.48  1794.09   100
  5   189.311   280   497.966  4870   213.924  1201.98  1041.36   100
  6   195.812     0   173.621  1110   221.875    72.12   183.59   100
  7   111.160     0    26.221  1200    34.396    45.37   122.36     0
  8    29.343     0    55.559   350    63.288    28.42    89.75     0
```

Table 2.6.2.2. North Sea Herring multifleet assessment. WEIGHTS AT AGE IN THE CATCH

```
Units  :  kg
, , area = A

   year
age      1997      1998      1999      2000     2001      2002      2003
  0 0.0000000 0.0000000 0.0090000 0.0170000 0.000000 0.0000000 0.0380000
  1 0.0800000 0.0730000 0.0660000 0.0770000 0.104000 0.0820000 0.0780000
  2 0.1180000 0.1200000 0.1240000 0.1270000 0.126000 0.1290000 0.1150000
  3 0.1480000 0.1460000 0.1530000 0.1600000 0.149000 0.1530000 0.1580000
  4 0.1920000 0.1840000 0.1700000 0.1800000 0.175000 0.1690000 0.1740000
```

```
  5 0.2300000 0.2210000 0.2080000 0.2000000 0.194000 0.1990000 0.1850000
  6 0.2300000 0.2370000 0.2330000 0.2190000 0.216000 0.2150000 0.2040000
  7 0.2280000 0.2500000 0.2440000 0.2440000 0.229000 0.2280000 0.2210000
  8 0.2602961 0.2805291 0.2718305 0.2707487 0.221922 0.2505347 0.2358647
   year
age      2004      2005      2006      2007      2008      2009      2010
  0 0.0000000 0.1190000 0.0650000 0.0080000 0.0100000 0.0170000 0.0000000
  1 0.0730000 0.0880000 0.1110000 0.0990000 0.0610000 0.0760000 0.0860000
  2 0.1210000 0.1220000 0.1270000 0.1490000 0.1410000 0.1480000 0.1390000
  3 0.1380000 0.1550000 0.1450000 0.1520000 0.1800000 0.1810000 0.1670000
  4 0.1830000 0.1660000 0.1720000 0.1640000 0.1810000 0.2160000 0.1920000
  5 0.2060000 0.2080000 0.1810000 0.1940000 0.1830000 0.2160000 0.2220000
  6 0.2210000 0.2230000 0.2200000 0.1900000 0.2160000 0.2390000 0.2220000
  7 0.2290000 0.2400000 0.2370000 0.2240000 0.2160000 0.2430000 0.2170000
  8 0.2467643 0.2657338 0.2460451 0.2375272 0.2622255 0.2538328 0.2393368
   year
age      2011     2012      2013      2014      2015      2016      2017
  0 0.0000000 0.035000 0.0000000 0.0180000 0.0000000 0.0000000 0.0000000
  1 0.1120000 0.086000 0.0460000 0.0840000 0.0750000 0.1020000 0.0832800
  2 0.1410000 0.131000 0.1400000 0.1370000 0.1230000 0.1350000 0.1136900
  3 0.1600000 0.171000 0.1560000 0.1730000 0.1540000 0.1560000 0.1561400
  4 0.1830000 0.185000 0.1980000 0.1860000 0.1880000 0.1810000 0.1732200
  5 0.1970000 0.206000 0.1980000 0.2150000 0.2000000 0.2060000 0.1884900
  6 0.2170000 0.222000 0.2150000 0.2120000 0.2210000 0.2150000 0.2145200
  7 0.2210000 0.239000 0.2330000 0.2260000 0.2170000 0.2310000 0.2203100
  8 0.2318784 0.243845 0.2375962 0.2428564 0.2345792 0.2296907 0.2307355
   year
age      2018      2019
  0 0.0000000 0.0000000
  1 0.0890300 0.0574700
  2 0.1175900 0.1923500
  3 0.1453400 0.1498000
  4 0.1838400 0.1700300
  5 0.1914100 0.2041100
  6 0.2151200 0.2081100
  7 0.2342400 0.2190000
  8 0.2455873 0.2434669

, , area = BD

   year
age       1997       1998        1999       2000       2001       2002
  0 0.01494580 0.01928857 0.009363923 0.01434264 0.01194930 0.01240503
  1 0.02865087 0.03231327 0.029272000 0.01893101 0.02900000 0.02303098
  2 0.04290294 0.06041595 0.066093750 0.06787500 0.05234839 0.05288193
  3 0.09153333 0.11767785 0.123714286 0.12972222 0.09616484 0.11445833
  4 0.12472727 0.13614439 0.142531915 0.14900000 0.12600000 0.16755556
  5 0.15035714 0.19657143 0.163000000 0.11900000 0.12100000 0.18000000
  6 0.15700000 0.21000000 0.174000000 0.18900000 0.12200000 0.19300000
  7 0.00000000 0.23200000 0.165000000 0.17000000 0.15400000 0.22800000
  8 0.00000000 0.28500000 0.000000000 0.19900000 0.25100000 0.24400000
   year
age       2003       2004       2005       2006       2007        2008
```

```
  0 0.01343119 0.01396358 0.01133906 0.01010078 0.01191188 0.007894138
  1 0.02360108 0.03315918 0.03273352 0.02647022 0.03649933 0.036908795
  2 0.04800000 0.07020707 0.06800000 0.05114936 0.05900000 0.085000000
  3 0.11653846 0.11005543 0.10500000 0.11453979 0.08500000 0.110000000
  4 0.13278261 0.14056193 0.15800000 0.15009706 0.13000000 0.133000000
  5 0.16200000 0.17357541 0.15700000 0.16580142 0.14500000 0.187000000
  6 0.16880000 0.17186877 0.16000000 0.19700000 0.19100000 0.161000000
  7 0.17800000 0.20480886 0.17800000 0.22500000 0.16500000 0.184000000
  8 0.17800000 0.23136654 0.00000000 0.21352474 0.21600000 0.159000000
   year
age       2009       2010        2011       2012       2013        2014
  0 0.00900000 0.00700000 0.007740515 0.01037637 0.00800000 0.007425728
  1 0.02991054 0.02686938 0.033147062 0.02889486 0.02685119 0.029558819
  2 0.08613572 0.06883792 0.045000000 0.07448209 0.04592681 0.026215384
  3 0.14813705 0.18399001 0.071000000 0.13067637 0.14816174 0.116530800
  4 0.18600000 0.14300000 0.000000000 0.00000000 0.19718703 0.188000000
  5 0.00000000 0.20500000 0.000000000 0.19500000 0.28800000 0.214000000
  6 0.31200000 0.19100000 0.000000000 0.16000000 0.21500000 0.206000000
  7 0.00000000 0.00000000 0.000000000 0.00000000 0.23300000 0.227000000
  8 0.26300000 0.00000000 0.000000000 0.18400000 0.23400000 0.226309343
   year
age        2015       2016       2017        2018        2019
  0 0.008428322 0.00700000 0.00890000 0.005449234 0.006064374
  1 0.020214437 0.02126004 0.02636988 0.026532076 0.031531002
  2 0.055000000 0.05212731 0.02479000 0.029537017 0.039000000
  3 0.095000000 0.08397668 0.07500000 0.048000000 0.065000000
  4 0.000000000 0.09300000 0.00000000 0.000000000 0.000000000
  5 0.147000000 0.07800000 0.00000000 0.000000000 0.000000000
  6 0.000000000 0.14600000 0.00000000 0.000000000 0.000000000
  7 0.000000000 0.00000000 0.00000000 0.000000000 0.000000000
  8 0.000000000 0.00000000 0.00000000 0.000000000 0.000000000

, , area = C

   year
age  1997  1998  1999  2000  2001  2002  2003  2004  2005  2006  2007
  0 0.021 0.029 0.018 0.022 0.025 0.015 0.013 0.024 0.027 0.020 0.048
  1 0.032 0.060 0.054 0.041 0.066 0.054 0.054 0.060 0.065 0.068 0.071
  2 0.084 0.082 0.091 0.078 0.076 0.101 0.073 0.069 0.072 0.081 0.075
  3 0.130 0.119 0.118 0.108 0.108 0.120 0.124 0.120 0.106 0.119 0.111
  4 0.170 0.163 0.139 0.164 0.130 0.143 0.151 0.138 0.154 0.141 0.123
  5 0.183 0.178 0.159 0.191 0.147 0.161 0.163 0.149 0.175 0.184 0.152
  6 0.192 0.196 0.191 0.183 0.221 0.179 0.193 0.169 0.189 0.188 0.179
  7 0.194 0.179 0.202 0.212 0.179 0.177 0.214 0.187 0.216 0.213 0.175
  8 0.201 0.226 0.210 0.198 0.000 0.000 0.187 0.178 0.209 0.206 0.144
   year
age  2008  2009  2010  2011  2012  2013  2014  2015  2016    2017    2018
  0 0.036 0.018 0.028 0.021 0.027 0.034 0.014 0.015 0.000 0.03380 0.02163
  1 0.071 0.086 0.072 0.053 0.065 0.091 0.065 0.042 0.054 0.05160 0.04951
  2 0.087 0.102 0.080 0.085 0.073 0.080 0.090 0.071 0.061 0.08015 0.05690
  3 0.109 0.081 0.122 0.115 0.124 0.135 0.117 0.133 0.124 0.10318 0.10484
  4 0.139 0.207 0.149 0.134 0.169 0.161 0.162 0.157 0.149 0.13839 0.15789
  5 0.168 0.000 0.191 0.191 0.175 0.200 0.191 0.180 0.188 0.17196 0.18110
```

```
  6 0.175 0.000 0.221 0.193 0.199 0.000 0.209 0.196 0.208 0.15292 0.18925
  7 0.203 0.000 0.216 0.234 0.220 0.000 0.221 0.197 0.209 0.14710 0.18664
  8 0.199 0.269 0.205 0.248 0.216 0.000 0.228 0.215 0.235 0.15980 0.20210
   year
age  2019
  0 0.022
  1 0.042
  2 0.062
  3 0.085
  4 0.116
  5 0.118
  6 0.165
  7 0.202
  8 0.000
```

Table 2.6.2.3. North Sea Herring multifleet assessment. WEIGHTS AT AGE IN THE STOCK

```
Units  :  kg
, , area = A

   year
age       1997        1998       1999        2000       2001        2002
  0 0.00500000 0.005666667 0.00600000 0.005666667 0.00600000 0.006333333
  1 0.04866667 0.047333333 0.05066667 0.051333333 0.05066667 0.047333333
  2 0.12333333 0.116000000 0.11600000 0.115666667 0.12166667 0.128000000
  3 0.18333333 0.187333333 0.17933333 0.183666667 0.17166667 0.171666667
  4 0.23033333 0.241333333 0.22633333 0.221333333 0.21000000 0.205333333
  5 0.23733333 0.264333333 0.25600000 0.248333333 0.23266667 0.228333333
  6 0.25666667 0.283666667 0.27333333 0.278666667 0.25533333 0.248333333
  7 0.28033333 0.286666667 0.27600000 0.286000000 0.27466667 0.270333333
  8 0.31004007 0.308339011 0.27811880 0.284171183 0.27449422 0.286521182
   year
age        2003        2004        2005        2006       2007       2008
  0 0.006666667 0.006666667 0.005666667 0.006666667 0.00600000 0.00800000
  1 0.047000000 0.042000000 0.041333333 0.041000000 0.05133333 0.05766667
  2 0.123000000 0.119333333 0.118000000 0.125666667 0.12800000 0.13033333
  3 0.173000000 0.165333333 0.164333333 0.155333333 0.16066667 0.16433333
  4 0.202333333 0.202666667 0.198000000 0.191000000 0.17966667 0.18066667
  5 0.222000000 0.223000000 0.224666667 0.216000000 0.20700000 0.19533333
  6 0.242333333 0.247666667 0.248000000 0.242000000 0.22366667 0.21766667
  7 0.265666667 0.267666667 0.265000000 0.252333333 0.23800000 0.22600000
  8 0.284946134 0.280490193 0.284851772 0.270150625 0.25639104 0.25556215
   year
age        2009        2010        2011       2012       2013        2014
  0 0.007333333 0.007333333 0.006666667 0.00600000 0.00600000 0.005666667
  1 0.061333333 0.052000000 0.043000000 0.04033333 0.04033333 0.043333333
  2 0.137333333 0.142333333 0.145666667 0.13800000 0.13566667 0.128666667
  3 0.181000000 0.190333333 0.187333333 0.18200000 0.17466667 0.176666667
  4 0.196666667 0.216000000 0.225000000 0.21133333 0.20866667 0.203666667
  5 0.210000000 0.223666667 0.239666667 0.23300000 0.22133333 0.215666667
  6 0.222666667 0.234333333 0.243666667 0.24100000 0.24200000 0.228666667
```

```
  7 0.233666667 0.240000000 0.250666667 0.24266667 0.24933333 0.241333333
  8 0.255734029 0.260650879 0.257270953 0.25251076 0.25179433 0.246572539
   year
age        2015       2016        2017        2018       2019
  0 0.005333333 0.00500000 0.004166667 0.004566667 0.00400000
  1 0.043666667 0.04333333 0.042866667 0.039966667 0.04023333
  2 0.127333333 0.12100000 0.110866667 0.101300000 0.09900000
  3 0.161333333 0.16033333 0.153166667 0.152966667 0.14846667
  4 0.200000000 0.18866667 0.182966667 0.185766667 0.17736667
  5 0.211666667 0.21600000 0.207100000 0.215033333 0.20896667
  6 0.224666667 0.22433333 0.226533333 0.229200000 0.22613333
  7 0.229000000 0.22433333 0.227066667 0.238766667 0.23786667
  8 0.239358137 0.23372066 0.229232697 0.246755779 0.25411003

, , area = BD

   year
age       1997        1998       1999        2000       2001        2002
  0 0.00500000 0.005666667 0.00600000 0.005666667 0.00600000 0.006333333
  1 0.04866667 0.047333333 0.05066667 0.051333333 0.05066667 0.047333333
  2 0.12333333 0.116000000 0.11600000 0.115666667 0.12166667 0.128000000
  3 0.18333333 0.187333333 0.17933333 0.183666667 0.17166667 0.171666667
  4 0.23033333 0.241333333 0.22633333 0.221333333 0.21000000 0.205333333
  5 0.23733333 0.264333333 0.25600000 0.248333333 0.23266667 0.228333333
  6 0.25666667 0.283666667 0.27333333 0.278666667 0.25533333 0.248333333
  7 0.28033333 0.286666667 0.27600000 0.286000000 0.27466667 0.270333333
  8 0.31004007 0.308339011 0.27811880 0.284171183 0.27449422 0.286521182
   year
age        2003        2004        2005        2006       2007       2008
  0 0.006666667 0.006666667 0.005666667 0.006666667 0.00600000 0.00800000
  1 0.047000000 0.042000000 0.041333333 0.041000000 0.05133333 0.05766667
  2 0.123000000 0.119333333 0.118000000 0.125666667 0.12800000 0.13033333
  3 0.173000000 0.165333333 0.164333333 0.155333333 0.16066667 0.16433333
  4 0.202333333 0.202666667 0.198000000 0.191000000 0.17966667 0.18066667
  5 0.222000000 0.223000000 0.224666667 0.216000000 0.20700000 0.19533333
  6 0.242333333 0.247666667 0.248000000 0.242000000 0.22366667 0.21766667
  7 0.265666667 0.267666667 0.265000000 0.252333333 0.23800000 0.22600000
  8 0.284946134 0.280490193 0.284851772 0.270150625 0.25639104 0.25556215
   year
age        2009        2010        2011       2012       2013        2014
  0 0.007333333 0.007333333 0.006666667 0.00600000 0.00600000 0.005666667
  1 0.061333333 0.052000000 0.043000000 0.04033333 0.04033333 0.043333333
  2 0.137333333 0.142333333 0.145666667 0.13800000 0.13566667 0.128666667
  3 0.181000000 0.190333333 0.187333333 0.18200000 0.17466667 0.176666667
  4 0.196666667 0.216000000 0.225000000 0.21133333 0.20866667 0.203666667
  5 0.210000000 0.223666667 0.239666667 0.23300000 0.22133333 0.215666667
  6 0.222666667 0.234333333 0.243666667 0.24100000 0.24200000 0.228666667
  7 0.233666667 0.240000000 0.250666667 0.24266667 0.24933333 0.241333333
  8 0.255734029 0.260650879 0.257270953 0.25251076 0.25179433 0.246572539
   year
age        2015       2016        2017        2018       2019
  0 0.005333333 0.00500000 0.004166667 0.004566667 0.00400000
  1 0.043666667 0.04333333 0.042866667 0.039966667 0.04023333
```

```
  2 0.127333333 0.12100000 0.110866667 0.101300000 0.09900000
  3 0.161333333 0.16033333 0.153166667 0.152966667 0.14846667
  4 0.200000000 0.18866667 0.182966667 0.185766667 0.17736667
  5 0.211666667 0.21600000 0.207100000 0.215033333 0.20896667
  6 0.224666667 0.22433333 0.226533333 0.229200000 0.22613333
  7 0.229000000 0.22433333 0.227066667 0.238766667 0.23786667
  8 0.239358137 0.23372066 0.229232697 0.246755779 0.25411003

, , area = C

   year
age       1997        1998       1999        2000       2001        2002
  0 0.00500000 0.005666667 0.00600000 0.005666667 0.00600000 0.006333333
  1 0.04866667 0.047333333 0.05066667 0.051333333 0.05066667 0.047333333
  2 0.12333333 0.116000000 0.11600000 0.115666667 0.12166667 0.128000000
  3 0.18333333 0.187333333 0.17933333 0.183666667 0.17166667 0.171666667
  4 0.23033333 0.241333333 0.22633333 0.221333333 0.21000000 0.205333333
  5 0.23733333 0.264333333 0.25600000 0.248333333 0.23266667 0.228333333
  6 0.25666667 0.283666667 0.27333333 0.278666667 0.25533333 0.248333333
  7 0.28033333 0.286666667 0.27600000 0.286000000 0.27466667 0.270333333
  8 0.31004007 0.308339011 0.27811880 0.284171183 0.27449422 0.286521182
   year
age        2003        2004        2005        2006       2007       2008
  0 0.006666667 0.006666667 0.005666667 0.006666667 0.00600000 0.00800000
  1 0.047000000 0.042000000 0.041333333 0.041000000 0.05133333 0.05766667
  2 0.123000000 0.119333333 0.118000000 0.125666667 0.12800000 0.13033333
  3 0.173000000 0.165333333 0.164333333 0.155333333 0.16066667 0.16433333
  4 0.202333333 0.202666667 0.198000000 0.191000000 0.17966667 0.18066667
  5 0.222000000 0.223000000 0.224666667 0.216000000 0.20700000 0.19533333
  6 0.242333333 0.247666667 0.248000000 0.242000000 0.22366667 0.21766667
  7 0.265666667 0.267666667 0.265000000 0.252333333 0.23800000 0.22600000
  8 0.284946134 0.280490193 0.284851772 0.270150625 0.25639104 0.25556215
   year
age        2009        2010        2011       2012       2013        2014
  0 0.007333333 0.007333333 0.006666667 0.00600000 0.00600000 0.005666667
  1 0.061333333 0.052000000 0.043000000 0.04033333 0.04033333 0.043333333
  2 0.137333333 0.142333333 0.145666667 0.13800000 0.13566667 0.128666667
  3 0.181000000 0.190333333 0.187333333 0.18200000 0.17466667 0.176666667
  4 0.196666667 0.216000000 0.225000000 0.21133333 0.20866667 0.203666667
  5 0.210000000 0.223666667 0.239666667 0.23300000 0.22133333 0.215666667
  6 0.222666667 0.234333333 0.243666667 0.24100000 0.24200000 0.228666667
  7 0.233666667 0.240000000 0.250666667 0.24266667 0.24933333 0.241333333
  8 0.255734029 0.260650879 0.257270953 0.25251076 0.25179433 0.246572539
   year
age        2015       2016        2017        2018       2019
  0 0.005333333 0.00500000 0.004166667 0.004566667 0.00400000
  1 0.043666667 0.04333333 0.042866667 0.039966667 0.04023333
  2 0.127333333 0.12100000 0.110866667 0.101300000 0.09900000
  3 0.161333333 0.16033333 0.153166667 0.152966667 0.14846667
  4 0.200000000 0.18866667 0.182966667 0.185766667 0.17736667
  5 0.211666667 0.21600000 0.207100000 0.215033333 0.20896667
  6 0.224666667 0.22433333 0.226533333 0.229200000 0.22613333
  7 0.229000000 0.22433333 0.227066667 0.238766667 0.23786667
```

```
  8 0.239358137 0.23372066 0.229232697 0.246755779 0.25411003
```

Table 2.6.2.4. North Sea Herring multifleet assessment. NATURAL MORTALITY

```
Units  :  NA
, , area = A

   year
age      1997      1998      1999      2000      2001      2002      2003
  0 0.8714153 0.8809581 0.8953693 0.9138225 0.9303382 0.9462271 0.9636406
  1 0.6323094 0.6414736 0.6612056 0.6887892 0.7089131 0.7237124 0.7391891
  2 0.4175451 0.4218480 0.4291405 0.4376797 0.4447908 0.4528783 0.4623603
  3 0.3407633 0.3411658 0.3447208 0.3494167 0.3550605 0.3641446 0.3756800
  4 0.3158974 0.3144479 0.3140061 0.3129517 0.3144011 0.3206260 0.3294129
  5 0.2949494 0.2944949 0.2949689 0.2952192 0.2974189 0.3032716 0.3111539
  6 0.2744636 0.2745619 0.2760781 0.2779683 0.2811793 0.2871590 0.2949874
  7 0.2684613 0.2687931 0.2699709 0.2713117 0.2737630 0.2783370 0.2843214
  8 0.2610349 0.2620768 0.2649014 0.2687185 0.2727170 0.2774175 0.2830219
   year
age      2004      2005      2006      2007      2008      2009      2010
  0 0.9778611 0.9924404 1.0051537 1.0126169 1.0176157 1.0160229 1.0077651
  1 0.7458320 0.7351250 0.7212731 0.7089871 0.6927028 0.6815790 0.6742762
  2 0.4675825 0.4670940 0.4651993 0.4606177 0.4534194 0.4486089 0.4455843
  3 0.3842515 0.3917235 0.3982069 0.3992761 0.3979235 0.3972307 0.3969625
  4 0.3371511 0.3469816 0.3567311 0.3614871 0.3648674 0.3680856 0.3710640
  5 0.3182483 0.3270457 0.3358458 0.3408919 0.3449711 0.3487946 0.3522990
  6 0.3020598 0.3098954 0.3176953 0.3228500 0.3272613 0.3316144 0.3358301
  7 0.2900766 0.2964710 0.3030145 0.3082212 0.3132112 0.3182143 0.3231951
  8 0.2882408 0.2937930 0.2992683 0.3031155 0.3064383 0.3102376 0.3144489
   year
age      2011      2012      2013      2014      2015      2016      2017
  0 0.9945248 0.9758610 0.9522143 0.9234139 0.8891311 0.8495409 0.8873620
  1 0.6682724 0.6657074 0.6645925 0.6661190 0.6716350 0.6800092 0.6725878
  2 0.4427270 0.4410072 0.4395108 0.4388913 0.4398892 0.4419012 0.4402272
  3 0.3960316 0.3949324 0.3931928 0.3911678 0.3893188 0.3873211 0.3892692
  4 0.3734170 0.3753545 0.3766790 0.3775302 0.3781232 0.3783272 0.3779935
  5 0.3552698 0.3578357 0.3598761 0.3615013 0.3628765 0.3639009 0.3627596
  6 0.3397322 0.3434756 0.3469157 0.3501437 0.3532930 0.3562775 0.3532380
  7 0.3281086 0.3330175 0.3378633 0.3426801 0.3475198 0.3523502 0.3475167
  8 0.3187356 0.3232706 0.3278875 0.3326709 0.3377392 0.3430125 0.3378075
   year
age      2018      2019
  0 0.8693360 0.8495409
  1 0.6758221 0.6800092
  2 0.4408952 0.4419012
  3 0.3883200 0.3873211
  4 0.3782252 0.3783272
  5 0.3633887 0.3639009
  6 0.3547852 0.3562775
  7 0.3499350 0.3523502
```

```
  8 0.3403759 0.3430125

, , area = BD

   year
age      1997      1998      1999      2000      2001      2002      2003
  0 0.8714153 0.8809581 0.8953693 0.9138225 0.9303382 0.9462271 0.9636406
  1 0.6323094 0.6414736 0.6612056 0.6887892 0.7089131 0.7237124 0.7391891
  2 0.4175451 0.4218480 0.4291405 0.4376797 0.4447908 0.4528783 0.4623603
  3 0.3407633 0.3411658 0.3447208 0.3494167 0.3550605 0.3641446 0.3756800
  4 0.3158974 0.3144479 0.3140061 0.3129517 0.3144011 0.3206260 0.3294129
  5 0.2949494 0.2944949 0.2949689 0.2952192 0.2974189 0.3032716 0.3111539
  6 0.2744636 0.2745619 0.2760781 0.2779683 0.2811793 0.2871590 0.2949874
  7 0.2684613 0.2687931 0.2699709 0.2713117 0.2737630 0.2783370 0.2843214
  8 0.2610349 0.2620768 0.2649014 0.2687185 0.2727170 0.2774175 0.2830219
   year
age      2004      2005      2006      2007      2008      2009      2010
  0 0.9778611 0.9924404 1.0051537 1.0126169 1.0176157 1.0160229 1.0077651
  1 0.7458320 0.7351250 0.7212731 0.7089871 0.6927028 0.6815790 0.6742762
  2 0.4675825 0.4670940 0.4651993 0.4606177 0.4534194 0.4486089 0.4455843
  3 0.3842515 0.3917235 0.3982069 0.3992761 0.3979235 0.3972307 0.3969625
  4 0.3371511 0.3469816 0.3567311 0.3614871 0.3648674 0.3680856 0.3710640
  5 0.3182483 0.3270457 0.3358458 0.3408919 0.3449711 0.3487946 0.3522990
  6 0.3020598 0.3098954 0.3176953 0.3228500 0.3272613 0.3316144 0.3358301
  7 0.2900766 0.2964710 0.3030145 0.3082212 0.3132112 0.3182143 0.3231951
  8 0.2882408 0.2937930 0.2992683 0.3031155 0.3064383 0.3102376 0.3144489
   year
age      2011      2012      2013      2014      2015      2016      2017
  0 0.9945248 0.9758610 0.9522143 0.9234139 0.8891311 0.8495409 0.8873620
  1 0.6682724 0.6657074 0.6645925 0.6661190 0.6716350 0.6800092 0.6725878
  2 0.4427270 0.4410072 0.4395108 0.4388913 0.4398892 0.4419012 0.4402272
  3 0.3960316 0.3949324 0.3931928 0.3911678 0.3893188 0.3873211 0.3892692
  4 0.3734170 0.3753545 0.3766790 0.3775302 0.3781232 0.3783272 0.3779935
  5 0.3552698 0.3578357 0.3598761 0.3615013 0.3628765 0.3639009 0.3627596
  6 0.3397322 0.3434756 0.3469157 0.3501437 0.3532930 0.3562775 0.3532380
  7 0.3281086 0.3330175 0.3378633 0.3426801 0.3475198 0.3523502 0.3475167
  8 0.3187356 0.3232706 0.3278875 0.3326709 0.3377392 0.3430125 0.3378075
   year
age      2018      2019
  0 0.8693360 0.8495409
  1 0.6758221 0.6800092
  2 0.4408952 0.4419012
  3 0.3883200 0.3873211
  4 0.3782252 0.3783272
  5 0.3633887 0.3639009
  6 0.3547852 0.3562775
  7 0.3499350 0.3523502
  8 0.3403759 0.3430125

, , area = C

   year
age      1997      1998      1999      2000      2001      2002      2003
```

```
  0 0.8714153 0.8809581 0.8953693 0.9138225 0.9303382 0.9462271 0.9636406
  1 0.6323094 0.6414736 0.6612056 0.6887892 0.7089131 0.7237124 0.7391891
  2 0.4175451 0.4218480 0.4291405 0.4376797 0.4447908 0.4528783 0.4623603
  3 0.3407633 0.3411658 0.3447208 0.3494167 0.3550605 0.3641446 0.3756800
  4 0.3158974 0.3144479 0.3140061 0.3129517 0.3144011 0.3206260 0.3294129
  5 0.2949494 0.2944949 0.2949689 0.2952192 0.2974189 0.3032716 0.3111539
  6 0.2744636 0.2745619 0.2760781 0.2779683 0.2811793 0.2871590 0.2949874
  7 0.2684613 0.2687931 0.2699709 0.2713117 0.2737630 0.2783370 0.2843214
  8 0.2610349 0.2620768 0.2649014 0.2687185 0.2727170 0.2774175 0.2830219
   year
age      2004      2005      2006      2007      2008      2009      2010
  0 0.9778611 0.9924404 1.0051537 1.0126169 1.0176157 1.0160229 1.0077651
  1 0.7458320 0.7351250 0.7212731 0.7089871 0.6927028 0.6815790 0.6742762
  2 0.4675825 0.4670940 0.4651993 0.4606177 0.4534194 0.4486089 0.4455843
  3 0.3842515 0.3917235 0.3982069 0.3992761 0.3979235 0.3972307 0.3969625
  4 0.3371511 0.3469816 0.3567311 0.3614871 0.3648674 0.3680856 0.3710640
  5 0.3182483 0.3270457 0.3358458 0.3408919 0.3449711 0.3487946 0.3522990
  6 0.3020598 0.3098954 0.3176953 0.3228500 0.3272613 0.3316144 0.3358301
  7 0.2900766 0.2964710 0.3030145 0.3082212 0.3132112 0.3182143 0.3231951
  8 0.2882408 0.2937930 0.2992683 0.3031155 0.3064383 0.3102376 0.3144489
   year
age      2011      2012      2013      2014      2015      2016      2017
  0 0.9945248 0.9758610 0.9522143 0.9234139 0.8891311 0.8495409 0.8873620
  1 0.6682724 0.6657074 0.6645925 0.6661190 0.6716350 0.6800092 0.6725878
  2 0.4427270 0.4410072 0.4395108 0.4388913 0.4398892 0.4419012 0.4402272
  3 0.3960316 0.3949324 0.3931928 0.3911678 0.3893188 0.3873211 0.3892692
  4 0.3734170 0.3753545 0.3766790 0.3775302 0.3781232 0.3783272 0.3779935
  5 0.3552698 0.3578357 0.3598761 0.3615013 0.3628765 0.3639009 0.3627596
  6 0.3397322 0.3434756 0.3469157 0.3501437 0.3532930 0.3562775 0.3532380
  7 0.3281086 0.3330175 0.3378633 0.3426801 0.3475198 0.3523502 0.3475167
  8 0.3187356 0.3232706 0.3278875 0.3326709 0.3377392 0.3430125 0.3378075
   year
age      2018      2019
  0 0.8693360 0.8495409
  1 0.6758221 0.6800092
  2 0.4408952 0.4419012
  3 0.3883200 0.3873211
  4 0.3782252 0.3783272
  5 0.3633887 0.3639009
  6 0.3547852 0.3562775
  7 0.3499350 0.3523502
  8 0.3403759 0.3430125
```

Table 2.6.2.5. North Sea Herring multifleet assessment. PROPORTION MATURE

```
Units  :  NA
, , area = A

   year
age 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010
```

```
  0 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
  1 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
  2 0.64 0.64 0.69 0.67 0.77 0.87 0.43 0.70 0.76 0.66 0.71 0.86 0.89 0.45
  3 0.94 0.89 0.91 0.96 0.92 0.97 0.93 0.65 0.96 0.88 0.92 0.98 1.00 0.90
  4 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 0.96 0.98 0.93 0.99 1.00 1.00
  5 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
  6 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
  7 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
  8 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
   year
age 2011 2012 2013 2014 2015 2016 2017 2018 2019
  0 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
  1 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
  2 0.87 0.91 0.83 0.85 0.70 0.71 0.55 0.37 0.59
  3 0.84 0.99 0.96 1.00 0.90 0.89 0.96 0.91 0.97
  4 1.00 1.00 0.98 1.00 0.96 0.95 0.97 0.98 0.99
  5 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
  6 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
  7 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
  8 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00

, , area = BD

   year
age 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010
  0 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
  1 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
  2 0.64 0.64 0.69 0.67 0.77 0.87 0.43 0.70 0.76 0.66 0.71 0.86 0.89 0.45
  3 0.94 0.89 0.91 0.96 0.92 0.97 0.93 0.65 0.96 0.88 0.92 0.98 1.00 0.90
  4 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 0.96 0.98 0.93 0.99 1.00 1.00
  5 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
  6 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
  7 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
  8 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
   year
age 2011 2012 2013 2014 2015 2016 2017 2018 2019
  0 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
  1 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
  2 0.87 0.91 0.83 0.85 0.70 0.71 0.55 0.37 0.59
  3 0.84 0.99 0.96 1.00 0.90 0.89 0.96 0.91 0.97
  4 1.00 1.00 0.98 1.00 0.96 0.95 0.97 0.98 0.99
  5 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
  6 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
  7 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
  8 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00

, , area = C

   year
age 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010
  0 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
  1 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
  2 0.64 0.64 0.69 0.67 0.77 0.87 0.43 0.70 0.76 0.66 0.71 0.86 0.89 0.45
```

```
  3 0.94 0.89 0.91 0.96 0.92 0.97 0.93 0.65 0.96 0.88 0.92 0.98 1.00 0.90
  4 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 0.96 0.98 0.93 0.99 1.00 1.00
  5 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
  6 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
  7 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
  8 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
   year
age 2011 2012 2013 2014 2015 2016 2017 2018 2019
  0 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
  1 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
  2 0.87 0.91 0.83 0.85 0.70 0.71 0.55 0.37 0.59
  3 0.84 0.99 0.96 1.00 0.90 0.89 0.96 0.91 0.97
  4 1.00 1.00 0.98 1.00 0.96 0.95 0.97 0.98 0.99
  5 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
  6 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
  7 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
  8 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
```

Table 2.6.2.6. North Sea Herring multifleet assessment. FRACTION OF HARVEST BEFORE SPAWNING

```
Units  :  NA
, , area = A

   year
age 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010
  0 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  1 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  2 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  3 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  4 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  5 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  6 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  7 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  8 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
   year
age 2011 2012 2013 2014 2015 2016 2017 2018 2019
  0 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  1 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  2 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  3 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  4 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  5 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  6 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  7 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  8 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67

, , area = BD

   year
age 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010
```

```
  0 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  1 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  2 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  3 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  4 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  5 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  6 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  7 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  8 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
   year
age 2011 2012 2013 2014 2015 2016 2017 2018 2019
  0 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  1 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  2 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  3 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  4 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  5 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  6 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  7 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  8 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67

, , area = C

   year
age 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010
  0 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  1 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  2 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  3 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  4 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  5 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  6 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  7 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  8 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
   year
age 2011 2012 2013 2014 2015 2016 2017 2018 2019
  0 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  1 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  2 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  3 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  4 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  5 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  6 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  7 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  8 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
```

Table 2.6.2.7. North Sea Herring multifleet assessment. FRACTION OF NATURAL MORTALITY BEFORE SPAWNING

Units : NA

, , area = A

age	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
0	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67
1	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67
2	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67
3	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67
4	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67
5	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67
6	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67
7	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67
8	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67

age	2011	2012	2013	2014	2015	2016	2017	2018	2019
0	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67
1	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67
2	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67
3	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67
4	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67
5	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67
6	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67
7	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67
8	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67

, , area = BD

age	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
0	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67
1	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67
2	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67
3	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67
4	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67
5	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67
6	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67
7	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67
8	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67

age	2011	2012	2013	2014	2015	2016	2017	2018	2019
0	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67
1	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67
2	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67
3	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67
4	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67
5	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67
6	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67
7	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67
8	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67

```
, , area = C

   year
age 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010
  0 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  1 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  2 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  3 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  4 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  5 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  6 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  7 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  8 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
   year
age 2011 2012 2013 2014 2015 2016 2017 2018 2019
  0 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  1 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  2 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  3 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  4 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  5 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  6 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  7 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  8 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
```

Table 2.6.2.8. North Sea Herring multifleet assessment. SURVEY INDICES

HERAS - Configuration

```
Herring in Sub-area IV, Divisions VIId & IIIa (autumn-spawners) (16/Mar/2020) . Imported
from VPA file.
      min       max plusgroup   minyear   maxyear    startf      endf
     1.00      8.00      8.00   1989.00   2019.00      0.54      0.56
Index type : number

HERAS - Index Values

Units  :  NA
   year
age    1989    1990    1991    1992    1993    1994    1995    1996
  1      -1      -1      -1      -1      -1      -1      -1      -1
  2 4090000 3306000 2634000 3734000 2984000 3185000 3849000 4497000
  3 3903000 3521000 1700000 1378000 1637000  839000 2041000 2824000
  4 1633000 3414000 1959000 1147000  902000  399000  672000 1087000
  5  492000 1366000 1849000 1134000  741000  381000  299000  311000
  6  283000  392000  644000 1246000  777000  321000  203000   99000
  7  120000  210000  228000  395000  551000  326000  138000   83000
  8   66000  176000  145000  218000  296000  350000  212000  339000
   year
age    1997    1998    1999     2000     2001     2002     2003    2004
```

```
  1 9361000 4449000 5087000 24736000  6837000 23055000  9829400 5183700
  2 5960000 5747000 3078000  2923000 12290000  4875000 18949400 3415900
  3 2935000 2520000 4725000  2156000  3083000  8220000  3081000 9191800
  4 1441000 1625000 1116000  3140000  1462000  1390000  4188900 2167300
  5  601000  982000  506000  1007000  1676000   794600   675100 2590700
  6  215000  445000  314000   483000   450000  1031000   494800  317100
  7   46000  170000  139000   266000   170000   244400   568300  327600
  8  237000  166000  141000   217000   157000   270500   323200  527650
   year
age    2005    2006    2007    2008    2009     2010     2011    2012
  1 3114100 6822800 6261000 3714000 4655000 14577000 10119000 7437000
  2 2055100 3772300 2750000 2853000 5632000  4237000  4166000 4719000
  3 3648500 1997200 1848000 1709000 2553000  4216000  2534000 4067000
  4 5789600 2097500  898000 1485000 1023000  2453000  2173000 1738000
  5 1212900 4175100  806000  809000 1077000  1246000  1016000 1209000
  6 1174900  618200 1323000  712000  674000  1332000   651000  593000
  7  139900  562100  243000 1749000  638000   688000   688000  247000
  8  233200  154700  217000  455000 1720000  2729000  1737000  696000
   year
age    2013     2014    2015     2016    2017    2018     2019
  1 6388000 11634000 6714000  9034000 3054000 9938000 10146000
  2 2683000  4918000 9495000 12011000 1761000 4254000  1303000
  3 3031000  2827000 2831000  5832000 6095000 1692000  2345000
  4 2895000  2939000 1591000  1273000 3142000 5150000  1212000
  5 1546000  1791000 1549000   822000  787000 2440000  3506000
  6  849000  1236000  926000   909000  365000  719000  1657000
  7  464000   669000  520000   395000  298000  529000   395000
  8  842000   461000  496000   366000  293000  404000   424000
```

IBTS-Q1 - Configuration

```
Herring in Sub-area IV, Divisions VIId & IIIa (autumn-spawners) (16/Mar/2020) . Imported
from VPA file.
         min          max    plusgroup      minyear      maxyear
   1.0000000    1.0000000           NA 1984.0000000 2020.0000000
      startf         endf
   0.1008259    0.1008259
Index type : number

IBTS-Q1 - Index Values

Units  :  NA
   year
age   1984    1985    1986    1987    1988    1989     1990    1991
  1 957324 1473183 1662159 3221178 1464182 1677569 768368.2 1085666
   year
age    1992    1993    1994    1995    1996    1997    1998     1999
  1 1147216 1838663 2812005 2266363 1277320 1350215 1804583 698806.6
   year
age    2000    2001    2002    2003     2004     2005     2006     2007
  1 2096596 1605575 1820055 1426762 771457.8 925583.4 717821.2 883302.7
   year
age     2008     2009     2010    2011     2012     2013    2014    2015
```

```
  1 774710.1 732798.5 916572.8 1613673 824527.6 505955.1 1645682 1943846
   year
age   2016    2017     2018     2019    2020
  1 558363 1361551 689636.3 970111.9 1145081
```

IBTS0 - Configuration

```
Herring in Sub-area IV, Divisions VIId & IIIa (autumn-spawners) (16/Mar/2020) . Imported
from VPA file.
      min       max plusgroup   minyear   maxyear    startf      endf
     0.00      0.00        NA   1992.00   2020.00      0.08      0.17
Index type : number

IBTS0 - Index Values

Units  :  NA
   year
age     1992     1993     1994     1995    1996     1997     1998     1999
  0 164.0899 195.7571 155.1368 170.4691 106.264 134.6798 51.71666 255.4222
   year
age     2000     2001     2002     2003     2004     2005     2006
  0 109.8237 341.3018 150.7038 70.83748 43.88171 82.06045 64.41743
   year
age     2007     2008     2009     2010     2011     2012     2013
  0 50.91532 39.53371 99.18411 74.10116 77.63466 65.07967 61.17656
   year
age     2014     2015     2016     2017     2018     2019     2020
  0 113.7963 21.76008 81.69031 27.83202 102.1129 51.62587 62.41121
```

IBTS-Q3 - Configuration

```
Herring in Sub-area IV, Divisions VIId & IIIa (autumn-spawners) (16/Mar/2020) . Imported
from VPA file.
         min          max    plusgroup      minyear      maxyear
   0.0000000    5.0000000           NA 1998.0000000 2019.0000000
      startf         endf
   0.6084662    0.6084662
Index type : number

IBTS-Q3 - Index Values

Units  :  NA
   year
age      1998       1999       2000       2001       2002      2003
  0 707529.29 4233846.75 1620038.45 1714578.46 2055109.72 833224.14
  1 415995.22  290830.27  763292.82  317776.68 1940710.52 467668.41
  2 281888.09  205967.99  256000.32  219364.82  438205.77 557140.92
  3  90723.61  122047.54  115690.52   93775.23  341437.92 145835.21
  4  24717.72   49316.26   66902.87   41645.09   79278.42 109662.86
  5  10726.45   17602.24   17044.41   25305.84   31226.51  18512.78
   year
age       2004       2005      2006       2007      2008       2009
  0 1970515.25 1005504.45 962447.25 2086570.65 524669.09 2654058.23
```

```
  1  384254.10  382307.62 288008.48  132097.51 150256.12  199023.94
  2  281709.01  112453.04 192018.99   92766.30 112671.15   93460.99
  3  411046.51   81907.19  77885.34   97733.80  58448.44   61031.71
  4   93091.92   96320.65  45055.96   48852.73  34431.66   25875.50
  5   48867.94   30631.40  51266.22   29610.43  18428.13   11714.79
   year
age       2010      2011      2012       2013       2014      2015
  0 1236261.22 765326.25 730383.60 1692837.79 6751020.89 486178.94
  1  503511.61 312408.38 204328.24  256455.03  433998.02 714517.44
  2  172333.79 173233.15  89601.62  139602.35  191263.38 348475.49
  3   79991.16  97020.29  64651.12  119332.48   85553.69 123410.84
  4   35528.12  48163.41  36532.75   81910.09   75575.16  64702.78
  5   14991.30  20709.64  21092.99   38385.03   42936.54  43663.74
   year
age       2016      2017       2018       2019
  0 1581744.08 796376.86 1761034.92 1400298.87
  1  169323.28 275389.01  324256.82  136400.79
  2  359009.05  76519.79  113537.58   70812.24
  3  206745.55 193058.61   47077.15   39172.62
  4   64513.46 123311.33   83658.56   24716.52
  5   40839.27  39288.74   37960.22   34846.04
```

LAI-ORSH - Configuration

```
      min       max plusgroup   minyear   maxyear    startf      endf
     0.00      1.00      1.00   1972.00   2019.00      0.67      0.67
Index type : partial

LAI-ORSH - Index Values

Units  :  NA
   year
age 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985
  0 1133 2029  758  371  545 1133 3047 2882 3534 3667 2353 2579 1795 5632
  1 4583  822  421   50   81  221   50 2362  720  277 1116  812 1912 3432
   year
age 1986 1987 1988  1989  1990 1991 1992 1993 1994 1995 1996 1997 1998
  0 3529 7409 7538 11477    -1 1021  189   -1   26   -1   -1   -1   -1
  1 1842 1848 8832  5725 10144 2397 4917   66 1179 8688  809 3611 8528
   year
age 1999 2000  2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011
  0   -1   -1    -1   -1   -1   -1   -1 6311   -1 4978   -1   -1   -1
  1 4064 3972 11918 6669 3199 7055 3380 2312 1753 6875 7543 2362 3831
   year
age  2012  2013 2014 2015 2016 2017 2018 2019
  0    -1    -1   -1   -1   -1   -1   -1 2488
  1 19552 21282 6604 9631   -1   -1  102   -1
```

LAI-BUN - Configuration

```
      min       max plusgroup   minyear   maxyear    startf      endf
```

```
     0.00      1.00      1.00   1972.00   2019.00      0.67      0.67
Index type : partial

LAI-BUN - Index Values

Units  :  NA
   year
age 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985
  0   30    3  101  312    0  124   -1  197   21    3  340 3647 2327 2521
  1    0    4  284   -1    1   32  162   10    1   12  257  768 1853 1812
   year
age 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999
  0 3278 2551 6812 5879 4590   -1   -1   -1   -1   -1   -1   -1   -1   -1
  1  341  670 5248  692 2045 2032  822  174   -1   -1  184   23 1490  185
   year
age 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
  0   28   -1   -1   -1   -1   -1   -1   -1   -1   -1   -1   -1   -1   -1
  1  155  164 1038 2263 3884 1364  280 1304  533 4629 1493 2839 5856 8618
   year
age 2014 2015 2016 2017 2018 2019
  0   -1   -1   -1   -1   -1 5654
  1 5033 3496 3872 5833 1740 3794
```

LAI-CNS - Configuration

```
      min       max plusgroup   minyear   maxyear    startf      endf
     0.00      3.00      3.00   1972.00   2019.00      0.67      0.67
Index type : partial

LAI-CNS - Index Values

Units  :  NA
   year
age 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984  1985
  0  165  492   81   -1   64  520 1406  662  317  903   86 1459  688   130
  1   88  830   -1   90  108  262   81  131  188  235   64  281 2404 13039
  2  134 1213 1184   77    0   89  269  507    9  119 1077   63  824  1794
  3   22  152   -1    6   10    3    2    7   13    0   23   -1  433   215
   year
age 1986 1987 1988 1989  1990 1991 1992 1993 1994 1995 1996 1997 1998 1999
  0 1611  799 5533 1442 19965 4823   10   -1   -1   -1   -1   -1  205   -1
  1 6112 4927 3808 5010  1239 2110  165  685 1464   -1  564   -1   66  134
  2  188 1992 1960 2364   975 1249  163   85   44   43   -1   -1   -1  181
  3   36  113  206    2    -1   -1   -1   -1   -1   -1   -1   -1   -1   -1
   year
age 2000 2001 2002  2003 2004 2005 2006 2007  2008 2009 2010  2011 2012
  0   -1   -1   -1    -1   -1   -1   -1   -1    -1   -1   -1    -1   -1
  1  376 1604   -1 12018 5545 5614 2259  291 11201 4219 2317 17766  517
  2   -1   -1 3291  3277   -1   -1   -1   -1    -1   -1   -1    -1   -1
  3   -1   -1   -1    -1   -1   -1   -1   -1    -1   -1   -1    -1   -1
   year
age 2013 2014 2015 2016 2017 2018  2019
```

```
  0   -1   -1   -1   -1   -1   -1    -1
  1 7354 1149 3424 3288 3965 1509 10605
  2   -1   -1   -1   -1   -1   -1    -1
  3   -1   -1   -1   -1   -1   -1    -1
```

LAI-SNS - Configuration

```
      min       max plusgroup   minyear   maxyear    startf      endf
     0.00      2.00      2.00   1972.00   2019.00      0.67      0.67
Index type : partial

LAI-SNS - Index Values

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

Table 2.6.2.9. North Sea Herring multifleet assessment. STOCK OBJECT CONFIGURATION

```
      min       max plusgroup   minyear   maxyear   minfbar   maxfbar
        0         8         8      1997      2019         2         6
```

Table 2.6.2.10. North Sea Herring multifleet assessment. sam CONFIGURATION SETTINGS

```
name           : North Sea herring multifleet
desc            : Imported from a VPA file. ( ./data/index.txt ).  Tue Mar 24 12:15:33
2020
range          :       min       max plusgroup   minyear   maxyear   minfbar   maxfbar
range          :         0         8         8      1947      2020         2         6
fleets         :  catch A catch BD  catch C    HERAS  IBTS-Q1    IBTS0  IBTS-Q3 LAI-ORSH
```

```
fleets         :        0        0        0        2        2        2        2        6
fleets         :  LAI-BUN  LAI-CNS  LAI-SNS sumFleet
fleets         :        6        6        6        7
plus.group     : TRUE
states         :           age
states         : fleet       0  1  2  3  4  5  6  7  8
states         :   catch A  -1  0  1  2  3  4  5  6  6
states         :   catch BD  7  8  9 10 10 10 -1 -1 -1
states         :   catch C  -1 11 12 13 14 14 14 -1 -1
states         :   HERAS    -1 -1 -1 -1 -1 -1 -1 -1 -1
states         :   IBTS-Q1  -1 -1 -1 -1 -1 -1 -1 -1 -1
states         :   IBTS0    -1 -1 -1 -1 -1 -1 -1 -1 -1
states         :   IBTS-Q3  -1 -1 -1 -1 -1 -1 -1 -1 -1
states         :   LAI-ORSH -1 -1 -1 -1 -1 -1 -1 -1 -1
states         :   LAI-BUN  -1 -1 -1 -1 -1 -1 -1 -1 -1
states         :   LAI-CNS  -1 -1 -1 -1 -1 -1 -1 -1 -1
states         :   LAI-SNS  -1 -1 -1 -1 -1 -1 -1 -1 -1
states         :   sumFleet -1 -1 -1 -1 -1 -1 -1 -1 -1
logN.vars      : 0 1 1 1 1 1 1 1 1
logP.vars      : 0 1 2
catchabilities :           age
catchabilities : fleet       0  1  2  3  4  5  6  7  8
catchabilities :   catch A  -1 -1 -1 -1 -1 -1 -1 -1 -1
catchabilities :   catch BD -1 -1 -1 -1 -1 -1 -1 -1 -1
catchabilities :   catch C  -1 -1 -1 -1 -1 -1 -1 -1 -1
catchabilities :   HERAS    -1  2  3  4  4  4  4  4  4
catchabilities :   IBTS-Q1  -1  0 -1 -1 -1 -1 -1 -1 -1
catchabilities :   IBTS0     1 -1 -1 -1 -1 -1 -1 -1 -1
catchabilities :   IBTS-Q3   5  6  7  8  9 10 -1 -1 -1
catchabilities :   LAI-ORSH 11 -1 -1 -1 -1 -1 -1 -1 -1
catchabilities :   LAI-BUN  11 -1 -1 -1 -1 -1 -1 -1 -1
catchabilities :   LAI-CNS  11 -1 -1 -1 -1 -1 -1 -1 -1
catchabilities :   LAI-SNS  11 -1 -1 -1 -1 -1 -1 -1 -1
catchabilities :   sumFleet -1 -1 -1 -1 -1 -1 -1 -1 -1
power.law.exps :           age
power.law.exps : fleet       0  1  2  3  4  5  6  7  8
power.law.exps :   catch A  -1 -1 -1 -1 -1 -1 -1 -1 -1
power.law.exps :   catch BD -1 -1 -1 -1 -1 -1 -1 -1 -1
power.law.exps :   catch C  -1 -1 -1 -1 -1 -1 -1 -1 -1
power.law.exps :   HERAS    -1 -1 -1 -1 -1 -1 -1 -1 -1
power.law.exps :   IBTS-Q1  -1 -1 -1 -1 -1 -1 -1 -1 -1
power.law.exps :   IBTS0    -1 -1 -1 -1 -1 -1 -1 -1 -1
power.law.exps :   IBTS-Q3  -1 -1 -1 -1 -1 -1 -1 -1 -1
power.law.exps :   LAI-ORSH -1 -1 -1 -1 -1 -1 -1 -1 -1
power.law.exps :   LAI-BUN  -1 -1 -1 -1 -1 -1 -1 -1 -1
power.law.exps :   LAI-CNS  -1 -1 -1 -1 -1 -1 -1 -1 -1
power.law.exps :   LAI-SNS  -1 -1 -1 -1 -1 -1 -1 -1 -1
power.law.exps :   sumFleet -1 -1 -1 -1 -1 -1 -1 -1 -1
f.vars         :           age
f.vars         : fleet       0  1  2  3  4  5  6  7  8
f.vars         :   catch A  -1  0  0  0  0  0  1  1  1
f.vars         :   catch BD  2  3  3  3  3  3 -1 -1 -1
f.vars         :   catch C  -1  4  5  6  6  6  6 -1 -1
```

```
f.vars         :   HERAS    -1 -1 -1 -1 -1 -1 -1 -1 -1
f.vars         :   IBTS-Q1  -1 -1 -1 -1 -1 -1 -1 -1 -1
f.vars         :   IBTS0    -1 -1 -1 -1 -1 -1 -1 -1 -1
f.vars         :   IBTS-Q3  -1 -1 -1 -1 -1 -1 -1 -1 -1
f.vars         :   LAI-ORSH -1 -1 -1 -1 -1 -1 -1 -1 -1
f.vars         :   LAI-BUN  -1 -1 -1 -1 -1 -1 -1 -1 -1
f.vars         :   LAI-CNS  -1 -1 -1 -1 -1 -1 -1 -1 -1
f.vars         :   LAI-SNS  -1 -1 -1 -1 -1 -1 -1 -1 -1
f.vars         :   sumFleet -1 -1 -1 -1 -1 -1 -1 -1 -1
obs.vars       :           age
obs.vars       : fleet       0  1  2  3  4  5  6  7  8
obs.vars       :   catch A  -1  0  1  1  1  1  2  2  2
obs.vars       :   catch BD  3  4  5  5  5  5 -1 -1 -1
obs.vars       :   catch C  -1  6  7  8  8  8  8 -1 -1
obs.vars       :   HERAS    -1  9 10 10 10 10 10 11 11
obs.vars       :   IBTS-Q1  -1 12 -1 -1 -1 -1 -1 -1 -1
obs.vars       :   IBTS0    13 -1 -1 -1 -1 -1 -1 -1 -1
obs.vars       :   IBTS-Q3  14 15 16 16 16 16 -1 -1 -1
obs.vars       :   LAI-ORSH 17 -1 -1 -1 -1 -1 -1 -1 -1
obs.vars       :   LAI-BUN  17 -1 -1 -1 -1 -1 -1 -1 -1
obs.vars       :   LAI-CNS  17 -1 -1 -1 -1 -1 -1 -1 -1
obs.vars       :   LAI-SNS  17 -1 -1 -1 -1 -1 -1 -1 -1
obs.vars       :   sumFleet -1 -1 -1 -1 -1 -1 -1 -1 -1
srr            : 0
scaleNoYears   : 0
scaleYears     : NA
scalePars      :
cor.F          : 2 2 2
cor.obs        : NA NA NA -1 -1 -1 0 -1 -1 -1 -1 -1 NA NA NA NA -1 -1 0 -1 -1 -1 -1 -1 NA
NA NA NA -1 -1 0 -1 -1 -1 -1 -1 NA NA NA NA -1 -1 0 -1 -1 -1 -1 -1 NA NA NA NA -1 -1 0 -
1 -1 -1 -1 -1 NA NA NA NA -1 -1 -1 -1 -1 -1 -1 -1 NA NA NA NA -1 -1 -1 -1 -1 -1 -1 -1 NA
NA NA NA -1 -1 -1 -1 -1 -1 -1 -1
cor.obs.Flag   : ID ID ID ID ID ID AR ID ID ID ID NA
biomassTreat   : -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1
timeout        : 3600
likFlag        : LN LN LN LN LN LN LN LN LN LN LN LN
fixVarToWeight : FALSE
simulate       : FALSE
residuals      : TRUE
sumFleets      : A BD C
```

Table 2.6.2.11. North Sea Herring multifleet assessment. FLR, R SOFTWARE VERSIONS

```
FLSAM.version                        2.1.0
FLCore.version                      2.6.14
R.version      R version 3.6.3 (2020-02-29)
platform                x86_64-w64-mingw32
run.date               2020-03-24 12:34:49
```

Table 2.6.2.12. North Sea Herring multifleet assessment. STOCK SUMMARY

Year	Recruitment Age 0	Low	High	TSB	Low	High	SSB	Low	High	Fbar (Ages 2-6)	Low	High	Landings	Landings SOP
	thousands	thousands	thousands							f	f	f	tonnes	
1947	52991791	28959058	96968966	10182377	7558234	13717598	6004208	4224937	8532794	0.1098	0.0758	0.1591	264313	0.7395
1948	51205504	29578664	88645099	8722658	6540741	11632440	4863393	3458677	6838624	0.1057	0.0743	0.1504	391628	0.7829
1949	44906588	26215653	76923569	8233940	6258653	10832645	4512407	3260996	6244048	0.1277	0.0907	0.1799	363163	0.8691
1950	62694268	37276080	105444865	8024248	6179703	10419362	4355691	3208857	5912400	0.1315	0.0952	0.1815	388157	0.8133
1951	59766910	35837309	99674991	8074743	6290607	10364893	3996319	2976375	5365776	0.1644	0.1210	0.2234	374065	0.7886
1952	57849822	34969560	95700429	7889542	6162276	10100955	3908720	2914714	5241712	0.1823	0.1343	0.2475	394709	0.8206
1953	62201288	38790782	99740196	7605773	5953404	9716758	3686851	2740498	4960000	0.1879	0.1382	0.2555	482281	0.9027
1954	58957444	37088914	93720192	7401781	5806772	9434909	3387762	2494386	4601106	0.2265	0.1651	0.3108	587698	0.9074
1955	49110768	31172925	77370588	7067425	5540572	9015044	3422641	2528820	4632387	0.1971	0.1440	0.2696	663813	0.9223
1956	36514524	23219020	57423202	6481474	5107127	8225663	3249030	2406238	4387013	0.2024	0.1488	0.2752	514597	0.9662
1957	83883083	53001531	132757894	6369278	5052514	8029211	2913990	2162317	3926963	0.2199	0.1619	0.2986	406482	0.9390
1958	35484096	22725988	55404460	6380864	5053619	8056688	2436269	1814392	3271290	0.2031	0.1513	0.2728	257870	0.9259
1959	39390387	24676953	62876588	6952901	5561109	8693019	3575962	2686718	4759527	0.2477	0.1857	0.3305	168443	0.9364
1960	16313220	10272494	25906188	5799946	4659964	7218805	3072850	2325315	4060699	0.2025	0.1531	0.2678	187611	0.8779
1961	75349457	47446872	119661012	5959766	4851340	7321445	3038371	2342057	3941706	0.2246	0.1734	0.2908	226478	0.9146
1962	36030060	23316838	55675012	5543974	4526510	6790143	2055679	1572195	2687845	0.2737	0.2119	0.3534	434710	0.9534
1963	41920335	27641073	63576203	6313396	5201838	7662478	3322441	2614466	4222130	0.1600	0.1270	0.2017	511416	0.9583
1964	42741114	28272819	64613396	5977794	5119467	6980026	2868973	2344414	3510901	0.2531	0.2076	0.3086	517356	0.9474
1965	21402505	14157529	32355026	5190566	4546099	5926394	2152434	1794092	2582350	0.4910	0.4108	0.5867	494099	0.9548
1966	22140466	14810753	33097590	3881532	3414914	4411910	1737658	1459292	2069123	0.4531	0.3820	0.5375	563610	0.9672
1967	28941643	19385217	43209146	2938348	2608794	3309533	1018483	866856	1196632	0.6478	0.5558	0.7551	498437	0.9715
1968	28882628	19242058	43353275	2478060	2166903	2833898	544234	461874	641280	1.0303	0.8993	1.1803	603536	0.9821
1969	14738320	9692645	22410609	1922551	1647326	2243759	496825	402606	613094	0.8544	0.7409	0.9852	442138	0.9962
1970	28538403	18979149	42912380	1874355	1611684	2179835	484859	391164	600997	0.9086	0.7875	1.0484	264313	0.0715
1971	22366928	15035107	33274088	1724896	1462461	2034425	303814	247069	373591	1.3591	1.1944	1.5466	391628	0.0522
1972	15371473	10340777	22849556	1560332	1331761	1828134	377045	305239	465743	0.5507	0.4694	0.6460	363163	0.0658

1973	8232281	5519746	12277820	1233858	1074732	1416544	302463	248704	367843	0.8840	0.7663	1.0197	388157	0.0772
1974	13675474	9021594	20730107	886037	764575	1026795	209290	172993	253201	0.8314	0.7177	0.9633	374065	0.0742
1975	3346609	2166095	5170499	709983	590380	853815	117124	94603	145007	1.0855	0.9154	1.2871	394709	0.0788
1976	4495132	2808463	7194758	548019	446078	673256	174443	128265	237247	0.7402	0.5612	0.9762	482281	0.0426
1977	5607178	3425443	9178505	409324	319547	524326	139645	99138	196702	0.2607	0.1851	0.3670	587698	0.0411
1978	6170981	3707256	10272018	488006	374391	636100	168359	122609	231179	0.1817	0.1084	0.3048	663813	0.0471
1979	10986797	6850244	17621230	640962	503683	815656	222744	168467	294510	0.1492	0.0891	0.2497	514597	0.0301
1980	16504934	10971576	24828961	863837	695986	1072169	254619	199342	325223	0.1351	0.1040	0.1757	406482	0.0256
1981	34408394	23129535	51187263	1397145	1128109	1730340	334338	262817	425322	0.2101	0.1644	0.2685	257870	0.0427
1982	55482702	37690139	81674683	2114055	1708635	2615671	477993	380443	600555	0.1550	0.1234	0.1948	168443	0.0588
1983	54151411	37385004	78437209	2808494	2315367	3406646	655858	527099	816070	0.2285	0.1850	0.2822	187611	0.0580
1984	55874003	38585393	80908967	3643777	3064708	4332259	1021553	821733	1269962	0.3112	0.2551	0.3798	226478	0.0458
1985	67628119	46368088	98635995	4186184	3548802	4938044	1105111	899104	1358318	0.4014	0.3295	0.4892	434710	0.0347
1986	82502703	56417845	120647927	4792784	4039818	5686091	1160239	948461	1419304	0.3730	0.3054	0.4557	511416	0.0192
1987	74143208	50875740	108051800	4860334	4128607	5721748	1426414	1164893	1746646	0.3369	0.2767	0.4104	517356	0.0347
1988	46380904	31939638	67351679	4725075	4051856	5510149	1849838	1515166	2258433	0.3225	0.2663	0.3906	494099	0.0245
1989	37800213	25961645	55037196	4200862	3664696	4815472	1906032	1604067	2264841	0.3109	0.2595	0.3724	563610	0.0278
1990	33113193	22653210	48403009	4224824	3681285	4848616	2084211	1756968	2472403	0.2446	0.2029	0.2948	498437	0.0151
1991	36340449	24980554	52866252	4033996	3518114	4625525	1854577	1569569	2191338	0.2609	0.2167	0.3141	603536	0.0143
1992	64886378	46426840	90685519	4060745	3529258	4672270	1433654	1206595	1703442	0.3068	0.2541	0.3704	442138	0.0120
1993	69218686	49053652	97673188	3783664	3249829	4405190	1032400	858900	1240948	0.3584	0.2953	0.4350	264313	0.1274
1994	56623356	39884189	80387857	3698973	3129445	4372150	1095452	913896	1313076	0.3589	0.2962	0.4348	391628	0.1494
1995	60132094	42274047	85534009	3622192	3066873	4278062	1157811	958865	1398034	0.3245	0.2656	0.3963	363163	0.0863
1996	49202715	34880132	69406479	3618899	3061167	4278248	1361588	1130285	1640227	0.1566	0.1276	0.1923	388157	0.0957
1997	40897657	28727869	58222849	3627940	3090961	4258206	1520407	1269411	1821033	0.1410	0.1151	0.1727	374065	0.0961
1998	26097797	18678175	36464752	3930170	3370618	4582613	1731007	1457380	2056008	0.1806	0.1484	0.2198	394709	0.0430
1999	82296940	58675493	115427858	3957639	3407932	4596014	1814787	1526066	2158131	0.1720	0.1419	0.2084	482281	0.0502
2000	52967526	38074554	73685926	4862836	4147638	5701359	1858523	1565784	2205992	0.1706	0.1407	0.2069	587698	0.0229
2001	103526184	72804840	147210965	5405738	4623221	6320702	2392285	2015120	2840043	0.1443	0.1184	0.1760	663813	0.0345
2002	50643694	36275387	70703140	6465567	5498968	7602074	2827762	2383165	3355303	0.1345	0.1106	0.1635	514597	0.0226
2003	26880540	19308585	37421873	6848854	5859560	8005176	2901026	2458386	3423365	0.1583	0.1306	0.1919	406482	0.0404
2004	32082787	22989814	44772230	5635108	4865534	6526403	2781992	2360573	3278644	0.1913	0.1578	0.2320	257870	0.0359

2005	29512069	21291659	40906263	4692038	4082992	5391933	2508143	2120417	2966765	0.2386	0.1967	0.2895	168443	0.0299
2006	29168218	20968570	40574294	4042890	3515191	4649808	2076919	1756956	2455151	0.2158	0.1776	0.2621	187611	0.0635
2007	34859596	24673960	49249957	3345195	2897726	3861763	1625697	1372055	1926227	0.1888	0.1550	0.2299	226478	0.0292
2008	30976399	21918072	43778361	3487659	2992184	4065179	1739228	1468404	2060000	0.1140	0.0937	0.1387	434710	0.0177
2009	48658402	34740116	68152913	4118124	3517964	4820670	2169060	1826299	2576151	0.0625	0.0512	0.0764	511416	0.0230
2010	39880153	28682660	55449064	4900119	4193367	5725988	2276098	1911261	2710578	0.0622	0.0510	0.0759	517356	0.0184
2011	34377544	24721636	47804909	4863130	4195675	5636765	2688053	2289857	3155494	0.0827	0.0684	0.1000	494099	0.0207
2012	32187823	23079811	44890140	4732003	4103769	5456411	2757176	2348553	3236894	0.1515	0.1255	0.1830	563610	0.0072
2013	42409242	30137771	59677398	4561058	3972548	5236751	2507560	2139319	2939185	0.1772	0.1468	0.2141	498437	0.0149
2014	65013622	45783068	92321710	4964611	4312835	5714887	2500227	2130852	2933632	0.1715	0.1418	0.2074	603536	0.0052
2015	17311934	12270662	24424359	5267635	4539817	6112135	2349471	2000668	2759086	0.1797	0.1481	0.2179	442138	0.0131
2016	32077307	23065028	44610985	5209596	4474858	6064973	2745638	2320700	3248385	0.1986	0.1635	0.2413		
2017	19757648	14016840	27849692	4403858	3785983	5122570	2446245	2053316	2914365	0.1647	0.1358	0.1999	264313	0.7395
2018	33481370	23323890	48062400	4105874	3533190	4771382	2126005	1771859	2550935	0.1945	0.1590	0.2380	391628	0.7829
2019	32355791	21764990	48100055	3370357	2857605	3975115	1750201	1429110	2143435	0.1704	0.1346	0.2157	363163	0.8691
2020	29721206	16312145	54152908	3043156	2426383	3816709	1407211	1048360	1888896	0.1704	0.0788	0.3682	388157	0.8133

Table 2.6.2.13. North Sea Herring multifleet assessment. ESTIMATED FISHING MORTALITY

```
Units  :  f
, , area = A

   year
age        1947        1948       1949        1950        1951        1952
  0 0.000000000 0.000000000 0.00000000 0.000000000 0.000000000 0.000000000
  1 0.001191938 0.001164389 0.00143109 0.001849824 0.002824751 0.003415827
  2 0.036413130 0.035271910 0.04434182 0.058412382 0.091761175 0.111916450
  3 0.083940748 0.083828114 0.09866455 0.115439723 0.158458577 0.166385124
  4 0.097078133 0.098205470 0.11535596 0.130810401 0.174239599 0.179617084
  5 0.127567209 0.125973280 0.14562958 0.148834883 0.180538424 0.193234881
  6 0.202791843 0.184112708 0.23284002 0.201122672 0.213221589 0.255406534
  7 0.226493841 0.206773311 0.27369395 0.217205749 0.208870106 0.284997966
  8 0.226493841 0.206773311 0.27369395 0.217205749 0.208870106 0.284997966
   year
age        1953        1954        1955        1956        1957
  0 0.000000000 0.000000000 0.000000000 0.000000000 0.000000000
  1 0.004023518 0.005078631 0.005434346 0.006253664 0.006657265
  2 0.132736834 0.169854963 0.181439952 0.210059221 0.223445436
  3 0.179836383 0.214714272 0.205329380 0.215787431 0.225425585
  4 0.181970074 0.206385464 0.184007519 0.184996065 0.196787801
  5 0.193994438 0.223542229 0.190766053 0.188574680 0.210137273
  6 0.245044318 0.310991417 0.215463807 0.204095330 0.234403979
  7 0.268295977 0.337778627 0.195506869 0.203730127 0.229441681
  8 0.268295977 0.337778627 0.195506869 0.203730127 0.229441681
   year
age        1958        1959        1960        1961        1962
  0 0.000000000 0.000000000 0.000000000 0.000000000 0.000000000
  1 0.007025144 0.008113512 0.006895489 0.007543924 0.007441785
  2 0.235737401 0.274530107 0.229016556 0.251754394 0.246725873
  3 0.227380659 0.260681393 0.210487355 0.241162823 0.278021164
  4 0.188120714 0.223182935 0.179691893 0.209502151 0.257293157
  5 0.189805719 0.224336084 0.181160717 0.202608319 0.261975152
  6 0.165677853 0.246125379 0.202192563 0.208997055 0.316686162
  7 0.141543084 0.244574129 0.228444944 0.199241824 0.300345024
  8 0.141543084 0.244574129 0.228444944 0.199241824 0.300345024
   year
age        1963        1964       1965       1966      1967       1968
  0 0.000000000 0.000000000 0.00000000 0.00000000 0.0000000 0.00000000
  1 0.005676455 0.008348186 0.01416961 0.01290248 0.0153944 0.02659002
  2 0.182415429 0.275605823 0.48753762 0.43804677 0.5280325 0.95284878
  3 0.188301708 0.292193120 0.54537737 0.51364056 0.6848348 1.20259972
  4 0.155818884 0.249895479 0.47757385 0.45284489 0.6239498 0.95158491
  5 0.150293852 0.240023672 0.46579107 0.45807028 0.6503287 0.90569195
  6 0.114295600 0.196050381 0.46679452 0.39073511 0.7384280 1.12432186
  7 0.125084786 0.190822382 0.47616580 0.47898144 0.9060044 1.16564974
  8 0.125084786 0.190822382 0.47616580 0.47898144 0.9060044 1.16564974
   year
age      1969      1970      1971       1972       1973       1974
  0 0.0000000 0.0000000 0.0000000 0.00000000 0.00000000 0.00000000
  1 0.0197390 0.0217371 0.0235931 0.01672614 0.02352954 0.02194995
```

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  2 0.6843785 0.7568328 0.8220630 0.56219414 0.81144253 0.74967043
  3 0.8607365 0.9529927 1.0495348 0.64078563 0.95226792 0.87849765
  4 0.7733037 0.8627114 1.0280000 0.54102898 0.81055759 0.77761854
  5 0.8039119 0.8154818 1.1025377 0.49801409 0.81212966 0.84257645
  6 1.1357973 1.1400400 2.7753113 0.49156360 1.01346957 0.88976378
  7 1.0132827 0.8737571 1.6734414 0.28903101 0.67023465 0.78815596
  8 1.0132827 0.8737571 1.6734414 0.28903101 0.67023465 0.78815596
   year
age       1975       1976        1977        1978        1979        1980
  0 0.00000000 0.00000000 0.000000000 0.000000000 0.000000000 0.000000000
  1 0.02654755 0.01862278 0.006593931 0.005404257 0.005122789 0.005248562
  2 0.91874873 0.62322470 0.200371961 0.160646730 0.150939588 0.154412179
  3 1.14656368 0.85443780 0.302146490 0.223268644 0.195318369 0.187256729
  4 1.01136888 0.73745894 0.266569748 0.192040073 0.158802718 0.144258232
  5 1.11779071 0.78104049 0.315375180 0.211978367 0.161295661 0.131264139
  6 1.21381567 0.69007138 0.205902738 0.107277766 0.065128759 0.043287384
  7 1.52549927 0.98045350 0.341319136 0.186014891 0.113723757 0.073345665
  8 1.52549927 0.98045350 0.341319136 0.186014891 0.113723757 0.073345665
   year
age        1981        1982        1983        1984        1985
  0 0.000000000 0.000000000 0.000000000 0.000000000 0.000000000
  1 0.006018653 0.005179098 0.006125715 0.007316947 0.009247042
  2 0.178229880 0.150587678 0.179897434 0.217249551 0.278817911
  3 0.230008553 0.193135757 0.237943490 0.299572448 0.384000061
  4 0.213481012 0.167911303 0.240420177 0.331982095 0.429097306
  5 0.227845167 0.152251786 0.240664275 0.334924118 0.417278268
  6 0.181989060 0.090925672 0.220467567 0.347468361 0.468547541
  7 0.323584442 0.129949409 0.299353865 0.448937121 0.530579815
  8 0.323584442 0.129949409 0.299353865 0.448937121 0.530579815
   year
age        1986        1987        1988        1989        1990
  0 0.000000000 0.000000000 0.000000000 0.000000000 0.000000000
  1 0.008724336 0.008273282 0.007765702 0.007992528 0.007031221
  2 0.260601670 0.245094631 0.227937933 0.234555187 0.203425989
  3 0.338116989 0.300354311 0.271115951 0.266718952 0.218830640
  4 0.384494901 0.351720441 0.331621950 0.323073962 0.253111190
  5 0.389035210 0.360350841 0.351306192 0.332705489 0.256902852
  6 0.459788895 0.388233841 0.385921970 0.349513850 0.238973184
  7 0.519443994 0.394143229 0.403156779 0.359363754 0.256256404
  8 0.519443994 0.394143229 0.403156779 0.359363754 0.256256404
   year
age        1991        1992       1993       1994        1995        1996
  0 0.000000000 0.000000000 0.00000000 0.00000000 0.000000000 0.000000000
  1 0.008430622 0.009279709 0.01049272 0.01028126 0.007957184 0.003749499
  2 0.247472456 0.274203846 0.31289762 0.30584421 0.230642967 0.101240031
  3 0.251310389 0.289856445 0.35756584 0.38649894 0.332828263 0.157526920
  4 0.266075085 0.309679621 0.37632891 0.40441255 0.352537701 0.165790520
  5 0.251532814 0.289734378 0.32591866 0.32141268 0.313063246 0.158287269
  6 0.229834441 0.305462237 0.34781642 0.30532261 0.315284734 0.120764389
  7 0.212835404 0.294012706 0.33261535 0.26369146 0.262609408 0.090579733
  8 0.212835404 0.294012706 0.33261535 0.26369146 0.262609408 0.090579733
   year
age        1997        1998        1999        2000        2001
```

```
  0 0.000000000 0.000000000 0.000000000 0.000000000 0.000000000
  1 0.003098475 0.003964822 0.003733941 0.003514785 0.002647492
  2 0.082112477 0.106003466 0.096808461 0.088623864 0.063763742
  3 0.138202694 0.180028107 0.178529165 0.170521639 0.132946008
  4 0.148380306 0.188781008 0.186371064 0.190483202 0.163609187
  5 0.144572561 0.188281325 0.182793923 0.190203608 0.179000600
  6 0.114474552 0.173493566 0.153563549 0.156565822 0.158098890
  7 0.090995687 0.115211277 0.095808808 0.102671027 0.140015613
  8 0.090995687 0.115211277 0.095808808 0.102671027 0.140015613
   year
age        2002        2003        2004        2005        2006
  0 0.000000000 0.000000000 0.000000000 0.000000000 0.000000000
  1 0.002350023 0.002304553 0.002203403 0.002634719 0.002841691
  2 0.054856080 0.052659070 0.049634266 0.058340139 0.061731832
  3 0.115991049 0.118436160 0.119668528 0.136457357 0.135764760
  4 0.152025197 0.170764841 0.188235709 0.221247839 0.210729218
  5 0.172833028 0.213106642 0.254939065 0.303775711 0.274885702
  6 0.156290330 0.204333931 0.311498715 0.442461165 0.373363037
  7 0.143905963 0.177071648 0.268852541 0.460263047 0.424102110
  8 0.143905963 0.177071648 0.268852541 0.460263047 0.424102110
   year
age        2007        2008       2009        2010       2011        2012
  0 0.000000000 0.000000000 0.00000000 0.000000000 0.00000000 0.000000000
  1 0.002737504 0.002608284 0.00187046 0.001983688 0.00227582 0.003238007
  2 0.057520744 0.053011642 0.03645613 0.038531799 0.04477842 0.065030379
  3 0.124596244 0.090111450 0.05326192 0.057881513 0.07502344 0.124534959
  4 0.188972273 0.122564764 0.06905716 0.068959768 0.09176226 0.159956898
  5 0.241421502 0.148403273 0.08363991 0.080799109 0.10771430 0.190877344
  6 0.317593208 0.145710933 0.06227512 0.056945589 0.08397856 0.204946630
  7 0.372555553 0.183280571 0.08774562 0.069133850 0.09097336 0.217294716
  8 0.372555553 0.183280571 0.08774562 0.069133850 0.09097336 0.217294716
   year
age        2013        2014        2015       2016        2017        2018
  0 0.000000000 0.000000000 0.000000000 0.00000000 0.000000000 0.000000000
  1 0.002849793 0.002639797 0.002049917 0.00198796 0.001621964 0.001689365
  2 0.056258362 0.053032413 0.041937556 0.04191324 0.034013815 0.035897811
  3 0.120974677 0.119080730 0.101062894 0.11636226 0.109761746 0.120792173
  4 0.175155036 0.176452678 0.162292301 0.18305879 0.172016932 0.199590205
  5 0.227436240 0.225655279 0.234260093 0.25645550 0.221502184 0.265382580
  6 0.294449967 0.270441386 0.341154471 0.38377671 0.274018045 0.340673488
  7 0.339656602 0.329147107 0.472903426 0.57555081 0.403690278 0.493117012
  8 0.339656602 0.329147107 0.472903426 0.57555081 0.403690278 0.493117012
   year
age        2019        2020
  0 0.000000000 0.000000000
  1 0.001353414 0.001353396
  2 0.028408060 0.028407709
  3 0.102631450 0.102630286
  4 0.169035474 0.169033714
  5 0.238837695 0.238835413
  6 0.305324360 0.305319904
  7 0.447185055 0.447179065
  8 0.447185055 0.447179065
```

```
, , area = BD

   year
age         1947         1948         1949         1950         1951
  0 0.0004254691 0.0004057721 0.0007496947 0.0012983618 0.0021474644
  1 0.0006236132 0.0005664338 0.0019677105 0.0059968307 0.0166401784
  2 0.0001596298 0.0001503870 0.0003184482 0.0006257946 0.0011663822
  3 0.0002230317 0.0002153825 0.0003369227 0.0005041291 0.0007306202
   year
age         1952        1953        1954        1955        1956
  0 0.0029737922 0.003704661 0.004617573 0.004916170 0.004485667
  1 0.0322038739 0.050300257 0.071459417 0.101809938 0.104915711
  2 0.0017383400 0.002266006 0.002785317 0.003451984 0.003522532
  3 0.0009153046 0.001064992 0.001194180 0.001345343 0.001344339
   year
age        1957        1958        1959        1960        1961
  0 0.005162996 0.005494037 0.009062819 0.014309740 0.014723436
  1 0.128637649 0.118994757 0.144103315 0.158428212 0.112822994
  2 0.003943895 0.003764828 0.004187979 0.004379081 0.003550911
  3 0.001428313 0.001382809 0.001450255 0.001457796 0.001287938
   year
age        1962        1963        1964        1965        1966
  0 0.009135413 0.012962161 0.016623988 0.015504825 0.021955649
  1 0.078525696 0.118912506 0.209404018 0.202545839 0.225066163
  2 0.002780829 0.003549529 0.004982881 0.004883634 0.005158329
  3 0.001115287 0.001280505 0.001590605 0.001592814 0.001661627
   year
age        1967        1968        1969        1970        1971
  0 0.028921219 0.030999598 0.022085615 0.035301627 0.049707655
  1 0.279992795 0.296404469 0.259564807 0.311145348 0.491395254
  2 0.005798923 0.006034370 0.005546661 0.006187814 0.008102060
  3 0.001793051 0.001843874 0.001754345 0.001881205 0.002207203
   year
age        1972        1973        1974        1975        1976
  0 0.064959730 0.071182267 0.092586031 0.114665270 0.084138440
  1 0.558725560 0.561475494 0.467446346 0.438398174 0.188659621
  2 0.008833681 0.008823322 0.007863606 0.007496529 0.004431910
  3 0.002337408 0.002343405 0.002193530 0.002139386 0.001561401
   year
age        1977        1978        1979        1980        1981
  0 0.075950802 0.094162224 0.116188179 0.143357570 0.314505543
  1 0.110822965 0.100556114 0.094066240 0.086459527 0.179157589
  2 0.003131091 0.002995307 0.002932628 0.002853071 0.004365784
  3 0.001262257 0.001225452 0.001208038 0.001187061 0.001502701
   year
age        1982        1983        1984        1985        1986
  0 0.313315313 0.310395074 0.191454602 0.128128711 0.101927053
  1 0.172865698 0.202185994 0.182303846 0.227673500 0.236135187
  2 0.004343858 0.004891074 0.004763584 0.005721029 0.006180265
  3 0.001495961 0.001605099 0.001593940 0.001787428 0.001863019
   year
age        1987        1988        1989        1990        1991
```

```
  0 0.133901676 0.128329096 0.115342063 0.094992145 0.118512594
  1 0.315495279 0.393209165 0.316793609 0.270778057 0.224790747
  2 0.007833976 0.009519714 0.009202201 0.009346684 0.009727777
  3 0.002144970 0.002401882 0.002346308 0.002350455 0.002400390
   year
age        1992        1993        1994       1995        1996        1997
  0 0.195380970 0.211421648 0.140936945 0.13216858 0.067881163 0.024526968
  1 0.262797263 0.240225767 0.121103687 0.10707732 0.066965226 0.023329534
  2 0.011975573 0.012860003 0.009716907 0.01015923 0.008776931 0.005766687
  3 0.002730617 0.002893165 0.002490202 0.00259376 0.002377326 0.001873694
   year
age        1998        1999        2000        2001        2002
  0 0.021394465 0.024595204 0.029347917 0.020269044 0.026071202
  1 0.022637230 0.017197492 0.018403510 0.006978742 0.016543792
  2 0.006290206 0.006023339 0.006427652 0.003866011 0.006474955
  3 0.001933940 0.001899925 0.001765649 0.001222338 0.001289424
   year
age        2003         2004        2005         2006         2007
  0 0.028391870 0.0360621807 0.050843770 0.0409406078 0.0289817697
  1 0.024657707 0.0294634360 0.039006448 0.0197926438 0.0106197951
  2 0.007312579 0.0080335357 0.008139999 0.0051658312 0.0025269984
  3 0.000971650 0.0008266217 0.000572396 0.0003833313 0.0001364983
   year
age          2008         2009         2010         2011         2012
  0 0.03037552674 0.0253415705 0.0263188196 0.0306942632 0.0340106867
  1 0.01085909179 0.0106473355 0.0102415520 0.0119213011 0.0173176398
  2 0.00190778057 0.0019012095 0.0022059916 0.0020703886 0.0030044718
  3 0.00007777724 0.0001001045 0.0001916648 0.0001815494 0.0002588558
   year
age         2013         2014         2015          2016          2017
  0 0.0257010496 0.0327145627 0.0444153416 0.05791078362 0.04391751108
  1 0.0145494689 0.0152157593 0.0165222572 0.01933276144 0.01242271982
  2 0.0028647232 0.0027030016 0.0020082267 0.00195367683 0.00098327138
  3 0.0002376307 0.0002068359 0.0001065275 0.00009283426 0.00003386248
   year
age          2018          2019          2020
  0 0.04311169413 0.03105075007 0.03105442223
  1 0.00901278844 0.00706593160 0.00706556329
  2 0.00064187832 0.00049502582 0.00049501031
  3 0.00002393186 0.00002168145 0.00002168104
```

Table 2.6.2.14. North Sea Herring multifleet assessment. ESTIMATED POPULATION ABUNDANCE

```
Units  :  NA
   year
age     1947     1948     1949     1950       1951     1952     1953
  0 52991791 51205504 44906588 62694268 59766909.5 57849822 62201288
  1 19603408 23568649 22930723 18909009 28933887.8 26393449 25276879
  2 16125281  9961607 14055611 11757343  9078741.3 14450339 12642029
  3  6305835  9256383  7917733 11052838  7566301.3  5008093  7429502
  4  8499678  4056669  4635135  5828798  8065479.2  4377636  3281081
```

```
  5  5278194  5749311  2532781  2633192  4116934.4  4464080  2549119
  6  4659903  3420660  3597453  1583815  1658444.3  2436111  2588666
  7  2479580  2585793  2144457  1981642   904453.3  1049006  1377989
  8  7535805  5739955  4887660  3608416  3011548.0  2486357  1954032
   year
age     1954       1955       1956       1957       1958       1959
  0 58957444 49110768.2 36514524.3 83883083.0 35484096.4 39390387.3
  1 28179604 25358002.4 21961507.9 14787926.7 45114205.5 15203606.2
  2 11854652 13871470.8 10931602.1 10137142.0  5868277.4 23914069.1
  3  6735301  6541095.1  7598508.2  4644371.3  5496718.8  2618355.3
  4  3910473  3381307.2  3595625.1  4352131.8  2310565.9  2810129.6
  5  2087415  2235294.1  1824035.8  2072409.6  2731466.0  1326791.8
  6  1477089  1275422.8  1288353.5  1137735.8  1138934.2  1393291.0
  7  1479510   799722.5   688744.5   795596.9   666976.4   671703.6
  8  1935821  1605495.6  1671418.3  1398831.9  1191288.7  1461702.1
   year
age       1960       1961       1962       1963       1964       1965
  0 16313220.3 75349457.2 36030059.7 41920334.5 42741114.1 21402504.9
  1 19266566.2  5217574.9 37152450.2 16053052.7 17814332.0 19995568.8
  2  6413813.2  8916978.0  1896188.9 19940493.4  7569030.1  6719341.5
  3 12903377.6  2911571.5  3721905.7  1176620.8 10881682.2  3730671.9
  4  1277755.5  8493491.7  1611121.2  1463739.0   755625.6  5959007.0
  5  1382455.0   792074.2  5122661.5   787479.2   834244.9   434097.1
  6   721352.0   952818.9   490624.3  2643776.9   573141.6   463410.1
  7   725997.5   405165.0   619144.7   233242.9  1746950.4   353352.8
  8  1343962.5  1014065.7   815065.3   831226.1   610959.7  1513091.8
   year
age       1966       1967       1968        1969        1970        1971
  0 22140466.1 28941642.5 28882628.3 14738319.81 28538402.93 22366928.41
  1  9421482.8  9073891.0 12433894.0 12332169.18  6512009.90 12601064.64
  2  8442248.2  3902507.2  3277775.0  4653168.47  4515177.86  2539003.07
  3  2309796.2  3391624.3  1911788.9   693207.36  1583955.78  1288272.97
  4  1488802.8   903589.1  1219842.4   320283.35   218489.26   393110.79
  5  2531747.1   702895.9   306810.0   370822.50   102496.66    55230.28
  6   189464.4   924791.5   264761.6    81513.41   117138.93    31156.86
  7   201056.9   113395.8   284288.1    70616.10    16656.34    32885.34
  8   929414.1   492674.3   173951.5    98214.93    45612.24    17921.99
   year
age         1972        1973         1974        1975        1976
  0 15371472.543 8232280.983 13675474.377 3346609.160 4495131.809
  1  9760675.252 6372129.011  3234487.059 6485883.085 1088321.899
  2  3759269.057 2847391.323  1715527.379 1010480.283 2155195.663
  3   819297.196 1240277.844   789230.958  470889.585  237062.792
  4   335723.276  314757.477   285242.032  250716.751  105025.682
  5   101356.352  129570.709   104878.718   87637.869   70443.601
  6    15344.762   48555.821    42491.287   29889.703   16309.359
  7     1092.367    8276.329    11635.547   12554.724    7348.432
  8     7083.188    4726.784     5861.691    6335.749    2712.283
   year
age        1977        1978         1979         1980        1981
  0 5607178.266 6170980.660 10986797.455 16504933.726 34408394.13
  1 1883959.285 2412460.552  2379250.310  4431757.506  6375025.45
  2  382023.470  852991.442  1080345.965   971267.979  2089085.17
```

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  3  755669.202  283338.074   484121.645   574733.308   404198.46
  4   62683.755  318142.327   219729.328   273539.882   262428.55
  5   30720.279   39659.984   155967.996   184886.541   161809.85
  6   23771.478   14461.058    27151.343    79592.484   137485.73
  7    5911.798   12891.623     8544.550    21895.374    67271.85
  8    2764.274    4360.629     9413.479     9609.708    24819.97
   year
age        1982        1983        1984        1985        1986
  0 55482701.53 54151411.36 55874003.49 67628118.77 82502703.09
  1 10278728.22 17877200.62 15565619.41 18515283.34 25870961.54
  2  2430632.24  3950262.20  7058015.60  6437858.14  6341655.54
  3  1283203.34  1290099.29  2081212.43  3994948.11  3323339.12
  4   241577.04   603183.00   782220.44  1131034.11  1753154.84
  5   141798.43   146360.19   312757.26   407059.57   489173.08
  6    90087.02   116743.39    90485.79   139436.10   190112.55
  7    80354.97    58668.83    75715.29    53501.09    59953.44
  8    47231.20    95652.34    91030.59    83278.89    70947.79
   year
age        1987        1988       1989       1990       1991       1992
  0 74143207.72 46380904.21 37800213.3 33113192.8 36340449.2 64886378.5
  1 33989243.61 25347551.37 16653928.1 13273011.5 13378517.2 13041706.4
  2 10571710.99 12338650.76  8267781.1  5523511.6  5005253.1  5651842.3
  3  3011904.74  5427872.37  6676780.5  4619645.8  2812380.3  2145493.4
  4  1766115.01  1558257.66  3095328.5  4338552.3  2735449.1  1595582.1
  5   894728.71   939699.55   820684.7  1854677.9  2583287.7  1601084.8
  6   255136.77   453627.32   472813.6   450727.1  1056012.7  1560463.3
  7    86617.72   129860.79   228996.9   261557.4   251798.0   639165.6
  8    57840.36    78273.42   106264.8   195884.3   237318.5   288601.3
   year
age       1993       1994       1995       1996       1997       1998
  0 69218686.3 56623356.0 60132093.7 49202714.8 40897657.2 26097797.4
  1 20794011.2 21390275.3 19179640.2 19154913.9 19026842.0 16655682.1
  2  4755376.0  7177996.8  7813677.0  7203636.3  7871162.9 11051047.2
  3  2385481.0  1782875.1  3143839.3  3763675.4  3803307.4  3832355.9
  4  1135910.6  1007647.1   895972.6  1371061.4  2003352.7  1861249.4
  5   886846.7   495462.5   452775.5   429497.5   803213.1  1063490.6
  6   895132.5   419825.6   247882.2   193911.3   255885.8   544104.6
  7   766530.5   404707.4   207682.5   122603.8   120942.8   160760.6
  8   497004.2   573579.7   459356.0   314174.1   250868.5   205415.2
   year
age       1999       2000        2001       2002       2003       2004
  0 82296940.5 52967525.6 103526184.0 50643694.1 26880539.5 32082787.2
  1 10884069.3 32535094.7  19168571.4 42687746.8 18851329.3  9604961.4
  2  6812872.9  6652042.9  15045003.5  9598590.9 23308135.5  7356937.6
  3  6444545.7  3604262.8   4314975.7  9646844.5  5471842.5 13242433.0
  4  2013363.5  3769181.8   2044016.6  2297133.2  5977499.2  3521779.6
  5   931392.3  1201427.8   2039146.1  1111349.0  1274146.9  3592817.6
  6   521932.0   591021.6    608086.3  1252826.5   693465.3   660943.5
  7   292368.5   321915.2    330242.0   367531.3   768940.2   446612.0
  8   175823.7   252606.4    337000.0   361922.9   370137.6   542935.7
   year
age       2005       2006       2007       2008       2009     2010
  0 29512068.9 29168217.9 34859596.2 30976398.7 48658402.4 39880153
```

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  1 13471816.2  9731981.5 10031115.8 12156629.7 11926198.4 17388617
  2  4496159.0  6553136.3  4086608.9  5597466.2  7169232.8  7246084
  3  4619161.2  2992680.9  3653104.3  2634611.6  3202859.7  4780453
  4  7673925.9  2894624.3  1825475.1  2060908.2  1718837.2  2397377
  5  2066881.1  4869001.6  1633222.8  1171454.2  1355825.6  1310852
  6  1898849.6  1009639.7  2559942.9  1017733.0   810386.1  1166125
  7   334716.2   860408.1   530136.5  1641429.3   755739.1   607639
  8   473677.2   351768.7   570568.1   714789.5  1899361.6  2041410
   year
age       2011       2012       2013       2014       2015       2016
  0 34377544.2 32187822.7 42409241.5 65013622.3 17311933.6 32077307.1
  1 15560276.5 12376768.9 11652527.7 19045480.7 26511598.2  6862656.6
  2  8518624.8  7745926.9  5567522.9  7003327.2 12830786.1 15935208.3
  3  4534023.3  6146468.5  5164757.9  3898877.9  3661076.0  8686387.6
  4  2995344.8  3201818.6  4183416.9  4070930.2  2368778.3  2239299.6
  5  1500900.6  2022290.7  2354242.2  2767635.4  2497871.8  1440314.3
  6   890647.6   952656.6  1389079.3  1485657.3  1627936.8  1379542.8
  7   737694.5   578180.5   587083.9   811058.3   840597.7   817099.1
  8  1706356.1  1324078.5  1201893.4   890386.6   971260.0   875323.0
   year
age       2017       2018       2019       2020
  0 19757648.5 33481370.0 32355791.5 29721206.3
  1 12543650.6  8143814.0 11970602.7 13858645.1
  2  3172483.7  5819277.6  3217313.6  5986455.9
  3 10328975.5  2281480.9  3342160.8  1996459.5
  4  5853404.7  7019756.4  1612034.4  2046692.1
  5  1465106.6  3949758.9  4039923.0   932395.3
  6   712954.9   940573.3  2347313.1  2210799.7
  7   642427.2   460625.2   481131.3  1211135.7
  8   734053.9   851380.6   665940.5   518460.7
```

Table 2.6.2.15. North Sea Herring multifleet assessment. PREDICTED CATCH-AT-AGE 1947-1996 (summed fleets)

```
Units  :  NA
   year
age       1947      1948       1949       1950       1951      1952
  0   15425.94  14216.00   23030.77   55671.69   87748.16  117573.3
  1   27776.07  31914.66   59132.92  109917.17  410184.89  677210.0
  2  473655.96 283621.34  501754.97  550311.32  656955.95 1266151.0
  3  422740.90 619692.05  620132.36 1005976.75  927030.61  642490.2
  4  663200.58 320004.80  426393.23  604246.50 1092061.05  610025.2
  5  537628.05 578702.80  292225.60  310349.26  580424.08  670143.0
  6  730990.09 491335.95  639160.49  246592.59  272242.20  469955.1
  7  430886.50 413915.11  440803.93  331632.76  146106.90  223396.0
  8 1309950.31 919108.74 1005005.02  604073.10  486648.30  529663.1
   year
age      1953      1954      1955      1956      1957       1958      1959
  0  157436.9  185925.7  164867.4  111867.7  295706.4  133090.76  243335.7
  1  979391.2 1521981.6 1892065.4 1696169.7 1375136.3 3925862.25 1579586.7
  2 1302578.0 1534616.0 1912767.1 1718685.7 1686573.6 1022972.98 4766532.4
  3 1024286.4 1090901.3 1018362.8 1237007.4  786496.8  937869.23  504331.9
  4  463030.8  618921.0  482708.7  515807.9  660550.4  336603.54  477611.2
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  5  384304.1  357724.2  332345.0  268372.0  336341.7  404336.22  228329.2
  6  481371.1  338413.5  211353.7  203280.4  203356.0  148461.74  260103.9
  7  278341.9  364720.1  121662.2  108777.4  139866.2   75301.53  125013.8
  8  394824.1  477358.4  244324.3  264062.5  245994.6  134540.44  272131.7
   year
age      1960       1961      1962       1963       1964      1965
  0  158759.3  754362.90  224352.9  369761.25  482746.12  225565.2
  1 2162032.3  435504.59 2255413.7 1386019.76 2576013.60 2880554.6
  2 1093554.0 1646890.23  343333.3 2776133.95 1520636.88 2156605.9
  3 2055252.1  523288.83  757643.3  169341.21 2316237.63 1324862.0
  4  178615.6 1363105.38  310248.5  179407.36  142051.86 1931006.2
  5  196236.2  124322.77 1010074.6   94107.19  152536.80  138948.6
  6  112854.2  153607.34  114174.6  243440.54   87188.27  148798.9
  7  127133.6   62708.58  137999.9   23448.56  259953.29  115552.1
  8  235425.0  157000.91  181726.2   83592.97   90942.85  494958.6
   year
age       1966      1967      1968       1969       1970       1971
  0  329506.08  565705.5  604522.2  220626.96  679131.17  744441.92
  1 1477019.98 1722138.9 2551577.2 2231667.78 1371589.85 3810567.36
  2 2492287.74 1334619.3 1693480.1 1927156.75 2007150.84 1195922.71
  3  783242.04 1426300.9 1151252.6  341019.95  831663.11  717840.55
  4  462515.27  359285.2  646955.1  148306.52  108845.17  218642.80
  5  799760.18  290176.4  158813.9  177530.54   49547.49   32220.19
  6   52644.63  418758.6  156590.4   48489.42   69835.05   26561.12
  7   66056.74   58993.1  171965.8   39379.14    8466.31   23768.16
  8  305450.85  256382.1  105251.7   54784.91   23191.06   12956.44
   year
age         1972        1973       1974        1975       1976        1977
  0  664517.0281  389258.817 831034.574  250342.202 250464.059 283128.6560
  1 3215425.2531 2120680.925 945317.591 1803392.399 150445.789 154710.6027
  2 1355914.3813 1329804.294 761013.292  511018.227 833027.432  58383.0074
  3  328592.2539  650819.887 394128.066  275939.926 115783.265 164928.4338
  4  120023.1647  150503.019 132707.010  138020.995  47021.456  12450.3762
  5   34241.3085   62490.214  51820.398   51527.959  33077.276   7125.2245
  6    5133.4439   27030.201  21786.924   18454.472   7051.734   3793.7157
  7     235.4946    3509.146   5517.412    8714.109   4024.092   1475.8501
  8    1527.4947    2004.747   2780.335    4398.680   1485.709    690.3348
   year
age        1978        1979         1980        1981         1982
  0 383033.7266 832312.7858 1520612.6152 6451481.265 10322818.047
  1 180312.8001 167810.9618  292542.7411  793839.015  1242332.219
  2 107666.9500 129560.6844  119297.7990  294113.337   298255.862
  3  47407.8938  71884.0173   82282.4762   69867.337   190373.816
  4  47192.2764  27432.9970   31307.6772   43076.617    32004.178
  5   6496.4687  19960.9059   19595.9114   28440.523    17352.719
  6   1261.1296   1470.8414    2909.0121   19758.973     6781.677
  7   1884.7278    791.0757    1334.7418   16162.891     8485.488
  8    637.7789    871.9291     586.1178    5966.748     4990.886
   year
age       1983       1984       1985       1986       1987       1988
  0 9909526.78 6561831.42 5428387.93 5303120.93 6164688.48 3709647.45
  1 2498103.24 2021479.03 2940878.71 4263621.36 7133915.12 6370048.76
  2  569097.94 1199096.05 1359831.78 1280464.38 2057618.55 2293778.50
```

```
  3  231708.77  459043.60 1092426.28  823845.35  680748.98 1131316.76
  4  110741.20  190557.95  342483.19  488600.44  459823.08  387770.15
  5   27151.84   77427.91  121411.11  138487.56  238923.30  246583.79
  6   20065.17   23183.77   45790.89   61743.29   72507.37  128629.25
  7   13235.30   24018.41   19407.71   21458.92   24915.30   38117.32
  8   21595.09   28901.87   30231.99   25406.70   16644.22   22984.63
   year
age       1989       1990       1991       1992      1993       1994
  0 2741891.24 2000377.25 2718675.27 7778041.23 8939452.0 5031301.37
  1 3553438.76 2509282.93 2215385.96 2472706.42 3723308.5 2294872.24
  2 1581639.97  949159.38 1009480.12 1242801.32 1161220.8 1708217.34
  3 1379488.12  810038.95  558249.36  480630.07  636106.3  506262.54
  4  755708.61  862322.99  568280.89  376462.59  314700.8  295412.64
  5  206383.26  375372.92  514715.75  360120.20  220390.0  121606.85
  6  123824.35   85414.20  194027.32  366673.34  234858.5   98901.71
  7   61177.74   52251.61   42611.54  143848.44  191671.2   82744.27
  8   28402.03   39157.81   40211.14   65081.97  124592.8  117645.51
   year
age       1995        1996
  0 5037781.48 2172246.206
  1 1879097.88 1320131.044
  2 1497755.00  740298.191
  3  795773.24  519268.384
  4  235222.33  190195.504
  5  108898.45   57826.342
  6   60124.85   20492.678
  7   42292.45    9326.977
  8   93890.63   23990.854
```

Table 2.6.2.16. North Sea Herring multifleet assessment. CATCH-AT-AGE RESIDUALS 1947-1996 (summed fleets)

```
Units  :  NA
   year
age           1947          1948       1949       1950       1951
  0 0.000000000000  0.0000000000  0.0000000  0.0000000  0.0000000
  1 0.000000000000  1.6763948031  0.0000000  0.0000000  3.6366445
  2 0.003803974062  3.2149192903  2.2582415  0.3324272 -1.0052863
  3 5.976998589785  3.3741468336  1.4162999  0.7310880  0.1393934
  4 0.000005463472  1.4732163080 -0.6229474  1.4378079  1.6526802
  5 1.564537141025  0.2653490235  0.1980542 -1.0284663  0.9664654
  6 2.510224904974  1.6523708665  0.5072678 -0.4168431 -0.6349659
  7 0.194678529914 -0.0238804705  1.4103571 -0.1013004 -0.0280305
  8 1.796274565982 -0.0002728092  0.1860118 -0.2827679 -0.1162220
   year
age       1952        1953       1954       1955        1956        1957
  0  0.0000000  1.92197765  0.4980945 -0.2463143 -0.66557749  1.08072803
  1  0.9361980  0.28172796  0.1649020  0.3417575  0.15512982 -0.16235529
  2 -0.7104467 -0.59338276 -0.1774475  0.0579161 -0.36057612  0.02008057
  3 -1.7261917 -1.49618601 -0.9475774 -1.1194200 -0.82377845 -1.82075765
  4 -0.2069229  0.07417182 -1.1508716 -1.3242056 -0.46124017  0.18604213
  5  0.1477315 -0.08793209  0.6617736 -0.4581783 -0.82999823  0.29859205
```

```
  6  0.9860945  0.28048870  0.5558783  0.4458254  0.12354010  0.67245982
  7  1.7465168  0.23305533  0.3714273 -0.8705319 -0.01881574  0.37339666
  8  1.4638036  0.65244392  1.0314145 -0.7864980  1.97320216  0.31868785
   year
age       1958        1959        1960        1961       1962       1963
  0 -0.9969680  0.00000000  0.59294817  2.19263575 -1.9213173  0.8888631
  1  1.1348238 -0.34269383  0.12445034 -3.26019274  0.8706540  0.2522296
  2 -0.3165291  1.63865349 -0.98519962  0.09898932 -2.2305273  1.2191723
  3 -0.1031804 -1.50783614 -0.13907656 -0.62775999  0.4618362 -0.2774421
  4 -1.2266307 -0.22088927 -0.95592060  1.48426039  0.7521476 -3.4366544
  5  0.3390807 -0.34878433 -1.42977109  0.03040965  0.8509634 -2.2877694
  6 -0.8815083  0.08337111  0.75580947  0.30126834  0.9591278 -0.4522460
  7 -0.7232912  0.48902276 -0.03228896 -1.13643036  0.7591513 -0.8183902
  8 -0.5959134  2.30948535  1.33744636 -1.58720684 -0.5448990  0.3562401
   year
age       1964       1965        1966        1967        1968       1969
  0  0.2807665 -1.2943144  0.71494213  0.77633379  0.46843176 -2.1778808
  1  0.6352091  0.6199451 -0.48152923 -0.50686763 -0.21222361  0.4125877
  2  0.6148288 -0.2295986 -0.05910311 -0.14438621  0.23888529 -0.4857211
  3  0.6956751  0.8898955 -1.64441266  0.09025701  1.83993958 -3.2426407
  4  1.4126585  1.0417597 -0.60994447 -0.37638159 -1.28910394 -1.3110973
  5 -0.2137682  0.7614785  0.01389934  0.19459690 -1.65314126 -0.3960823
  6  0.4662358 -0.2997487 -0.75007106 -0.38427924  0.07182717  1.0006679
  7 -0.2401305  0.8193296  0.28409651  1.57536080 -1.90820252 -0.3977047
  8 -1.7241223  0.1941150  0.81243312 -0.83758348  1.06824728 -2.4592983
   year
age        1970        1971        1972       1973       1974       1975
  0  1.96244668  0.06459975  0.07813457 -1.0618464  1.2323408 -1.2394871
  1 -0.39405211  0.65068852 -0.15670411 -0.2379243 -1.3641628  0.7743102
  2 -0.13752770  0.45837634 -0.89651984 -0.7303104 -1.2087360  0.3084954
  3 -0.62559411 -1.25675488 -0.09194488  0.2971076 -0.3324684  0.2057770
  4 -0.27758426 -0.30150314 -0.76375221  1.1066073 -1.0294155  0.8669649
  5 -0.78621722 -1.37617354 -1.12236225  1.1920224  1.4200970  0.3610135
  6 -0.26464763  1.67360640 -1.20135567  2.4123122 -0.3146951 -1.3117772
  7 -2.40596010  0.59329791 -3.36301836  2.4851822  0.8393524  2.0302863
  8  0.02179797 -0.61543412  0.43194856  0.9515379  2.0028497  0.2554176
   year
age        1976        1977 1978 1979       1980       1981        1982
  0 -0.39720198  0.18456185    0    0  1.5004697  2.5803550  0.75680763
  1 -2.97829126 -0.84187845    0    0 -0.7270726  0.2338973 -0.80361011
  2 -0.02033085 -3.19618578    0    0 -0.3531468  0.6888490 -0.86027391
  3  0.30546021 -0.09254521    0    0 -0.3086987 -1.6776056  1.20388500
  4 -0.10261852 -1.90312197    0    0  0.3302685 -0.1251313 -0.09389326
  5  0.23999193 -1.01253340    0    0  2.3465755  0.5497252 -0.07041632
  6 -2.44241985  0.60661544    0    0 -2.9898950  4.1703654 -0.45944011
  7  1.24062689 -0.10678048    0    0  1.1546882  2.6803179 -1.55238027
  8 -1.96670357 -0.54066870    0    0 -2.2382041  1.6283252 -0.50467080
   year
age       1983        1984        1985       1986        1987        1988
  0  0.3267254 -0.65794949 -0.78750424 -0.4479547  0.59804284 -0.86714212
  1  0.3855354  0.01122359  0.90868539  0.9585942  0.10573915  1.08264931
  2  0.1468757  0.07897868  0.52893675 -0.4322631  0.43819939 -0.08413128
  3  0.1330117  0.50671740  1.17735519  0.2242003 -0.81610968 -0.35452297
```

```
  4  0.5642239  0.97600989  0.26157358 -0.7201860  0.23171377 -0.10310364
  5  0.6072250  0.30275083 -0.06541379 -0.5541213  0.28295333  0.45931763
  6  2.7253943  0.11468472 -0.88862637  0.2721526 -0.08466497 -0.01603100
  7 -0.2062706  0.89396013  0.68290588 -0.5505951 -0.90763580  0.10099968
  8  1.2001074  0.66124175  0.58218589  1.8060508 -0.31469374  0.47545142
   year
age        1989        1990       1991       1992        1993        1994
  0 -0.32034324 -0.91505079  0.4076556  1.6178646  0.27249104 -0.87442019
  1 -0.82119496  0.55421949 -0.5081002 -0.6717247 -0.42124865 -1.67135126
  2  0.08362139 -0.02074785  1.0429712  0.1201875 -0.09408469 -1.28660912
  3 -0.13095163 -0.06067437 -0.2016389 -0.0855467  0.43782081 -0.20124847
  4  0.44577753  0.01441010 -0.7270860  0.2802363  0.25701740  1.02361739
  5 -0.24642253  0.26266629 -0.6073259  0.3305923 -0.18133099 -1.77051246
  6 -0.45148115 -0.31237084  0.2969924  0.4163068 -0.21391929 -1.07795238
  7 -0.08808912  0.38549002 -1.4699110  0.7473954 -0.21205029 -1.24029031
  8 -0.24997048  0.24904134 -0.4461709 -0.3966554  0.51817582 -0.09823056
   year
age       1995       1996
  0  0.3992745 -1.2270276
  1 -0.7936420  0.1649295
  2 -1.7582367 -3.0836756
  3  0.5132602 -0.3289446
  4 -0.3955713 -1.6543327
  5  0.8349952 -0.1658593
  6 -0.2767952  0.9370553
  7 -0.3417235 -1.0589785
  8  0.2271525 -1.8503770
```

Table 2.6.2.17. North Sea Herring multifleet assessment. PREDICTED INDEX AT AGE LAI-ORSH

```
Units  :  NA
   year
age     1972     1973      1974     1975      1976     1977     1978
  0 2308.509 1851.873 1099.8760 647.1364 1130.1374 824.7905 935.7554
  1 1340.271 1075.158  638.5645 375.7136  656.1337 478.8558 543.2796
   year
age      1979      1980     1981     1982     1983     1984    1985
  0 1328.9290 1685.0382 2114.563 2639.262 2609.570 3587.944 4085.63
  1  771.5478  978.2973 1227.670 1532.299 1515.061 2083.084 2372.03
   year
age     1986     1987     1988     1989     1990     1991     1992
  0 4698.965 5699.942 6697.169 7566.462       NA 3934.495 936.7481
  1 2728.119 3309.265 3888.233 4392.926 4200.856 2284.284 543.8560
   year
age     1993     1994     1995     1996     1997     1998     1999
  0       NA 890.6409       NA       NA       NA       NA       NA
  1 480.1602 517.0871 1857.296 4792.451 6047.581 6885.936 7540.132
   year
age     2000     2001     2002     2003     2004     2005     2006
  0       NA       NA       NA       NA       NA       NA 6171.387
  1 7760.599 8910.746 8847.299 6517.756 5215.365 4579.375 3582.976
```

```
   year
age     2007     2008     2009     2010     2011    2012     2013    2014
  0       NA 4484.478       NA       NA       NA      NA       NA      NA
  1 2362.441 2603.592 2787.197 2876.017 3786.828 4195.17 3875.385 3568.47
   year
age     2015     2018     2019
  0       NA       NA 1657.107
  1 3073.761 733.8047       NA
```

Table 2.6.2.18. North Sea Herring multifleet assessment. INDEX AT AGE RESIDUALS LAI-ORSH

```
Units  :  NA
   year
age     1972        1973       1974       1975       1976        1977
  0 1.356885  0.11026241 -0.9668326 -0.4861022  0.2737448  1.03433601
  1 1.367649 -0.08988364 -0.4221544 -1.5346186 -0.7959615 -0.06648087
   year
age      1978     1979        1980       1981        1982        1983
  0  1.935566 1.628796  0.95401482  0.5124014  0.11854758 -0.05923156
  1 -1.184158 1.546439 -0.03681079 -1.1559506 -0.06445275 -0.50860767
   year
age       1984      1985        1986       1987      1988      1989
  0 -0.1817556 0.5301445 -0.08274676  0.4305656 0.2934881 0.7100293
  1  0.2796557 0.4210527 -0.18980539 -0.3254024 0.7556194 0.4487689
   year
age      1990       1991      1992      1993      1994     1995
  0        NA -1.2794985 -1.974920        NA -1.654097       NA
  1 0.6643821 -0.1016824  1.350135 -1.072055  2.056072 2.311549
   year
age        1996       1997      1998       1999        2000      2001
  0          NA         NA        NA         NA          NA        NA
  1 -0.05731425 -0.1879486 0.2437372 -0.2851473 -0.4784196 0.1322101
   year
age       2002       2003      2004        2005       2006       2007
  0         NA         NA        NA          NA  0.1724099         NA
  1 -0.3968978 -0.8636024 0.1728643 -0.05879057 -0.2454789 -0.1221582
   year
age      2008      2009        2010      2011     2012     2013      2014
  0 0.3755036        NA          NA        NA       NA       NA        NA
  1 0.9223481 0.8225126 -0.01853485 0.3701493 1.617641 1.648724 0.4689029
   year
age      2015      2018      2019
  0        NA        NA 0.6722727
  1 0.8238508 -1.868202        NA
```

Table 2.6.2.19. North Sea Herring multifleet assessment. PREDICTED INDEX AT AGE LAI-BUN

```
Units  :  NA
   year
age     1972      1973      1974     1975     1976     1977     1978
  0 21.98895 17.639413 112.56698 71.10465       NA 63.87924       NA
  1       NA  6.871859  43.85318       NA 9.480862 24.88570 46.11013
   year
age     1979      1980     1981     1982      1983     1984      1985
  0 64.57884 16.361221 28.96267 352.8857 1755.3748 2806.064 2538.8399
  1 25.15825  6.373909 11.28311 137.4752  683.8486 1093.170  989.0664
   year
age      1986     1987     1988     1989     1990     1991    1992
  0 2285.6042 2683.862 4654.798 4166.211 5322.421       NA      NA
  1  890.4123 1045.563 1813.389 1623.048 2073.478 3362.952 4470.28
   year
age     1993     1996     1997     1998     1999     2000     2001
  0       NA       NA       NA       NA       NA 195.4298       NA
  1 3030.147 561.3765 169.6535 317.8413 154.9747  76.1344 229.2309
   year
age     2002     2003     2004     2005    2006     2007     2008     2009
  0       NA       NA       NA       NA      NA       NA       NA       NA
  1 737.4687 1486.623 1760.861 1278.497 729.099 796.5325 723.8967 1349.674
   year
age     2010     2011     2012     2013     2014   2015     2016     2017
  0       NA       NA       NA       NA       NA     NA       NA       NA
  1 1445.598 2123.744 2672.923 3405.019 3408.105 3126.4 3779.307 3813.705
   year
age    2018     2019
  0      NA 5786.572
  1 4486.16 2254.299
```

Table 2.6.2.20. North Sea Herring multifleet assessment. INDEX AT AGE RESIDUALS LAI-BUN

```
Units  :  NA
   year
age       1972        1973     1974     1975      1976      1977     1978
  0 -0.3264201 -1.37589458 1.325944 0.622026        NA 1.4553941       NA
  1         NA  0.06862822 1.960361       NA -2.361647 0.4196813 1.499903
   year
age       1979       1980       1981     1982      1983      1984
  0  0.3949763 -0.8655318 -0.9863637 1.549464 1.4031931 0.2137484
  1 -1.1829569 -1.8334456  1.0586190 1.224382 0.3411073 0.6185063
   year
age      1985       1986        1987      1988       1989      1990
  0 0.1592201  0.0351558  0.02743315 0.7760330  0.5267477 0.1983381
  1 0.5137552 -0.9483379 -0.29681866 0.9654793 -0.5550519 0.1813717
   year
age      1991       1992     1993      1996      1997     1998       1999
  0        NA         NA       NA        NA        NA       NA         NA
  1 0.0168791 -0.4791295 -2.66928 -2.170667 -2.172867 1.260456 -0.6610685
```

```
   year
age       2000     2001      2002      2003      2004      2005       2006
  0 -1.6626597       NA        NA        NA        NA        NA         NA
  1  0.9805759 0.373644 0.8969661 0.5462103 0.7492309 -0.132851 -0.8443287
   year
age      2007        2008     2009       2010     2011     2012     2013
  0        NA          NA       NA         NA       NA       NA       NA
  1 0.6683741 -0.06879095 1.412438 0.07470418 0.559806 1.234073 1.489342
   year
age     2014      2015      2016      2017       2018        2019
  0       NA        NA        NA        NA         NA -0.05898927
  1 0.630779 0.4631181 0.1962898 0.6764039 -0.3624391  0.28628254
```

Table 2.6.2.21. North Sea Herring multifleet assessment. PREDICTED INDEX AT AGE LAI-CNS

```
Units  :  NA
   year
age      1972      1973     1974       1975       1976       1977
  0 445.44351 357.33226 292.2692         NA 167.823189 152.673488
  1 637.45201 511.36039       NA 206.666530 240.163403 218.483419
  2 304.06796 243.92160 199.5083  98.581022         NA 104.217740
  3  21.07354  16.90507       NA   6.832193   7.939567   7.222848
   year
age       1978      1979       1980     1981      1982     1983      1984
  0 187.358341 217.13796 174.958170 245.5113 394.43224 566.0686 1126.8546
  1 268.119184 310.73532 250.373917 351.3390 564.45232 810.0726 1612.5854
  2 127.894260 148.22238 119.429675 167.5906 269.24673 386.4089  769.2117
  3   8.863758  10.27261   8.277117       NA  18.66024       NA   53.3105
   year
age       1985       1986       1987       1988       1989     1990
  0 1328.87745 1388.25682 1735.03209 2008.39905 1682.25013 1766.877
  1 1901.69029 1986.66515 2482.91796 2874.11978 2407.38432 2528.490
  2  907.11627  947.64972 1184.36492 1370.97025 1148.33498 1206.103
  3   62.86802   65.67721   82.08284   95.01559   79.58577       NA
   year
age      1991     1992     1993     1994     1995     1996    1998
  0 1059.3509 210.7562       NA       NA       NA       NA 299.487
  1 1515.9843 301.6027 255.7366 218.1349       NA 509.9525 428.581
  2  723.1325 143.8661 121.9877 104.0515 166.5079       NA      NA
  3        NA       NA       NA       NA       NA       NA      NA
   year
age     1999     2000     2001     2002     2003     2004     2005
  0       NA       NA       NA       NA       NA       NA       NA
  1 470.5192 621.2461 1398.746       NA 3517.319 3377.813 3098.388
  2 224.4401       NA       NA 1280.481 1677.779       NA       NA
  3       NA       NA       NA       NA       NA       NA       NA
   year
age     2006     2007     2008     2009     2010     2011     2012    2013
  0       NA       NA       NA       NA       NA       NA       NA      NA
  1 2308.591 1584.296 1908.633 2218.818 2294.108 2940.826 2628.094 2576.56
  2       NA       NA       NA       NA       NA       NA       NA      NA
```

```
  3       NA       NA       NA       NA       NA       NA       NA       NA
   year
age     2014     2015     2016     2017     2018     2019
  0       NA       NA       NA       NA       NA       NA
  1 2576.088 2727.119 3224.211 2723.233 1895.266 2317.251
  2       NA       NA       NA       NA       NA       NA
  3       NA       NA       NA       NA       NA       NA
```

Table 2.6.2.22. North Sea Herring multifleet assessment. INDEX AT AGE RESIDUALS LAI-CNS

```
Units  :  NA
   year
age       1972      1973      1974       1975       1976       1977
  0 -0.6693743 0.8605067 -1.397317         NA -0.1774154  1.1604566
  1 -0.6951781 0.7782469        NA -1.1368018 -0.1029398  0.1125024
  2  0.3854345 1.4874278  1.211713 -0.1545739         NA -0.1720578
  3  0.8938121 1.7137540        NA -0.1083896  0.6920744 -0.7112215
   year
age       1978       1979       1980       1981       1982       1983
  0  2.0589068  1.0952232  0.2826112  1.0872244 -1.2264681  0.7766191
  1 -0.7794670 -0.6316490 -0.4494097 -0.4370122 -1.4578253 -0.9085009
  2  0.8435063  1.0964964 -2.1470262 -0.3215225  1.5422474 -1.3269801
  3 -1.0245974 -0.3216698  0.5433821         NA  0.3862391         NA
   year
age      1984       1985        1986       1987      1988       1989
  0 0.3233399 -1.5009691  0.01418682 -0.4460174 0.8338163 -0.2780413
  1 0.9185467  2.0238112  0.76158351  0.7486980 0.1264993  0.4470916
  2 0.4973354  0.7375073 -1.49839994  0.5049523 0.1653246  0.3849029
  3 2.0112036  1.0775885 -0.51464399  0.2809607 0.4751496 -3.1785501
   year
age       1990        1991        1992       1993      1994      1995
  0  1.9112935  0.84802477 -3.70384979         NA        NA        NA
  1 -0.8263592 -0.24731040 -0.63833366  0.9029948  1.306217        NA
  2 -0.3430863 -0.05999216  0.06218255 -0.3740906 -1.104236 -1.440604
  3         NA          NA          NA         NA        NA        NA
   year
age       1996       1998       1999      2000     2001     2002      2003
  0         NA -0.8528587         NA        NA       NA       NA        NA
  1 -0.4096517 -1.6331706 -0.6245100 0.3309796 1.037871       NA 1.4563061
  2         NA         NA  0.3111583        NA       NA 1.536102 0.6878248
  3         NA         NA         NA        NA       NA       NA        NA
   year
age      2004      2005       2006      2007     2008      2009       2010
  0        NA        NA         NA        NA       NA        NA         NA
  1 0.5555259 0.6108599 -0.1501593 -1.208608 1.745884 0.6784587 0.08491009
  2        NA        NA         NA        NA       NA        NA         NA
  3        NA        NA         NA        NA       NA        NA         NA
   year
age     2011      2012     2013      2014      2015     2016      2017
  0       NA        NA       NA        NA        NA       NA        NA
  1 1.620018 -1.162974 1.281183 -0.357214 0.6134334 0.401049 0.7197233
```

```
  2       NA        NA       NA        NA        NA       NA        NA
  3       NA        NA       NA        NA        NA       NA        NA
   year
age        2018     2019
  0          NA       NA
  1 -0.01007814 1.488977
  2          NA       NA
  3          NA       NA
```

Table 2.6.2.23. North Sea Herring multifleet assessment. PREDICTED INDEX AT AGE LAI-SNS

```
Units  :  NA
   year
age     1972     1973     1974     1975     1976     1977     1978
  0 8.123406       NA       NA 3.544383       NA 7.315533 20.45746
  1 6.478209       NA 5.530888 2.826555 4.173166       NA 16.31430
  2       NA 2.179489       NA       NA       NA       NA       NA
   year
age     1979     1980      1981      1982      1983     1984     1985
  0       NA 97.60609 172.59537 263.92757 246.84743 327.5158 363.8064
  1 52.02520 77.83837        NA 210.47552 196.85454 261.1855 290.1263
  2 21.81895 32.64478  57.72528  88.27173  82.55921 109.5391 121.6766
   year
age     1986     1987     1988      1989     1990     1991     1992
  0 336.1940 510.6707 770.3123 1284.7200 1782.419 1663.196 618.1749
  1 268.1061 407.2469 614.3044 1024.5314 1421.434 1326.356 492.9787
  2 112.4415 170.7961 257.6343  429.6802       NA       NA       NA
   year
age     1993     1994     1995      1996      1997      1998      1999
  0 608.3666 466.7524 613.3552 1059.2507 1201.8013 1223.6555 1149.3403
  1 485.1569 372.2232 489.1352  844.7255  958.4059  975.8341  916.5696
  2       NA       NA 205.1393  354.2710  401.9477  409.2570  384.4019
   year
age      2000      2001      2002     2003     2004     2005     2006
  0 1121.2941 1980.5096 2644.6111 3968.281 4561.195 4730.823 5002.229
  1  894.2035 1579.4059 2109.0100 3164.603 3637.437 3772.711 3989.150
  2  375.0217  662.3901  884.5018 1327.209 1525.512 1582.245 1673.017
   year
age     2007     2008     2009     2010     2011     2012      2013
  0 4332.971 4531.484 5658.289 5986.108 5634.472 4957.176 2608.8973
  1 3455.434 3613.743 4512.342 4773.769 4493.348 3953.221 2080.5291
  2 1449.181 1515.575 1892.440 2002.080 1884.474 1657.949  872.5571
   year
age     2014      2015     2016     2017     2018     2019
  0       NA 2938.7817 4439.718 4357.999 3094.607 3713.480
  1       NA 2343.6035 3540.562 3475.393       NA 2961.406
  2 986.4992  982.8884 1484.883       NA       NA       NA
```

Table 2.6.2.24. North Sea Herring multifleet assessment. INDEX AT AGE RESIDUALS LAI-SNS

```
Units  :  NA
   year
age      1972      1973      1974        1975      1976       1977
  0 -0.407725        NA        NA -0.91026219        NA -0.5922436
  1  1.945232        NA 0.2679241  0.05826303 0.6773998         NA
  2        NA -1.080158        NA          NA        NA         NA
   year
age       1978     1979      1980        1981       1982        1983
  0  1.9874495       NA 1.5779778  1.89905975  0.4507975 -1.44879137
  1 -0.2241189 2.133298 0.8041784          NA -0.2089477  0.01323085
  2         NA 1.954288 0.3954561 -0.04049521 -0.7447951 -0.41562105
   year
age       1984        1985       1986        1987       1988      1989
  0  0.1315237  1.20593487  0.3904131  0.77624278  0.8204243 0.8677289
  1 -0.5088826 -0.05312096 -0.9110326 -0.10778823 -0.9592801 1.0703794
  2 -0.9291847 -1.19292840 -1.5194422  0.03316116 -0.3918890 0.4398310
   year
age       1990       1991       1992      1993        1994       1995
  0 0.64781453  0.9871800 -0.6534687 0.6948230 -0.22494273 -1.9284074
  1 0.09882312 -0.3114381  1.2954622 0.4268258  0.07794644 -0.3239541
  2         NA         NA         NA        NA          NA  0.1495582
   year
age       1996       1997       1998       1999      2000       2001
  0 -0.7998581  1.6789086 -0.1526622 -0.3471826  1.373349 -0.3149120
  1  0.1233771 -0.3417850 -0.3026442  0.2383089 -1.103821  1.2233445
  2  0.7383102 -0.3330206 -0.8920718 -0.1393250 -1.096827  0.2638078
   year
age       2002       2003       2004       2005       2006         2007
  0 -0.2680782 1.31052487  0.6560517 -1.3542074  0.9979426  0.351323139
  1 -1.5834968 0.17607647 -0.1946849  0.6593912 -0.1010296 -0.009190141
  2  0.3478074 0.02017891  1.0624956  1.3548046  0.3925295  1.031920422
   year
age       2008       2009      2010        2011      2012      2013
  0  0.8253177 1.17670104 0.2981831 -0.05005143 1.3143837 -5.002596
  1 -0.1281609 1.19136016 0.8847806  0.21804678 0.7520391  1.913030
  2  1.0152856 0.04084318 1.1042146 -0.41261476 0.3964274  1.325283
   year
age      2014        2015       2016      2017       2018      2019
  0        NA -0.01618142  1.7064957 1.1348075 -0.8044394 1.4162582
  1        NA -0.24473466 -0.5159889 0.6378617         NA 0.5582267
  2 0.7890399 -0.01592103  0.2845567        NA         NA        NA
```

Table 2.6.2.25. North Sea Herring multifleet assessment. PREDICTED INDEX AT AGE IBTS-Q1

```
Units  :  NA
   year
age    1984    1985    1986    1987    1988    1989     1990    1991
  1 1162859 1377449 1924647 2510590 1859168 1231812 987100.4 1000424
   year
```

```
age     1992    1993    1994    1995    1996    1997    1998     1999
  1 972751.6 1555750 1621146 1456792 1461092 1456912 1274482 831755.9
   year
age    2000    2001    2002    2003     2004    2005     2006     2007
  1 2479514 1461254 3247576 1429861 727690.2 1020759 740018.6 764659.9
   year
age     2008     2009    2010    2011     2012     2013    2014    2015
  1 928386.8 912044.8 1330858 1191218 947082.9 892069.2 1457647 2027216
   year
age     2016     2017     2018     2019    2020
  1 524331.2 959691.7 623136.8 915908.3 1060368
```

Table 2.6.2.26. North Sea Herring multifleet assessment. INDEX AT AGE RESIDUALS IBTS-Q1

```
Units  :  NA
   year
age       1984      1985      1986     1987      1988      1989       1990
  1 -0.1613603 0.9053539 0.9559064 1.824686 -1.089489 0.5896949 -0.8288632
   year
age      1991     1992       1993      1994      1995      1996      1997
  1 0.8967076 -0.13328 -0.2789059 0.5525326 0.4238923 -1.179383 0.2576232
   year
age     1998      1999       2000      2001      2002       2003      2004
  1 1.005488 0.1115111 -0.9557553 0.6960816 -1.845754 -0.5548838 0.4485724
   year
age      2005       2006      2007       2008       2009      2010
  1 0.3113187 -0.3339794 0.1883438 -0.5160011 0.01654388 -1.435548
   year
age     2011       2012      2013     2014     2015      2016     2017
  1 1.363569 -0.5960683 -1.536668 1.188785 0.434221 0.1828247 1.272208
   year
age      2018       2019      2020
  1 0.3074688 -0.6474979 0.4344462
```

Table 2.6.2.27. North Sea Herring multifleet assessment. PREDICTED INDEX AT AGE HERAS

```
Units  :  NA
   year
age       1989      1990      1991      1992      1993       1994
  1 7274946.63 5972795.8 6203294.8 5963503.1 9669014.5 10671619.3
  2 4524533.04 3079291.2 2717441.9 3009534.9 2469868.6  3737157.2
  3 4414995.96 3137943.2 1872004.0 1392700.0 1486888.7  1091705.4
  4 2023564.93 2949096.8 1841124.3 1043392.2  713436.9   621666.0
  5  536964.50 1266174.3 1766363.4 1069136.5  579252.8   323840.1
  6  308848.62  313157.5  736933.5 1043199.7  583955.2   280139.3
  7  149641.44  181076.4  178496.3  432836.0  507804.5   278352.4
  8   69478.81  135718.5  168482.0  195913.2  330275.8   396020.3
   year
age      1995       1996        1997      1998      1999       2000
```

```
  1 9683768.4 9897434.63 10039575.89 8755862.6 5681164.6 16730385.3
  2 4223271.7 4175640.27  4610746.18 6378654.2 3938759.3  3846265.1
  3 1977783.0 2606753.47  2664926.53 2629417.3 4420232.5  2479051.3
  4  567309.1  962509.91  1422727.30 1295062.5 1403676.3  2624752.6
  5  296670.0  306497.39   578240.17  748350.7  657474.8   844970.2
  6  164338.7  143096.29   189606.75  390669.3  378711.5   427882.1
  7  142861.9   92723.27    91485.49  119974.3  220390.3   241570.5
  8  317400.0  238655.11   190542.63  153867.0  132907.7   189830.6
   year
age      2001       2002       2003      2004      2005      2006
  1 9872027.6 21743032.5  9445932.1 4782618.4 6711934.7 4943644.2
  2 8837336.1  5643472.0 13601385.7 4285890.9 2607763.8 3808210.4
  3 3035634.7  6821005.0  3834203.5 9229482.4 3177644.7 2053862.8
  4 1446891.8  1631318.4  4179143.7 2428489.3 5169765.8 1951670.0
  5 1444707.7   787731.3   879093.0 2413189.6 1345296.2 3205665.8
  6  440007.8   904746.1   485321.1  434385.1 1156377.4  636135.0
  7  242453.8   268577.2   549940.8  302730.5  203495.3  531687.8
  8  247557.7   264612.7   264909.2  368394.1  288403.1  217823.2
   year
age      2007      2008      2009      2010      2011      2012      2013
  1 5165042.0 6322427.4 6249376.0 9152143.4 8200891.8 6507228.0 6141681.2
  2 2393426.9 3304080.2 4285726.1 4334307.4 5081388.4 4569499.9 3303606.2
  3 2522981.4 1856314.6 2304047.3 3430618.9 3224434.9 4255720.2 3586537.0
  4 1242838.6 1452802.2 1245687.5 1734622.3 2137411.6 2198137.7 2846110.2
  5 1092636.0  823102.3  985151.1  952087.0 1072303.2 1378163.1 1570714.6
  6 1658853.2  723193.0  601480.9  866054.8  650273.2  649418.6  899743.4
  7  336053.7 1151494.5  557232.2  451404.4  540015.8  393774.3  372819.9
  8  362700.4  503310.1 1406621.6 1523840.9 1255562.8  906621.3  767445.8
   year
age       2014       2015      2016      2017      2018      2019
  1 10023426.4 13883469.9 3578005.6 6588930.5 4280350.6 6290148.5
  2  4162861.7  7659993.5 9519509.5 1905021.8 3492095.4 1939440.9
  3  2712983.1  2573704.3 6066605.2 7230880.6 1588675.5 2352468.8
  4  2766238.4  1621358.9 1515543.7 3986285.4 4708396.3 1099590.9
  5  1846634.3  1657205.6  943686.5  979146.6 2576025.4 2673023.2
  6   973319.2  1023824.2  846323.9  465349.2  591355.7 1503646.2
  7   516667.0   493461.2  452134.0  391761.6  267059.1  285704.9
  8   570332.5   573240.0  486845.5  450033.6  496211.3  397484.3
```

Table 2.6.2.28. North Sea Herring multifleet assessment. INDEX AT AGE RESIDUALS HERAS

```
Units  :  NA
   year
age        1989       1990       1991       1992       1993        1994
  1  0.00000000  0.0000000  0.0000000  0.0000000  0.0000000  0.00000000
  2 -0.11874064 -0.4059424  0.2974545  0.8704575 -0.1498163 -1.34298622
  3 -0.19170587  0.9353845 -0.9179751 -0.9275820 -0.6210491 -2.05241108
  4 -0.33497245  1.5509561  0.2264361  0.3502018  0.4021498 -2.33519520
  5 -0.22205363  1.0976058  0.3543215  0.3073934  0.6668151 -0.15083886
  6 -0.32856988  1.1348560 -0.4368060  0.6911248  0.7399364  0.08047269
  7 -0.37906198  0.6102984  0.3474899 -0.3742082 -0.4379814 -0.09484917
```

```
  8  0.09869623  0.9729327 -0.7755563 -0.1389064 -0.6368146 -0.73020695
   year
age        1995        1996       1997        1998        1999       2000
  1  0.00000000  0.00000000  0.2820532 -1.59667207  0.07738851  0.4889217
  2 -1.62978060 -1.01298444  0.6597337 -0.59513590 -1.48022284 -0.2023720
  3  0.39241755  0.49466545 -0.5335664 -0.70621972 -0.41456064 -0.2272438
  4  0.88221425 -0.04636895 -0.6115774  0.01564264 -1.71023797  0.5497475
  5 -0.35767043 -0.00910169 -0.1037536  0.17665291 -2.02489554  0.3475362
  6  0.02077646 -1.99668068 -0.1308173 -0.32174783 -1.74308963  0.1735635
  7 -0.86076710 -0.54755206 -2.7337707  0.51529490 -2.25526250 -0.3667508
  8 -1.93494007  0.37460393  0.3661156 -0.44601389 -0.29564945 -0.2168363
   year
age       2001        2002       2003       2004       2005        2006
  1 -0.3678063 -0.09351437 -0.2946054  0.3563208 -1.3117805  0.57059406
  2  1.9276151 -0.35333855  2.0504830 -1.1048423 -0.9068999  0.09664043
  3  0.1334064  1.10376621 -0.9387558  0.0155205  1.0614367  0.40142350
  4 -0.1397731 -1.24689061 -0.4221984 -0.4545732  0.5339229  0.61410614
  5  0.2926679 -0.14397849 -2.2204395 -0.2255769 -0.4256296  1.57657796
  6 -0.6505012  0.21985087 -0.2369499 -2.3939530 -0.1595502 -0.12451915
  7 -2.0368821 -0.91283235 -0.5742123 -0.2502230 -1.8732297 -0.16918675
  8 -2.1221360 -0.43803857  0.1218045  0.5880648 -1.1117933 -1.36414634
   year
age        2007       2008        2009      2010        2011        2012
  1  0.24389252 -1.2569664 -0.01922671 0.8277066  0.87977695  0.15587503
  2  0.33675066 -0.7918537  1.91211473 0.5767235 -0.62568702  0.64287186
  3 -1.70264358  0.6332765  1.40311980 1.1303004 -1.13759123 -0.03025288
  4 -0.85160000  1.0750008 -0.16513615 2.1306008 -0.06996681 -0.83824478
  5 -0.73422966  1.3632459  1.33277917 1.6612231 -0.53869609 -0.42210799
  6 -0.05981671  1.4734725  1.46240995 2.6681173 -0.10335746 -0.41925883
  7 -0.52227966  2.3893391  1.12560248 1.7459682  0.58651376 -1.73354897
  8 -0.99640170  0.2632209  1.30787413 2.0502350  0.66401380 -0.84735559
   year
age       2013       2014       2015       2016        2017       2018
  1  0.1325736  1.2192370 -1.0812560  2.2761912 -1.53454820  2.0830172
  2 -0.1241144  1.8938068  2.3084922  2.0445876  0.33414217  1.0147727
  3  0.2019091  0.8169574  0.8270987 -0.3024453 -0.83856388  1.1303080
  4  0.8779830  1.0739012  0.1845438 -0.6169223 -0.84706898  0.6152317
  5  0.7161770  0.5132299 -0.2797019 -0.1714042 -0.08624817  0.2152084
  6  0.5509172  1.9057709 -0.2879403  0.7962655 -0.26997562  1.9836082
  7  0.8819543  0.8781296  0.3125970 -0.2236355 -0.18066235  2.9248565
  8  0.2951848 -0.7279682 -0.3615709 -0.6244992 -0.58346308 -0.2795280
   year
age       2019
  1  0.3442492
  2 -1.9286151
  3 -0.4518098
  4  1.3703263
  5  1.5682391
  6  0.8992208
  7  1.3011879
  8  0.2658163
```

Table 2.6.2.29. North Sea Herring multifleet assessment. PREDICTED INDEX AT AGE IBTS0

```
Units  :  NA
   year
age     1992     1993     1994     1995     1996     1997     1998
  0 137.2187 146.1867 120.7308 128.4192 105.8834 88.41192 56.37263
   year
age     1999     2000     2001     2002     2003     2004     2005
  0 177.3748 113.8304 222.2773 108.4408 57.41614 68.34074 62.63446
   year
age     2006     2007     2008     2009     2010     2011     2012
  0 61.88295 73.99929 65.70359 103.2942 84.73639 73.12556 68.59922
   year
age     2013     2014     2015     2016     2017     2018     2019
  0 90.74503 139.4921 37.24917 69.24453 42.52353 72.23033 70.08059
   year
age     2020
  0 64.37422
```

Table 2.6.2.30. North Sea Herring multifleet assessment. INDEX AT AGE RESIDUALS IBTS0

```
Units  :  NA
   year
age      1992      1993       1994      1995      1996     1997       1998
  0 0.8634374 0.2977856 -0.3770855 0.1467973 -0.361059 1.765499 -0.2242101
   year
age     1999       2000     2001      2002        2003       2004
  0 1.568518 -0.7115297 1.031604 0.3321442 -0.03366296 -0.7765319
   year
age      2005       2006       2007      2008    2009       2010
  0 0.2852178 -0.2703188 -0.4992696 -1.207378 1.14574 -0.4628993
   year
age       2011      2012      2013        2014      2015      2016
  0 -0.3445791 -0.115152 0.5447876 -0.05881465 -2.665633 0.4272633
   year
age      2017      2018       2019       2020
  0 -1.048075 0.6158523 -0.3167163 -0.1116502
```

Table 2.6.2.31. North Sea Herring multifleet assessment. CATCH-AT-AGE catch A

```
Units  :  NA
   year
age       1997      1998      1999      2000      2001      2002      2003
  1  42672.620  47656.49  29161.49  81077.56  36024.99  70586.97  30173.56
  2 501845.975 898557.50 506578.46 452849.90 746588.61 410098.07 950014.26
  3 413892.350 533861.44 890035.30 476550.89 453232.56 887787.12 510319.51
  4 236713.961 275069.40 294235.20 562443.20 265582.74 278087.94 802288.46
  5  93534.152 158231.20 134894.53 180500.11 290087.18 152709.81 211079.56
```

```
  6  24176.791  75866.82  64988.10  74887.81  77770.47 158132.01 111465.81
  7   9244.458  15379.93  23459.91  27574.53  37866.20  43142.54 109067.86
  8  19242.644  19713.94  14141.89  21664.03  38659.90  42502.37  52532.50
   year
age       2004       2005       2006      2007      2008      2009
  1   14625.98   24541.13   19417.57  19489.92  22685.82  16056.78
  2  282242.45  202007.14  312043.22 182493.58 231871.51 206397.14
  3 1242307.59  488803.19  314461.18 354127.00 187809.87 137320.62
  4  515102.54 1294085.63  465243.67 265229.38 199905.14  96147.19
  5  696419.34  465261.86 1001102.08 298814.73 137209.20  92057.47
  6  153772.93  590117.31  272080.38 600295.48 118149.18  41712.24
  7   91984.17  108062.13  259303.80 143253.19 237125.53  54503.25
  8  111916.17  153104.61  106188.52 154528.46 103582.08 137491.09
   year
age      2010      2011      2012      2013      2014      2015       2016
  1  24916.90  25608.43  28924.31  24014.85  36315.42  39098.57   9780.285
  2 220599.21 300687.34 393418.71 245821.66 291911.38 424458.79 527136.625
  3 222283.48 271192.86 596785.77 488323.85 363478.10 292145.85 793742.539
  4 133730.48 219756.65 396498.15 563039.11 551408.61 296882.57 313631.181
  5  85951.48 129388.69 297023.72 404873.65 472263.44 440430.07 275191.470
  6  54915.11  60965.14 150272.27 301891.54 299315.95 400265.54 374050.803
  7  34747.61  54822.87  96622.92 144841.70 194398.83 271219.23 306434.243
  8 117215.85 127364.98 222257.06 297841.07 214365.01 314706.76 329572.453
   year
age      2017       2018      2019      2020
  1  14673.14    9927.02  11687.68  13530.92
  2  85534.86  165496.36  72682.68 135239.06
  3 892057.15  215879.52 271121.17 161954.08
  4 774332.30 1064052.00 209833.94 266409.55
  5 245729.36  778011.48 724638.19 167241.68
  6 145097.18  230879.11 524249.54 493754.38
  7 182353.32  153467.76 148129.22 372876.69
  8 209250.32  284827.73 205861.15 160269.20
```

Table 2.6.2.32. North Sea Herring multifleet assessment. CATCH-AT-AGE RESIDUALS catch A

```
Units  :  NA
   year
age        1997         1998       1999         2000        2001
  1  0.19117128 -0.046732853  0.5022327  0.101248403 -0.25724349
  2 -1.67108526  1.720567438 -1.2094012  0.625568362 -1.22800385
  3 -0.02135837 -0.664342159  1.2976824 -0.731181157  0.70654762
  4 -0.13615777 -0.970594059 -0.3733700  0.324133136 -0.03277064
  5 -0.11903493 -0.008932506 -0.5672356  0.051392350  0.01462688
  6  0.60343835  1.233588861 -0.3653788  0.008170969 -0.33448276
  7  1.04877723 -0.561781759 -0.0809600  0.075743896  1.37500414
  8 -0.70585716 -1.008345229 -1.5744847 -1.458725581  0.53080432
   year
age        2002        2003       2004        2005         2006
  1  0.10974318  0.46579543 -1.4654061  0.99530278 -0.172095877
  2 -0.30921956  0.14594932 -0.9375283  0.25903895  0.667235633
```

```
  3  0.03837181 -0.25659052  0.7431691  0.07928973  0.028736068
  4 -0.37528676  0.47393060  0.9806952  0.07509347 -0.183734810
  5 -0.76212565  0.64701583  0.7805658  0.22686140 -0.023709299
  6  0.63800199 -0.04017316  0.6946529  0.04029303 -0.972600980
  7  0.41728677  0.16874583  1.0234002  0.99853132 -0.009192591
  8 -0.74712712 -1.50745145 -1.7668753 -0.54584193 -0.266781857
   year
age        2007        2008       2009       2010       2011        2012
  1  0.18727008  1.13702333  0.3212917  0.5739283 -0.4880246  0.54093981
  2 -1.15289344  0.71973783  0.3918287  0.8790095  0.2906002  0.46093659
  3  0.58378356 -1.64910259 -2.8296286  0.1708823  0.9972157  2.14067725
  4  0.32607686 -1.58697577 -0.7283485 -0.5722790  0.3539109  0.98674003
  5 -0.15807605 -0.59544847 -0.6996133 -0.2430846  0.2564670  0.70236638
  6 -0.02038223 -0.69125821 -0.3234408  0.3541184  0.3381088  0.03763611
  7  0.29637752 -0.09805633  0.4795683 -1.0324712 -0.6877159  0.48144559
  8 -0.27878233  0.89191111  0.7526137 -0.4218023 -0.1854891 -1.27912643
   year
age       2013        2014       2015         2016       2017        2018
  1  1.5700167  1.02185038 -1.0557443 -1.388074803 -0.6583027 -0.09738641
  2 -1.7119614  0.29487144  0.7391440  0.929336133 -1.2564181 -0.13967752
  3  0.8640904  0.27104674 -1.6732364  0.985188982  1.6925551  0.59738662
  4  1.0467658  1.01005732  0.0320078 -0.516791109  0.6035522  0.97034174
  5  1.4479252 -0.09695185  0.9277162  0.005951604 -0.3651044  0.98397974
  6  0.8514255 -0.87987950  1.0151680 -0.389819086 -1.0526740 -0.37257478
  7  0.3184374  0.06559848  0.6564248  0.207332233 -0.6169038  0.18822959
  8  0.2214316 -0.73724512  0.7982889  0.672483264  0.5244503  1.36297797
   year
age       2019 2020
  1 -0.9472896    0
  2 -1.7078296    0
  3  0.6216123    0
  4  0.5236779    0
  5  0.4712831    0
  6  0.6773821    0
  7 -0.2498768    0
  8  0.9763276    0
```

Table 2.6.2.33. North Sea Herring multifleet assessment. CATCH-AT-AGE catch BD

```
Units  :  NA
   year
age       1997       1998        1999        2000        2001       2002
  0 662552.854 367787.852 1323349.945 1006374.834 1354230.222 844362.015
  1 321297.480 272095.645  134309.682  424524.289   94961.264 496921.101
  2  35244.199  53320.064   31518.875   32843.993   45265.845  48406.057
  3   5611.379   5734.971    9471.842    4934.397    4167.131   9869.161
  4   2989.140   2817.909    2999.525    5213.463    1984.191   2358.644
  5   1212.224   1625.279    1402.068    1675.572    1980.913   1139.295
   year
age        2003       2004        2005        2006        2007
  0 484038.0009 727109.173 931561.4485 740512.5651 627660.6449
```

```
  1 322843.9236 195575.495 363326.2545 135245.2199  75608.6345
  2 131925.1342  45682.247  28185.3624  26112.3407   8017.2985
  3   4186.6602   8581.357   2050.3768    887.8799    387.9551
  4   4565.0122   2262.031   3347.9624    846.3110    191.5803
  5    962.4076   2258.090    876.6798   1396.0484    168.9481
   year
age         2008        2009        2010        2011        2012
  0 583017.64335 766145.4112 654116.8821 660031.2857 689154.2570
  1  94448.07013  91400.9863 128643.0802 134143.1903 154694.1616
  2   8344.58132  10763.7361  12629.5685  13902.6725  18176.3577
  3    162.10296    258.0908    736.0538    656.2602   1240.4666
  4    126.85594    139.3739    371.6866    434.7832    641.6469
  5     71.91049    110.1791    203.8868    218.0810    402.8048
   year
age        2013         2014        2015          2016         2017
  0 695390.9800 1369440.8420 499826.2350 1220975.44469 564586.24757
  1 122606.5771  209321.6721 315133.1375   95112.52426 112382.42270
  2  12517.4462   14878.3903  20325.6835   24571.10543   2472.64185
  3    959.2152     631.3392    307.9426     633.25084    275.20761
  4    763.8684     646.3553    194.8716     159.05119    152.43158
  5    423.0215     432.8773    200.2813      99.61649     37.56625
   year
age         2018         2019         2020
  0 946728.23131 667957.11415 613639.99781
  1  52960.79204  61019.27918  70639.77754
  2   2959.19237   1266.53513   2356.56906
  3     42.77098     57.27582     34.21342
  4    127.58516     26.91449     34.17092
  5     70.16009     65.78194     15.18189
```

Table 2.6.2.34. North Sea Herring multifleet assessment. CATCH-AT-AGE RESIDUALS catch BD

```
Units  :  NA
   year
age       1997       1998       1999        2000       2001       2002
  0 -2.2338978 -1.2173768  1.8945286 -0.23066508  0.7018663 -0.7042538
  1 -1.6676367  0.5517446 -1.1175752  0.38990531 -3.0551599  2.0293559
  2  1.6634701  0.2894075  0.2387934  0.12213286  0.0760979  0.5864213
  3  0.8725409 -0.3371259  0.5279568 -0.04148314  0.5765680  0.2774891
  4 -0.3180687  0.5795621  0.1538951 -0.05820375  0.9472848 -0.6621953
  5  0.9318854 -0.2485978 -0.3273518 -0.64045231 -0.7944831 -0.1226341
   year
age        2003        2004        2005           2006       2007
  0 -1.07111556  0.55039064  0.57819288 -0.06560139577 -0.3156524
  1  1.08146412  0.03674465  1.05528497 -1.62636219978 -1.1663108
  2  0.04102094  0.37569703  0.08949261 -0.00007533975  0.1126135
  3 -0.77145936  0.01421565 -0.24101830  0.79181267036 -1.5831977
  4 -0.36809962  0.11314145 -1.74070699  0.74673967354 -1.1823362
  5 -1.05567348 -0.25940645 -1.20588224  0.48638366599 -1.0148592
   year
age        2008         2009       2010       2011      2012       2013
```

```
  0  0.17371503  0.003962201 -0.2032756  0.2924428 0.1200079 -0.6333048
  1 -0.09081403  0.561601411 -0.3870525  0.4099251 0.7143843 -0.1471741
  2  0.11188650 -0.114940170  0.0619682 -1.5748904 0.2162077  0.9372812
  3 -0.52778260  0.783811042  2.0708523 -0.8935280 1.1593766 -0.1780247
  4 -1.88697144 -2.002196700  1.3700835  0.0000000 0.0000000  0.4456840
  5 -2.98638060  0.000000000  2.3037429  0.0000000 0.4529423  0.0141358
   year
age       2014       2015        2016       2017       2018       2019
  0 0.95804198 -0.9897339  1.48385602 -1.2055012  1.1166937 -0.8316170
  1 0.06080789  0.2853898 -0.02229664 -0.3828464 -0.8387408 -0.2966789
  2 0.18928762 -0.2034036  0.01118471  0.2508922 -0.6950100 -1.1683360
  3 0.55736383 -1.5162035  1.44713509 -4.3011879 -1.0184948  0.4602191
  4 0.34423542  0.0000000  0.67623589  0.0000000  0.0000000  0.0000000
  5 0.77443684 -1.9532747 -0.85473491  0.0000000  0.0000000  0.0000000
   year
age 2020
  0    0
  1    07
  2    0
  3    0
  4    0
  5    0
```

Table 2.6.2.35. North Sea Herring multifleet assessment. CATCH-AT-AGE catch C

```
Units  :  NA
   year
age       1997       1998       1999       2000        2001        2002
  1 367238.281 289394.067 179260.728 497394.212 149081.0326 209754.7637
  2 145903.338 186293.067 110941.622 103279.055 138938.8471  62512.1089
  3  53342.861  40765.823  61393.825  29815.683   7184.1483   5621.8604
  4  12840.596   9042.311   8678.427  13822.670   1431.1102    564.6595
  5   5207.411   5215.312   4056.556   4442.513   1428.7458    272.7472
  6   1699.915   2713.713   2326.326   2239.155    433.6774    312.3257
   year
age        2003       2004       2005      2006       2007       2008
  1 173106.3155 88379.7735 121035.600 72323.365 53654.4941 47971.5657
  2 250783.9310 79868.1849  47606.859 59080.602 28384.4422 30751.8076
  3  15034.6113 37303.9046  11868.491  4698.798  2557.2085   926.0459
  4   7068.2204  4196.2511   7695.749  1684.466   455.1898   254.1944
  5   1490.1404  4188.9408   2015.168  2778.643   401.4163   144.0945
  6    820.6901   756.9957   1754.810   555.997   613.0033   126.3707
   year
age        2009        2010       2011       2012       2013       2014
  1 33687.24248 43565.15852 56790.7634 50651.9514 45732.3282 84404.8420
  2 30618.58622 28308.10803 45185.9710 44961.7793 31653.1683 44387.5891
  3   536.69552   619.25350  1548.1601  2857.5978  2289.8013  2515.6062
  4   102.58737   107.72625   344.3048   489.1085   581.3575   809.4085
  5    81.09825    59.09268   172.6983   307.0463   321.9491   542.0774
  6    49.35315    53.56964   104.3706   144.6789   185.4244   286.6680
   year
```

age	2015	2016	2017	2018	2019	2020
1	170795.804	28743.0264	63019.7843	35161.2801	39083.0415	45244.40253
2	110861.500	98614.2714	22610.7166	36733.0537	16290.2579	30309.76763
3	6338.746	5516.1213	9905.0946	1504.4842	1105.2593	660.13434
4	1284.835	433.6510	1661.3619	1291.2517	137.8067	174.93811
5	1320.503	271.6031	409.4370	710.0695	336.8146	77.72376
6	824.058	246.6969	195.4285	164.1472	190.6115	179.49974

Table 2.6.2.36. North Sea Herring multifleet assessment. CATCH-AT-AGE RESIDUALS catch C

Units : NA

age \ year	1997	1998	1999	2000	2001	2002
1	3.8361788	1.5108319	0.41373202	-0.03841227	0.42059316	-0.69862253
2	0.3707909	-0.6320655	0.08018703	0.34592077	-0.58510427	-0.50468661
3	-0.6165594	-1.4731386	0.78158195	-0.54770270	-0.63817584	-0.79977701
4	1.6972901	0.9688745	0.55243991	0.49293492	-1.63556202	-0.03494368
5	0.6301093	-1.0920019	0.25984147	0.47912290	-3.03719575	-0.61633603
6	0.1991686	0.3112789	-1.23956540	0.01999718	-0.09087732	-1.58480858

age \ year	2003	2004	2005	2006	2007	2008
1	0.4013119	-1.6294710	0.6832039	0.1509166	0.8427183	-0.4600293
2	0.2493790	1.0128187	1.2819073	-0.8304439	0.4888763	0.1950539
3	0.8164989	-0.8348399	-0.4287030	0.3887045	-1.6533302	0.1452721
4	2.0643903	1.0061560	-1.2908720	-0.2477728	-0.8975900	-0.8713763
5	0.2058373	1.3507850	-0.1500310	-0.8873638	1.3166807	-0.2558488
6	0.4910979	0.7365310	-0.1523493	-0.7904986	-2.3909518	-1.1781328

age \ year	2009	2010	2011	2012	2013	2014
1	0.1145871	0.8345365	-0.77125552	0.296620427	0.1583190	-0.2026716
2	-2.8718846	0.4221191	1.12848963	-0.148997461	1.3168608	1.0257444
3	-0.1075765	-1.3692351	1.73865288	0.002968461	-0.2631215	1.0679634
4	1.2030686	0.4658981	-0.33823973	1.344324729	-1.0280401	-0.7767343
5	0.0000000	0.5554369	0.01141888	-0.878192197	-0.1267821	-0.1652431
6	0.0000000	-1.6756246	0.24143484	0.340128473	0.0000000	-0.5126119

age \ year	2015	2016	2017	2018	2019	2020
1	-1.1523205	-1.36401543	0.4237810	-0.615206801	0.6006021	0
2	0.5222302	-1.16840833	0.6543007	-0.348408432	-0.2620157	0
3	1.5346031	0.04385775	-0.2706928	0.005871081	0.5130766	0
4	0.7017707	-0.02326144	0.7876699	0.200716576	-1.7922231	0
5	2.0336278	-0.53760015	1.3286988	0.240011790	-2.3668417	0
6	0.1461137	-0.14464269	-1.8473221	0.155180391	-0.8767829	0

Table 2.6.2.37. North Sea Herring multifleet assessment. PREDICTED INDEX AT AGE IBTS-Q3

```
Units  :  NA
   year
age       1998       1999       2000       2001       2002     2003
  0 1003511.69 3130748.96 1986744.48 3865603.55 1866210.18 978719.7
  1  387843.05  251458.28  739340.27  436330.16  959884.03 416281.6
  2  256420.36  158364.44  154647.64  355920.56  227311.62 547408.5
  3   82402.28  138519.16   77710.47   95386.19  214445.72 120428.0
  4   34608.72   37519.16   70148.92   38736.86   43689.40 111738.6
  5   15827.51   13910.18   17870.01   30577.51   16673.28  18553.8
   year
age       2004       2005       2006       2007       2008       2009
  0 1152677.23 1041541.47 1027647.58 1231529.05 1090094.09 1719261.94
  1  210628.75  295614.93  218183.24  228282.67  279733.79  276722.65
  2  172461.32  104885.40  153199.57   96364.41  133140.05  172928.44
  3  289722.08   99610.96   64367.05   79122.06   58338.89   72569.92
  4   64835.84  137680.98   51981.38   33136.40   38877.93   33433.68
  5   50786.71   28217.93   67321.59   22985.32   17405.76   20906.96
   year
age       2010       2011       2012       2013       2014      2015
  0 1415353.51 1226663.73 1159305.46 1557440.12 2419426.80 653162.22
  1  405448.13  363358.95  288242.92  272122.55  444043.11 614719.67
  2  174900.01  204986.19  184119.06  133194.84  167869.60 309036.03
  3  108025.46  101435.30  133497.48  112541.10   85148.44  80864.98
  4   46548.43   57272.68   58658.40   75876.70   73737.87  43252.97
  5   20204.40   22715.70   29048.85   33032.89   38835.86  34831.03
   year
age       2016      2017       2018       2019
  0 1229614.61 746465.59 1279540.74 1260726.84
  1  158349.50 291833.59  189595.22  278610.58
  2  384083.13  76904.03  140963.00   78325.76
  3  190478.22 227091.04   49865.23   73923.72
  4   40381.69 106284.96  125335.44   29323.02
  5   19807.96  20595.62   54044.38   56165.23
```

Table 2.6.2.38. North Sea Herring multifleet assessment. INDEX AT AGE RESIDUALS IBTS-Q3

```
Units  :  NA
   year
age       1998       1999       2000       2001       2002       2003
  0 -0.5319871  0.4382924 -0.5389602 -1.7773159 -0.2850552 -0.6550294
  1  0.1697082  0.4600631  0.3625995  0.2709578  2.3360805  0.3689644
  2  0.4949172  0.7344169  2.5137427 -1.3767920  1.4558371  0.1315090
  3 -0.1146639 -1.2438998  0.3755835  0.9095560  0.2844281  0.9527303
  4 -1.9731533  1.3168361 -1.4165273  0.2222596  1.0206529 -0.6412237
  5 -1.1769922  0.2828997 -0.3783274 -0.9742384  1.0023609 -0.2256467
   year
age       2004        2005       2006       2007        2008       2009
  0  1.4169169 -0.42912598 -0.2754433  1.3808140 -0.79396854  1.2234575
  1  0.8689586  1.29857911  0.7750000 -2.3751048 -0.81610394 -1.0736188
```

```
  2  1.0084027 -0.02985815  0.4747271  0.4814713  0.09834225 -2.0118996
  3  0.2683086 -0.87305171  0.4544809  1.1469451  0.81194092  0.8677124
  4  0.7627222 -0.98299555 -0.9737971  1.5699587 -0.29706831 -0.2342632
  5 -1.0941226  1.11960735 -0.7400861  0.4877228  0.84772713 -1.4654522
   year
age       2010        2011        2012       2013       2014        2015
  0 -0.1626475 -1.03452037 -0.73735160  1.0198372  2.0969218 -0.51441334
  1  0.8276759  0.23726850 -0.40580086 -0.1975468 -0.8947261  1.27735806
  2 -0.1795734  0.06240037 -1.69726345  0.5426707  0.4358756  0.32370236
  3 -1.4339401  0.16095116 -1.12274988  0.3930024 -0.1804619  1.12146489
  4 -0.4809372 -0.68757305 -0.00474729  0.1720030  0.2262338  0.75174660
  5 -0.6259399 -0.10015297 -0.12762649  0.5592569  0.3796617  0.03661339
   year
age          2016       2017       2018       2019
  0  0.2999762654  0.4777058  0.1700705  0.6003140
  1 -0.0994992967 -0.4944303  1.1051089 -2.6086108
  2 -0.0004989331  0.5770191 -1.6199971  1.0919038
  3  0.2568964090 -0.5948991  0.5691664 -2.4736768
  4  1.6973410443  1.0494052 -1.4845296  0.9432827
  5  1.8408781115  2.4869017 -0.3935654 -1.5682065
```

Table 2.6.2.40. North Sea Herring multifleet assessment. FIT PARAMETERS

```
                  name        value    std.dev
1               logFpar  -2.50042513 0.07619125
2               logFpar -12.93258371 0.09596781
3               logFpar  -0.26234433 0.12336523
4               logFpar  -0.24370270 0.07376331
5               logFpar  -0.08143628 0.07131696
6               logFpar  -2.70929435 0.13472608
7               logFpar  -3.33875484 0.11486926
8               logFpar  -3.42508284 0.09581572
9               logFpar  -3.51295170 0.09640774
10              logFpar  -3.67374703 0.09821500
11              logFpar  -3.90885624 0.09977047
12              logFpar  -4.30220521 0.11306072
13         logSdLogFsta  -1.14050379 0.08910760
14         logSdLogFsta  -0.63094227 0.08897742
15         logSdLogFsta  -0.77452881 0.21618826
16         logSdLogFsta  -0.57634463 0.13205794
17         logSdLogFsta  -0.95416656 0.26757757
18         logSdLogFsta  -1.20281019 0.31682413
19         logSdLogFsta  -0.09933670 0.18228095
20            logSdLogN  -0.58426996 0.11912042
21            logSdLogN  -1.69260945 0.08029379
22            logSdLogP   0.15417136 0.09780270
23            logSdLogP  -0.28279112 0.15810216
24            logSdLogP  -0.18418958 0.12999604
25          logSdLogObs   0.12419966 0.16680633
26          logSdLogObs  -1.97269091 0.15653544
```

27	logSdLogObs	-1.90443268	0.23985001
28	logSdLogObs	-0.98355853	0.24790734
29	logSdLogObs	-1.15323340	0.25786648
30	logSdLogObs	0.33623418	0.09224168
31	logSdLogObs	-0.27186708	0.18165574
32	logSdLogObs	-0.55042599	0.16235490
33	logSdLogObs	-0.40234823	0.09724154
34	logSdLogObs	-0.71929386	0.15731771
35	logSdLogObs	-1.60459829	0.08459151
36	logSdLogObs	-1.13986464	0.12251844
37	logSdLogObs	-1.26543086	0.15116908
38	logSdLogObs	-1.08871490	0.17650365
39	logSdLogObs	-0.66544140	0.17850503
40	logSdLogObs	-0.85554579	0.17211397
41	logSdLogObs	-1.13705798	0.09896621
42	logSdLogObs	0.17326675	0.04423975
43	transfIRARdist	-0.21469877	0.27273366
44	itrans_rho	1.57474999	0.13027383
45	itrans_rho	0.69470363	0.21700983
46	itrans_rho	2.59088483	1.60282761
47	rhop	0.50339732	0.22247981
48	logAlphaSCB.LAI-ORSH	-0.54372997	0.31452374
49	logAlphaSCB.LAI-BUN	-0.94270105	0.34421565
50	logAlphaSCB.LAI-CNS	0.35840855	0.33794283
51	logAlphaSCB.LAI-CNS	-0.38181921	0.35356482
52	logAlphaSCB.LAI-CNS	-3.05105221	0.40858591
53	logAlphaSCB.LAI-SNS	-0.22630540	0.25057211
54	logAlphaSCB.LAI-SNS	-1.09525478	0.27271399

Table 2.6.2.41. North Sea Herring multifleet assessment. NEGATIVE LOG-LIKELIHOOD

1565.36538008841

Table 2.6.3.1. North Sea Herring single fleet assessment. CATCH IN NUMBER

Units : thousands

year									
age	1947	1948	1949	1950	1951	1952	1953	1954	1955
0	0	0	0	0	0	0	150000	219000	164000
1	0	3000	0	0	462000	722000	1023000	1451000	2072000
2	494000	247000	478000	535000	660000	1346000	1322000	1493000	1931000
3	415000	672000	644000	1039000	959000	576000	1003000	1111000	1032000
4	638000	328000	396000	617000	1255000	610000	474000	591000	479000
5	526000	601000	287000	290000	630000	652000	386000	361000	337000
6	756000	487000	652000	254000	262000	464000	473000	330000	232000
7	431000	400000	462000	331000	142000	236000	278000	379000	120000
8	1311000	917000	1037000	597000	445000	554000	392000	511000	215000

year								
age	1956	1957	1958	1959	1960	1961	1962	1963

```
  0   96000  279000   97000       0  194600 1269200  141800  442800
  1 1697000 1483000 4279000 1609000 2392700  336000 2146900 1262200
  2 1860000 1644000 1029000 4934000 1142300 1889400  269600 2961200
  3 1221000  736000  999000  488000 1966700  479900  797400  177200
  4  516000  644000  322000  497000  165900 1455900  335100  158300
  5  249000  344000  461000  233000  167700  124000 1081800   80600
  6  194000  207000  147000  249000  112900  157900  126900  229700
  7  104000  147000   73000  120000  125800   61400  145100   22400
  8  292000  253000  118000  301000  270600  143500  173100   93000
   year
age    1964    1965    1966    1967    1968    1969    1970    1971
  0  496900  157100  374500  645400  839300  112000  898100  684000
  1 2971700 3209300 1383100 1674300 2425000 2503300 1196200 4378500
  2 1547500 2217600 2569700 1171500 1795200 1883000 2002800 1146800
  3 2243100 1324600  741200 1364700 1494300  296300  883600  662500
  4  148400 2039400  450100  371500  621400  133100  125200  208300
  5  149000  145100  889800  297800  157100  190800   50300   26900
  6   95000  151900   45300  393100  145000   49900   61000   30500
  7  256300  117600   64800   67900  163400   42700    7900   26800
  8   84000  491400  331800  254400  105500   52500   24200   12500
   year
age    1972    1973   1974    1975   1976   1977 1978 1979    1980    1981
  0  750400  289400 996100  263800 238200 256800   NA   NA 1262700 9519700
  1 3340600 2368000 846100 2460500 126600 144300   NA   NA  245100  872000
  2 1440500 1344200 772600  541700 901500  44700   NA   NA  134000  284300
  3  343800  659200 362000  259600 117300 186400   NA   NA   91800   56900
  4  130600  150200 126000  140500  52000  10800   NA   NA   32200   39500
  5   32900   59300  56100   57200  34500   7000   NA   NA   21700   28500
  6    5000   30600  22300   16100   6100   4100   NA   NA    2300   22700
  7     200    3700   5000    9100   4400   1500   NA   NA    1400   18700
  8    1500    2000   3100    4800   1400    700   NA   NA     500    6600
   year
age     1982     1983    1984    1985    1986    1987    1988    1989
  0 11956700 13296900 6973300 4211000 3724700 8229200 3164800 3057800
  1  1116400  2448600 1818400 3253000 4801400 6836300 7867000 3145900
  2   299400   573800 1146200 1326300 1266700 2137200 2232500 1593700
  3   230100   216400  441400 1182400  840800  667900 1090700 1363800
  4    33700   105100  201500  368500  465900  467100  383700  809300
  5    14400    26200   81100  124500  129800  245800  255800  211800
  6     6800    22800   22600   43600   62100   74700  128100  123700
  7     7800    12800   25200   20200   20500   23800   38000   61000
  8     4700    23100   29700   29200   28400   16200   23800   28200
   year
age    1990    1991     1992     1993    1994    1995    1996   1997
  0 1302800 2386600 10331300 10265400 4498900 7438469 2311226 431175
  1 3020000 2138900  2303100  3826800 1785200 1664874 1606393 479702
  2  899300 1132800  1284900  1176300 1783200 1444061  642084 687920
  3  779100  556700   442700   609000  489100  816703  525601 446909
  4  861000  548900   361500   305500  347600  231794  172099 284920
  5  387500  501200   360500   215600  109000  118536   57586 109178
  6   80200  205300   375600   226000   91800   55128   22534  31389
  7   54400   39300   152400   188000   76400   41409    9264  11832
  8   40700   38600    62500   129000  116600   98200   21143  24467
```

```
   year
age    1998    1999    2000    2001   2002    2003    2004    2005   2006
  0  259526 1566349 1105085 1832691 730279  369074  715597 1015554 878637
  1  977680  303520 1171677  614469 837557  617021  206648  715547 222111
  2 1220105  616354  622853  842635 579592 1221992  447918  355453 401087
  3  537932 1058716  463170  485628 970577  529386 1366155  485746 310602
  4  276333  294066  646814  278884 292205  835552  543376 1318647 464620
  5  175817  135648  213466  321743 140701  244780  753231  479961 997782
  6   88927   69299   82481   90918 174570  107751  169324  576154 252150
  7   15232   27998   35706   38252  48908  123291  104945  115212 247042
  8   20550   12228   17087   20602  43322   46715   97142  146808 106412
   year
age   2007   2008   2009   2010   2011   2012   2013    2014   2015
  0 621005 798284 650043 574895 778927 773241 461571 1388685 538228
  1 235553 235022 175923 280728 159504 284906 413000  370590 394878
  2 219115 331772 259434 293887 367820 455259 324920  382990 551802
  3 417452 184771 106738 236804 275016 673465 485185  386131 247555
  4 285746 199069  93321 126241 218711 404265 571269  616563 282813
  5 309454 137529  86137  83893 130127 306234 422765  487582 461041
  6 629187 118349  37951  61542  62938 152577 327213  284562 432034
  7 147830 215542  53130  33305  52081 104461 145330  191729 271280
  8 156750 117258 143131 113675 125734 205427 313638  214513 337811
   year
age    2016    2017    2018   2019
  0 1583568  462148 1337404 649197
  1  109135  209356   73260 172202
  2  625483  108706  206232 105505
  3  818585 1079854  200527 307520
  4  293372  837770 1178604 198443
  5  280451  222790  848961 730016
  6  367844  145511  223637 528327
  7  307347  175533  144999 133409
  8  359076  221296  332482 217686
```

Table 2.6.3.2. North Sea Herring single fleet assessment. WEIGHTS AT AGE IN THE CATCH

```
Units  :  kg
   year
age  1947  1948   1949  1950   1951  1952  1953   1954   1955  1956   1957
  0 0.015 0.015 0.0150 0.015 0.0150 0.015 0.015 0.0150 0.0150 0.015 0.0150
  1 0.050 0.050 0.0500 0.050 0.0500 0.050 0.050 0.0500 0.0500 0.050 0.0500
  2 0.122 0.122 0.1280 0.128 0.1340 0.137 0.137 0.1390 0.1400 0.140 0.1410
  3 0.140 0.140 0.1450 0.151 0.1570 0.165 0.167 0.1690 0.1700 0.172 0.1730
  4 0.156 0.156 0.1610 0.166 0.1760 0.183 0.190 0.1930 0.1950 0.197 0.1980
  5 0.171 0.171 0.1760 0.180 0.1890 0.199 0.205 0.2110 0.2140 0.216 0.2180
  6 0.185 0.185 0.1890 0.193 0.2010 0.210 0.218 0.2230 0.2280 0.231 0.2330
  7 0.197 0.197 0.2010 0.204 0.2110 0.219 0.226 0.2330 0.2380 0.242 0.2440
  8 0.242 0.242 0.2435 0.245 0.2475 0.251 0.254 0.2565 0.2595 0.261 0.2625
   year
age   1958   1959  1960  1961  1962  1963  1964  1965  1966  1967  1968
  0 0.0150 0.0150 0.015 0.015 0.015 0.015 0.015 0.015 0.015 0.015 0.015
  1 0.0500 0.0500 0.050 0.050 0.050 0.050 0.050 0.050 0.050 0.050 0.050
```

```
  2 0.1410 0.1430 0.126 0.126 0.126 0.126 0.126 0.126 0.126 0.126 0.126
  3 0.1740 0.1760 0.176 0.176 0.176 0.176 0.176 0.176 0.176 0.176 0.176
  4 0.1990 0.2010 0.211 0.211 0.211 0.211 0.211 0.211 0.211 0.211 0.211
  5 0.2190 0.2210 0.243 0.243 0.243 0.243 0.243 0.243 0.243 0.243 0.243
  6 0.2340 0.2360 0.251 0.251 0.251 0.251 0.251 0.251 0.251 0.251 0.251
  7 0.2450 0.2470 0.267 0.267 0.267 0.267 0.267 0.267 0.267 0.267 0.267
  8 0.2635 0.2645 0.271 0.271 0.271 0.271 0.271 0.271 0.271 0.271 0.271
   year
age  1969  1970  1971  1972  1973  1974  1975  1976  1977  1978  1979
  0 0.015 0.015 0.015 0.015 0.015 0.015 0.015 0.015 0.015 0.015 0.015
  1 0.050 0.050 0.050 0.050 0.050 0.050 0.050 0.050 0.050 0.050 0.050
  2 0.126 0.126 0.126 0.126 0.126 0.126 0.126 0.126 0.126 0.126 0.126
  3 0.176 0.176 0.176 0.176 0.176 0.176 0.176 0.176 0.176 0.176 0.176
  4 0.211 0.211 0.211 0.211 0.211 0.211 0.211 0.211 0.211 0.211 0.211
  5 0.243 0.243 0.243 0.243 0.243 0.243 0.243 0.243 0.243 0.243 0.243
  6 0.251 0.251 0.251 0.251 0.251 0.251 0.251 0.251 0.251 0.251 0.251
  7 0.267 0.267 0.267 0.267 0.267 0.267 0.267 0.267 0.267 0.267 0.267
  8 0.271 0.271 0.271 0.271 0.271 0.271 0.271 0.271 0.271 0.271 0.271
   year
age  1980  1981     1982      1983      1984      1985      1986      1987
  0 0.015 0.007 0.010000 0.0100000 0.0100000 0.0090000 0.0060000 0.0110000
  1 0.050 0.049 0.059000 0.0590000 0.0590000 0.0360000 0.0670000 0.0350000
  2 0.126 0.118 0.118000 0.1180000 0.1180000 0.1280000 0.1210000 0.0990000
  3 0.176 0.142 0.149000 0.1490000 0.1490000 0.1640000 0.1530000 0.1500000
  4 0.211 0.189 0.179000 0.1790000 0.1790000 0.1940000 0.1820000 0.1800000
  5 0.243 0.211 0.217000 0.2170000 0.2170000 0.2110000 0.2080000 0.2110000
  6 0.251 0.222 0.238000 0.2380000 0.2380000 0.2200000 0.2210000 0.2340000
  7 0.267 0.267 0.265000 0.2650000 0.2650000 0.2580000 0.2380000 0.2580000
  8 0.271 0.271 0.274234 0.2745238 0.2746263 0.2821301 0.2572113 0.2881358
   year
age      1988      1989      1990      1991      1992      1993      1994
  0 0.0110000 0.0170000 0.0190000 0.0170000 0.0100000 0.0100000 0.0060000
  1 0.0550000 0.0430000 0.0550000 0.0580000 0.0530000 0.0330000 0.0560000
  2 0.1110000 0.1150000 0.1140000 0.1300000 0.1020000 0.1150000 0.1300000
  3 0.1450000 0.1530000 0.1490000 0.1660000 0.1750000 0.1450000 0.1590000
  4 0.1740000 0.1730000 0.1770000 0.1840000 0.1890000 0.1890000 0.1810000
  5 0.1970000 0.2080000 0.1930000 0.2030000 0.2070000 0.2040000 0.2140000
  6 0.2160000 0.2310000 0.2290000 0.2170000 0.2230000 0.2280000 0.2400000
  7 0.2370000 0.2470000 0.2360000 0.2350000 0.2370000 0.2440000 0.2550000
  8 0.2565714 0.2631489 0.2608182 0.2630415 0.2631664 0.2734558 0.2761973
   year
age      1995      1996      1997      1998     1999      2000     2001
  0 0.0090000 0.0150000 0.0150000 0.0210000 0.009000 0.0150000 0.012000
  1 0.0420000 0.0180000 0.0440000 0.0510000 0.045000 0.0330000 0.048000
  2 0.1300000 0.1120000 0.1080000 0.1140000 0.115000 0.1130000 0.118000
  3 0.1690000 0.1560000 0.1480000 0.1450000 0.151000 0.1570000 0.149000
  4 0.1980000 0.1880000 0.1950000 0.1830000 0.171000 0.1790000 0.177000
  5 0.2070000 0.2040000 0.2270000 0.2190000 0.207000 0.2010000 0.198000
  6 0.2430000 0.2120000 0.2260000 0.2380000 0.233000 0.2160000 0.213000
  7 0.2470000 0.2610000 0.2350000 0.2470000 0.245000 0.2460000 0.238000
  8 0.2809153 0.2814938 0.2549437 0.2878952 0.267719 0.2731261 0.269744
   year
age      2002      2003      2004      2005      2006      2007     2008
```

```
  0 0.0120000 0.0140000 0.0140000 0.0110000 0.0100000 0.0124000 0.007900
  1 0.0370000 0.0370000 0.0360000 0.0440000 0.0490000 0.0638000 0.053500
  2 0.1180000 0.1040000 0.1000000 0.0990000 0.1170000 0.1214000 0.128800
  3 0.1530000 0.1580000 0.1380000 0.1530000 0.1440000 0.1513000 0.179600
  4 0.1700000 0.1740000 0.1830000 0.1660000 0.1720000 0.1634000 0.181200
  5 0.1990000 0.1840000 0.2010000 0.2080000 0.1810000 0.1933000 0.183200
  6 0.2140000 0.2050000 0.2160000 0.2230000 0.2200000 0.1900000 0.215700
  7 0.2280000 0.2220000 0.2280000 0.2400000 0.2370000 0.2232000 0.216100
  8 0.2504017 0.2366464 0.2545115 0.2653676 0.2460061 0.2374933 0.262076
   year
age      2009      2010     2011      2012      2013      2014      2015
  0 0.0094000 0.0075000 0.008000 0.0106000 0.0077000 0.0075000 0.0087000
  1 0.0514000 0.0571000 0.041300 0.0463000 0.0468000 0.0522000 0.0261000
  2 0.1440000 0.1292000 0.131700 0.1243000 0.1162000 0.1240000 0.1135000
  3 0.1811000 0.1669000 0.159300 0.1706000 0.1563000 0.1719000 0.1538000
  4 0.2158000 0.1912000 0.183100 0.1854000 0.1977000 0.1861000 0.1883000
  5 0.2162000 0.2203000 0.197000 0.2058000 0.1980000 0.2148000 0.2001000
  6 0.2390000 0.2193000 0.216700 0.2215000 0.2154000 0.2118000 0.2212000
  7 0.2428000 0.2160000 0.221100 0.2387000 0.2334000 0.2264000 0.2170000
  8 0.2532723 0.2383892 0.231918 0.2427213 0.2378432 0.2426541 0.2347182
   year
age      2016      2017      2018      2019
  0 0.0071000 0.0090000 0.0054000 0.0064000
  1 0.0265000 0.0380000 0.0394000 0.0395000
  2 0.1267000 0.0990000 0.1085000 0.1210000
  3 0.1549000 0.1560000 0.1451000 0.1465000
  4 0.1803000 0.1730000 0.1838000 0.1688000
  5 0.2059000 0.1880000 0.1914000 0.2036000
  6 0.2151000 0.2150000 0.2151000 0.2081000
  7 0.2313000 0.2200000 0.2342000 0.2195000
  8 0.2299244 0.2305184 0.2455776 0.2434812
```

Table 2.6.3.3. North Sea Herring single fleet assessment. WEIGHTS AT AGE IN THE STOCK

```
Units  :  kg
   year
age   1947   1948      1949      1950      1951      1952      1953
  0 0.0150 0.0150 0.0150000 0.0150000 0.0150000 0.0150000 0.0150000
  1 0.0500 0.0500 0.0500000 0.0500000 0.0500000 0.0500000 0.0500000
  2 0.1220 0.1220 0.1240000 0.1260000 0.1300000 0.1330000 0.1360000
  3 0.1400 0.1400 0.1416667 0.1453333 0.1510000 0.1576667 0.1630000
  4 0.1560 0.1560 0.1576667 0.1610000 0.1676667 0.1750000 0.1830000
  5 0.1710 0.1710 0.1726667 0.1756667 0.1816667 0.1893333 0.1976667
  6 0.1850 0.1850 0.1863333 0.1890000 0.1943333 0.2013333 0.2096667
  7 0.1970 0.1970 0.1983333 0.2006667 0.2053333 0.2113333 0.2186667
  8 0.2625 0.2625 0.2630000 0.2640000 0.2658333 0.2683333 0.2713333
   year
age      1954      1955      1956      1957      1958      1959      1960
  0 0.0150000 0.0150000 0.0150000 0.0150000 0.0150000 0.0150000 0.0150000
  1 0.0500000 0.0500000 0.0500000 0.0500000 0.0500000 0.0500000 0.0500000
  2 0.1376667 0.1386667 0.1396667 0.1403333 0.1406667 0.1416667 0.1463333
```

```
  3 0.1670000 0.1686667 0.1703333 0.1716667 0.1730000 0.1743333 0.1790000
  4 0.1886667 0.1926667 0.1950000 0.1966667 0.1980000 0.1993333 0.2076667
  5 0.2050000 0.2100000 0.2136667 0.2160000 0.2176667 0.2193333 0.2263333
  6 0.2170000 0.2230000 0.2273333 0.2306667 0.2326667 0.2343333 0.2486667
  7 0.2260000 0.2323333 0.2376667 0.2413333 0.2436667 0.2453333 0.2636667
  8 0.2743333 0.2771667 0.2795000 0.2815000 0.2828333 0.2840000 0.2936240
   year
age      1961      1962      1963      1964      1965      1966      1967
  0 0.0150000 0.0150000 0.0150000 0.0150000 0.0150000 0.0150000 0.0150000
  1 0.0500000 0.0500000 0.0500000 0.0500000 0.0500000 0.0500000 0.0500000
  2 0.1510000 0.1550000 0.1550000 0.1550000 0.1550000 0.1550000 0.1550000
  3 0.1833333 0.1870000 0.1870000 0.1870000 0.1870000 0.1870000 0.1870000
  4 0.2156667 0.2230000 0.2230000 0.2230000 0.2230000 0.2230000 0.2230000
  5 0.2330000 0.2390000 0.2390000 0.2390000 0.2390000 0.2390000 0.2390000
  6 0.2626667 0.2760000 0.2760000 0.2760000 0.2760000 0.2760000 0.2760000
  7 0.2816667 0.2990000 0.2990000 0.2990000 0.2990000 0.2990000 0.2990000
  8 0.3034146 0.3090087 0.3092903 0.3101214 0.3069573 0.3102731 0.3100755
   year
age      1968      1969      1970     1971   1972   1973     1974    1975
  0 0.0150000 0.0150000 0.0150000 0.015000 0.0150 0.0150 0.015000 0.01500
  1 0.0500000 0.0500000 0.0500000 0.050000 0.0500 0.0500 0.050000 0.05000
  2 0.1550000 0.1550000 0.1550000 0.155000 0.1550 0.1550 0.155000 0.15500
  3 0.1870000 0.1870000 0.1870000 0.187000 0.1870 0.1870 0.187000 0.18700
  4 0.2230000 0.2230000 0.2230000 0.223000 0.2230 0.2230 0.223000 0.22300
  5 0.2390000 0.2390000 0.2390000 0.239000 0.2390 0.2390 0.239000 0.23900
  6 0.2760000 0.2760000 0.2760000 0.276000 0.2760 0.2760 0.276000 0.27600
  7 0.2990000 0.2990000 0.2990000 0.299000 0.2990 0.2990 0.299000 0.29900
  8 0.3112209 0.3088686 0.3090248 0.311952 0.3076 0.3078 0.308129 0.30775
   year
age      1976  1977   1978      1979   1980  1981      1982      1983
  0 0.0150000 0.015 0.0150 0.0150000 0.0150 0.015 0.0150000 0.0150000
  1 0.0500000 0.050 0.0500 0.0500000 0.0500 0.050 0.0500000 0.0500000
  2 0.1550000 0.155 0.1550 0.1550000 0.1550 0.155 0.1550000 0.1550000
  3 0.1870000 0.187 0.1870 0.1870000 0.1870 0.187 0.1870000 0.1870000
  4 0.2230000 0.223 0.2230 0.2230000 0.2230 0.223 0.2230000 0.2230000
  5 0.2390000 0.239 0.2390 0.2390000 0.2390 0.239 0.2390000 0.2390000
  6 0.2760000 0.276 0.2760 0.2760000 0.2760 0.276 0.2760000 0.2760000
  7 0.2990000 0.299 0.2990 0.2990000 0.2990 0.299 0.2990000 0.2990000
  8 0.3077143 0.306 0.3096 0.3068571 0.3072 0.307 0.3074043 0.3091429
   year
age       1984       1985      1986       1987       1988        1989
  0 0.01733333 0.01566667 0.0140000 0.00900000 0.00800000 0.008666667
  1 0.05666667 0.05633333 0.0610000 0.05033333 0.04833333 0.043666667
  2 0.15033333 0.13800000 0.1300000 0.12166667 0.12300000 0.122333333
  3 0.19033333 0.18700000 0.1833333 0.17000000 0.16633333 0.165333333
  4 0.22966667 0.23233333 0.2316667 0.21233333 0.20833333 0.204666667
  5 0.24333333 0.24666667 0.2520000 0.23000000 0.22900000 0.228333333
  6 0.28200000 0.27466667 0.2730000 0.24200000 0.24833333 0.252333333
  7 0.31066667 0.32100000 0.3146667 0.27466667 0.25866667 0.261333333
  8 0.34351178 0.35438242 0.3627746 0.30562963 0.28535714 0.288595745
   year
age       1990       1991       1992        1993        1994       1995
  0 0.01233333 0.01133333 0.01033333 0.005666667 0.007333333 0.00600000
```

```
  1 0.05200000 0.05900000 0.06366667 0.061000000 0.060000000 0.05733333
  2 0.12566667 0.13900000 0.13666667 0.134000000 0.126333333 0.12933333
  3 0.17433333 0.18366667 0.19400000 0.184333333 0.191666667 0.18566667
  4 0.21166667 0.21200000 0.21400000 0.213000000 0.214333333 0.21066667
  5 0.24366667 0.23866667 0.23433333 0.234333333 0.239666667 0.22433333
  6 0.27066667 0.26533333 0.25300000 0.261666667 0.274666667 0.26800000
  7 0.28366667 0.27966667 0.27166667 0.272666667 0.291333333 0.29333333
  8 0.30788452 0.30953886 0.29870453 0.307936434 0.320523728 0.32614016
   year
age      1996       1997        1998       1999        2000       2001
  0 0.0060000 0.00500000 0.005666667 0.00600000 0.005666667 0.00600000
  1 0.0540000 0.04866667 0.047333333 0.05066667 0.051333333 0.05066667
  2 0.1296667 0.12333333 0.116000000 0.11600000 0.115666667 0.12166667
  3 0.1993333 0.18333333 0.187333333 0.17933333 0.183666667 0.17166667
  4 0.2273333 0.23033333 0.241333333 0.22633333 0.221333333 0.21000000
  5 0.2343333 0.23733333 0.264333333 0.25600000 0.248333333 0.23266667
  6 0.2736667 0.25666667 0.283666667 0.27333333 0.278666667 0.25533333
  7 0.3006667 0.28033333 0.286666667 0.27600000 0.286000000 0.27466667
  8 0.3270679 0.31004007 0.308339011 0.27811880 0.284171183 0.27449422
   year
age        2002        2003        2004        2005        2006       2007
  0 0.006333333 0.006666667 0.006666667 0.005666667 0.006666667 0.00600000
  1 0.047333333 0.047000000 0.042000000 0.041333333 0.041000000 0.05133333
  2 0.128000000 0.123000000 0.119333333 0.118000000 0.125666667 0.12800000
  3 0.171666667 0.173000000 0.165333333 0.164333333 0.155333333 0.16066667
  4 0.205333333 0.202333333 0.202666667 0.198000000 0.191000000 0.17966667
  5 0.228333333 0.222000000 0.223000000 0.224666667 0.216000000 0.20700000
  6 0.248333333 0.242333333 0.247666667 0.248000000 0.242000000 0.22366667
  7 0.270333333 0.265666667 0.267666667 0.265000000 0.252333333 0.23800000
  8 0.286521182 0.284946134 0.280490193 0.284851772 0.270150625 0.25639104
   year
age       2008        2009        2010        2011       2012       2013
  0 0.00800000 0.007333333 0.007333333 0.006666667 0.00600000 0.00600000
  1 0.05766667 0.061333333 0.052000000 0.043000000 0.04033333 0.04033333
  2 0.13033333 0.137333333 0.142333333 0.145666667 0.13800000 0.13566667
  3 0.16433333 0.181000000 0.190333333 0.187333333 0.18200000 0.17466667
  4 0.18066667 0.196666667 0.216000000 0.225000000 0.21133333 0.20866667
  5 0.19533333 0.210000000 0.223666667 0.239666667 0.23300000 0.22133333
  6 0.21766667 0.222666667 0.234333333 0.243666667 0.24100000 0.24200000
  7 0.22600000 0.233666667 0.240000000 0.250666667 0.24266667 0.24933333
  8 0.25556215 0.255734029 0.260650879 0.257270953 0.25251076 0.25179433
   year
age        2014        2015       2016        2017        2018       2019
  0 0.005666667 0.005333333 0.00500000 0.004166667 0.004566667 0.00400000
  1 0.043333333 0.043666667 0.04333333 0.042866667 0.039966667 0.04023333
  2 0.128666667 0.127333333 0.12100000 0.110866667 0.101300000 0.09900000
  3 0.176666667 0.161333333 0.16033333 0.153166667 0.152966667 0.14846667
  4 0.203666667 0.200000000 0.18866667 0.182966667 0.185766667 0.17736667
  5 0.215666667 0.211666667 0.21600000 0.207100000 0.215033333 0.20896667
  6 0.228666667 0.224666667 0.22433333 0.226533333 0.229200000 0.22613333
  7 0.241333333 0.229000000 0.22433333 0.227066667 0.238766667 0.23786667
  8 0.246572539 0.239358137 0.23372066 0.229232697 0.246755779 0.25411003
```

Table 2.6.3.4. North Sea Herring single fleet assessment. NATURAL MORTALITY

Units : NA

age	1947	1948	1949	1950	1951	1952	1953
0	0.8135307	0.8135307	0.8135307	0.8135307	0.8135308	0.8135307	0.8135307
1	0.6750149	0.6750149	0.6750149	0.6750149	0.6750148	0.6750149	0.6750150
2	0.4424777	0.4424777	0.4424777	0.4424777	0.4424777	0.4424777	0.4424778
3	0.3894577	0.3894577	0.3894577	0.3894577	0.3894577	0.3894577	0.3894577
4	0.3617534	0.3617534	0.3617534	0.3617534	0.3617534	0.3617534	0.3617534
5	0.3443683	0.3443683	0.3443683	0.3443683	0.3443683	0.3443683	0.3443683
6	0.3347824	0.3347824	0.3347824	0.3347824	0.3347824	0.3347824	0.3347824
7	0.3290872	0.3290872	0.3290872	0.3290872	0.3290872	0.3290872	0.3290872
8	0.3283752	0.3283752	0.3283752	0.3283752	0.3283752	0.3283752	0.3283752

age	1954	1955	1956	1957	1958	1959	1960
0	0.8135308	0.8135307	0.8135307	0.8135312	0.8135302	0.8135307	0.8135326
1	0.6750146	0.6750151	0.6750152	0.6750136	0.6750167	0.6750153	0.6750087
2	0.4424777	0.4424778	0.4424778	0.4424774	0.4424782	0.4424778	0.4424761
3	0.3894576	0.3894578	0.3894578	0.3894574	0.3894581	0.3894578	0.3894563
4	0.3617534	0.3617534	0.3617534	0.3617533	0.3617536	0.3617534	0.3617529
5	0.3443683	0.3443683	0.3443683	0.3443683	0.3443683	0.3443682	0.3443683
6	0.3347824	0.3347824	0.3347824	0.3347826	0.3347822	0.3347823	0.3347832
7	0.3290872	0.3290871	0.3290871	0.3290874	0.3290869	0.3290871	0.3290882
8	0.3283752	0.3283752	0.3283751	0.3283754	0.3283749	0.3283751	0.3283762

age	1961	1962	1963	1964	1965	1966	1967
0	0.8135272	0.8135323	0.8135383	0.8135110	0.8135475	0.8135563	0.8134293
1	0.6750260	0.6750113	0.6749888	0.6750778	0.6749675	0.6749210	0.6753448
2	0.4424807	0.4424767	0.4424709	0.4424945	0.4424646	0.4424536	0.4425652
3	0.3894602	0.3894567	0.3894521	0.3894717	0.3894464	0.3894382	0.3895306
4	0.3617544	0.3617529	0.3617514	0.3617588	0.3617487	0.3617467	0.3617810
5	0.3443682	0.3443682	0.3443687	0.3443678	0.3443680	0.3443702	0.3443650
6	0.3347812	0.3347827	0.3347856	0.3347752	0.3347872	0.3347944	0.3347440
7	0.3290854	0.3290876	0.3290915	0.3290772	0.3290940	0.3291034	0.3290342
8	0.3283735	0.3283756	0.3283796	0.3283652	0.3283820	0.3283915	0.3283220

age	1968	1969	1970	1971	1972	1973	1974
0	0.8136569	0.8135827	0.8130484	0.8143397	0.8133599	0.8114455	0.8182138
1	0.6746366	0.6747816	0.6766161	0.6725121	0.6752167	0.6821197	0.6601998
2	0.4423750	0.4424207	0.4429001	0.4418043	0.4425576	0.4443383	0.4385170
3	0.3893704	0.3894136	0.3898078	0.3888898	0.3895430	0.3909907	0.3861357
4	0.3617183	0.3617408	0.3618839	0.3615302	0.3618081	0.3623135	0.3604690
5	0.3443688	0.3443769	0.3443493	0.3443803	0.3444012	0.3442663	0.3444733
6	0.3348231	0.3348162	0.3345928	0.3350602	0.3347955	0.3339227	0.3364625
7	0.3291444	0.3291317	0.3288263	0.3294753	0.3290936	0.3279101	0.3314221
8	0.3284324	0.3284201	0.3281136	0.3287636	0.3283831	0.3271940	0.3307138

age	1975	1976	1977	1978	1979	1980	1981
0	0.8104203	0.8057025	0.8047344	0.8064925	0.8102209	0.8172173	0.8274914
1	0.6833306	0.7028286	0.7182187	0.7301416	0.7391092	0.7443256	0.7458190
2	0.4448176	0.4496803	0.4530271	0.4549542	0.4555319	0.4544437	0.4517433
3	0.3915027	0.3953336	0.3974290	0.3980001	0.3972606	0.3948411	0.3907612

```
  4 0.3626420 0.3638296 0.3639133 0.3629697 0.3611322 0.3583281 0.3545417
  5 0.3444641 0.3438615 0.3425790 0.3406726 0.3382412 0.3352751 0.3317545
  6 0.3340014 0.3313040 0.3283186 0.3250641 0.3216048 0.3180074 0.3142432
  7 0.3279486 0.3243595 0.3206191 0.3167357 0.3127549 0.3087363 0.3046563
  8 0.3272416 0.3236265 0.3198121 0.3158315 0.3117531 0.3076064 0.3033674
   year
age      1982      1983      1984      1985      1986      1987      1988
  0 0.8383555 0.8590581 0.8809267 0.8934130 0.9037276 0.9089402 0.9055544
  1 0.7453371 0.7391267 0.7304259 0.7230871 0.7138885 0.7044524 0.6956670
  2 0.4480561 0.4428878 0.4366100 0.4275364 0.4159904 0.4069106 0.3996457
  3 0.3858179 0.3782072 0.3694208 0.3592993 0.3472028 0.3381516 0.3327748
  4 0.3499919 0.3438174 0.3366285 0.3266155 0.3141998 0.3051551 0.3001102
  5 0.3277630 0.3228028 0.3171952 0.3096474 0.3004945 0.2934900 0.2889626
  6 0.3102333 0.3057392 0.3008707 0.2945230 0.2870705 0.2811765 0.2771440
  7 0.3004356 0.2958686 0.2910635 0.2850467 0.2781549 0.2727453 0.2690913
  8 0.2990244 0.2941664 0.2890815 0.2833436 0.2770111 0.2718492 0.2681644
   year
age      1989      1990      1991      1992      1993      1994      1995
  0 0.8969649 0.8905781 0.8847789 0.8765258 0.8710855 0.8653465 0.8611988
  1 0.6872170 0.6789194 0.6670819 0.6525472 0.6419350 0.6322777 0.6253381
  2 0.3924870 0.3887871 0.3910214 0.3965857 0.4012131 0.4062928 0.4119019
  3 0.3287391 0.3266214 0.3289607 0.3346403 0.3387533 0.3412051 0.3434764
  4 0.2964264 0.2949764 0.2990174 0.3070347 0.3127427 0.3169675 0.3205615
  5 0.2852925 0.2833107 0.2848702 0.2889228 0.2919481 0.2950066 0.2978004
  6 0.2738176 0.2716721 0.2719104 0.2738530 0.2751515 0.2759697 0.2768056
  7 0.2661460 0.2642858 0.2646607 0.2666571 0.2680060 0.2687452 0.2695653
  8 0.2651373 0.2628437 0.2619613 0.2622382 0.2623560 0.2617543 0.2614389
   year
age      1996      1997      1998      1999      2000      2001      2002
  0 0.8644131 0.8714153 0.8809581 0.8953693 0.9138225 0.9303382 0.9462271
  1 0.6266946 0.6323094 0.6414736 0.6612056 0.6887892 0.7089131 0.7237124
  2 0.4148836 0.4175451 0.4218480 0.4291405 0.4376797 0.4447908 0.4528783
  3 0.3428210 0.3407633 0.3411658 0.3447208 0.3494167 0.3550605 0.3641446
  4 0.3193077 0.3158974 0.3144479 0.3140061 0.3129517 0.3144011 0.3206260
  5 0.2970118 0.2949494 0.2944949 0.2949689 0.2952192 0.2974189 0.3032716
  6 0.2759604 0.2744636 0.2745619 0.2760781 0.2779683 0.2811793 0.2871590
  7 0.2692426 0.2684613 0.2687931 0.2699709 0.2713117 0.2737630 0.2783370
  8 0.2612232 0.2610349 0.2620768 0.2649014 0.2687185 0.2727170 0.2774175
   year
age      2003      2004      2005      2006      2007      2008      2009
  0 0.9636406 0.9778611 0.9924404 1.0051537 1.0126169 1.0176157 1.0160229
  1 0.7391891 0.7458320 0.7351250 0.7212731 0.7089871 0.6927028 0.6815790
  2 0.4623603 0.4675825 0.4670940 0.4651993 0.4606177 0.4534194 0.4486089
  3 0.3756800 0.3842515 0.3917235 0.3982069 0.3992761 0.3979235 0.3972307
  4 0.3294129 0.3371511 0.3469816 0.3567311 0.3614871 0.3648674 0.3680856
  5 0.3111539 0.3182483 0.3270457 0.3358458 0.3408919 0.3449711 0.3487946
  6 0.2949874 0.3020598 0.3098954 0.3176953 0.3228500 0.3272613 0.3316144
  7 0.2843214 0.2900766 0.2964710 0.3030145 0.3082212 0.3132112 0.3182143
  8 0.2830219 0.2882408 0.2937930 0.2992683 0.3031155 0.3064383 0.3102376
   year
age      2010      2011      2012      2013      2014      2015      2016
  0 1.0077651 0.9945248 0.9758610 0.9522143 0.9234139 0.8891311 0.8495409
  1 0.6742762 0.6682724 0.6657074 0.6645925 0.6661190 0.6716350 0.6800092
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  2 0.4455843 0.4427270 0.4410072 0.4395108 0.4388913 0.4398892 0.4419012
  3 0.3969625 0.3960316 0.3949324 0.3931928 0.3911678 0.3893188 0.3873211
  4 0.3710640 0.3734170 0.3753545 0.3766790 0.3775302 0.3781232 0.3783272
  5 0.3522990 0.3552698 0.3578357 0.3598761 0.3615013 0.3628765 0.3639009
  6 0.3358301 0.3397322 0.3434756 0.3469157 0.3501437 0.3532930 0.3562775
  7 0.3231951 0.3281086 0.3330175 0.3378633 0.3426801 0.3475198 0.3523502
  8 0.3144489 0.3187356 0.3232706 0.3278875 0.3326709 0.3377392 0.3430125
   year
age      2017      2018      2019
  0 0.8873620 0.8693360 0.8495409
  1 0.6725878 0.6758221 0.6800092
  2 0.4402272 0.4408952 0.4419012
  3 0.3892692 0.3883200 0.3873211
  4 0.3779935 0.3782252 0.3783272
  5 0.3627596 0.3633887 0.3639009
  6 0.3532380 0.3547852 0.3562775
  7 0.3475167 0.3499350 0.3523502
  8 0.3378075 0.3403759 0.3430125
```

Table 2.6.3.5. North Sea Herring single fleet assessment. PROPORTION MATURE

```
Units  :  NA
   year
age 1947 1948 1949 1950 1951 1952 1953 1954 1955 1956 1957 1958 1959 1960
  0    0    0    0    0    0    0    0    0    0    0    0    0    0    0
  1    0    0    0    0    0    0    0    0    0    0    0    0    0    0
  2    1    1    1    1    1    1    1    1    1    1    1    1    1    1
  3    1    1    1    1    1    1    1    1    1    1    1    1    1    1
  4    1    1    1    1    1    1    1    1    1    1    1    1    1    1
  5    1    1    1    1    1    1    1    1    1    1    1    1    1    1
  6    1    1    1    1    1    1    1    1    1    1    1    1    1    1
  7    1    1    1    1    1    1    1    1    1    1    1    1    1    1
  8    1    1    1    1    1    1    1    1    1    1    1    1    1    1
   year
age 1961 1962 1963 1964 1965 1966 1967 1968 1969 1970 1971 1972 1973 1974
  0    0    0    0    0    0    0    0    0    0    0    0 0.00 0.00 0.00
  1    0    0    0    0    0    0    0    0    0    0    0 0.00 0.00 0.00
  2    1    1    1    1    1    1    1    1    1    1    1 0.82 0.82 0.82
  3    1    1    1    1    1    1    1    1    1    1    1 1.00 1.00 1.00
  4    1    1    1    1    1    1    1    1    1    1    1 1.00 1.00 1.00
  5    1    1    1    1    1    1    1    1    1    1    1 1.00 1.00 1.00
  6    1    1    1    1    1    1    1    1    1    1    1 1.00 1.00 1.00
  7    1    1    1    1    1    1    1    1    1    1    1 1.00 1.00 1.00
  8    1    1    1    1    1    1    1    1    1    1    1 1.00 1.00 1.00
   year
age 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988
  0 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00  0.0 0.00  0.0 0.00
  1 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00  0.0 0.00  0.0 0.00
  2 0.82 0.82 0.82 0.82 0.82 0.82 0.82 0.82 0.82 0.82  0.7 0.75  0.8 0.85
  3 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00  1.0 1.00  1.0 0.93
  4 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00  1.0 1.00  1.0 1.00
```

```
  5 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00  1.0 1.00  1.0 1.00
  6 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00  1.0 1.00  1.0 1.00
  7 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00  1.0 1.00  1.0 1.00
  8 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00  1.0 1.00  1.0 1.00
   year
age 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002
  0 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
  1 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
  2 0.82 0.91 0.86 0.50 0.47 0.73 0.67 0.61 0.64 0.64 0.69 0.67 0.77 0.87
  3 0.94 0.97 0.99 0.99 0.61 0.93 0.95 0.98 0.94 0.89 0.91 0.96 0.92 0.97
  4 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
  5 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
  6 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
  7 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
  8 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
   year
age 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016
  0 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
  1 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
  2 0.43 0.70 0.76 0.66 0.71 0.86 0.89 0.45 0.87 0.91 0.83 0.85 0.70 0.71
  3 0.93 0.65 0.96 0.88 0.92 0.98 1.00 0.90 0.84 0.99 0.96 1.00 0.90 0.89
  4 1.00 1.00 0.96 0.98 0.93 0.99 1.00 1.00 1.00 1.00 0.98 1.00 0.96 0.95
  5 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
  6 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
  7 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
  8 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
   year
age 2017 2018 2019
  0 0.00 0.00 0.00
  1 0.00 0.00 0.00
  2 0.55 0.37 0.59
  3 0.96 0.91 0.97
  4 0.97 0.98 0.99
  5 1.00 1.00 1.00
  6 1.00 1.00 1.00
  7 1.00 1.00 1.00
  8 1.00 1.00 1.00
```

Table 2.6.3.6. North Sea Herring single fleet assessment. FRACTION OF HARVEST BEFORE SPAWNING

```
Units  :  NA
   year
age 1947 1948 1949 1950 1951 1952 1953 1954 1955 1956 1957 1958 1959 1960
  0 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  1 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  2 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  3 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  4 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  5 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  6 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  7 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
```

```
  8 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
   year
age 1961 1962 1963 1964 1965 1966 1967 1968 1969 1970 1971 1972 1973 1974
  0 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  1 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  2 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  3 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  4 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  5 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  6 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  7 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  8 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
   year
age 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988
  0 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  1 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  2 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  3 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  4 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  5 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  6 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  7 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  8 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
   year
age 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002
  0 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  1 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  2 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  3 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  4 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  5 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  6 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  7 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  8 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
   year
age 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016
  0 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  1 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  2 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  3 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  4 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  5 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  6 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  7 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  8 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
   year
age 2017 2018 2019
  0 0.67 0.67 0.67
  1 0.67 0.67 0.67
  2 0.67 0.67 0.67
  3 0.67 0.67 0.67
  4 0.67 0.67 0.67
  5 0.67 0.67 0.67
```

```
  6 0.67 0.67 0.67
  7 0.67 0.67 0.67
  8 0.67 0.67 0.67
```

Table 2.6.3.7. North Sea Herring single fleet assessment. FRACTION OF NATURAL MORTALITY BEFORE SPAWNING

```
Units  :  NA
   year
age 1947 1948 1949 1950 1951 1952 1953 1954 1955 1956 1957 1958 1959 1960
  0 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  1 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  2 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  3 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  4 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  5 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  6 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  7 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  8 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
   year
age 1961 1962 1963 1964 1965 1966 1967 1968 1969 1970 1971 1972 1973 1974
  0 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  1 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  2 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  3 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  4 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  5 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  6 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  7 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  8 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
   year
age 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988
  0 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  1 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  2 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  3 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  4 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  5 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  6 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  7 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  8 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
   year
age 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002
  0 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  1 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  2 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  3 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  4 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  5 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  6 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  7 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  8 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
```

```
   year
age 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016
  0 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  1 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  2 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  3 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  4 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  5 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  6 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  7 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
  8 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67 0.67
   year
age 2017 2018 2019
  0 0.67 0.67 0.67
  1 0.67 0.67 0.67
  2 0.67 0.67 0.67
  3 0.67 0.67 0.67
  4 0.67 0.67 0.67
  5 0.67 0.67 0.67
  6 0.67 0.67 0.67
  7 0.67 0.67 0.67
  8 0.67 0.67 0.67
```

Table 2.6.3.8. North Sea Herring single fleet assessment. SURVEY INDICES

HERAS - Configuration

```
Herring in Sub-area IV, Divisions VIId & IIIa (autumn-spawners) (16/Mar/2020) . Imported
from VPA file.
      min       max plusgroup   minyear   maxyear    startf      endf
     1.00      8.00      8.00   1989.00   2019.00      0.54      0.56
Index type : number
```

HERAS - Index Values

```
Units  :  NA
   year
age    1989    1990    1991    1992    1993    1994    1995    1996
  1      -1      -1      -1      -1      -1      -1      -1      -1
  2 4090000 3306000 2634000 3734000 2984000 3185000 3849000 4497000
  3 3903000 3521000 1700000 1378000 1637000  839000 2041000 2824000
  4 1633000 3414000 1959000 1147000  902000  399000  672000 1087000
  5  492000 1366000 1849000 1134000  741000  381000  299000  311000
  6  283000  392000  644000 1246000  777000  321000  203000   99000
  7  120000  210000  228000  395000  551000  326000  138000   83000
  8   66000  176000  145000  218000  296000  350000  212000  339000
   year
age    1997    1998    1999     2000     2001     2002     2003    2004
  1 9361000 4449000 5087000 24736000  6837000 23055000  9829400 5183700
  2 5960000 5747000 3078000  2923000 12290000  4875000 18949400 3415900
  3 2935000 2520000 4725000  2156000  3083000  8220000  3081000 9191800
```

```
  4 1441000 1625000 1116000  3140000  1462000  1390000  4188900 2167300
  5  601000  982000  506000  1007000  1676000   794600   675100 2590700
  6  215000  445000  314000   483000   450000  1031000   494800  317100
  7   46000  170000  139000   266000   170000   244400   568300  327600
  8  237000  166000  141000   217000   157000   270500   323200  527650
   year
age    2005    2006    2007    2008    2009     2010     2011    2012
  1 3114100 6822800 6261000 3714000 4655000 14577000 10119000 7437000
  2 2055100 3772300 2750000 2853000 5632000  4237000  4166000 4719000
  3 3648500 1997200 1848000 1709000 2553000  4216000  2534000 4067000
  4 5789600 2097500  898000 1485000 1023000  2453000  2173000 1738000
  5 1212900 4175100  806000  809000 1077000  1246000  1016000 1209000
  6 1174900  618200 1323000  712000  674000  1332000   651000  593000
  7  139900  562100  243000 1749000  638000   688000   688000  247000
  8  233200  154700  217000  455000 1720000  2729000  1737000  696000
   year
age    2013     2014    2015     2016    2017    2018     2019
  1 6388000 11634000 6714000  9034000 3054000 9938000 10146000
  2 2683000  4918000 9495000 12011000 1761000 4254000  1303000
  3 3031000  2827000 2831000  5832000 6095000 1692000  2345000
  4 2895000  2939000 1591000  1273000 3142000 5150000  1212000
  5 1546000  1791000 1549000   822000  787000 2440000  3506000
  6  849000  1236000  926000   909000  365000  719000  1657000
  7  464000   669000  520000   395000  298000  529000   395000
  8  842000   461000  496000   366000  293000  404000   424000
```

IBTS-Q1 - Configuration

```
Herring in Sub-area IV, Divisions VIId & IIIa (autumn-spawners) (16/Mar/2020) . Imported
from VPA file.
         min          max    plusgroup      minyear      maxyear
   1.0000000    1.0000000           NA 1984.0000000 2020.0000000
      startf         endf
   0.1008259    0.1008259
Index type : number

IBTS-Q1 - Index Values

Units  :  NA
   year
age   1984    1985    1986    1987    1988    1989     1990    1991
  1 957324 1473183 1662159 3221178 1464182 1677569 768368.2 1085666
   year
age    1992    1993    1994    1995    1996    1997    1998     1999
  1 1147216 1838663 2812005 2266363 1277320 1350215 1804583 698806.6
   year
age    2000    2001    2002    2003     2004     2005     2006     2007
  1 2096596 1605575 1820055 1426762 771457.8 925583.4 717821.2 883302.7
   year
age     2008     2009     2010    2011     2012     2013    2014    2015
  1 774710.1 732798.5 916572.8 1613673 824527.6 505955.1 1645682 1943846
   year
age   2016    2017     2018     2019    2020
```

```
  1 558363 1361551 689636.3 970111.9 1145081
```

IBTS0 - Configuration

```
Herring in Sub-area IV, Divisions VIId & IIIa (autumn-spawners) (16/Mar/2020) . Imported
from VPA file.
      min       max plusgroup   minyear   maxyear    startf      endf
     0.00      0.00        NA   1992.00   2020.00      0.08      0.17
Index type : number

IBTS0 - Index Values

Units  :  NA
   year
age     1992     1993     1994     1995    1996     1997     1998     1999
  0 164.0899 195.7571 155.1368 170.4691 106.264 134.6798 51.71666 255.4222
   year
age     2000     2001     2002     2003     2004     2005     2006
  0 109.8237 341.3018 150.7038 70.83748 43.88171 82.06045 64.41743
   year
age     2007     2008     2009     2010     2011     2012     2013
  0 50.91532 39.53371 99.18411 74.10116 77.63466 65.07967 61.17656
   year
age     2014     2015     2016     2017     2018     2019     2020
  0 113.7963 21.76008 81.69031 27.83202 102.1129 51.62587 62.41121
```

IBTS-Q3 - Configuration

```
Herring in Sub-area IV, Divisions VIId & IIIa (autumn-spawners) (16/Mar/2020) . Imported
from VPA file.
         min          max    plusgroup      minyear      maxyear
   0.0000000    5.0000000           NA 1998.0000000 2019.0000000
      startf         endf
   0.6084662    0.6084662
Index type : number

IBTS-Q3 - Index Values

Units  :  NA
   year
age      1998       1999       2000       2001       2002      2003
  0 707529.29 4233846.75 1620038.45 1714578.46 2055109.72 833224.14
  1 415995.22  290830.27  763292.82  317776.68 1940710.52 467668.41
  2 281888.09  205967.99  256000.32  219364.82  438205.77 557140.92
  3  90723.61  122047.54  115690.52   93775.23  341437.92 145835.21
  4  24717.72   49316.26   66902.87   41645.09   79278.42 109662.86
  5  10726.45   17602.24   17044.41   25305.84   31226.51  18512.78
   year
age       2004       2005      2006       2007      2008       2009
  0 1970515.25 1005504.45 962447.25 2086570.65 524669.09 2654058.23
  1  384254.10  382307.62 288008.48  132097.51 150256.12  199023.94
  2  281709.01  112453.04 192018.99   92766.30 112671.15   93460.99
  3  411046.51   81907.19  77885.34   97733.80  58448.44   61031.71
```

```
  4   93091.92   96320.65  45055.96   48852.73  34431.66   25875.50
  5   48867.94   30631.40  51266.22   29610.43  18428.13   11714.79
   year
age       2010      2011      2012       2013       2014      2015
  0 1236261.22 765326.25 730383.60 1692837.79 6751020.89 486178.94
  1  503511.61 312408.38 204328.24  256455.03  433998.02 714517.44
  2  172333.79 173233.15  89601.62  139602.35  191263.38 348475.49
  3   79991.16  97020.29  64651.12  119332.48   85553.69 123410.84
  4   35528.12  48163.41  36532.75   81910.09   75575.16  64702.78
  5   14991.30  20709.64  21092.99   38385.03   42936.54  43663.74
   year
age       2016      2017       2018       2019
  0 1581744.08 796376.86 1761034.92 1400298.87
  1  169323.28 275389.01  324256.82  136400.79
  2  359009.05  76519.79  113537.58   70812.24
  3  206745.55 193058.61   47077.15   39172.62
  4   64513.46 123311.33   83658.56   24716.52
  5   40839.27  39288.74   37960.22   34846.04
```

LAI-ORSH - Configuration

```
      min       max plusgroup   minyear   maxyear    startf      endf
     0.00      1.00      1.00   1972.00   2019.00      0.67      0.67
Index type : partial

LAI-ORSH - Index Values

Units  :  NA
   year
age 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985
  0 1133 2029  758  371  545 1133 3047 2882 3534 3667 2353 2579 1795 5632
  1 4583  822  421   50   81  221   50 2362  720  277 1116  812 1912 3432
   year
age 1986 1987 1988  1989  1990 1991 1992 1993 1994 1995 1996 1997 1998
  0 3529 7409 7538 11477    -1 1021  189   -1   26   -1   -1   -1   -1
  1 1842 1848 8832  5725 10144 2397 4917   66 1179 8688  809 3611 8528
   year
age 1999 2000  2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011
  0   -1   -1    -1   -1   -1   -1   -1 6311   -1 4978   -1   -1   -1
  1 4064 3972 11918 6669 3199 7055 3380 2312 1753 6875 7543 2362 3831
   year
age  2012  2013 2014 2015 2016 2017 2018 2019
  0    -1    -1   -1   -1   -1   -1   -1 2488
  1 19552 21282 6604 9631   -1   -1  102   -1
```

LAI-BUN - Configuration

```
      min       max plusgroup   minyear   maxyear    startf      endf
     0.00      1.00      1.00   1972.00   2019.00      0.67      0.67
Index type : partial
```

LAI-BUN - Index Values

Units : NA

age	year 1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
0	30	3	101	312	0	124	-1	197	21	3	340	3647	2327	2521
1	0	4	284	-1	1	32	162	10	1	12	257	768	1853	1812

age	year 1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
0	3278	2551	6812	5879	4590	-1	-1	-1	-1	-1	-1	-1	-1	-1
1	341	670	5248	692	2045	2032	822	174	-1	-1	184	23	1490	185

age	year 2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
0	28	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
1	155	164	1038	2263	3884	1364	280	1304	533	4629	1493	2839	5856	8618

age	year 2014	2015	2016	2017	2018	2019
0	-1	-1	-1	-1	-1	5654
1	5033	3496	3872	5833	1740	3794

LAI-CNS - Configuration

min	max	plusgroup	minyear	maxyear	startf	endf
0.00	3.00	3.00	1972.00	2019.00	0.67	0.67

Index type : partial

LAI-CNS - Index Values

Units : NA

age	year 1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
0	165	492	81	-1	64	520	1406	662	317	903	86	1459	688	130
1	88	830	-1	90	108	262	81	131	188	235	64	281	2404	13039
2	134	1213	1184	77	0	89	269	507	9	119	1077	63	824	1794
3	22	152	-1	6	10	3	2	7	13	0	23	-1	433	215

age	year 1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
0	1611	799	5533	1442	19965	4823	10	-1	-1	-1	-1	-1	205	-1
1	6112	4927	3808	5010	1239	2110	165	685	1464	-1	564	-1	66	134
2	188	1992	1960	2364	975	1249	163	85	44	43	-1	-1	-1	181
3	36	113	206	2	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1

age	year 2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
1	376	1604	-1	12018	5545	5614	2259	291	11201	4219	2317	17766	517
2	-1	-1	3291	3277	-1	-1	-1	-1	-1	-1	-1	-1	-1
3	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1

age	year 2013	2014	2015	2016	2017	2018	2019
0	-1	-1	-1	-1	-1	-1	-1
1	7354	1149	3424	3288	3965	1509	10605
2	-1	-1	-1	-1	-1	-1	-1

```
  3   -1   -1   -1   -1   -1   -1    -1
```

LAI-SNS - Configuration

```
      min       max plusgroup   minyear   maxyear    startf      endf
     0.00      2.00      2.00   1972.00   2019.00      0.67      0.67
Index type : partial

LAI-SNS - Index Values

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

Table 2.6.3.9. North Sea Herring single fleet assessment. STOCK OBJECT CONFIGURATION

```
      min       max plusgroup   minyear   maxyear   minfbar   maxfbar
        0         8         8      1947      2019         2         6
```

Table 2.6.3.10. North Sea Herring single fleet assessment. sam CONFIGURATION SETTINGS

```
name           : North Sea Herring
desc            : Imported from a VPA file. ( ./data/index.txt ).  Tue Mar 24 09:11:22
2020
range          :       min       max plusgroup   minyear   maxyear   minfbar   maxfbar
range          :         0         8         8      1947      2020         2         6
fleets         : catch unique        HERAS      IBTS-Q1        IBTS0      IBTS-Q3
fleets         :            0            2            2            2            2
fleets         :     LAI-ORSH      LAI-BUN      LAI-CNS      LAI-SNS
fleets         :            6            6            6            6
```

```
plus.group     : TRUE
states         :               age
states         : fleet           0  1  2  3  4  5  6  7  8
states         :   catch unique  0  1  2  3  4  5  6  7  7
states         :   HERAS        -1 -1 -1 -1 -1 -1 -1 -1 -1
states         :   IBTS-Q1      -1 -1 -1 -1 -1 -1 -1 -1 -1
states         :   IBTS0        -1 -1 -1 -1 -1 -1 -1 -1 -1
states         :   IBTS-Q3      -1 -1 -1 -1 -1 -1 -1 -1 -1
states         :   LAI-ORSH     -1 -1 -1 -1 -1 -1 -1 -1 -1
states         :   LAI-BUN      -1 -1 -1 -1 -1 -1 -1 -1 -1
states         :   LAI-CNS      -1 -1 -1 -1 -1 -1 -1 -1 -1
states         :   LAI-SNS      -1 -1 -1 -1 -1 -1 -1 -1 -1
logN.vars      : 0 1 1 1 1 1 1 1 1
logP.vars      : 0 1 2
catchabilities :               age
catchabilities : fleet           0  1  2  3  4  5  6  7  8
catchabilities :   catch unique -1 -1 -1 -1 -1 -1 -1 -1 -1
catchabilities :   HERAS        -1  1  2  3  3  3  3  3  3
catchabilities :   IBTS-Q1      -1  4 -1 -1 -1 -1 -1 -1 -1
catchabilities :   IBTS0         0 -1 -1 -1 -1 -1 -1 -1 -1
catchabilities :   IBTS-Q3       5  6  7  8  9 10 -1 -1 -1
catchabilities :   LAI-ORSH     11 -1 -1 -1 -1 -1 -1 -1 -1
catchabilities :   LAI-BUN      11 -1 -1 -1 -1 -1 -1 -1 -1
catchabilities :   LAI-CNS      11 -1 -1 -1 -1 -1 -1 -1 -1
catchabilities :   LAI-SNS      11 -1 -1 -1 -1 -1 -1 -1 -1
power.law.exps :               age
power.law.exps : fleet           0  1  2  3  4  5  6  7  8
power.law.exps :   catch unique -1 -1 -1 -1 -1 -1 -1 -1 -1
power.law.exps :   HERAS        -1 -1 -1 -1 -1 -1 -1 -1 -1
power.law.exps :   IBTS-Q1      -1 -1 -1 -1 -1 -1 -1 -1 -1
power.law.exps :   IBTS0        -1 -1 -1 -1 -1 -1 -1 -1 -1
power.law.exps :   IBTS-Q3      -1 -1 -1 -1 -1 -1 -1 -1 -1
power.law.exps :   LAI-ORSH     -1 -1 -1 -1 -1 -1 -1 -1 -1
power.law.exps :   LAI-BUN      -1 -1 -1 -1 -1 -1 -1 -1 -1
power.law.exps :   LAI-CNS      -1 -1 -1 -1 -1 -1 -1 -1 -1
power.law.exps :   LAI-SNS      -1 -1 -1 -1 -1 -1 -1 -1 -1
f.vars         :               age
f.vars         : fleet           0  1  2  3  4  5  6  7  8
f.vars         :   catch unique  0  0  1  1  1  1  2  2  2
f.vars         :   HERAS        -1 -1 -1 -1 -1 -1 -1 -1 -1
f.vars         :   IBTS-Q1      -1 -1 -1 -1 -1 -1 -1 -1 -1
f.vars         :   IBTS0        -1 -1 -1 -1 -1 -1 -1 -1 -1
f.vars         :   IBTS-Q3      -1 -1 -1 -1 -1 -1 -1 -1 -1
f.vars         :   LAI-ORSH     -1 -1 -1 -1 -1 -1 -1 -1 -1
f.vars         :   LAI-BUN      -1 -1 -1 -1 -1 -1 -1 -1 -1
f.vars         :   LAI-CNS      -1 -1 -1 -1 -1 -1 -1 -1 -1
f.vars         :   LAI-SNS      -1 -1 -1 -1 -1 -1 -1 -1 -1
obs.vars       :               age
obs.vars       : fleet           0  1  2  3  4  5  6  7  8
obs.vars       :   catch unique  0  0  1  1  1  1  2  2  2
obs.vars       :   HERAS        -1  3  4  4  4  4  4  5  5
obs.vars       :   IBTS-Q1      -1  6 -1 -1 -1 -1 -1 -1 -1
obs.vars       :   IBTS0         7 -1 -1 -1 -1 -1 -1 -1 -1
```

```
obs.vars       :   IBTS-Q3       8  9 10 10 10 10 -1 -1 -1
obs.vars       :   LAI-ORSH     11 -1 -1 -1 -1 -1 -1 -1 -1
obs.vars       :   LAI-BUN      11 -1 -1 -1 -1 -1 -1 -1 -1
obs.vars       :   LAI-CNS      11 -1 -1 -1 -1 -1 -1 -1 -1
obs.vars       :   LAI-SNS      11 -1 -1 -1 -1 -1 -1 -1 -1
srr            : 0
scaleNoYears   : 0
scaleYears     : NA
scalePars      :
cor.F          : 0
cor.obs        : NA -1 -1 -1 0 -1 -1 -1 -1 NA NA -1 -1 0 -1 -1 -1 -1 NA NA -1 -1 0 -1 -1
-1 -1 NA NA -1 -1 0 -1 -1 -1 -1 NA NA -1 -1 0 -1 -1 -1 -1 NA NA -1 -1 -1 -1 -1 -1 -1 NA
NA -1 -1 -1 -1 -1 -1 -1 NA NA -1 -1 -1 -1 -1 -1 -1
cor.obs.Flag   : ID ID ID ID AR ID ID ID ID
biomassTreat   : -1 -1 -1 -1 -1 -1 -1 -1 -1
timeout        : 3600
likFlag        : LN LN LN LN LN LN LN LN LN
fixVarToWeight : FALSE
simulate       : FALSE
residuals      : TRUE
sumFleets      :
```

Table 2.6.3.11. North Sea Herring single fleet assessment. FLR, R SOFTWARE VERSIONS

```
FLSAM.version                        2.1.0
FLCore.version                      2.6.14
R.version      R version 3.6.3 (2020-02-29)
platform                x86_64-w64-mingw32
run.date               2020-03-24 09:15:37
```

Table 2.6.3.12 North Sea Herring single fleet assessment. STOCK SUMMARY

Year	Recruitment Age 0	Low	High	TSB	Low	High	SSB	Low	High	Fbar (Ages 2-6)	Low	High	Landings	Landings SOP
										f	f	f	tonnes	
1947	55442046	29905600	102784111	9514194	7132890	12690492	5444829	3877739	7645220	0.1215	0.0818	0.1805	581760	1.4609
1948	55876843	31678907	98558375	8292207	6245114	11010320	4418539	3167651	6163396	0.1213	0.0842	0.1747	502100	1.3326
1949	51265908	29304331	89686173	8128234	6166702	10713700	4278054	3105900	5892574	0.1333	0.0931	0.1910	508500	1.4502
1950	69958768	40885165	119706726	8144604	6229709	10648101	4242634	3118227	5772492	0.1401	0.0997	0.1969	491700	1.3073
1951	62903205	37225495	106293100	8422471	6485542	10937869	4079525	3013172	5523258	0.1682	0.1220	0.2318	600400	1.3238
1952	59789405	35869796	99659694	8217604	6333240	10662634	4092850	3011779	5561967	0.1708	0.1231	0.2369	664400	1.2720
1953	60169912	37252432	97186094	7874106	6093926	10174319	3876624	2837935	5295474	0.1779	0.1279	0.2475	698500	1.1979
1954	57435650	36226606	91061632	7652489	5948217	9845065	3638878	2647526	5001434	0.1984	0.1418	0.2777	762900	1.2509
1955	48441248	30871961	76009245	7168764	5590532	9192537	3534030	2583230	4834787	0.1958	0.1406	0.2725	806400	1.0598
1956	35839655	22928560	56020999	6477457	5080423	8258652	3271684	2395037	4469207	0.1973	0.1439	0.2705	675200	1.2712
1957	84393829	53743758	132523637	6389720	5062191	8065384	2951670	2170723	4013573	0.2103	0.1538	0.2876	682900	1.1575
1958	33238126	21470586	51455185	6291604	4999854	7917088	2399474	1765576	3260962	0.2194	0.1624	0.2965	670500	1.1674
1959	37425200	23562576	59443652	6833037	5475176	8527651	3561458	2670354	4749924	0.2391	0.1782	0.3208	784500	1.5186
1960	16309280	10293621	25840529	5580295	4501905	6917004	2942338	2218904	3901634	0.2101	0.1589	0.2779	696200	1.1830
1961	68959229	44079793	107881069	5635841	4613327	6884988	2839855	2186584	3688300	0.2444	0.1898	0.3147	696700	1.1348
1962	32094128	20835020	49437586	5171682	4242577	6304256	1986885	1512947	2609287	0.2743	0.2120	0.3548	627800	1.1705
1963	42338883	28117982	63752123	5696068	4712187	6885379	2858685	2234934	3656521	0.1967	0.1539	0.2514	716000	0.8602
1964	43973249	29328388	65930887	5689208	4876663	6637137	2619620	2126733	3226737	0.2862	0.2350	0.3487	871200	1.0656
1965	21743710	14486180	32637238	5124826	4484932	5856018	2129513	1772629	2558248	0.4717	0.3917	0.5682	1168800	1.1496
1966	22643104	15291380	33529357	3795288	3349181	4300814	1625507	1362186	1939730	0.4837	0.4092	0.5718	895500	1.0707
1967	28845442	19560752	42537194	2937456	2609701	3306374	1027011	871844	1209794	0.6416	0.5469	0.7527	695500	1.1757
1968	29481027	19939176	43589110	2528519	2216655	2884259	576056	486737	681765	0.9683	0.8258	1.1354	717800	1.2551
1969	14134725	9379871	21299914	1916117	1655703	2217489	495333	400313	612906	0.8715	0.7436	1.0215	546700	0.9674
1970	28850402	19492289	42701281	1866904	1617880	2154258	476378	383355	591972	0.9344	0.8066	1.0826	563100	0.9657
1971	22558603	15477360	32879676	1724932	1480088	2010279	327573	266883	402065	1.2760	1.0961	1.4853	520100	1.0747
1972	15707167	10795289	22853958	1529936	1323719	1768278	332372	270122	408967	0.6639	0.5603	0.7866	497500	0.9197
1973	8018521	5468988	11756594	1218960	1072152	1385870	297388	244949	361054	0.8717	0.7536	1.0083	484000	0.9575

1974	13791442	9230751	20605460	870463	759173	998067	199525	165832	240063	0.8749	0.7514	1.0186	275100	0.9680
1975	3264700	2130559	5002570	698534	585950	832749	114693	93525	140652	1.0410	0.8568	1.2647	312800	0.9343
1976	4153767	2630144	6560011	507034	422916	607884	153552	115065	204911	0.8068	0.6192	1.0514	174800	0.9530
1977	4990994	3076853	8095941	348921	278580	437024	102379	74363	140950	0.3719	0.2745	0.5037	46000	1.1979
1978	5407630	3240377	9024400	422003	328595	541962	135459	99364	184667	0.2686	0.1939	0.3720	11000	1.2152
1979	10142908	6303246	16321526	558623	442807	704731	179619	136591	236201	0.2195	0.1604	0.3006	25100	1.0056
1980	15498007	10452150	22979791	757271	611860	937240	197292	155315	250615	0.1932	0.1521	0.2455	70764	1.0936
1981	36679638	25515603	52728358	1362055	1103291	1681510	297000	233182	378283	0.2144	0.1701	0.2704	174879	1.0081
1982	58184169	40921789	82728484	2082564	1690256	2565927	416142	329984	524797	0.1902	0.1517	0.2384	275079	0.9786
1983	57260462	41018772	79933171	2866889	2366341	3473317	635887	506650	798089	0.2355	0.1901	0.2918	387202	1.0771
1984	55842014	39396147	79153186	3724869	3136726	4423291	1064208	848447	1334837	0.3037	0.2472	0.3730	428631	1.0543
1985	67199646	46641412	96819378	4268595	3631456	5017521	1166105	945081	1438818	0.3808	0.3084	0.4703	613780	1.0419
1986	81773211	56509183	118332238	4806198	4072134	5672590	1185654	970009	1449239	0.3584	0.2920	0.4400	671488	1.1373
1987	77668232	54103878	111495785	4885070	4165325	5729183	1413250	1155157	1729008	0.3441	0.2826	0.4190	792058	1.0173
1988	45701177	31814546	65649140	4759542	4090252	5538349	1859715	1522375	2271806	0.3244	0.2676	0.3932	887686	1.1641
1989	37952843	26465288	54426701	4190995	3660448	4798439	1910569	1607009	2271471	0.3102	0.2585	0.3721	787899	1.0335
1990	32037356	22125556	46389442	4122992	3606755	4713119	2017634	1703382	2389861	0.2557	0.2118	0.3086	645229	1.0515
1991	35723373	24843479	51367982	3927476	3434785	4490838	1786189	1512483	2109425	0.2794	0.2325	0.3358	658008	1.0197
1992	66560766	48399794	91536247	4007349	3489135	4602530	1398218	1179429	1657592	0.3094	0.2564	0.3734	716799	0.9950
1993	70049041	50309297	97534024	3768205	3237566	4385817	1022493	855330	1222325	0.3485	0.2883	0.4211	671397	1.0231
1994	54139051	38358082	76412498	3687108	3112017	4368473	1092977	912441	1309233	0.3608	0.2984	0.4363	568234	1.0498
1995	61319615	43621562	86198087	3600618	3042707	4260827	1170736	968505	1415195	0.3117	0.2544	0.3820	579371	1.0084
1996	48824437	34833350	68435152	3505379	2968291	4139649	1287777	1068417	1552176	0.1810	0.1436	0.2280	275098	0.9987
1997	39938479	28175720	56611939	3525246	3005729	4134557	1452361	1210393	1742700	0.1645	0.1329	0.2036	264313	1.0006
1998	26090257	18741413	36320714	3873979	3325036	4513550	1699792	1430809	2019343	0.1878	0.1534	0.2299	391628	1.0018
1999	80759705	57900426	112643902	3873549	3342118	4489483	1758435	1480030	2089209	0.1805	0.1482	0.2199	363163	1.0000
2000	55531856	40127669	76849394	4760640	4073717	5563393	1823680	1537571	2163027	0.1813	0.1488	0.2209	388157	1.0004
2001	97988382	69561405	138032334	5340967	4573804	6236807	2307837	1945659	2737432	0.1580	0.1287	0.1940	374065	0.9901
2002	49897731	35819044	69510050	6250728	5331710	7328157	2744745	2313868	3255858	0.1477	0.1200	0.1818	394709	0.9974
2003	27756693	19989852	38541257	6675942	5716293	7796696	2797505	2372501	3298643	0.1736	0.1419	0.2124	482281	1.0153
2004	32539335	23393141	45261487	5641907	4875208	6529180	2738275	2322859	3227983	0.2170	0.1747	0.2694	587698	0.9985
2005	30341243	21987477	41868880	4721140	4106046	5428377	2522543	2131386	2985487	0.2344	0.1895	0.2900	663813	1.0033

2006	28560875	20629973	39540701	4010397	3489736	4608739	2056338	1740569	2429393	0.2082	0.1684	0.2574	514597	0.9950
2007	32181373	22918150	45188673	3375327	2923425	3897084	1671401	1412628	1977576	0.1796	0.1451	0.2222	406482	1.0056
2008	29370465	20953710	41168088	3409745	2934219	3962336	1744565	1476202	2061715	0.1131	0.0925	0.1382	257870	1.0040
2009	47186986	33818802	65839459	3860774	3307411	4506720	2043585	1723917	2422529	0.0666	0.0531	0.0834	168443	1.0023
2010	38620068	27832658	53588474	4664752	3997838	5442921	2164868	1816068	2580660	0.0706	0.0573	0.0869	187611	1.0034
2011	34472022	24881021	47760109	4710111	4068498	5452908	2583386	2202054	3030754	0.0917	0.0750	0.1121	226478	0.9938
2012	32914796	23663891	45782150	4721549	4093586	5445843	2746510	2340231	3223322	0.1477	0.1206	0.1807	434710	1.0109
2013	41542187	29566909	58367729	4573351	3984606	5249085	2517682	2150321	2947802	0.1744	0.1422	0.2139	511416	1.0014
2014	65896564	46534664	93314462	4893654	4255212	5627887	2450220	2090493	2871848	0.1774	0.1450	0.2171	517356	1.0029
2015	17736871	12601389	24965232	5154993	4441281	5983399	2275326	1939378	2669467	0.1840	0.1474	0.2297	494099	1.0017
2016	32774160	23656048	45406807	5116067	4392400	5958960	2684887	2271643	3173307	0.1887	0.1514	0.2353	563610	1.0000
2017	19642967	13967300	27624963	4281553	3688036	4970585	2331184	1957019	2776887	0.1700	0.1380	0.2094	498437	1.0013
2018	33126846	23178025	47346048	3992167	3433000	4642412	2051917	1707248	2466170	0.1911	0.1538	0.2373	603536	1.0015
2019	32308000	21801982	47876695	3281463	2784090	3867692	1684747	1375154	2064039	0.1784	0.1380	0.2305	442138	1.0023
2020	29574086	16262013	53783415	2966665	2368327	3716167	1363402	1038042	1790741	0.1784	0.1100	0.2893		

Table 2.6.3.13. North Sea Herring single fleet assessment. ESTIMATED FISHING MORTALITY

```
Units  :  f
   year
age         1947         1948         1949        1950        1951
  0 0.0038680829 0.0038679739 0.0038691764 0.003864836 0.003866312
  1 0.0002239749 0.0002239749 0.0009512344 0.004040284 0.017135085
  2 0.0426527964 0.0326619890 0.0410732110 0.053848670 0.079867185
  3 0.0925967990 0.1062577792 0.1100013071 0.122802788 0.145432327
  4 0.0999162464 0.1101941341 0.1181905290 0.146493763 0.199125694
  5 0.1356282788 0.1441350842 0.1511065372 0.150983882 0.199919910
  6 0.2366595951 0.2132587228 0.2463473728 0.226295673 0.216599842
  7 0.2440899274 0.2364311185 0.3057133066 0.241456868 0.216433270
  8 0.2440899274 0.2364311185 0.3057133066 0.241456868 0.216433270
   year
age        1952       1953        1954        1955        1956        1957
  0 0.003867015 0.00386692 0.005201551 0.004868157 0.004152742 0.004727644
  1 0.034706648 0.05386228 0.075341142 0.114120418 0.118392601 0.146789554
  2 0.110907085 0.13304112 0.159856273 0.191088893 0.239155033 0.230929315
  3 0.131116945 0.16005581 0.201269970 0.204954717 0.211378376 0.216556482
  4 0.173802713 0.16824426 0.171507840 0.173133250 0.182550927 0.189628278
  5 0.191057176 0.18745364 0.201420404 0.176898180 0.166631121 0.210495003
  6 0.247038551 0.24088270 0.258182287 0.232682393 0.186773703 0.203864224
  7 0.301866584 0.28307951 0.326278007 0.179081260 0.202183694 0.210056552
  8 0.301866584 0.28307951 0.326278007 0.179081260 0.202183694 0.210056552
   year
age        1958        1959       1960       1961        1962      1963
  0 0.004806232 0.008867736 0.01649044 0.02142176 0.008565914 0.0141900
  1 0.140422584 0.167206865 0.17196207 0.10302471 0.097699476 0.1290354
  2 0.253577574 0.284941669 0.28516726 0.31304004 0.199851072 0.2361116
  3 0.247118418 0.247582857 0.21274163 0.24153377 0.320019110 0.2375260
  4 0.183247145 0.219930362 0.18228463 0.23132823 0.279661344 0.1867872
  5 0.233210631 0.215791481 0.16148631 0.21046195 0.259634146 0.1697214
  6 0.179960746 0.227130972 0.20897164 0.22571318 0.312145531 0.1532115
  7 0.132615409 0.232926986 0.25008981 0.19822441 0.270870456 0.1601679
  8 0.132615409 0.232926986 0.25008981 0.19822441 0.270870456 0.1601679
   year
age       1964       1965       1966       1967       1968       1969
  0 0.01560181 0.01250797 0.02308514 0.03178558 0.03543563 0.01623076
  1 0.22883465 0.23708690 0.22577586 0.28020263 0.30557688 0.32066742
  2 0.30956232 0.47956817 0.47345324 0.46582817 0.90359534 0.70816658
  3 0.31415537 0.49850449 0.51715025 0.68768339 1.33107073 0.80818672
  4 0.28786493 0.48414056 0.46960200 0.65545978 0.79612131 0.75405519
  5 0.26892804 0.46419967 0.58619767 0.68898052 0.87129158 0.83650042
  6 0.25064214 0.43230815 0.37202195 0.70999470 0.93941586 1.25069159
  7 0.20480209 0.46378764 0.55868589 0.94723604 1.14961107 1.01261159
  8 0.20480209 0.46378764 0.55868589 0.94723604 1.14961107 1.01261159
   year
age       1970       1971       1972       1973      1974      1975
  0 0.03988314 0.04680556 0.06606864 0.06110913 0.1003303 0.1183654
  1 0.31814656 0.55860720 0.58591215 0.64078316 0.4912970 0.5126066
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  2 0.76997225 0.74483094 0.70525858 0.81756914 0.8529715 0.9859528
  3 0.98920814 0.92658297 0.73062679 0.97429426 0.8288543 1.0725248
  4 0.96402217 0.94603094 0.68386006 0.77988677 0.7918424 0.9642941
  5 0.83630437 0.75527961 0.55709691 0.76652254 0.9717513 1.2490066
  6 1.11266327 3.00708314 0.64259909 1.02014155 0.9289947 0.9330231
  7 0.96004239 1.38803804 0.34763522 0.60037670 0.8058348 1.5165573
  8 0.96004239 1.38803804 0.34763522 0.60037670 0.8058348 1.5165573
   year
age       1976       1977      1978      1979       1980      1981
  0 0.08979959 0.08211371 0.1023754 0.1211176 0.14665013 0.3714641
  1 0.21211189 0.13117132 0.1190915 0.1131976 0.10153572 0.1904366
  2 0.69231303 0.19500848 0.1969874 0.2066268 0.21982673 0.1979118
  3 0.94878168 0.52141605 0.3357090 0.2861474 0.25486016 0.2106100
  4 0.87034345 0.32547662 0.2594957 0.2025664 0.18660939 0.2079270
  5 0.90128299 0.48012449 0.3495067 0.2913117 0.23626768 0.2443671
  6 0.62147552 0.33737194 0.2012013 0.1110705 0.06852648 0.2113438
  7 0.98317164 0.41361571 0.3471277 0.2500760 0.14645930 0.4515270
  8 0.98317164 0.41361571 0.3471277 0.2500760 0.14645930 0.4515270
   year
age      1982      1983      1984      1985       1986      1987      1988
  0 0.3483109 0.3638179 0.2036645 0.1067077 0.08319026 0.1467448 0.1164089
  1 0.1736471 0.1941902 0.1864053 0.2699901 0.28605776 0.3266187 0.4476051
  2 0.1793502 0.1941049 0.2107741 0.2607228 0.27734583 0.2778675 0.2470355
  3 0.2691160 0.2377726 0.2842357 0.3820670 0.33899270 0.3000505 0.2698402
  4 0.2034892 0.2560871 0.3501622 0.4315465 0.36889906 0.3586031 0.3373308
  5 0.1557290 0.2345160 0.3538798 0.4061233 0.36265957 0.3771442 0.3765551
  6 0.1431913 0.2551817 0.3192234 0.4236266 0.44423007 0.4066723 0.3910402
  7 0.2110252 0.3714081 0.5153423 0.5309270 0.52397231 0.3849345 0.4001062
  8 0.2110252 0.3714081 0.5153423 0.5309270 0.52397231 0.3849345 0.4001062
   year
age      1989       1990      1991      1992      1993      1994      1995
  0 0.1177832 0.07481728 0.1124450 0.2256546 0.2272392 0.1491976 0.1642005
  1 0.3440432 0.34621957 0.2631865 0.2779383 0.2649990 0.1412992 0.1313707
  2 0.2572841 0.23893578 0.3241013 0.3366275 0.3585454 0.3447147 0.2446519
  3 0.2611064 0.22916537 0.2622181 0.2882686 0.3610112 0.3783847 0.3459168
  4 0.3453813 0.27154767 0.2674560 0.3023210 0.3771384 0.4899821 0.3403387
  5 0.3431195 0.29286521 0.2661286 0.2938289 0.3124079 0.2960403 0.3536538
  6 0.3439351 0.24582932 0.2772455 0.3261736 0.3331872 0.2949729 0.2741884
  7 0.3546437 0.27660749 0.2151725 0.3083250 0.3589400 0.2768337 0.2492684
  8 0.3546437 0.27660749 0.2151725 0.3083250 0.3589400 0.2768337 0.2492684
   year
age       1996       1997       1998       1999       2000       2001
  0 0.06824782 0.02010162 0.01710940 0.02749881 0.02998868 0.02832624
  1 0.10678339 0.04582281 0.07007496 0.04376473 0.05020245 0.04135639
  2 0.13255780 0.11687763 0.14197034 0.12040924 0.11605383 0.07879771
  3 0.20334406 0.17097074 0.18085448 0.21349314 0.16970618 0.15135998
  4 0.18207497 0.19007170 0.19700750 0.19021137 0.21652642 0.17904074
  5 0.19211332 0.17930471 0.20872672 0.19670842 0.21855087 0.19630878
  6 0.19466019 0.16517620 0.21045695 0.18182553 0.18548841 0.18453950
  7 0.09468741 0.12663256 0.11661242 0.10496887 0.11045069 0.12097941
  8 0.09468741 0.12663256 0.11661242 0.10496887 0.11045069 0.12097941
   year
age       2002       2003       2004       2005       2006       2007
```

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  0 0.02359840 0.02286972 0.03443633 0.04988162 0.04725590 0.03399506
  1 0.03260610 0.04284341 0.03440938 0.06085923 0.03509362 0.03360672
  2 0.07676871 0.07133892 0.07676463 0.09326507 0.08068351 0.06721923
  3 0.13376075 0.12471031 0.13192191 0.13291468 0.13312427 0.13893300
  4 0.17516003 0.18896961 0.19922403 0.21981197 0.21178621 0.18835224
  5 0.17166373 0.26671083 0.29384666 0.30426155 0.27135908 0.23655073
  6 0.18095905 0.21636685 0.38309024 0.42178102 0.34418331 0.26683826
  7 0.15829278 0.18212846 0.27552723 0.51348026 0.46086493 0.37199490
  8 0.15829278 0.18212846 0.27552723 0.51348026 0.46086493 0.37199490
   year
age       2008       2009       2010       2011       2012       2013
  0 0.03898757 0.02438180 0.02513088 0.03408032 0.03395498 0.02074963
  1 0.02936033 0.02331364 0.02210483 0.01693434 0.03018870 0.04197958
  2 0.07543715 0.05547104 0.05666934 0.05869877 0.07288504 0.07162221
  3 0.08630566 0.04748275 0.06594732 0.08303756 0.13163691 0.12088964
  4 0.12227184 0.07541091 0.07156391 0.09733345 0.15408323 0.17641750
  5 0.14315147 0.08801687 0.08861189 0.11647419 0.18650019 0.22658454
  6 0.13820968 0.06653357 0.07017152 0.10292931 0.19315960 0.27661675
  7 0.17710827 0.09230044 0.06886223 0.09230063 0.21790346 0.33103819
  8 0.17710827 0.09230044 0.06886223 0.09230063 0.21790346 0.33103819
   year
age       2014       2015       2016       2017       2018       2019
  0 0.03201914 0.04633756 0.06352935 0.04128708 0.05376825 0.03313218
  1 0.02816071 0.02144750 0.02112709 0.02144111 0.01405297 0.01931502
  2 0.06896242 0.05761163 0.05040058 0.04226940 0.04572393 0.03933860
  3 0.12201793 0.08989165 0.12109327 0.13481219 0.11238816 0.13022234
  4 0.19364502 0.15826746 0.16799159 0.19559705 0.21969740 0.16247072
  5 0.24041218 0.25313575 0.24533834 0.20814904 0.28196502 0.25552430
  6 0.26219612 0.36122015 0.35878137 0.26928587 0.29551746 0.30420072
  7 0.34136996 0.49309649 0.61022659 0.44695910 0.45631062 0.41558463
  8 0.34136996 0.49309649 0.61022659 0.44695910 0.45631062 0.41558463
   year
age       2020
  0 0.03314350
  1 0.01930452
  2 0.03933860
  3 0.13022234
  4 0.16247072
  5 0.25552430
  6 0.30420072
  7 0.41558463
  8 0.41558463
```

Table 2.6.3.14. North Sea Herring single fleet assessment. ESTIMATED POPULATION ABUNDANCE

```
Units  :  NA
   year
age     1947     1948     1949     1950     1951       1952     1953
  0 55442046 55876843 51265908 69958768 62903205 59789404.8 60169912
  1 19949359 24461284 24926861 21683248 32323262 27609843.8 26238621
  2 14105671 10154918 14719731 12809339 10531794 15533627.0 13095187
```

```
  3  5750546  7943109  7458694 10806877  8202762  5874945.9  8215995
  4  8074177  3713686  4319440  5384520  7700511  4604420.5  3643508
  5  4921163  5252745  2389821  2531423  3874962  4419945.9  2685772
  6  4103861  3104701  3298410  1473084  1608925  2355400.5  2621045
  7  2316068  2289597  1877187  1829326   852452   978977.8  1340589
  8  7019262  5246020  4374225  3293152  2904955  2326537.3  1839569
   year
age     1954       1955       1956       1957       1958       1959
  0 57435650 48441247.8 35839654.7 84393828.7 33238125.5 37425199.8
  1 27657594 24612020.7 21441895.4 14436111.7 44579173.1 14027745.0
  2 12437926 13676175.3 10455477.1  9918345.2  5702277.5 23618412.3
  3  7138735  6697804.3  7647809.2  4638696.3  5353582.0  2633818.5
  4  4457812  3612314.7  3660873.6  4366515.1  2352877.4  2847676.4
  5  2259996  2474753.9  1987565.6  2097395.7  2543771.8  1373424.9
  6  1618396  1284512.1  1433856.4  1239723.7  1144902.4  1363797.0
  7  1505340   894129.2   707644.3   865124.8   728305.8   684637.6
  8  1851321  1715807.4  1689141.0  1446859.1  1316588.3  1439243.4
   year
age       1960       1961       1962       1963       1964       1965
  0 16309280.0 68959228.6 32094128.3 42338883.5 43973249.2 21743709.8
  1 18228143.9  5353693.9 33035793.1 14864546.9 18106577.3 20032393.8
  2  5729892.5  8049777.2  2001573.1 17309454.0  7192229.5  6819583.9
  3 12634052.1  2732565.1  3301554.4  1074893.4 10015339.6  3769648.4
  4  1252949.0  8181118.4  1507914.8  1243654.5   694933.5  5753166.0
  5  1427886.3   759983.0  5089895.7   684795.7   746159.7   429826.2
  6   739077.9   934412.0   444696.7  2521731.2   476806.0   426649.0
  7   722434.1   416642.7   586227.8   210253.0  1646443.5   300777.8
  8  1248670.2  1031648.4   841649.7   756320.3   578575.3  1439023.6
   year
age       1966       1967       1968        1969        1970        1971
  0 22643103.7 28845441.8 29481026.5 14134725.13 28850402.00 22558603.46
  1  9676876.8  9283151.0 12376281.4 12336211.16  6409150.79 12493711.28
  2  8253205.6  4093868.3  3380306.8  4623071.32  4461355.93  2579122.73
  3  2297504.9  3352377.9  2033286.1   704278.87  1579268.39  1277635.44
  4  1478449.0   896602.7  1260415.3   311328.13   225845.77   386867.69
  5  2337465.7   689058.0   307638.7   391178.91   101621.16    58007.53
  6   195834.0   877549.9   258365.9    83846.06   120558.87    30439.34
  7   190726.5   106979.1   291172.3    73820.70    16258.07    30962.44
  8   849223.0   452647.0   161779.8    99968.95    45531.93    17282.28
   year
age          1972        1973         1974        1975        1976
  0 15707166.6178 8018520.733 13791441.690 3264700.448 4153766.523
  1  9854241.7225 6416375.867  3157075.608 6449343.231 1045004.289
  2  3520325.0405 2854897.795  1644904.704  989046.154 1977778.983
  3   816009.8956 1178680.988   789084.025  447044.224  219348.952
  4   325167.3003  309532.596   277530.337  251584.206   97362.403
  5    96845.5384  124809.444   102930.114   87595.623   65424.221
  6    18121.8850   44244.763    41990.784   28072.460   16011.929
  7      968.8523    7988.478    11406.302   12036.372    7709.393
  8     7874.4239    4826.749     5610.632    5885.323    2700.281
   year
age        1977        1978         1979         1980        1981
  0 4990993.599 5407629.510 10142908.340 15498007.356 36679638.41
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```
  1 1741674.030 2150218.858  2053168.322  4086494.419  6140470.44
  2  367929.437  794637.406   961865.394   824909.574  1940686.51
  3  565701.529  255987.763   442611.895   486243.599   381947.20
  4   50788.224  219437.953   163632.927   228786.826   245098.99
  5   22849.918   29096.038   114603.403   121446.674   143737.01
  6   17567.335    9542.686    16657.981    58554.726    91138.45
  7    5728.173    8676.562     5360.726    12302.954    46937.14
  8    2644.830    3946.956     6136.444     5868.998    14358.93
   year
age        1982        1983        1984        1985        1986
  0 58184169.30 57260462.40 55842014.14 67199646.38 81773211.47
  1 10369889.81 18619471.49 15892859.60 18400794.33 25789801.25
  2  2303883.21  4004044.24  7492663.11  6867564.05  6325636.04
  3  1106083.66  1261074.87  2142443.32  4156523.44  3425214.23
  4   221496.73   552937.10   774374.05  1163600.73  1789065.74
  5   130473.05   144250.30   304773.32   414135.47   502899.83
  6    74374.31    99607.39    91488.26   144498.48   195987.80
  7    56767.81    49522.31    64543.72    53356.67    65325.71
  8    30219.64    66252.27    70767.39    70308.35    62432.32
   year
age        1987        1988       1989       1990       1991       1992
  0 77668232.24 45701177.12 37952843.2 32037356.0 35723373.2 66560765.7
  1 34205224.40 25948749.07 16335543.8 13057391.0 13058886.6 12939764.4
  2 10383259.80 12493909.01  8275478.8  5357871.3  4743887.1  5419783.1
  3  3030161.35  5415159.04  6774988.3  4570819.0  2795387.4  2111904.6
  4  1770113.05  1558545.38  3044878.8  4240670.3  2726793.3  1610885.5
  5   891862.31   919847.49   821941.1  1746728.5  2503255.9  1606415.9
  6   257431.66   446900.15   461413.7   461352.3   969710.2  1503848.1
  7    91303.46   129525.36   223222.5   253370.2   266058.4   573376.1
  8    57618.69    78654.33   106119.4   190834.8   232889.9   294279.3
   year
age       1993       1994       1995       1996        1997       1998
  0 70049041.3 54139051.0 61319615.4 48824436.7 39938479.35 26090256.7
  1 20848276.5 21440885.7 18532898.8 19133785.5 18408527.58 16646830.6
  2  4707499.3  7185225.4  7909036.0  6785729.9  7992222.76 10664230.5
  3  2336124.0  1805997.1  3133870.8  3551588.4  3475435.80  3917821.9
  4  1135668.7   973403.6   904509.3  1324724.7  1919685.88  1798480.3
  5   909493.7   508601.4   419806.8   409484.5   787797.61  1055288.4
  6   908856.1   439891.5   260192.6   162468.7   257484.08   499886.6
  7   746494.5   424232.6   219646.2   127043.8    91693.85   163510.7
  8   460165.8   545381.2   449199.2   341228.3   276964.50   212557.3
   year
age       1999       2000       2001       2002       2003       2004
  0 80759704.5 55531856.0 97988382.4 49897730.6 27756693.4 32539335.4
  1 10773922.1 30975773.1 20976319.2 39957619.7 18921089.7 10092494.5
  2  6812845.2  6616141.4 14422188.4  9669648.9 22486639.8  7700748.8
  3  6131393.7  3569519.3  4086413.7  9258632.7  5484065.2 13175685.0
  4  2022989.0  3687432.7  2027806.9  2161381.1  5646669.4  3532207.2
  5   898661.6  1220643.9  2074253.1  1116305.5  1168568.6  3399920.1
  6   514900.1   559125.3   637847.5  1271943.9   692258.8   579163.8
  7   258883.0   315972.2   317690.9   364612.1   761433.3   430751.3
  8   191071.3   244728.4   274920.5   359980.6   403688.0   609564.5
   year
```

age	2005	2006	2007	2008	2009	2010
0	30341243.3	28560875.3	32181373.4	29370464.8	47186985.8	38620068.3
1	13535081.0	9992767.3	9753415.0	10996504.6	10823393.4	16868391.2
2	4743493.7	6413888.5	4371789.0	5333975.7	6206534.8	6586639.1
3	4684678.8	3010112.2	3627882.2	2655207.3	3154694.7	4415017.0
4	7703194.8	2841922.6	1878293.0	2043817.4	1621056.1	2288709.4
5	2091314.4	4859058.9	1631339.3	1209361.8	1285186.6	1209883.4
6	1832498.4	1021826.0	2712682.5	1024147.8	819632.3	1128632.3
7	282575.2	842326.2	519791.5	1840326.1	720589.5	622353.6
8	476571.0	312832.1	520665.7	644854.9	1908067.9	2101455.4

year

age	2011	2012	2013	2014	2015	2016
0	34472022.1	32914796.4	41542187.2	65896563.7	17736871.0	32774160.3
1	15349994.1	12472014.9	11748473.4	18555620.3	26730537.4	7231212.2
2	8152849.5	7729916.0	5776897.3	6936117.4	12176901.7	15594653.2
3	4282297.9	6058111.0	5156027.3	3864075.8	3769693.0	8360525.3
4	2868059.5	3194086.9	4153555.7	3965957.0	2383655.5	2288604.1
5	1438607.3	2031779.7	2380509.9	2675476.1	2399459.8	1495923.1
6	800276.4	940046.1	1360928.8	1520567.6	1524771.6	1346313.9
7	749053.9	505305.7	591344.8	812147.6	840890.5	761903.2
8	1778549.0	1402411.3	1173744.7	862291.6	897043.6	785438.5

year

age	2017	2018	2019	2020
0	19642966.8	33126845.7	32307999.7	29574086.3
1	12499279.1	8351984.9	11680453.8	13806386.3
2	3354906.4	5535803.3	3453792.2	5804262.7
3	9858235.1	2356908.3	2978775.0	2134501.2
4	5539876.8	6690358.6	1637735.3	1775298.7
5	1478295.5	3806497.1	3874659.5	953626.2
6	766882.1	967431.7	2268738.5	2085549.9
7	629709.5	514085.1	519202.2	1172039.9
8	634840.6	729185.0	635240.4	538392.0

Table 2.6.3.15. North Sea Herring single fleet assessment. CATCH-AT-AGE catch unique

Units : NA

year

age	1947	1948	1949	1950	1951	1952
0	146508.53	147653.352	135511.10	184714.80	166149.1	157953.1
1	3248.79	3983.565	17234.88	63590.71	399703.3	686182.2
2	476702.05	264010.584	479379.79	543718.80	655195.8	1323102.8
3	422498.49	665496.291	645816.68	1038509.82	923923.9	600501.6
4	646151.20	326215.501	405463.61	618395.04	1173630.2	619604.9
5	530089.61	598947.285	284767.85	301413.13	597421.0	653867.1
6	739814.38	509732.646	616248.49	255122.56	267886.3	441161.0
7	430294.93	413461.291	424858.52	336599.21	142202.6	219158.4
8	1304506.38	947645.328	990321.79	606141.19	484749.8	520995.3

year

age	1953	1954	1955	1956	1957	1958	1959
0	158954.5	203982.0	161034.9	101665.4	272472.0	109092.02	226238.2
1	1003513.8	1465716.5	1942508.3	1752400.5	1444927.7	4280210.42	1585318.8

```
  2 1324654.0 1493578.1 1935808.5 1812942.4 1666729.1 1041704.81 4781704.7
  3 1011711.8 1084979.9 1034880.7 1215180.4  753352.7  978649.12  482273.8
  4  475821.0  592574.8  484375.1  515374.1  636494.5  332393.67  474865.2
  5  390468.0  350809.9  341169.1  259316.6  338838.0  450636.93  226916.1
  6  480016.6  315206.1  228081.4  208678.7  195406.0  161047.98  236977.4
  7  283814.0  360293.3  125535.3  110992.3  140471.6   77357.24  121994.8
  8  389577.1  443242.2  240977.1  265023.6  235004.9  139887.84  256540.0
   year
age      1960       1961      1962       1963       1964       1965
  0  182736.6 1001574.62  187432.4  408611.79  466329.41  185107.22
  1 2114277.9  383303.72 2248206.8 1317966.71 2727481.63 3115588.10
  2 1160859.0 1768499.73  295147.2 2967215.80 1564917.49 2136326.78
  3 2019166.0  489452.83  756666.1  189679.40 2259132.91 1245457.31
  4  176153.0 1427583.71  311277.2  178798.79  147122.09 1879608.69
  5  180969.4  122759.16  991961.7   90873.33  149995.24  136831.55
  6  119135.1  161456.50  102209.1  305719.92   90460.30  128791.70
  7  137145.2   64185.51  119410.6   26631.73  261274.09   96318.55
  8  237120.9  158981.30  171493.3   95830.78   91843.91  460963.36
   year
age      1966       1967      1968       1969        1970       1971
  0  354150.1  618902.86  704001.0  155892.15  774132.051  707866.85
  1 1440161.0 1675219.71 2410513.0 2505319.39 1291751.330 4013767.56
  2 2559107.4 1252954.30 1678641.1 1944984.73 1990081.510 1124716.70
  3  781236.0 1411321.73 1291545.6  331780.61  847572.392  658437.11
  4  471461.9  368825.67  594380.7  141458.58  120598.309  204194.32
  5  891820.7  295956.62  155112.8  192027.85   49878.153   26574.79
  6   52236.8  386579.81  137211.2   52591.67   70885.432   26419.24
  7   70626.5   57240.54  174769.7   41149.73    8772.833   20530.93
  8  314565.0  242263.06   97131.1   55741.03   24575.890   11462.70
   year
age        1972        1973       1974        1975       1976        1977
  0  690293.294  326902.519 905199.197  251700.661 246420.130 271747.8585
  1 3281051.544 2280107.715 921125.632 1928346.655 145227.921 153936.2109
  2 1476625.102 1325983.026 787781.524  518580.590 816295.930  52804.5984
  3  358610.031  626382.850 378583.209  251746.757 114457.626 192938.4139
  4  137917.396  143902.635 130465.387  134325.829  48675.000  11944.0052
  5   35551.709   57765.663  55615.029   54706.883  33722.627   7477.7373
  6    7431.151   24727.285  22129.800   14849.532   6416.212   4327.6438
  7     244.730    3124.610   5490.293    8331.691   4228.930   1678.3712
  8    1989.690    1888.505   2701.392    4074.897   1481.647    775.2177
   year
age       1978       1979         1980        1981         1982
  0 363655.701 799311.846 1458614.2315 7937791.806 11865332.548
  1 172555.051 156405.539  280003.8745  759267.065  1177776.591
  2 115001.687 145351.751  131906.7188  282466.434   306918.280
  3  60891.590  91755.383   91135.3129   60453.405   218396.034
  4  42390.071  25337.712   32914.9516   38978.386    34613.952
  5   7345.218  24774.119   21856.2745   26699.176    16111.033
  6   1492.878   1501.929    3328.0198   14981.272     8562.365
  7   2201.034   1025.169    1447.5211   14869.476     9377.727
  8   1001.650   1174.049     690.8858    4551.413     4995.342
   year
age        1983       1984       1985       1986       1987       1988
```

```
  0 12020593.82 6941321.64 4532530.56 4323758.30 7039633.03 3332226.41
  1  2350592.65 1939449.54 3149501.96 4663493.87 6971226.59 6920746.32
  2   574820.15 1162608.19 1294393.75 1265418.10 2088941.57 2272867.20
  3   223866.32  447046.35 1121462.32  840156.17  672081.28 1097521.83
  4   106485.06  196149.61  352006.71  478202.74  463900.91  388763.08
  5    25934.33   78565.07  120116.96  133323.76  245068.26  252938.19
  6    19454.38   21764.28   43671.20   61754.96   75695.54  127463.78
  7    13420.93   22832.07   19365.08   23539.32   25754.90   37782.38
  8    17968.47   25055.19   25536.27   22507.89   16259.58   22952.83
   year
age       1989       1990       1991       1992      1993       1994
  0 2808366.59 1537310.03 2542124.41 9101046.41 9660531.6 5074996.33
  1 3506616.10 2827840.85 2237242.44 2340874.45 3632115.5 2109490.41
  2 1565753.49  950762.90 1098356.03 1293008.12 1182362.2 1741724.99
  3 1336350.68  803583.18  553398.29  453114.02  606582.2  487218.32
  4  776122.94  879131.35  556785.17  364679.69  309403.4  327315.26
  5  209387.49  388838.28  512187.37  357715.30  213244.0  113680.85
  6  118387.95   88537.60  206872.30  368853.75  226861.4   98862.56
  7   58976.49   54131.16   45470.28  134449.35  199066.6   90515.91
  8   28049.95   40797.57   39851.15   69142.85  123023.0  116735.43
   year
age       1995       1996       1997       1998       1999       2000
  0 6297581.83 2166852.33 531276.477  294576.45 1450154.32 1077841.25
  1 1707800.90 1447851.02 612542.325  834655.23  338354.50 1099295.98
  2 1418651.81  692685.53 723613.311 1157264.95  631111.94  589599.28
  3  783284.11  556468.24 465090.911  551999.49 1003119.27  472549.12
  4  225261.59  189688.71 286352.213  277364.33  302225.71  619899.85
  5  109098.55   62216.20 112482.716  173080.75  139642.80  208614.18
  6   54850.05   25226.30  34413.056   83360.98   75116.08   82997.96
  7   42715.74   10083.55   9592.086   15822.89   22661.45   29010.33
  8   87683.34   27185.79  29073.994   20633.90   16765.35   22496.54
   year
age       2001      2002       2003       2004       2005     2006
  0 1785242.47 753801.53  403534.48  704685.88  939985.76 834756.8
  1  610227.44 914046.00  562373.60  241106.48  567998.01 246022.3
  2  884705.07 576299.25 1243087.87  455868.33  338691.43 398793.6
  3  485306.99 975514.28  538106.39 1357735.41  484505.14 310856.2
  4  286566.89 298501.61  832665.95  544639.51 1292535.17 459082.8
  5  321360.18 152547.39  236722.22  747194.04  471810.89 988314.3
  6   94101.03 183804.39  117257.73  160614.85  548142.86 257241.1
  7   31755.22  46765.28  110828.49   90645.32   99445.71 271448.7
  8   27493.47  46190.94   58793.02  128380.71  167912.70 100978.7
   year
age     2007      2008      2009      2010      2011      2012     2013
  0 678259.0 706994.33 715122.97 605155.83 733822.97 703581.04 551087.4
  1 231347.0 229940.55 181076.61 268586.31 188169.35 271267.15 353660.2
  2 228330.7 312497.08 270423.41 293429.84 376353.06 440545.93 323943.0
  3 389777.8 181644.99 120919.89 233066.94 282532.28 619980.09 487354.0
  4 272141.7 197821.41  98737.37 132345.38 222654.17 382117.25 562833.6
  5 293153.9 136981.08  91648.83  86697.20 133583.75 292215.63 408091.9
  6 546855.0 113172.00  44985.01  65092.35  66557.41 140519.08 280109.8
  7 140281.3 257634.40  54550.01  35453.74  56444.37  84657.57 142736.6
  8 140836.1  90557.18 144982.57 120204.80 134607.14 235999.92 284574.8
```

age	year 2014	2015	2016	2017	2018	2019	2020
0	1358931.3	533823.1	1365268.7	528277.9	1162968.74	711046.6	651097.0
1	376743.6	413562.6	109814.7	193244.6	84787.45	162297.7	191733.8
2	375065.4	552695.1	620706.3	112496.3	200416.17	107844.5	181237.8
3	368797.3	269224.0	793633.9	1034390.0	208383.42	302814.2	216987.6
4	585076.7	291980.1	296219.8	824605.3	1106336.63	205525.4	222788.7
5	483270.3	453468.1	274837.5	234448.0	790850.61	738040.6	181645.6
6	298145.4	393569.6	345077.4	153728.0	210192.75	505113.6	464328.3
7	200796.1	280444.2	298544.4	194201.3	161035.36	150612.3	339990.2
8	214143.0	300435.9	308979.9	196612.1	229364.04	185026.6	156817.6

Table 2.6.3.16. North Sea Herring single fleet assessment. CATCH-AT-AGE RESIDUALS catch unique

Units : NA

age	year 1947	1948	1949	1950	1951	1952
0	0.000000	0.0000000000	0.00000000	0.000000000	0.0000000	0.00000000
1	0.000000	2.8832033218	0.00000000	0.000000000	3.8769942	0.87083043
2	1.097482	2.4424555752	1.37021062	0.305184502	-1.0593214	-0.76738153
3	1.802188	0.0009453391	1.33464305	-0.009204868	-0.7377701	-1.93740559
4	1.834505	-2.1421437271	-0.38416878	1.466578168	0.7326447	-1.59889670
5	1.212864	-0.0674503073	0.06771728	-0.465422581	1.3537031	-0.86684152
6	1.290966	0.0441693664	0.38789394	-0.238013141	-0.1612865	0.08730906
7	1.682250	-0.5807154416	0.88113933	-0.455577697	-0.1662658	0.59680402
8	3.009605	0.0457949197	0.59750088	-0.084192020	-0.1650082	0.65865082

age	year 1953	1954	1955	1956	1957	1958
0	2.1683420	0.4843715	-0.30385382	-0.65947884	1.21126278	-1.15470918
1	0.3317291	0.2403704	0.26546967	-0.04415264	0.08014454	0.83392133
2	-0.7029759	-0.3461986	-0.08244043	-0.49615387	-0.05136530	-0.50435305
3	-1.0887679	-0.2720175	-0.56752783	-0.35470263	-1.20823873	0.53381675
4	-0.8845216	-1.3434794	-1.06999879	-0.27872598	-0.19648543	-0.95757495
5	-0.7690977	-0.3030141	-1.38204146	-1.05097723	0.11211578	0.02620409
6	-0.4397990	-0.1715649	-0.64214605	-0.89156152	-0.01898035	-0.89141114
7	-0.4393625	-0.0895876	-1.35722540	-0.42823327	-0.08244099	-1.06676585
8	0.1283936	0.5321395	-0.87729050	0.68178808	0.02508006	-0.89858802

age	year 1959	1960	1961	1962	1963	1964
0	0.0000000	0.6159650	2.25326500	-2.41234357	1.15391889	0.2269763
1	-0.5663171	0.2420977	-2.62828097	0.98348016	0.56256165	0.6394982
2	1.4925161	-1.1215787	-0.05605497	-2.16887974	1.66586801	0.5446396
3	-0.5140454	0.1319635	-0.45264053	-0.18842224	0.00711036	1.0499512
4	0.3124137	-0.9693705	1.34313548	-0.01872995	-2.55382142	2.2700243
5	-0.4445715	-1.5305648	0.79359395	0.93314756	-2.29862045	1.0346162
6	0.1011952	-0.4043915	0.36241461	0.60991897	-1.95140126	1.2193659
7	0.4386064	-0.6868843	-0.48952028	1.22993424	-1.61352519	0.8544300
8	1.1876315	0.6162918	-0.95267654	-0.79509527	-0.46803115	-0.7937002

age	year 1965	1966	1967	1968	1969	1970
0	-1.3483420	0.9207074	0.7202777	0.37016371	-2.35725918	2.27665052

```
  1  0.1467123 -0.4491644 -0.2932713  0.06605356 -0.03365013  0.05669455
  2 -0.2331901  0.1200882 -0.3180198  0.14901267 -0.40328724 -0.12828687
  3  0.6746464 -1.7742268  0.5055107  1.71227741 -3.52940329  0.98644695
  4  1.3446173 -1.4469184 -0.4817876  0.13991680 -2.66484292  0.59403045
  5  1.7938470 -0.7283121 -0.2209769 -1.09180461 -1.10347656 -1.41105868
  6  0.6890629 -0.9792595 -0.1045814  0.02584878 -1.12457353 -0.72413170
  7  1.8133363 -0.8090265  0.6763125 -1.48265451 -0.82893123 -1.49286252
  8  0.1821773  0.2932368 -0.6480995 -0.44471594 -2.41562171 -1.37697877
   year
age       1971        1972       1973       1974        1975       1976
  0 -0.1399224  0.09557667 -1.1281649  1.3899520 -1.47902537 -0.2482292
  1  0.5760924 -0.19422415 -0.5350807 -1.0055401  0.66114953 -3.0825204
  2  0.3920462 -1.07425759 -0.1578942 -0.8101895  0.05587998 -0.4397002
  3 -0.5036371 -0.19912448  0.1144856 -0.9721944 -0.21210055 -0.4276307
  4 -0.4733747 -0.66649347  1.1410487 -1.1775735  0.56073699 -0.6853313
  5 -1.1260166 -0.92868655  1.4878051  0.3432772 -0.09354304 -0.5682454
  6  0.1987195 -1.80940614  1.8036795 -0.4494357 -0.45399651 -1.3335654
  7  1.0335166 -3.56356445  2.9196604 -0.1584540  0.52147570 -0.6479570
  8 -2.7239335 -1.43774835  1.8880223  1.5297076  0.90543273 -1.4161607
   year
age        1977 1978 1979       1980       1981       1982        1983
  0  0.07597696    0    0  1.3283809  2.6249341  0.5187393  0.19825435
  1 -0.23855554    0    0 -0.2462839  1.0740464 -0.5396140  0.71896516
  2 -2.76867757    0    0 -0.9089759  0.7226391 -0.9791483 -0.09711704
  3  0.23409772    0    0 -1.5817105 -0.7945850  1.1110091 -0.51002740
  4 -1.17981597    0    0 -1.1904637 -0.6033173  0.1977047 -0.15244324
  5 -1.22930555    0    0  1.9154171 -1.1429949 -1.7937485  0.98447033
  6 -0.29576788    0    0 -0.7196302  3.7767712 -1.4499989  1.84015248
  7 -0.99234594    0    0  1.6689785  2.7357989 -1.2550714  0.57587829
  8 -0.92205949    0    0 -0.2268339  4.1761216  0.2548988  2.82197531
   year
age       1984        1985        1986        1987         1988
  0 -0.7923819 -0.69629763 -0.20981987  0.94942664 -1.079191614
  1 -0.2704149  1.01274655  0.97777649  0.69591555 -0.087284042
  2  0.3847517  1.09031252  0.05003559  0.87128079 -0.588560642
  3  0.1435733  1.16832090 -0.06581243 -0.43317956 -0.044758462
  4  1.3512606  0.60552650 -0.82035448  0.28409207 -0.222805151
  5  0.5720777  0.68049271 -0.88991019  0.15287683  0.176235936
  6  0.1829367 -0.31759747 -0.12988267 -0.22306671 -0.205463000
  7  1.1527903 -0.04867301 -1.46669146 -0.85347208  0.001931288
  8  1.9409946  1.71018445  1.83841049 -0.01553572  0.212411215
   year
age        1989        1990        1991       1992         1993
  0 -0.13486482 -1.04072119  0.64547592  1.8312858  0.149833864
  1 -0.75121650 -0.12010274 -0.07233381 -0.3107737 -0.157092191
  2  0.11996513 -0.99927038  1.20636266  0.4280025 -0.283280396
  3  0.10125638 -0.47114420  0.15613760 -0.2777385 -0.002821862
  4  0.44111869 -0.29839956 -0.04012197  0.3352401  0.352011702
  5 -0.05294658  0.03386583 -0.12235399  0.3582504  0.248120780
  6 -0.14288358 -0.54599686  0.22810952  0.4005843  0.180770653
  7 -0.23680667 -0.38698205 -0.66838437  0.9636609 -0.121950832
  8 -0.18666007 -0.03594834 -0.36515872 -0.3976679  0.320249297
   year
```

age	1994	1995	1996	1997	1998	1999
0	-1.01539784	0.4939821	-1.3742176	-2.1563211	-0.88834251	2.1207717
1	-1.34920799	-0.1314740	-0.3193201	-1.4641466	0.84089892	-0.6823736
2	-0.63960151	-1.9816428	-2.8619811	-0.8058620	1.48190947	-1.0979078
3	-0.60763548	-0.6330188	-1.9717610	-0.9913479	-0.36516460	0.7558231
4	0.03586815	-0.7180212	-2.4440392	-0.1856058	-0.45938307	-0.4783784
5	-0.75779594	0.8116308	-1.8910604	-0.4159811	-0.03243927	-0.7275245
6	-0.56102053	-0.2046261	-1.4011193	-0.2679850	0.55006687	-0.7752285
7	-1.07141015	-0.3984453	-2.2350392	0.6952947	-0.13019736	-0.1657221
8	-0.13357967	-0.2266866	-1.2064461	-0.7897695	-0.51670799	-1.5581429

age \ year	2000	2001	2002	2003	2004	2005
0	-0.32054345	0.63931686	-1.09575152	-0.8653205	0.76395240	0.5346996
1	-0.01688250	-0.30569519	-0.41072217	0.3908034	-0.67352415	1.6797352
2	0.88036288	-1.27228618	-0.15563923	0.4442276	-0.31753797	0.7405728
3	-0.96133985	0.03737684	0.03422035	-0.2602042	0.05304423	0.1964495
4	0.66768168	-0.62647477	-0.44125533	0.3550985	0.33831439	0.2475762
5	0.33875187	-0.30868612	-0.96719124	0.8661768	0.43866355	0.1637642
6	0.09486309	-0.26492034	-0.04346561	0.1361076	0.75596632	0.2753387
7	0.52726668	0.40468157	0.34757893	0.3725920	1.17891088	1.4051500
8	-1.60327618	-1.65744327	-0.11362717	-0.9396057	-1.22318414	-0.7079332

age \ year	2006	2007	2008	2009	2010
0	-0.10316315	-0.410668293	0.2087393	-0.16987205	-0.268561809
1	-1.37813385	0.006060442	-0.4312757	-0.13165719	-0.169352648
2	-0.27539712	-0.835890892	0.9320637	-0.26890280	0.736398507
3	0.37639412	0.141480999	-1.1844506	-1.87590693	1.457694000
4	-0.01419789	-0.029367569	-1.3662832	-1.49629440	-0.008982707
5	0.20963612	-0.164088570	-1.0349389	-1.45908009	0.217555957
6	-0.50975916	-0.143386604	-1.0516869	-1.48816708	0.631091734
7	-0.41449654	-0.240514156	-1.1192945	-1.02706467	-0.391761058
8	-0.06727062	-0.144390219	0.4012754	-0.05909933	-0.035330412

age \ year	2011	2012	2013	2014	2015	2016
0	0.36693496	0.05219968	-0.60121593	1.2071315	-1.0855840	1.36345904
1	-0.39233652	1.08045031	0.89831009	-0.2620766	-0.8468485	0.05700013
2	-0.05431880	0.47091281	-0.42679240	0.6796029	0.5485179	0.22158185
3	0.81740705	2.01190833	-0.06702044	0.4098810	-1.3233749	1.42057656
4	0.94537257	1.98280462	0.77016081	1.2438507	-0.5655943	0.02591196
5	0.57735607	1.83982432	1.39419331	0.5739212	0.4426095	0.15959932
6	0.65202441	1.43169817	1.26441815	0.0685338	0.8370904	0.15973285
7	0.38746291	1.93049912	0.95338388	0.4136070	0.5478256	0.43305945
8	0.05498913	-0.54295811	0.48157490	-0.4374307	0.7168706	0.55098635

age \ year	2017	2018	2019	2020
0	-1.37606164	1.1813020	-0.8101466	0
1	-0.02170378	-0.5844188	0.4212925	0
2	-0.88219535	-0.2068544	-1.1972133	0
3	0.41325217	-0.3450561	-0.2165400	0
4	0.69533306	0.8361862	-0.6182608	0
5	-0.13233876	1.6468654	-0.1585924	0
6	-0.66845525	0.3344147	0.4508528	0
7	-0.94635000	0.3384592	-0.3978370	0

```
  8  0.50387035  1.4431848  0.8157804    0
```

Table 2.6.3.17. North Sea Herring single fleet assessment. PREDICTED INDEX AT AGE LAI-ORSH

```
Units  :  NA
   year
age     1972     1973      1974     1975     1976     1977     1978
  0 2078.709 1859.917 1071.6491 639.3247 988.6126 584.4691 726.8124
  1 1212.539 1084.915  625.1074 372.9267 576.6711 340.9287 423.9595
   year
age      1979      1980     1981     1982     1983     1984     1985
  0 1050.9661 1288.2055 1872.809 2298.352 2563.957 3917.453 4583.129
  1  613.0428  751.4277 1092.435 1340.660 1495.591 2285.103 2673.401
   year
age     1986     1987     1988     1989     1990     1991     1992
  0 5108.988 5988.752 7121.143 7952.690       NA 3974.483 935.0999
  1 2980.142 3493.320 4153.859 4638.912 4280.549 2318.370 545.4564
   year
age     1993     1994     1995     1996     1997     1998    1999   2000
  0       NA 889.2645       NA       NA       NA       NA      NA     NA
  1 486.9211 518.7200 1817.445 4663.239 5993.355 7043.149 7617.41 7942.8
   year
age     2001     2002     2003     2004     2005     2006     2007
  0       NA       NA       NA       NA       NA 6372.363       NA
  1 8970.269 9000.354 6623.344 5419.745 4868.978 3717.085 2539.809
   year
age     2008     2009    2010     2011     2012     2013     2014     2015
  0 4674.879       NA      NA       NA       NA       NA       NA       NA
  1 2726.920 2731.293 2835.73 3790.761 4326.598 4014.665 3609.938 3082.043
   year
age     2018     2019
  0       NA 1665.323
  1 740.0799       NA
```

Table 2.6.3.18. North Sea Herring single fleet assessment. INDEX AT AGE RESIDUALS LAI-ORSH

```
Units  :  NA
   year
age      1972       1973       1974       1975       1976      1977
  0 0.9535755 -0.4331756 -0.5470099 -0.7729207  0.2907140 1.9140522
  1 1.5462093 -0.6940832 -0.5240960 -1.7717666 -0.8428187 0.7894143
   year
age       1978     1979      1980       1981      1982       1983
  0  2.7866719 2.089468 1.4269047  0.8279461 0.2997620 -0.1303186
  1 -0.4829522 1.880516 0.4036348 -0.8920931 0.0911671 -0.5902602
   year
age       1984      1985       1986       1987      1988      1989
  0 -0.6928827 0.1935109 -0.1240551  0.3790471 0.2459064 0.6768771
  1 -0.1896217 0.1387613 -0.2357463 -0.3702661 0.7210795 0.4178133
```

```
   year
age      1990       1991      1992      1993      1994     1995
  0        NA -1.3039662 -1.990612        NA -1.718993       NA
  1 0.6657413 -0.1328554  1.341458 -1.072811  2.026868 2.309325
   year
age        1996        1997      1998       1999       2000      2001
  0          NA          NA        NA         NA         NA        NA
  1 -0.03060965 -0.09489708 0.2464663 -0.2712274 -0.4909325 0.1289649
   year
age       2002       2003      2004       2005       2006       2007
  0         NA         NA        NA         NA  0.1549671         NA
  1 -0.4167859 -0.8906661 0.1345411 -0.1015886 -0.2640056 -0.1467729
   year
age      2008      2009        2010      2011     2012     2013      2014
  0 0.3818619        NA          NA        NA       NA       NA        NA
  1 0.9232668 0.8425737 -0.01609682 0.3508849 1.571298 1.613169 0.4483023
   year
age      2015      2018      2019
  0        NA        NA 0.6720086
  1 0.8073867 -1.873082        NA
```

Table 2.6.3.19. North Sea Herring single fleet assessment. PREDICTED INDEX AT AGE LAI-BUN

```
Units  :  NA
   year
age     1972      1973      1974     1975     1976     1977     1978
  0 20.50907 18.350411 115.13275 76.97981       NA 61.52865       NA
  1       NA  6.897641  43.27665       NA 9.739586 23.12769 45.13309
   year
age     1979      1980     1981     1982      1983     1984     1985
  0 64.06644 16.067074 29.51972 353.1653 1872.5835 3116.229 2809.693
  1 24.08160  6.039369 11.09602 132.7495  703.8757 1171.343 1056.121
   year
age      1986     1987     1988     1989     1990     1991     1992
  0 2430.6123 2770.515 4922.271 4402.593 5400.473       NA       NA
  1  913.6303 1041.395 1850.207 1654.868 2029.956 3278.634 4441.607
   year
age     1993     1996     1997     1998     1999      2000     2001
  0       NA       NA       NA       NA       NA 200.95614       NA
  1 3062.242 577.9594 169.8615 327.6576 155.8421  75.53636 226.0276
   year
age     2002     2003     2004     2005     2006     2007     2008
  0       NA       NA       NA       NA       NA       NA       NA
  1 736.9592 1464.692 1774.975 1312.619 732.5742 836.1728 738.9656
   year
age     2009     2010     2011     2012     2013     2014     2015
  0       NA       NA       NA       NA       NA       NA       NA
  1 1302.442 1402.346 2092.716 2755.129 3575.947 3467.948 3128.666
   year
age     2016     2017     2018     2019
  0       NA       NA       NA 5859.822
```

```
  1 3789.257 3705.555 4438.791 2202.618
```

Table 2.6.3.20. North Sea Herring single fleet assessment. INDEX AT AGE RESIDUALS LAI-BUN

```
Units  :  NA
   year
age      1972        1973     1974      1975      1976      1977     1978
  0 -0.191631 -1.44588453 1.388216 0.3982158        NA 2.0437767       NA
  1        NA  0.04277676 2.035321        NA -2.325967 0.8371231 2.005365
   year
age       1979       1980       1981     1982      1983       1984
  0  0.5484755 -0.7214317 -0.9940804 1.585509 1.3564361 -0.3110575
  1 -1.0785510 -1.7673845  1.0788221 1.288662 0.3458204  0.2551603
   year
age       1985        1986        1987      1988       1989      1990
  0 -0.2246693 -0.02266447 -0.04929623 0.7580446  0.4763926 0.1938788
  1  0.2747409 -0.96674286 -0.31853908 0.9832198 -0.5658200 0.2038427
   year
age       1991       1992      1993      1996      1997     1998
  0         NA         NA        NA        NA        NA       NA
  1 0.01725587 -0.4575776 -2.672574 -2.167859 -2.231831 1.230628
   year
age       1999      2000      2001      2002      2003      2004
  0         NA -1.691022        NA        NA        NA        NA
  1 -0.6752219  0.995908 0.3916406 0.9016488 0.5389952 0.7283112
   year
age       2005       2006     2007        2008     2009       2010
  0         NA         NA       NA          NA       NA         NA
  1 -0.1674563 -0.8528227 0.652732 -0.06835265 1.441677 0.08212025
   year
age      2011     2012    2013      2014     2015      2016     2017
  0        NA       NA      NA        NA       NA        NA       NA
  1 0.5403415 1.187902 1.44848 0.6144584 0.450272 0.1840641 0.706288
   year
age       2018        2019
  0         NA -0.07128237
  1 -0.3265473  0.30024432
```

Table 2.6.3.21. North Sea Herring single fleet assessment. PREDICTED INDEX AT AGE LAI-CNS

```
Units  :  NA
   year
age      1972      1973     1974       1975       1976       1977
  0 427.77653 382.75146 298.8926         NA 175.105271 133.091849
  1 606.84508 542.97237       NA 220.757752 248.404863 188.804497
  2 291.76587 261.05642 203.8603 106.138419         NA  90.775570
  3  20.16503  18.04259       NA   7.335623   8.254317   6.273839
   year
age       1978       1979      1980     1981      1982     1983       1984
```

```
  0 175.062179 203.817198 163.30623 250.4716 377.36901 570.9355 1201.23518
  1 248.343733 289.135689 231.66671 355.3198 535.33681 809.9308 1704.07583
  2 119.401520 139.013940 111.38335 170.8347 257.38531 389.4077  819.30493
  3   8.252286   9.607774   7.69812       NA  17.78886       NA   56.62523
   year
age       1985       1986      1987       1988       1989     1990
  0 1429.65290 1446.50930 1760.3173 2066.41975 1735.63668 1771.334
  1 2028.10990 2052.02244 2497.1914 2931.42927 2462.17941 2512.820
  2  975.09771  986.59465 1200.6280 1409.40585 1183.79457 1208.142
  3   67.39265   68.18725   82.9799   97.40931   81.81647       NA
   year
age      1991     1992     1993     1994     1995     1996     1998
  0 1053.2779 205.9345       NA       NA       NA       NA 310.6755
  1 1494.1833 292.1392 250.9830 212.2946       NA 509.1886 440.7253
  2  718.3904 140.4580 120.6704 102.0694 165.5879       NA       NA
  3        NA       NA       NA       NA       NA       NA       NA
   year
age     1999     2000     2001     2002     2003     2004     2005
  0       NA       NA       NA       NA       NA       NA       NA
  1 479.9638 644.5049 1410.289       NA 3474.050 3405.456 3211.039
  2 230.7625       NA       NA 1295.082 1670.293       NA       NA
  3       NA       NA       NA       NA       NA       NA       NA
   year
age     2006     2007     2008     2009    2010     2011     2012     2013
  0       NA       NA       NA       NA      NA       NA       NA       NA
  1 2358.895 1674.884 1979.662 2149.928 2242.04 2922.401 2708.989 2670.613
  2       NA       NA       NA       NA      NA       NA       NA       NA
  3       NA       NA       NA       NA      NA       NA       NA       NA
   year
age     2014     2015    2016     2017     2018     2019
  0       NA       NA      NA       NA       NA       NA
  1 2609.894 2735.123 3249.73 2659.405 1846.896 2290.383
  2       NA       NA      NA       NA       NA       NA
  3       NA       NA      NA       NA       NA       NA
```

Table 2.6.3.22. North Sea Herring single fleet assessment. INDEX AT AGE RESIDUALS LAI-CNS

```
Units  :  NA
   year
age       1972      1973      1974       1975       1976        1977
  0  0.4094250 0.6808418 -1.271201         NA -0.7105600  2.06895207
  1 -0.5616920 0.6675048        NA -1.3120079 -0.4221469  0.93833119
  2  0.4522500 1.4077830  1.307900 -0.6149444         NA  0.54665931
  3  0.9557141 1.6620297        NA -0.4055627  0.4410501 -0.08690838
   year
age       1978       1979       1980       1981       1982       1983
  0  2.5973905  1.1855376  0.4631526  1.1683491 -1.1501172  0.8107628
  1 -0.3272384 -0.5522346 -0.2971534 -0.3557173 -1.4425265 -0.8779766
  2  1.2386800  1.1581421 -2.0700896 -0.2684134  1.5499451 -1.3311597
  3 -0.6823458 -0.2677323  0.5924481         NA  0.4099752         NA
   year
```

```
age       1984       1985        1986       1987      1988       1989
  0 0.07307588 -1.7278924 -0.01879499 -0.4904083 0.8718847 -0.3122096
  1 0.72496854  1.8485064  0.74460521  0.7213273 0.1672609  0.4249005
  2 0.32605817  0.5651472 -1.52601928  0.4773790 0.1955668  0.3580716
  3 1.86480637  0.9235538 -0.53980150  0.2596103 0.5064601 -3.2042479
   year
age       1990        1991        1992       1993      1994      1995
  0  1.9362377  0.85059141 -3.67700030         NA        NA        NA
  1 -0.8029704 -0.24435850 -0.59668027  0.9335421  1.289282        NA
  2 -0.3272440 -0.06340403  0.08804795 -0.3643129 -1.125871 -1.456915
  3         NA          NA          NA         NA        NA        NA
   year
age     1996       1998       1999      2000     2001     2002      2003
  0       NA -0.9031206         NA        NA       NA       NA        NA
  1 -0.38556 -1.6632010 -0.6372284 0.3062514 1.039785       NA 1.4701151
  2       NA         NA  0.2968803        NA       NA 1.538291 0.6907551
  3       NA         NA         NA        NA       NA       NA        NA
   year
age      2004      2005       2006      2007     2008      2009      2010
  0        NA        NA         NA        NA       NA        NA        NA
  1 0.5476612 0.5895621 -0.1563043 -1.217358 1.757325 0.7112674 0.0970424
  2        NA        NA         NA        NA       NA        NA        NA
  3        NA        NA         NA        NA       NA        NA        NA
   year
age    2011      2012     2013       2014      2015     2016      2017
  0      NA        NA       NA         NA        NA       NA        NA
  1 1.60476 -1.211525 1.240947 -0.3710008 0.5998923 0.385868 0.7498335
  2      NA        NA       NA         NA        NA       NA        NA
  3      NA        NA       NA         NA        NA       NA        NA
   year
age       2018     2019
  0         NA       NA
  1 0.03135325 1.503866
  2         NA       NA
  3         NA       NA
```

Table 2.6.3.23. North Sea Herring single fleet assessment. PREDICTED INDEX AT AGE LAI-SNS

```
Units  :  NA
   year
age     1972     1973     1974     1975     1976     1977     1978
  0 7.757547       NA       NA 3.667798       NA 6.273394 19.44135
  1 6.169737       NA 5.580891 2.917075 4.164247       NA 15.46210
  2       NA 2.296887       NA       NA       NA       NA       NA
   year
age     1979     1980      1981      1982      1983     1984     1985
  0       NA 95.80040 183.37074 258.61689 247.05128 339.2755 378.9276
  1 51.15811 76.19203        NA 205.68332 196.48495 269.8327 301.3689
  2 21.28568 31.70170  60.67996  85.57997  81.75275 112.2710 125.3925
   year
age     1986     1987     1988      1989     1990     1991     1992
```

```
  0 337.2216 505.5960 775.0096 1318.7338 1787.042 1671.832 616.8307
  1 268.1993 402.1109 616.3811 1048.8161 1421.271 1329.642 490.5781
  2 111.5914 167.3088 256.4616  436.3876       NA       NA       NA
   year
age     1993     1994     1995      1996      1997      1998      1999
  0 619.6249 465.2831 602.3138 1053.2151 1221.9502 1247.3447 1157.6376
  1 492.8004 370.0492 479.0325  837.6436  971.8421  992.0388  920.6929
  2       NA       NA 199.3141  348.5237  404.3605  412.7639  383.0786
   year
age      2000      2001      2002     2003     2004     2005     2006
  0 1141.0885 1979.1417 2616.7390 3933.553 4615.033 4887.587 5156.933
  1  907.5311 1574.0520 2081.1463 3128.435 3670.430 3887.199 4101.415
  2  377.6023  654.9259  865.9158 1301.668 1527.179 1617.372 1706.502
   year
age     2007     2008     2009     2010     2011     2012      2013
  0 4644.777 4739.972 5567.922 5970.090 5625.430 5104.573 2613.5732
  1 3694.086 3769.797 4428.282 4748.135 4474.020 4059.771 2078.6284
  2 1537.022 1568.523 1842.504 1975.587 1861.534 1689.175  864.8682
   year
age     2014      2015     2016     2017     2018     2019
  0       NA 2901.0223 4488.028 4326.980 3082.015 3740.706
  1       NA 2307.2426 3569.421 3441.336       NA 2975.060
  2 970.4205  959.9891 1485.152       NA       NA       NA
```

Table 2.6.3.24. North Sea Herring single fleet assessment. INDEX AT AGE RESIDUALS LAI-SNS

```
Units  :  NA
   year
age       1972      1973      1974        1975      1976      1977
  0 -0.3427024        NA        NA -1.09966967        NA -0.122797
  1  1.9570593        NA 0.3554103 -0.05827156 0.5504391        NA
  2         NA -0.981504        NA          NA        NA        NA
   year
age       1978     1979      1980         1981       1982        1983
  0  2.1241547       NA 1.5339842  1.921165675  0.4642515 -1.50273354
  1 -0.1510828 1.989533 0.7869420           NA -0.1972692 -0.02810629
  2         NA 1.850739 0.3923725 -0.004450729 -0.7415594 -0.44241447
   year
age        1984      1985       1986        1987       1988      1989
  0 -0.02066625  1.063179  0.3827616  0.77977683  0.8794208 0.8486109
  1 -0.61660314 -0.170285 -0.9153303 -0.10739805 -0.9167366 1.0493762
  2 -1.00204789 -1.274815 -1.5123297  0.03979381 -0.3499619 0.4233212
   year
age      1990       1991       1992      1993        1994       1995
  0 0.6659292  0.9678321 -0.6371519 0.6771811 -0.27091905 -1.9248803
  1 0.1106190 -0.3314678  1.3099527 0.4121662  0.05220974 -0.3046369
  2        NA         NA         NA        NA          NA  0.1710631
   year
age       1996       1997       1998       1999      2000       2001
  0 -0.7717289  1.6333220 -0.1890268 -0.3514135  1.349848 -0.3055415
  1  0.1487525 -0.3822350 -0.3263633  0.2385508 -1.125585  1.2326754
```

```
  2  0.7635507 -0.3575459 -0.9024997 -0.1340797 -1.103369  0.2729501
   year
age       2002       2003       2004      2005       2006        2007
  0 -0.2684102 1.31259070  0.6302191 -1.386830  0.9838430  0.32394742
  1 -1.5776202 0.17140393 -0.2176641  0.642873 -0.1181533 -0.03315693
  2  0.3651386 0.02150892  1.0492041  1.341054  0.3838816  1.01555147
   year
age       2008       2009      2010        2011      2012      2013
  0  0.8326610 1.21354639 0.3034594 -0.07466079 1.2650268 -5.017390
  1 -0.1238748 1.22137344 0.8897982  0.19736654 0.7029443  1.935466
  2  1.0264273 0.07115313 1.1131054 -0.42624241 0.3548591  1.336432
   year
age      2014         2015       2016      2017      2018      2019
  0        NA -0.016557299  1.6921383 1.1550109 -0.809484 1.4169246
  1        NA -0.242878362 -0.5352618 0.6509457        NA 0.5542497
  2 0.8093776 -0.007132457  0.2762174        NA        NA        NA
```

Table 2.6.3.25. North Sea Herring single fleet assessment. PREDICTED INDEX AT AGE IBTS-Q1

```
Units  :  NA
   year
age    1984    1985    1986    1987    1988    1989     1990     1991
  1 1197631 1376001 1927211 2548067 1911269 1216869 973272.9 982739.9
   year
age     1992    1993    1994    1995    1996    1997    1998     1999
  1 973754.1 1572622 1639217 1419305 1468759 1420993 1280682 829414.5
   year
age    2000    2001    2002    2003     2004    2005     2006     2007
  1 2376458 1607472 3060194 1445338 771081.6 1032460 765302.3 748009.4
   year
age   2008     2009    2010    2011     2012     2013    2014    2015
  1 845092 833229.5 1299713 1184054 961018.6 904292.9 1430018 2060279
   year
age     2016     2017     2018     2019    2020
  1 556899.5 963300.7 643944.6 899714.6 1063471
```

Table 2.6.3.26. North Sea Herring single fleet assessment. INDEX AT AGE RESIDUALS IBTS-Q1

```
Units  :  NA
   year
age       1984        1985      1986     1987      1988      1989
  1 -0.6814719 0.007299283 0.2128674 1.052921 -1.439817 0.9545864
   year
age       1990      1991        1992        1993     1994      1995
  1 -0.7946957 0.8817327 -0.09942406 -0.09257319 1.404788 0.8484396
   year
age       1996      1997     1998     1999       2000      2001    2002
  1 -0.8413866 0.5483171 1.157205 0.121766 -0.8981147 0.3975064 -1.1898
   year
```

```
age       2003        2004      2005       2006     2007        2008
  1 -0.3790905 -0.02182093 0.4026958 -0.3527853 0.363503 -0.01961185
   year
age      2009      2010     2011       2012      2013     2014      2015
  1 0.4529398 -1.256323 1.293813 -0.7594924 -1.639071 1.238104 0.2756952
   year
age       2016     2017     2018       2019      2020
  1 -0.3058115 1.228658 0.217914 -0.6510676 0.3848971
```

Table 2.6.3.27. North Sea Herring single fleet assessment. PREDICTED INDEX AT AGE HERAS

```
Units  :  NA
   year
age       1989      1990      1991      1992      1993       1994
  1 7203269.86 5777163.3 6087309.1 6031060.8 9843806.0 10894055.0
  2 4612163.41 3022527.9 2550562.0 2885109.7 2469619.3  3787655.3
  3 4607846.06 3167515.7 1899822.2 1410477.5 1495649.6  1143708.9
  4 2012554.45 2921423.6 1878557.0 1083911.6  731048.8   587522.5
  5  547290.70 1196961.0 1739296.8 1096836.4  613653.4   345684.6
  6  309039.47  326514.4  674451.3 1017095.1  611881.4   302308.4
  7  149257.46  177026.3  192240.2  393169.0  497455.4   295642.6
  8   70995.96  133439.4  168524.3  202280.9  307603.6   381533.8
   year
age      1995       1996       1997      1998      1999       2000
  1 9504282.7 9938614.30 9857436.37 8751744.1 5684708.1 16040950.4
  2 4391521.3 4000836.62 4746040.93 6231203.4 4012168.5  3887371.7
  3 2017866.2 2474261.81 2467496.55 2765890.4 4243304.6  2524016.1
  4  591602.7  945900.51 1367270.58 1277084.2 1442235.7  2592585.0
  5  276008.8  294364.35  570971.57  752751.7  645110.7   865665.2
  6  180785.9  117987.92  190203.38  360163.8  376554.9   407650.6
  7  155337.1   97837.55   69414.21  124442.5  198164.4   240958.0
  8  319103.4  263944.47  210526.22  162368.8  146665.7   186894.5
   year
age       2001       2002       2003      2004      2005      2006
  1 10795515.2 20495986.0  9569147.9 5109206.7 6792903.4 5125585.3
  2  8615549.0  5757253.5 13358610.2 4548061.1 2776943.4 3784843.6
  3  2909771.2  6623648.8  3917955.3 9331685.3 3302515.0 2114214.1
  4  1454263.7  1548060.8  3994400.2 2474045.2 5305991.3 1955672.7
  5  1487339.4   808760.9   800028.3 2284249.8 1390289.1 3273370.0
  6   464467.6   924982.3   491593.9  373788.7 1152802.8  667975.3
  7   240545.4   269785.1   554237.4  296897.5  170274.1  520594.6
  8   208280.7   266492.8   294049.4  420569.8  287595.3  193742.7
   year
age      2007      2008      2009      2010      2011      2012      2013
  1 5040855.3 5747859.8 5711054.8 8942514.4 8187726.5 6613608.1 6193457.8
  2 2605530.6 3177199.5 3747665.6 3981179.3 4930092.3 4642400.9 3474734.1
  3 2538496.5 1913883.9 2323877.8 3219896.5 3095469.6 4266197.2 3655961.0
  4 1305896.4 1470835.6 1194936.1 1687892.4 2082691.2 2245770.0 2882620.1
  5 1117111.0  869848.1  950844.8  893115.8 1044098.9 1416891.4 1622063.8
  6 1845125.7  745865.3  619437.8  849288.4  590182.2  658337.4  908611.7
  7  336381.8 1322078.4  540894.6  471922.5  559209.3  351108.4  385076.2
```

```
  8  337895.0  464988.5 1438546.4 1601189.8 1334645.7  979694.3  768532.8
   year
age      2014       2015      2016      2017      2018      2019
  1 9848348.1 14196509.3 3823501.4 6634875.9 4443546.4 6182194.9
  2 4179522.5  7379381.0 9477650.9 2049969.8 3374916.3 2111852.0
  3 2741234.5  2724720.2 5946669.3 6951797.8 1683540.8 2108129.7
  4 2725191.6  1669556.9 1594252.0 3801650.7 4530118.0 1144323.3
  5 1807623.3  1608617.1 1006621.6 1015953.9 2511054.5 2592731.3
  6 1021461.8   968313.2  854726.3  512285.9  636456.6 1484234.1
  7  524472.3   498229.3  422141.4  382693.7  310409.3  320174.8
  8  559928.4   534366.9  437422.1  387877.7  442609.5  393748.7
```

Table 2.6.3.28. North Sea Herring single fleet assessment. INDEX AT AGE RESIDUALS HERAS

```
Units  :  NA
   year
age        1989      1990       1991        1992       1993       1994
  1  0.00000000 0.0000000  0.0000000  0.00000000  0.0000000  0.0000000
  2 -0.33109729 0.1342259 -0.3324343  0.75568235 -0.2434258 -1.4930398
  3 -0.21722190 0.9123344 -0.6624366 -0.69101851 -0.7211828 -2.1053788
  4 -0.42760016 1.5409407  0.3665909  0.13590263  0.2318488 -2.4541036
  5 -0.08058128 1.2158772  0.4839243  0.10346593  0.5443316 -0.1094745
  6 -0.27779890 1.1588734 -0.3039943  0.66790618  0.6376346 -0.4758571
  7 -0.57707099 0.7887160  0.3367163 -0.29674049 -0.2731180 -0.4399182
  8  0.11135166 1.0278587 -0.9820768  0.08422129 -0.6415672 -1.1455874
   year
age       1995       1996        1997        1998        1999       2000
  1  0.0000000  0.0000000  0.55881904 -1.44049944  0.17605210  0.5397438
  2 -0.9802560  0.2561582  0.40407666 -0.10822059 -1.34505330 -0.1243992
  3 -0.0636435  0.6254653  0.22412282 -1.15258081  0.08068883 -0.4580321
  4  1.0109067  0.6881709 -0.23203476  0.01940235 -1.48781560  0.6643593
  5 -0.3118327  0.3022888  0.17867755  0.13907342 -1.57912817  0.3026302
  6 -0.1235038 -1.8772447  0.49858339  0.43151535 -1.56662846  0.4779964
  7 -1.0548534 -1.1141162 -2.15255654  0.64589443 -2.36167878 -0.4998831
  8 -2.1187398  0.4626908  0.03685231 -0.65423645 -0.71001945 -0.1087765
   year
age        2001       2002        2003        2004        2005        2006
  1 -0.62226828  0.4673469 -0.14029589 -0.07811619 -1.28744514  0.56281473
  2  1.81080272 -0.5700131  1.95836339 -1.57547627 -1.08602970  0.43978256
  3  0.58478619  1.1653885 -0.96818405 -0.11963320  0.55607932  0.27902357
  4  0.06774052 -0.8626656 -0.07663189 -0.33947017  0.05394396  0.48057560
  5  0.22398173 -0.2548230 -1.72060809  0.18175695 -0.53070617  1.33383475
  6 -0.85892390  0.2888180 -0.20422153 -1.56714876 -0.11749943 -0.50553929
  7 -2.15482351 -0.9526022 -0.60435119 -0.31322686 -1.53001229  0.01736275
  8 -1.58941757 -0.3617884 -0.10508434  0.13759682 -1.29104456 -1.09965326
   year
age       2007       2008      2009      2010       2011        2012
  1  0.4365392 -0.8307808 0.4002927 0.9858851  0.8534677 -0.04027331
  2  0.1609209  0.1835235 2.7735581 1.0728182 -0.6991617 -0.31040180
  3 -1.2373473  0.4908123 1.2996464 1.2704239 -0.6976411 -0.06876807
  4 -0.7816012  0.7723571 0.2507247 1.9470924 -0.1275233 -0.81098975
```

```
  5 -0.6721077  1.1353863 1.4257706 1.8837241 -0.5476063 -0.68606984
  6 -0.5223087  1.1342321 1.3065928 2.8298084  0.1891591 -0.54192540
  7 -0.6393129  2.6386227 1.4501638 1.8165585  0.4224784 -1.81619414
  8 -0.9477690  0.6716720 1.5334099 2.1914774  0.4305702 -1.45593862
   year
age        2013       2014        2015        2016        2017       2018
  1 -0.01955081  1.2598518 -1.27729881  1.87169868 -1.63827736 1.98175955
  2 -1.02475184  1.5652840  2.27745445  1.57916448 -0.47723329 0.27359394
  3  0.02352608  0.6471721  0.29279431 -0.02363008 -0.42321539 0.74310290
  4  0.59514640  1.1811499  0.25992203 -0.86284544 -0.35461727 0.84373930
  5  0.57807838  0.4985809  0.09370738 -0.29947146 -0.09568668 0.34170600
  6  0.31363304  1.3735652 -0.12114882  0.49368867 -0.91946203 1.23315372
  7  0.81794003  1.0255202  0.23910285  0.03394881 -0.25266848 3.16928348
  8  0.22226480 -0.8569851 -0.27741437 -0.40127791 -0.31705352 0.07944698
   year
age       2019
  1  0.3027102
  2 -2.3853838
  3 -0.1585027
  4  1.1642505
  5  1.4942242
  6  0.9425431
  7  1.1800735
  8  0.3821976
```

Table 2.6.3.29. North Sea Herring single fleet assessment. PREDICTED INDEX AT AGE IBTS0

```
Units  :  NA
   year
age     1992     1993     1994     1995     1996     1997     1998
  0 141.0904 148.5562 116.0239 131.2342 105.7108 86.91747 56.73333
   year
age     1999     2000     2001     2002     2003     2004     2005
  0 175.0686 120.0657 211.4681 107.5339 59.69341 69.75373 64.79809
   year
age     2006     2007     2008     2009     2010    2011     2012     2013
  0 60.91899 68.69111 62.61298 100.7988 82.57595 73.7463 70.58049 89.49184
   year
age     2014     2015     2016     2017     2018     2019     2020
  0 142.2684 38.38898 71.13397 42.55071 71.80933 70.38915 64.43271
```

Table 2.6.3.30. North Sea Herring single fleet assessment. INDEX AT AGE RESIDUALS IBTS0

```
Units  :  NA
   year
age       1992      1993      1994       1995      1996    1997       1998
  0 -0.1589054 0.2819204 0.4564294 0.01319253 0.5799452 2.13428 -0.4788656
   year
age     1999       2000     2001      2002       2003      2004      2005
```

```
  0 1.566193 -0.7090051 1.585146 0.3614282 -0.3060995 -1.083525 0.1175646
   year
age       2006        2007      2008     2009       2010       2011
  0 0.04779008 -0.08826931 -1.052652 1.273616 -0.3056007 -0.4216103
   year
age       2012      2013       2014      2015      2016       2017
  0 -0.2786536 0.4802185 -0.2252901 -2.694451 0.3988866 -0.8445323
   year
age      2018      2019       2020
  0 0.7642688 -0.218975 -0.1257349
```

Table 2.6.3.31. North Sea Herring single fleet assessment. PREDICTED INDEX AT AGE IBTS-Q3

```
Units  :  NA
   year
age       1998       1999       2000       2001       2002       2003
  0 1012581.76 3087399.39 2096071.15 3665332.49 1853831.45 1020817.61
  1  386970.04  251453.64  708134.90  476258.69  903888.30  421372.61
  2  249708.82  160917.55  155874.15  346071.96  231177.19  536275.56
  3   86815.57  132907.00   79237.06   91415.03  208195.95  123132.12
  4   34152.57   38585.47   69259.48   38931.79   41437.13  106777.44
  5   15918.19   13651.15   18294.65   31469.74   17130.91   16844.26
   year
age       2004       2005       2006       2007       2008       2009
  0 1178079.95 1078612.28 1009108.37 1141045.41 1035068.15 1679426.07
  1  225004.91  298878.18  226041.51  222483.94  253993.10  252620.19
  2  182466.30  111305.55  151832.70  104633.74  127583.40  150709.16
  3  293002.43  103643.24   66324.69   79602.77   60205.73   73272.14
  4   66066.10  141437.72   52125.60   34844.80   39389.95   32082.94
  5   47997.78   29180.64   68801.32   23520.89   18410.64   20185.42
   year
age       2010       2011       2012       2013       2014      2015
  0 1380816.24 1235729.69 1193474.11 1540456.60 2469764.17 672891.99
  1  395755.99  362589.24  292697.24  273931.69  435897.72 628395.66
  2  160116.81  198290.20  186583.10  139675.84  168038.83 296869.65
  3  101415.77   97404.68  133871.49  114806.31   86086.13  85737.65
  4   45320.66   55829.31   59994.65   76901.34   72624.72  44583.27
  5   18955.36   22119.89   29890.60   34134.72   38005.28  33793.31
   year
age       2016      2017       2018       2019
  0 1260430.15 748303.11 1266239.26 1265697.26
  1  169164.16 293670.54  196726.46  273549.43
  2  381398.15  82541.87  135857.99   85039.80
  3  186802.18 218176.25   52908.75   66187.15
  4   42547.65 101297.41  120536.28   30549.74
  5   21155.16  21399.19   52661.01   54456.40
```

Table 2.6.3.32. North Sea Herring single fleet assessment. INDEX AT AGE RESIDUALS IBTS-Q3

```
Units  :  NA
   year
age       1998       1999       2000         2001       2002         2003
  0 -0.6079410  0.4239333 -0.5223004 -1.550185170 -0.2758412 -0.737206094
  1  0.3407494  0.4946526  0.4092968 -0.007235645  2.8024917  0.572682257
  2  0.6918239  0.6527600  2.6243025 -1.352834268  1.1765222 -0.021763840
  3 -0.4198515 -1.0789138  0.3244650  1.144053476  0.2846599  0.903877201
  4 -1.8811539  1.2023946 -1.3262973  0.274559623  1.2096109 -0.476421659
  5 -1.2881866  0.4959110 -0.5245998 -1.087789837  0.8289420 -0.005994824
   year
age       2004        2005       2006      2007       2008        2009
  0  1.2849681 -0.47997010 -0.1551811  1.496371 -0.7098103  1.23365567
  1  0.6713514  1.43840823  0.6878134 -2.475976 -0.6037853 -0.89545042
  2  0.8940183 -0.06112766  0.7468905  0.217727  0.5714927 -1.66675162
  3  0.2725392 -1.13726607  0.3445437  1.469080  0.5675961  0.51152053
  4  0.7890420 -1.18520100 -0.9987558  1.539509 -0.3728624  0.09251306
  5 -0.9651728  1.13425498 -0.9359083  0.557987  0.8103991 -1.49667659
   year
age       2010        2011        2012        2013       2014       2015
  0 -0.1061452 -1.03633921 -0.77848828  0.96902864  1.9952276 -0.4983280
  1  0.9323347  0.19044984 -0.44365675 -0.17906894 -0.8897695  1.1744950
  2  0.1555620  0.01280361 -2.18871889  0.14121163  0.3592439  0.4814975
  3 -1.4455695  0.45527020 -0.99218680  0.55202617 -0.1654180  0.7976202
  4 -0.6545255 -0.82845442  0.04770058  0.09540425  0.3387516  0.9072813
  5 -0.4460209 -0.11100424 -0.24392290  0.56126461  0.4018069  0.2282090
   year
age       2016       2017       2018       2019
  0  0.2864098  0.5409983  0.2180309  0.6250593
  1 -0.3801736 -0.6453650  1.0272739 -2.7025268
  2 -0.1002694  0.1315924 -1.8947714  0.9081196
  3  0.5272568 -0.1666771  0.4863981 -2.0546342
  4  1.5441613  1.2290846 -1.1746782  0.7393533
  5  1.8940767  2.3868285 -0.2943493 -1.5126475
```

Table 2.6.3.34. North Sea Herring single fleet assessment. FIT PARAMETERS

```
                  name        value    std.dev
1               logFpar -12.92645214 0.09497463
2               logFpar  -0.25161514 0.12200976
3               logFpar  -0.22722562 0.07403482
4               logFpar  -0.06106206 0.07140616
5               logFpar  -2.49308454 0.07482621
6               logFpar  -2.70261495 0.13673416
7               logFpar  -3.32867462 0.11328128
8               logFpar  -3.41129054 0.09340551
9               logFpar  -3.49187339 0.09413935
10              logFpar  -3.65265623 0.09608322
11              logFpar  -3.88791344 0.09815626
```

12	logFpar	-4.26241945	0.11210760
13	logSdLogFsta	-0.61678992	0.12013332
14	logSdLogFsta	-1.15565916	0.09789931
15	logSdLogFsta	-0.67773017	0.09894372
16	logSdLogN	-0.58218224	0.11798400
17	logSdLogN	-1.69255577	0.08910093
18	logSdLogP	0.15399024	0.09812735
19	logSdLogP	-0.29667564	0.16251112
20	logSdLogP	-0.17878134	0.12723327
21	logSdLogObs	-1.43136417	0.38829527
22	logSdLogObs	-2.15088059	0.43454047
23	logSdLogObs	-1.40226232	0.18168369
24	logSdLogObs	-0.72968039	0.15759612
25	logSdLogObs	-1.54717802	0.08796857
26	logSdLogObs	-1.27577232	0.14486896
27	logSdLogObs	-1.28140274	0.15327222
28	logSdLogObs	-1.09227735	0.17506179
29	logSdLogObs	-0.63810752	0.18160095
30	logSdLogObs	-0.87075346	0.17511818
31	logSdLogObs	-1.17779644	0.10452888
32	logSdLogObs	0.17147975	0.04415029
33	transfIRARdist	-0.32673749	0.27901979
34	rhop	0.47631042	0.22413638
35	logAlphaSCB.LAI-ORSH	-0.53903047	0.31070830
36	logAlphaSCB.LAI-BUN	-0.97847252	0.34547267
37	logAlphaSCB.LAI-CNS	0.34967259	0.33787136
38	logAlphaSCB.LAI-CNS	-0.38264929	0.35330871
39	logAlphaSCB.LAI-CNS	-3.05465097	0.40786009
40	logAlphaSCB.LAI-SNS	-0.22901006	0.25061291
41	logAlphaSCB.LAI-SNS	-1.10589650	0.27271184

Table 2.6.3.35. North Sea Herring single fleet assessment. NEGATIVE LOG-LIKELIHOOD

1337.12613222629

Table 2.7.1. North Sea herring. Intermediate year (2020) assumptions for the stock.

Variable	Value	Notes
Fages (wr) 2–6 (2020)	0.20	Based on estimated catch 2020
SSB (2020)	1 287 790	Calculated based on catch constraint (in tonnes)
Rage (wr) 0 (2020)	29 574 086	Estimated by assessment model (in thousands)
Rage (wr) 0 (2021)	32 850 653	Weighted mean over 2010–2019 (in thousands)
Total catch (2020)	400 387	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 2.7.1. (cont.) North Sea herring. Intermediate year (2020), fleet wise assumptions for the catches and the fishing mortality. Weights are in tonnes

	Field	Value	Note
TACs	A-fleet TAC	385008	
	B-fleet TAC	8954	
	C-fleet TAC	24258	Total TAC in IIIa (including WBSS and NSAS)
	D-fleet TAC	6659	Total TAC in IIIa (including WBSS and NSAS)
TACs to catches variables	WBSS/NSAS split in the north sea	0.015	Value from terminal year
	B-fleet uptake	0.63	Average over the last 3 years (2017-2019)
	C-fleet transfer	0.50	Value for the Intermediate year
	C-fleet NSAS/WBSS split	0.27	Average over the last 3 years (2017-2019)
	D-fleet NSAS/WBSS split	0.66	Average over the last 3 years (2017-2019)
	D-fleet uptake	0.05	Average over the last 3 years (2017-2019)
F by fleet and total	$F_{(wr)\ 2–6}$ A-fleet	0.20	
	$F_{(wr)\ 0–1}$ B-fleet	0.02	
	$F_{(wr)\ 0–1}$ C-fleet	0.002	
	$F_{(wr)\ 0–1}$ D-fleet	0.0008	
	$F_{(wr)\ 2–6}$	0.20	
	$F_{(wr)\ 0–1}$	0.02	
NSAS catches by fleet	Catches A-fleet	391200	Includes C-fleet transfer and split of WBSS/NSAS in the north sea

	Field	Value	Note
	Catches B-fleet	5615	Includes fleet uptake
	Catches C-fleet	3330	Includes TAC transfer to the A fleet and WBSS/NSAS split.
	Catches D-fleet	241	Includes WBSS/NSAS split and fleet uptake

Table 2.7.2. North Sea herring. Reference points including results from management plan evaluation 2019 (ICES, 2019).

Framework^	Reference point	Value	Technical basis	Source
MSY approach	MSY $B_{trigger}$	1 400 000	5th percentile of B_{FMSY}	ICES (2018d)
	F_{MSY}	0.26	Stochastic simulations with a segmented regression and Ricker stock–recruitment curve from the short time-series (2002–2016).	ICES (2018d)
Precautionary approach	B_{lim}	800 000	Breakpoint in the segmented regression of the stock–recruitment time-series (1947–2016).	ICES (2018d)
	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 (2018d)
	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 (2018d)
	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 (2018d)
Management plan option A	$B_{trigger}$	1 500 000 t	Informed by simulations.	EU–Norway (2017; 2018)
	F_{target}	$F_{ages\ (wr)0–1} = 0.05$ $F_{ages\ (wr)2–6} = 0.23$	SSB is greater than $B_{trigger}$	EU–Norway (2017; 2018)
		$F_{ages\ (wr)0–1} = 0.05*SSB/B_{trigger}$ $F_{ages\ (wr)2–6} = 0.23*SSB/B_{trigger}$	SSB is less than $B_{trigger}$	EU–Norway (2017; 2018)
Management plan option A+C*	$B_{trigger}$	1 500 000 t	Informed by simulations.	EU–Norway (2017; 2018)
	F_{target}	$F_{ages\ (wr)0–1} = 0.05$ $F_{ages\ (wr)2–6} = 0.23$	SSB is greater than $B_{trigger}$	EU–Norway (2017; 2018)

Framework^	Reference point	Value	Technical basis	Source
		$F_{ages\ (wr)0–1}$ = 0.05*SSB/$B_{trigger}$ $F_{ages\ (wr)2–6}$ = 0.23*SSB/$B_{trigger}$	SSB is less than $B_{trigger}$	EU–Norway (2017; 2018)
Management plan option A+D**	$B_{trigger}$	1 500 000 t	Informed by simulations.	EU–Norway (2017; 2018)
	F_{target}	$F_{ages\ (wr)0–1}$ = 0.05 $F_{ages\ (wr)2–6}$ = 0.23	SSB is greater than $B_{trigger}$	EU–Norway (2017; 2018)
		$F_{ages\ (wr)0–1}$ = 0.05*SSB/$B_{trigger}$ $F_{ages\ (wr)2–6}$ = 0.23*SSB/$B_{trigger}$	SSB is less than $B_{trigger}$	EU–Norway (2017; 2018)
Management plan option B	$B_{trigger}$	1 500 000 t	Informed by simulations.	EU–Norway (2017; 2018)
	F_{target}	$F_{ages\ (wr)0–1}$ = 0.05 $F_{ages\ (wr)2–6}$ = 0.23	SSB is greater than $B_{trigger}$	EU–Norway (2017; 2018)
		$F_{ages\ (wr)0–1}$ = 0.05 $F_{ages\ (wr)2–6}$ = 0.23*SSB/$B_{trigger}$	SSB is less than $B_{trigger}$ and greater than B_{lim}	EU–Norway (2017; 2018)
		$F_{ages\ (wr)0–1}$ = 0.04 $F_{ages\ (wr)2–6}$ = 0.1	SSB is less than B_{lim}	EU–Norway (2017; 2018)

Table 2.7.3. North Sea Herring. Scenarios for prediction year (2019). Weights in tonnes.

Basis	F values by fleet and total						NSAS catches by fleet				Total stock catch	Biomass*				% Advice change ^
	A-fleet	B-fleet	C-fleet	D-fleet	$F_{ages\ (wr)2–6}$	$F_{ages\ (wr)0–1}$	A-fleet	B-fleet	C-fleet#	D-fleet#		SSB 2021	SSB 2022 **	%SSB change ***	A-fleet ****	
MSY approach^^	0.22	0.02	0	0	0.22	0.02	359367	6425	0	0	365792	1185977	1180568	-7.91	-6.66	-15.14
$F = F_{MSY}$	0.26	0.02	0	0	0.26	0.02	412470	7570	0	0	420040	1151509	1124228	-10.58	7.13	-2.56
F = 0	0	0	0	0	0.00	0.00	0	0	0	0	0	1410558	1622539	9.53	-100.00	-100.00
No change in A-fleet TAC	0.24	0.02	0	0	0.24	0.02	385008	6970	0	0	391978	1169374	1153096	-9.20	0.00	-9.07

Basis	F values by fleet and total						NSAS catches by fleet				Total stock catch	Biomass*				% Advice change ^
	A-fleet	B-fleet	C-fleet	D-fleet	$F_{ages\ (wr)\ 2–6}$	$F_{ages\ (wr)\ 0–1}$	A-fleet	B-fleet	C-fleet#	D-fleet#		SSB 2021	SSB 2022 **	%SSB change ***	A-fleet ****	
A-fleet TAC reduction of 15%	0.20	0.02	0	0	0.20	0.02	327257	5761	0	0	333018	1206661	1215687	-6.30	-15.00	-22.74
A-fleet TAC increase of 15%	0.28	0.03	0	0	0.28	0.03	442759	8251	0	0	451010	1131707	1093041	-12.12	15.00	4.63
$F = F_{2020}$	0.20	0.02	0	0	0.20	0.02	328563	5788	0	0	334351	1205822	1214243	-6.37	-14.66	-22.44
F_{pa}	0.30	0.03	0	0	0.30	0.03	462984	8717	0	0	471701	1118429	1072590	-13.15	20.25	9.43
F_{lim}	0.34	0.03	0	0	0.34	0.03	510788	9860	0	0	520648	1086870	1025413	-15.60	32.67	20.78
$SSB_{2021} = B_{pa}$	0.62	0.06	0	0	0.62	0.06	787754	17831	0	0	805585	900000	781185	-30.11	104.61	86.88
$SSB_{2021} = B_{lim}$	0.82	0.07	0	0	0.82	0.08	933742	23240	0	0	956982	800000	669586	-37.88	142.53	122.01
$SSB_{2021} = MSY\ B_{trigger}$	0.01	0.00	0	0	0.01	0.00	17454	268	0	0	17722	1400000	1598468	-8.71	-95.47	-95.89
MSY approach^^ with F_{01}=0.05 target	0.22	0.05	0	0	0.22	0.05	359114	15557	0	0	374671	1185986	1178000	-7.91	-6.73	-13.08
MSY approach with C- and D-fleets catches and C-fleet TAC transfer##	0.23	0.02	0.002	0.001	0.23	0.02	368119	6346	3330	241	378036	1179238	1166898	-8.43	-4.39	-12.30
MSY approach with C- and D-fleets catches and no C-fleet TAC transfer###	0.22	0.02	0.004	0.001	0.22	0.03	355855	6346	6661	241	369103	1186084	1175799	-7.90	-7.57	-14.37

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

** Assuming same catch scenario in 2021 as in 2020.

*** SSB (2021) relative to SSB (2020).

**** A-fleet catches (2021) relative to TAC 2020 for the A-fleet (385 008 tonnes).

^ Advice value 2021 relative to advice value 2020, using catches for all fleets (431 062 tonnes).

^^ Following the MSY advice rule $F_{MSY} \times SSB_{2021}/MSY\ B_{trigger}$ (ICES, 2016).

The catch for C- and D-fleets are set to zero because of the zero catch advice given for 2021 for the western Baltic spring-spawning herring stock.

Following the MSY advice rule $F_{MSY} \times SSB_{2021}/MSY\ B_{trigger}$ (ICES, 2016), assuming same catches as in 2020 for the C- and D-fleet and a 50% C-fleet TAC transfer to the A-fleet.

Following the MSY advice rule $F_{MSY} \times SSB_{2021}/MSY\ B_{trigger}$ (ICES, 2016), assuming same catches as in 2020 for the C- and D-fleet and no C-fleet TAC transfer to the A-fleet.

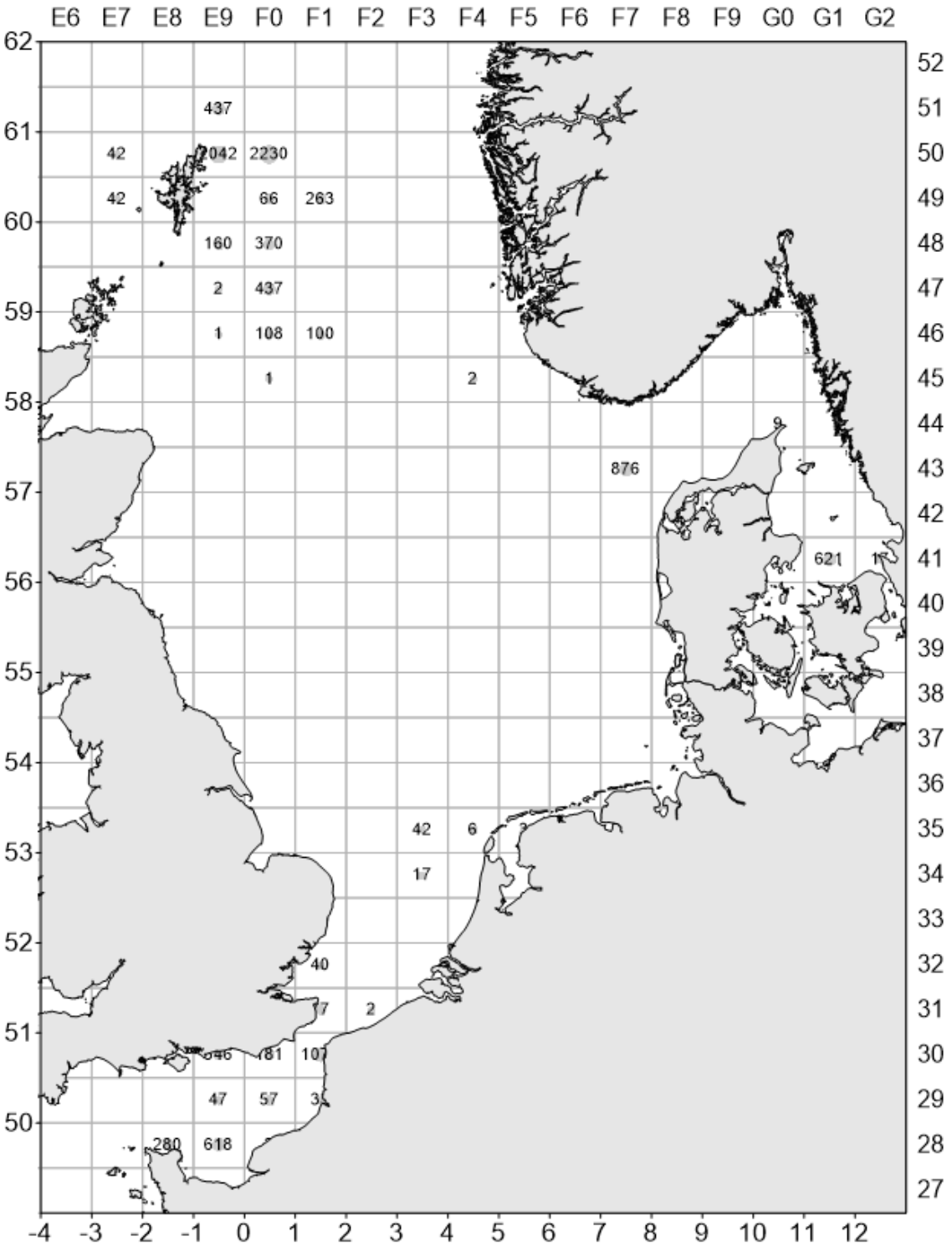


Figure 2.1.1a. Herring catches in the North Sea in the 1st quarter of 2019 (in tonnes) by statistical rectangle.

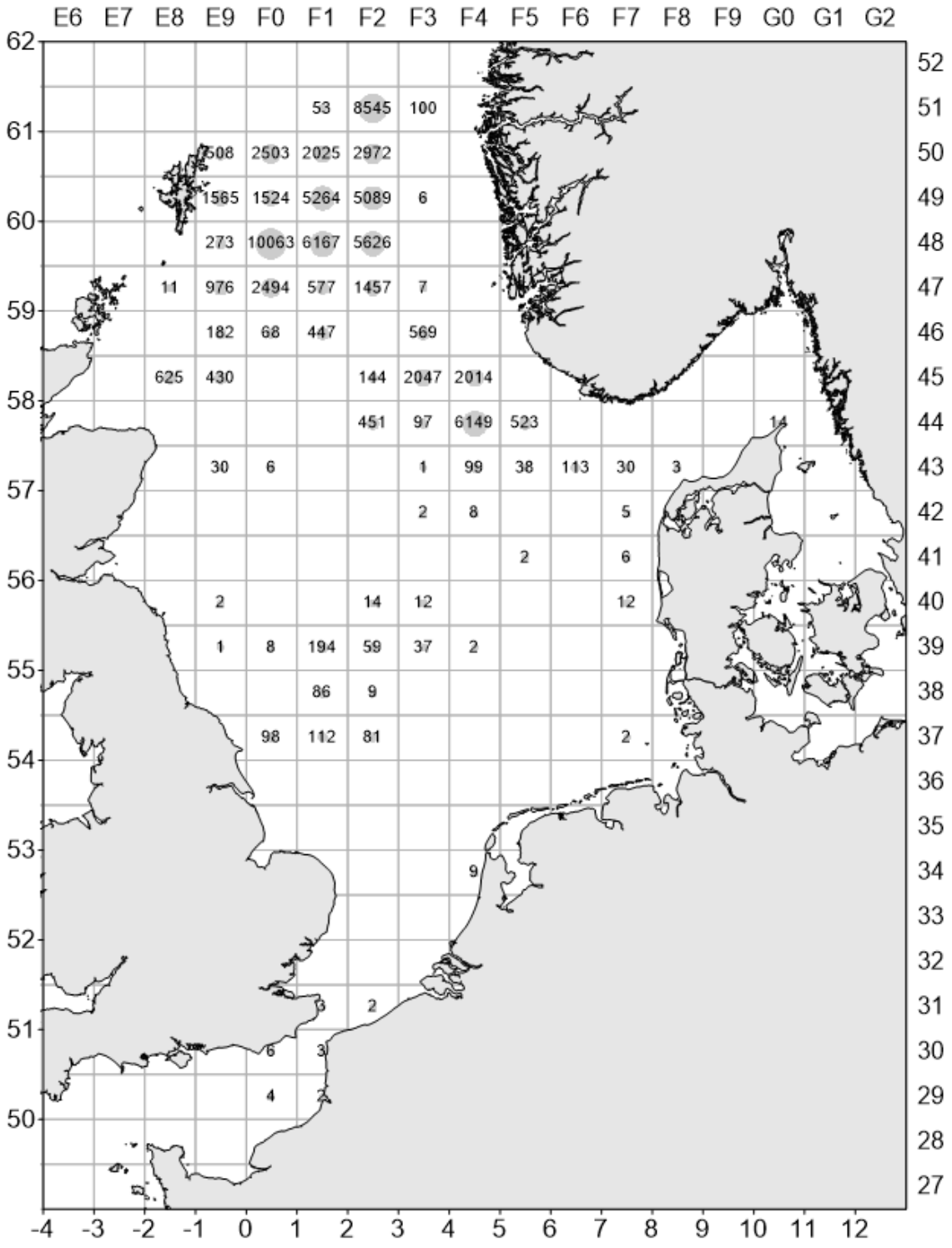


Figure 2.1.1b. Herring catches in the North Sea in the second quarter of 2019 (in tonnes) by statistical rectangle.

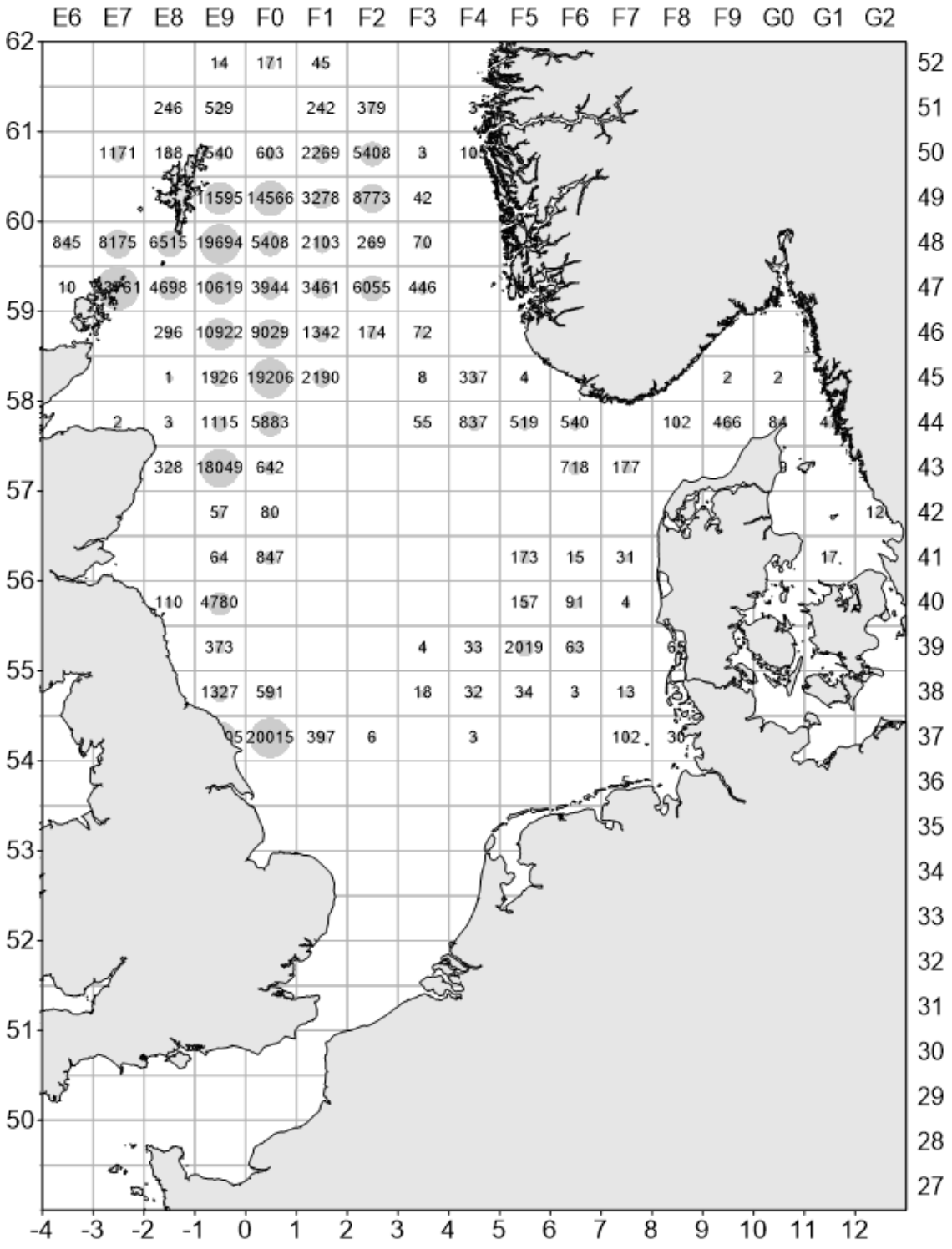


Figure 2.1.1c. Herring catches in the North Sea in the 3rd quarter of 2019 (in tonnes) by statistical rectangle.

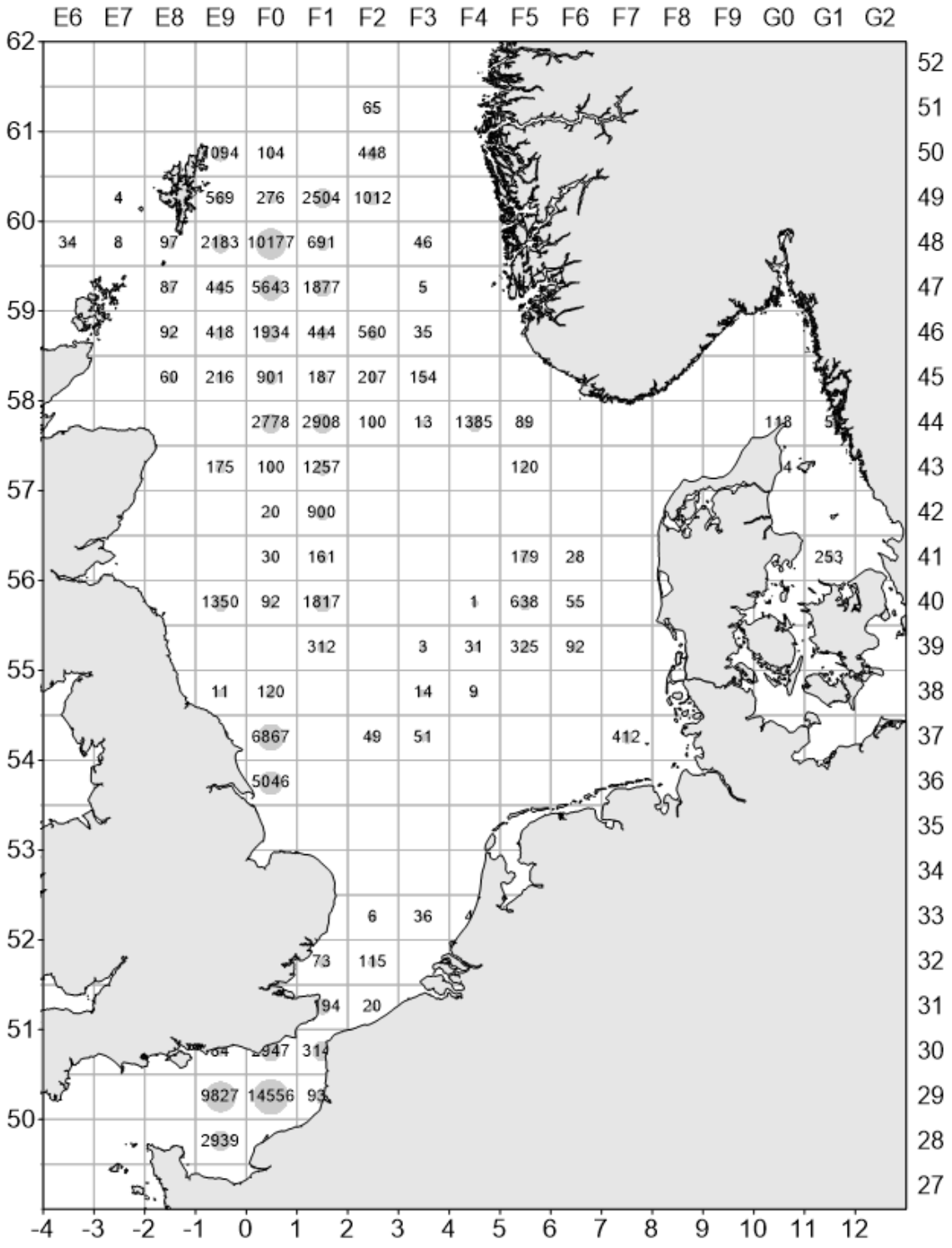


Figure 2.1.1d. Herring catches in the North Sea in the 4th quarter of 2019 (in tonnes) by statistical rectangle.

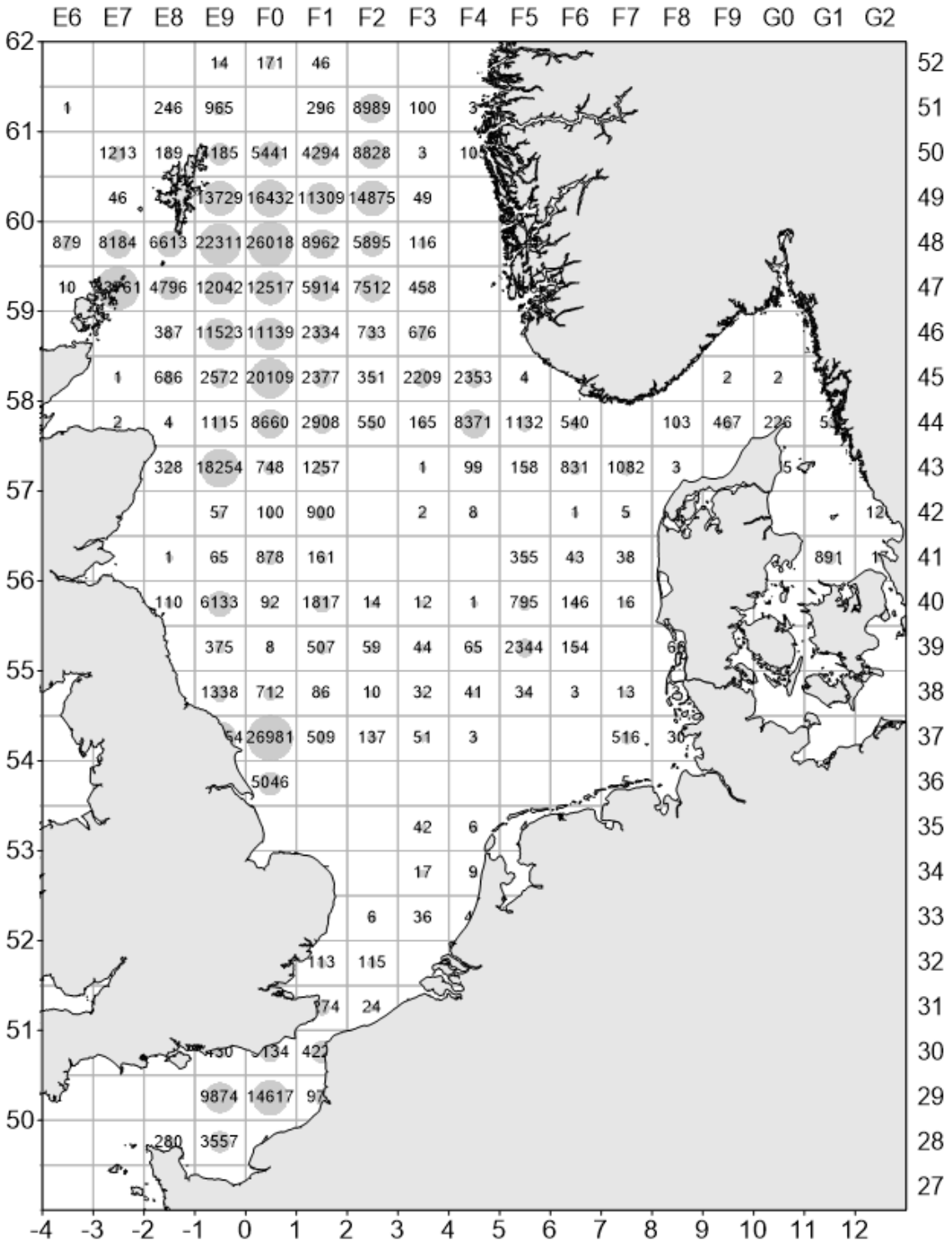
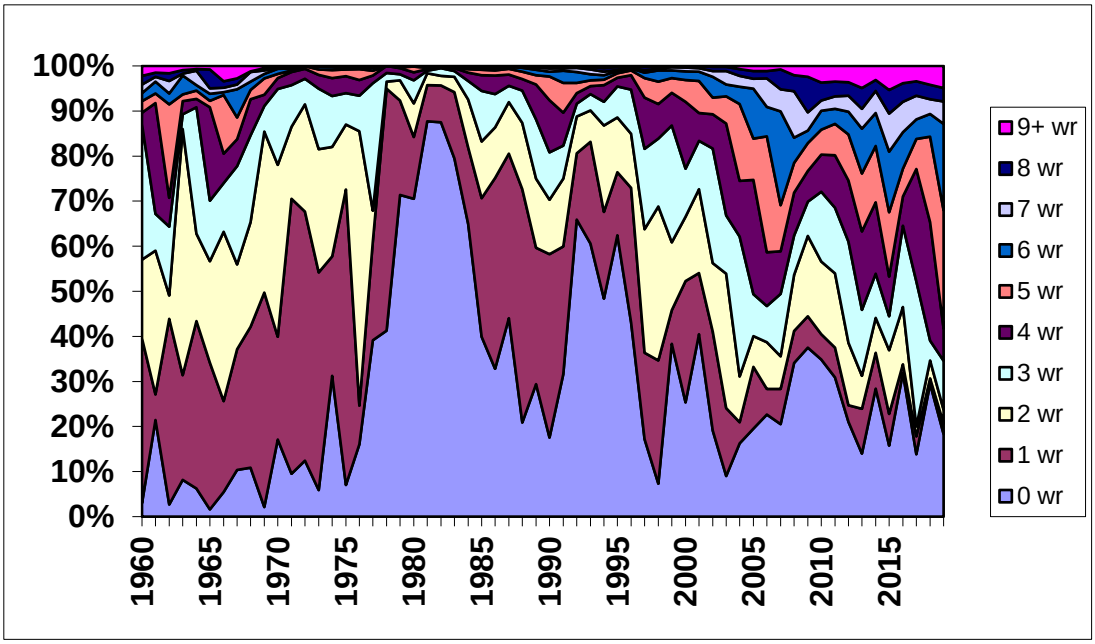


Figure 2.1.1e. Herring catches in the North Sea in all quarters of 2019 (in tonnes) by statistical rectangle.



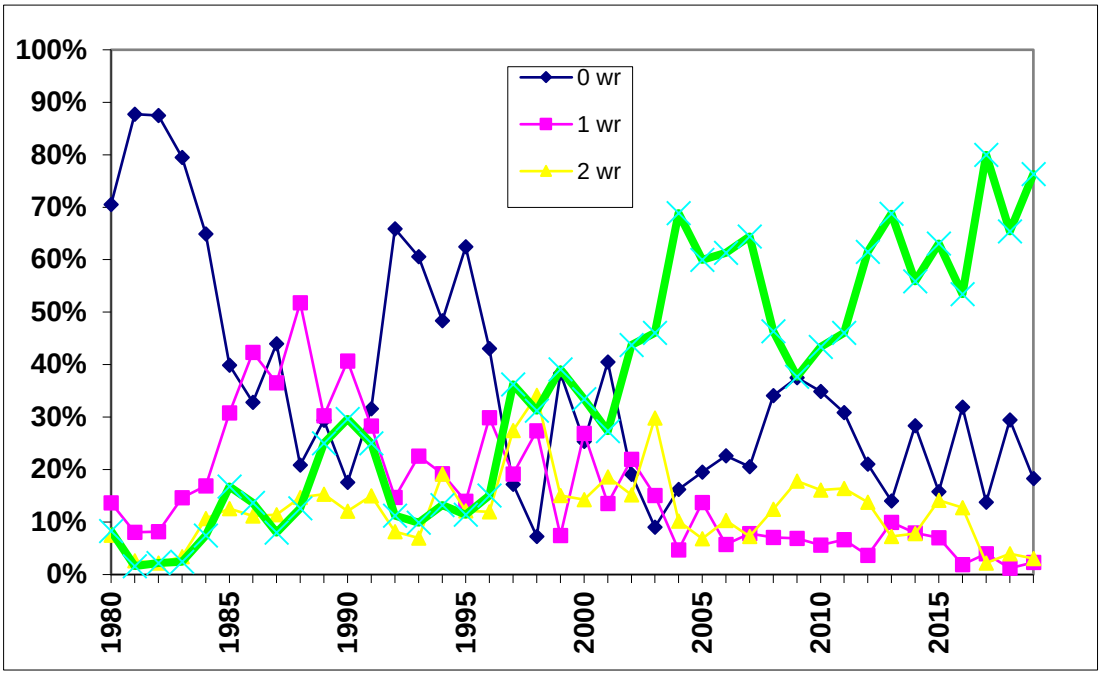


Figure 2.2.1. Proportions of age groups (numbers) in the total catch of herring caught in the North Sea (upper, 1960–2019, and lower panel, 1980–2019).

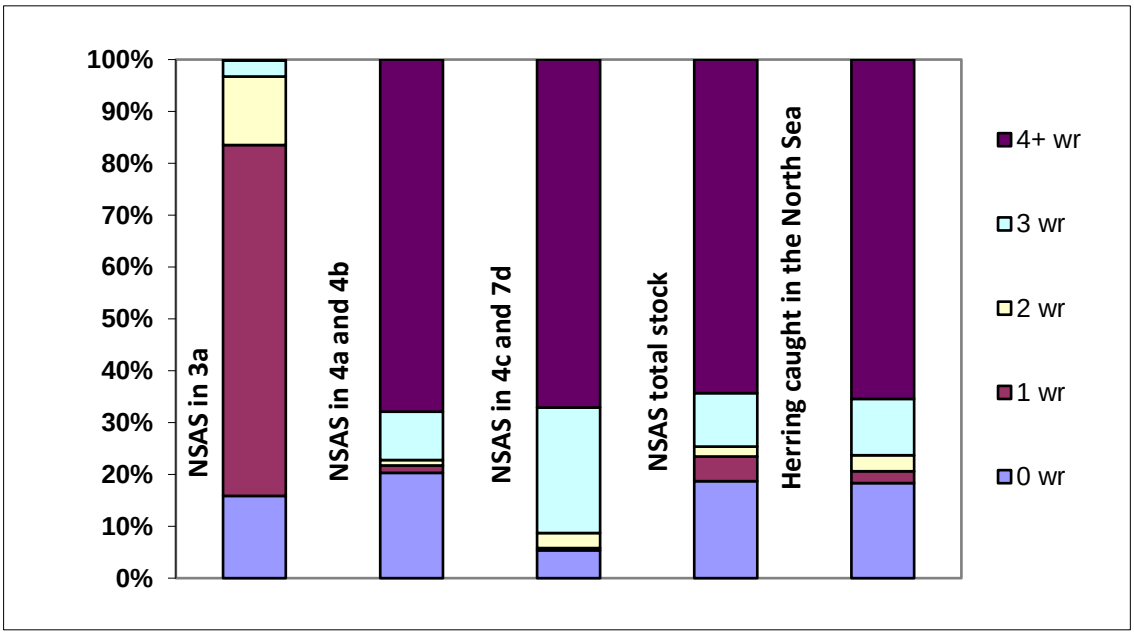


Figure 2.2.2. Proportion of age groups (numbers) in the total catch of NSAS and herring caught in the North Sea in 2019.

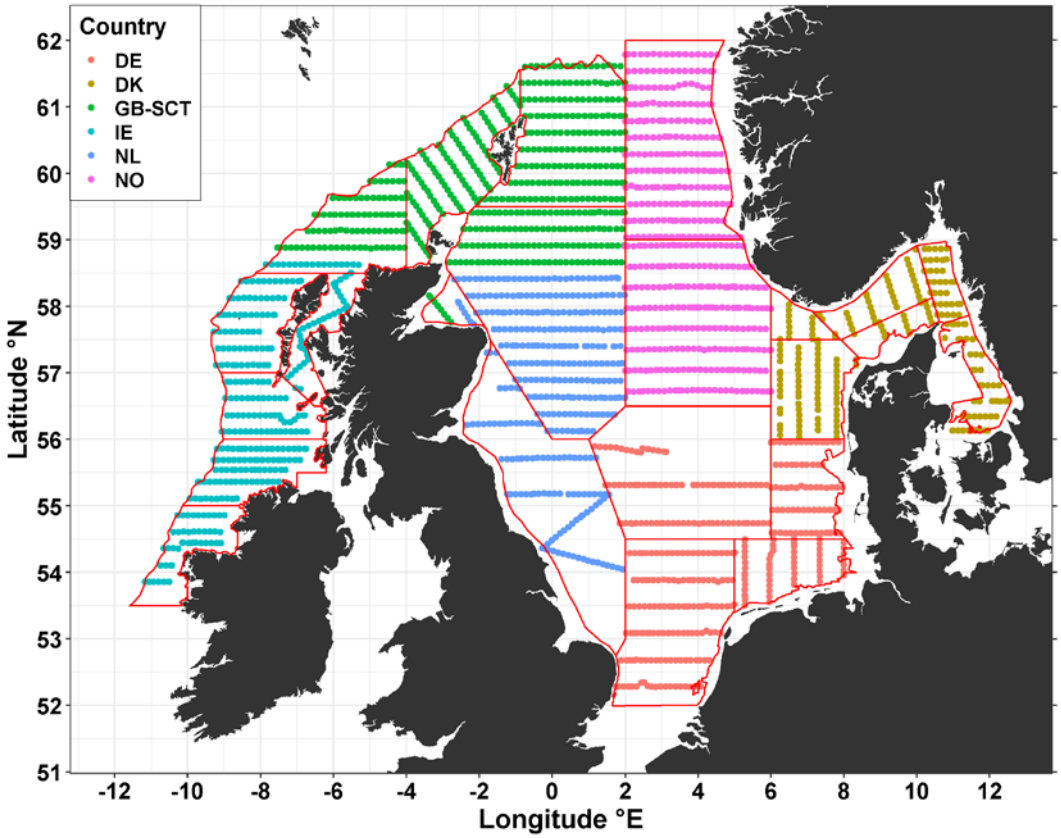


Figure 2.3.1.1. Cruise tracks and survey area coverage in the HERAS acoustic surveys in 2019 by nation.

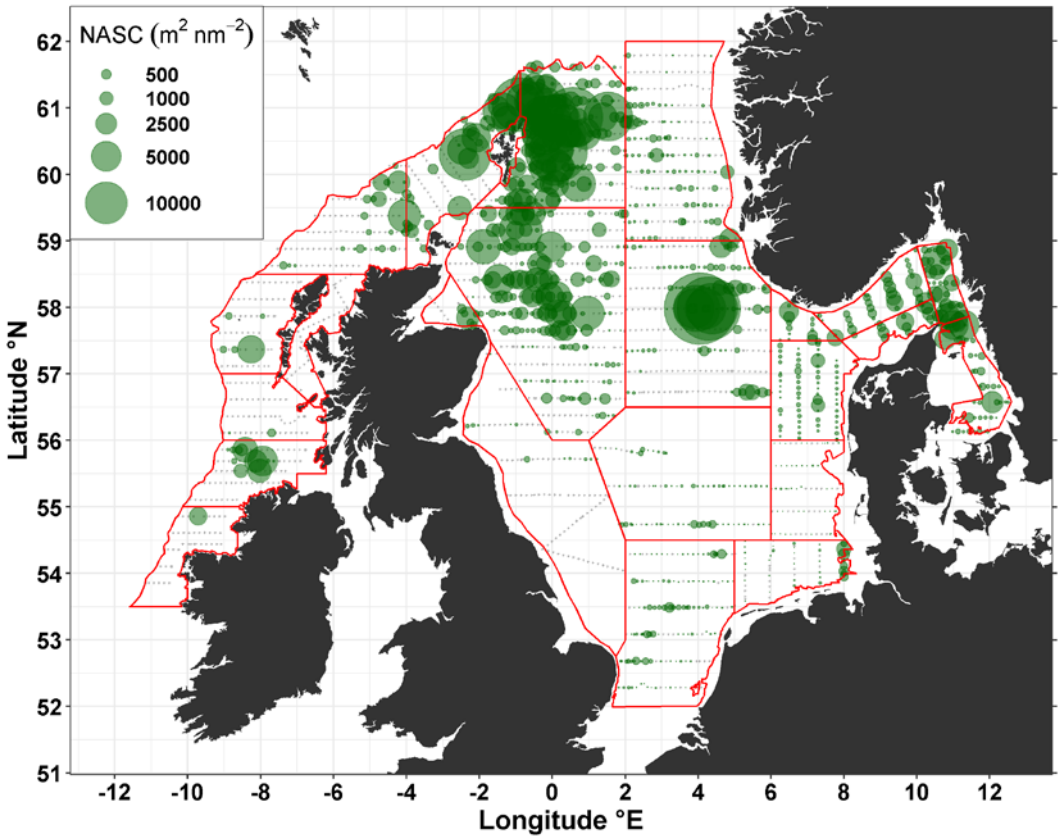


Figure 2.3.1.2. Distribution of NASC attributed to herring in HERAS in 2019. Acoustic intervals represented by light grey dot with green circles representing size and location of herring aggregations. NASC values are resampled at 5 nmi intervals along the cruise track. The red lines show the strata system.

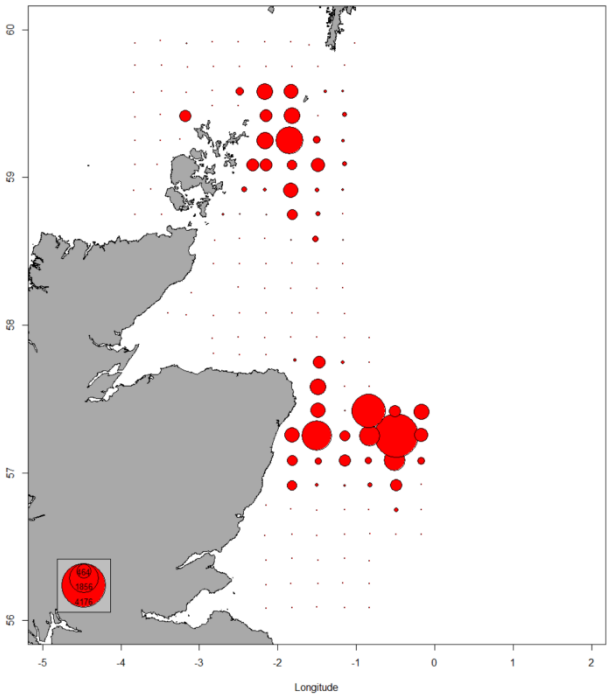


Figure 2.3.2.1. North Sea herring - Abundance of larvae < 10 mm (n/m²) in the Orkney/Shetlands and Buchan area, first half of September 2019 (maximum circle size = 4176 n/m²).

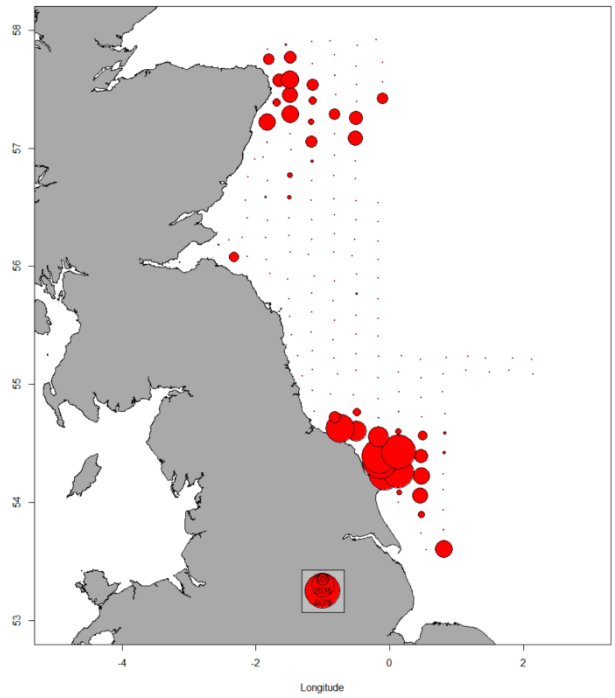


Figure 2.3.2.2: North Sea herring - Abundance of larvae < 10 mm (n/m²) in the Buchan and central North Sea area, second half of September 2019 (maximum circle size = 4579 n/m²).

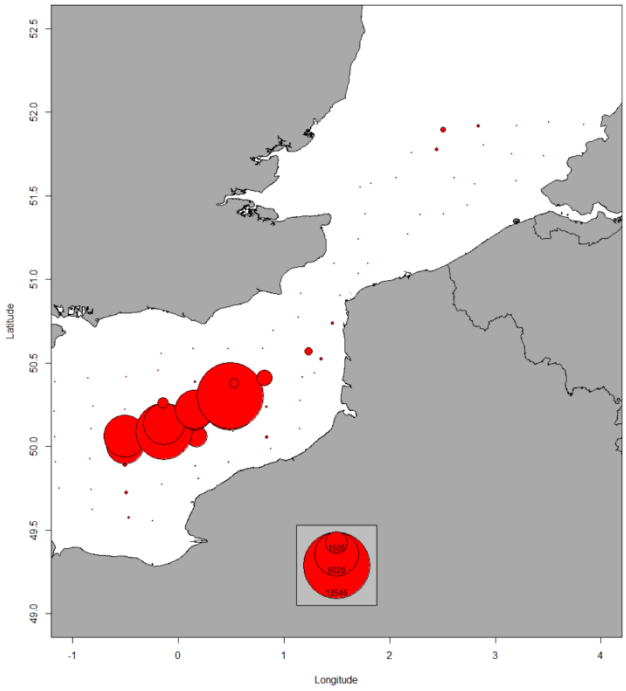


Figure 2.3.2.3. North Sea herring - Abundance of larvae <11 mm (n/m²) in the Southern North Sea and English Channel, second half of December 2019 (maximum circle size = 13 546 n/m²).

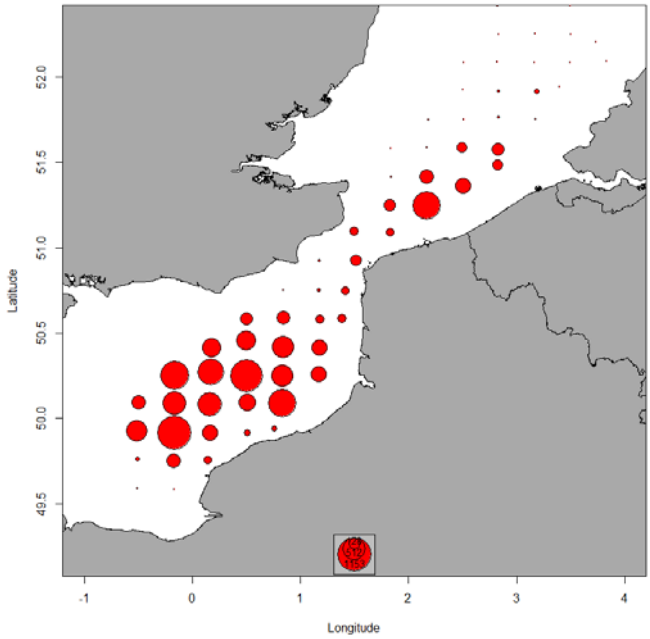


Figure 2.3.2.3. North Sea herring - Abundance of larvae <11 mm (n/m²) in the Southern North Sea and English Channel, first half of January 2020 (maximum circle size = 1153 n/m²).

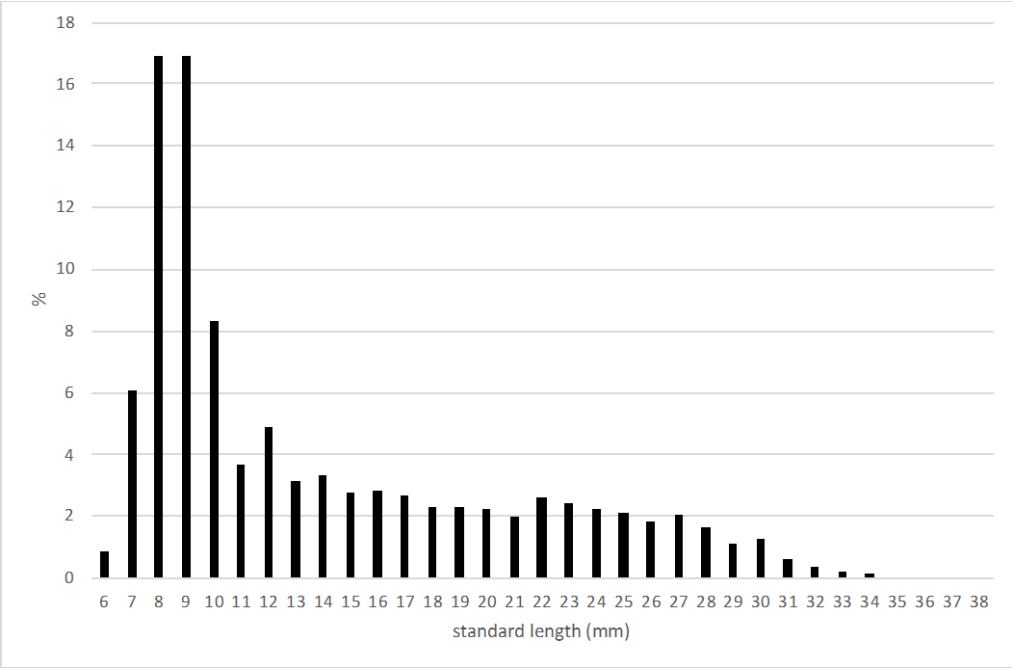


Figure 2.3.3.1. North Sea herring. Length distribution of all herring larvae caught during the 2020 Q1 IBTS.

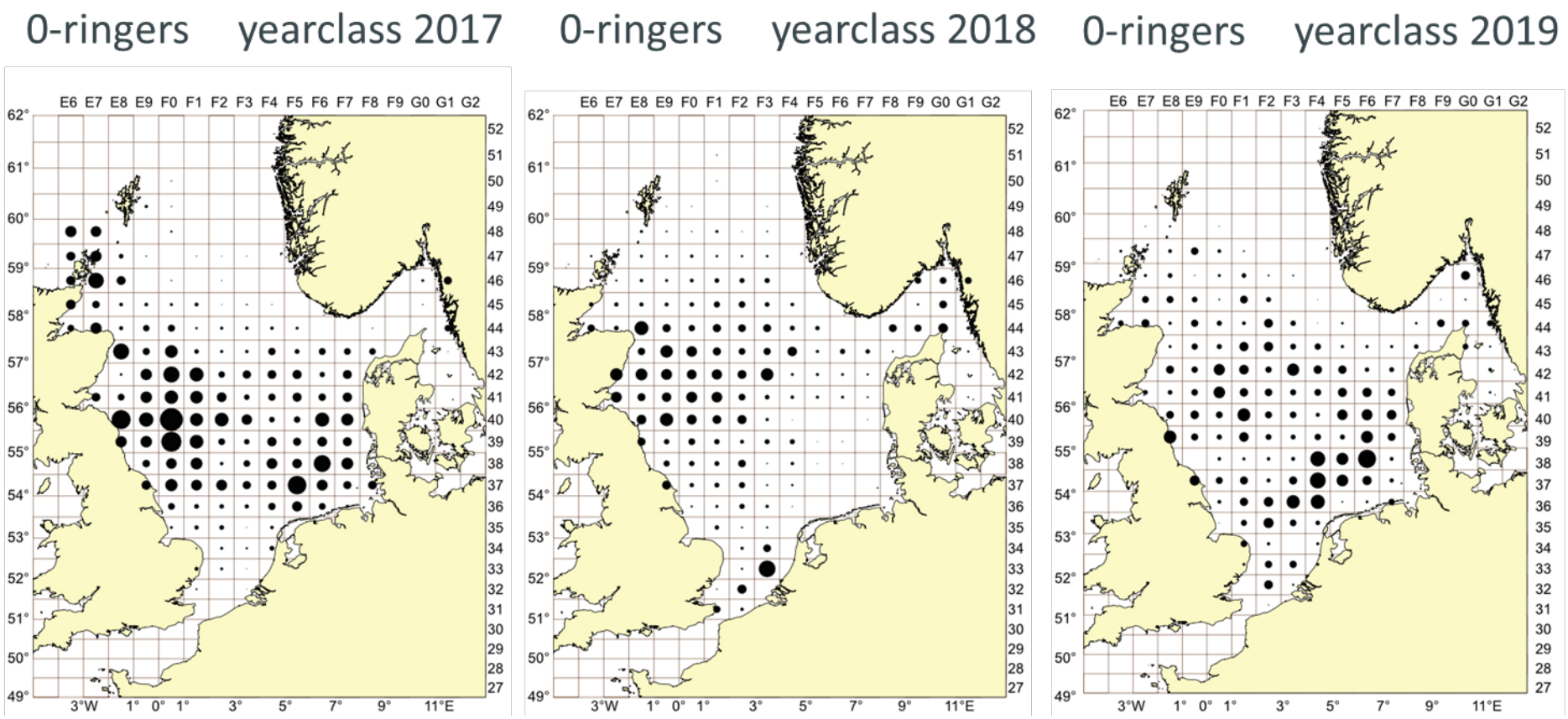


Figure 2.3.3.2. North Sea herring. Distribution of 0-ringer herring, year classes 2017–2019. Density estimates of 0-ringers within each statistical rectangle are based on MIK catches during IBTS in January/February 2018–2020. Areas of filled circles illustrate densities in no m^{-2}, the area of the largest circle represents a density of 1.83 m^{-2}. All circles are scaled to the same order of magnitude of the square root transformed densities.

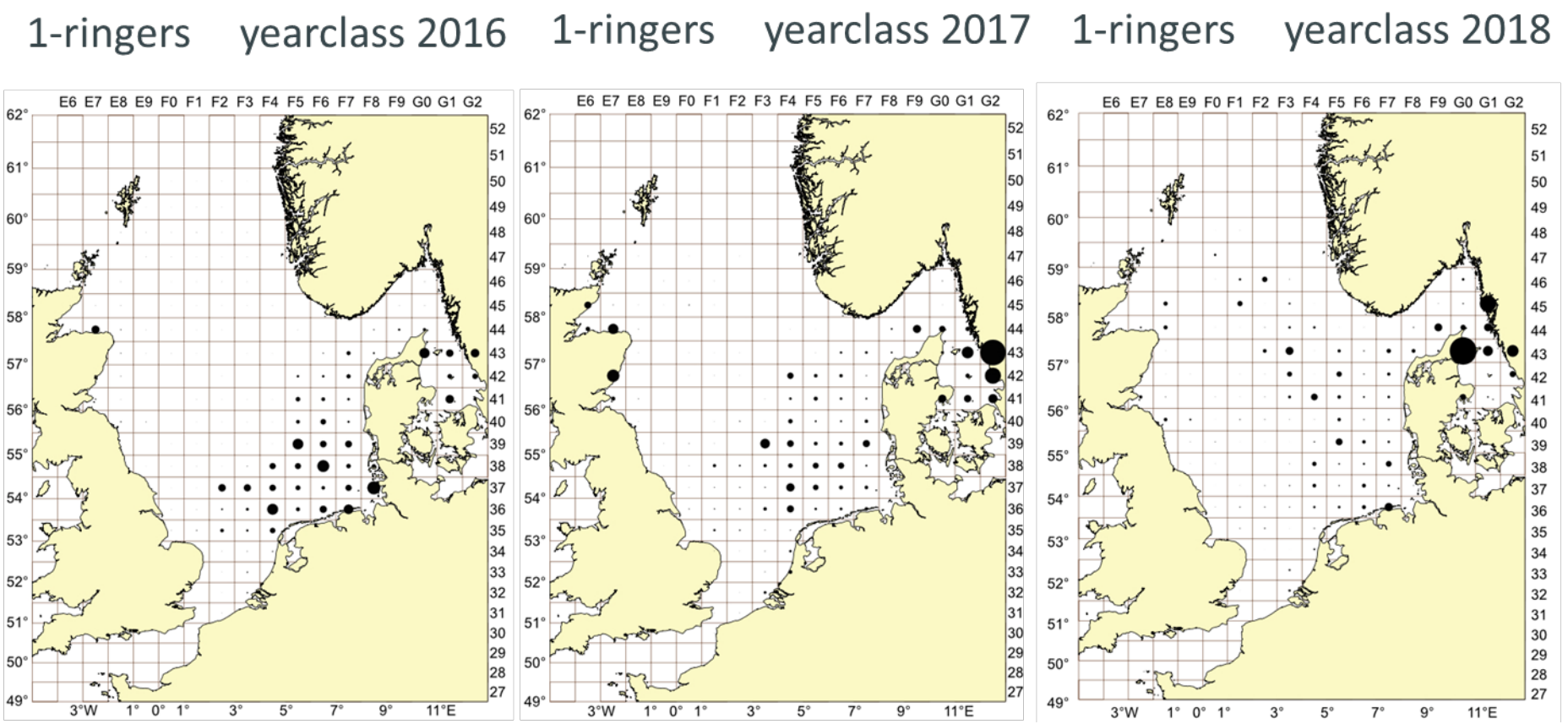


Figure 2.3.3.3. North Sea herring. Distribution of 1-ringer herring, year classes 2016–2018. Density estimates of 1-ringers within each statistical rectangle are based on GOV catches during IBTS in January/February 2018–2020. Areas of filled circles illustrate numbers per hour, scaled proportionally to the square root transformed CPUE data, the area of the largest circle extending across the boundary of a rectangle represents 99 136 h^{-1}.

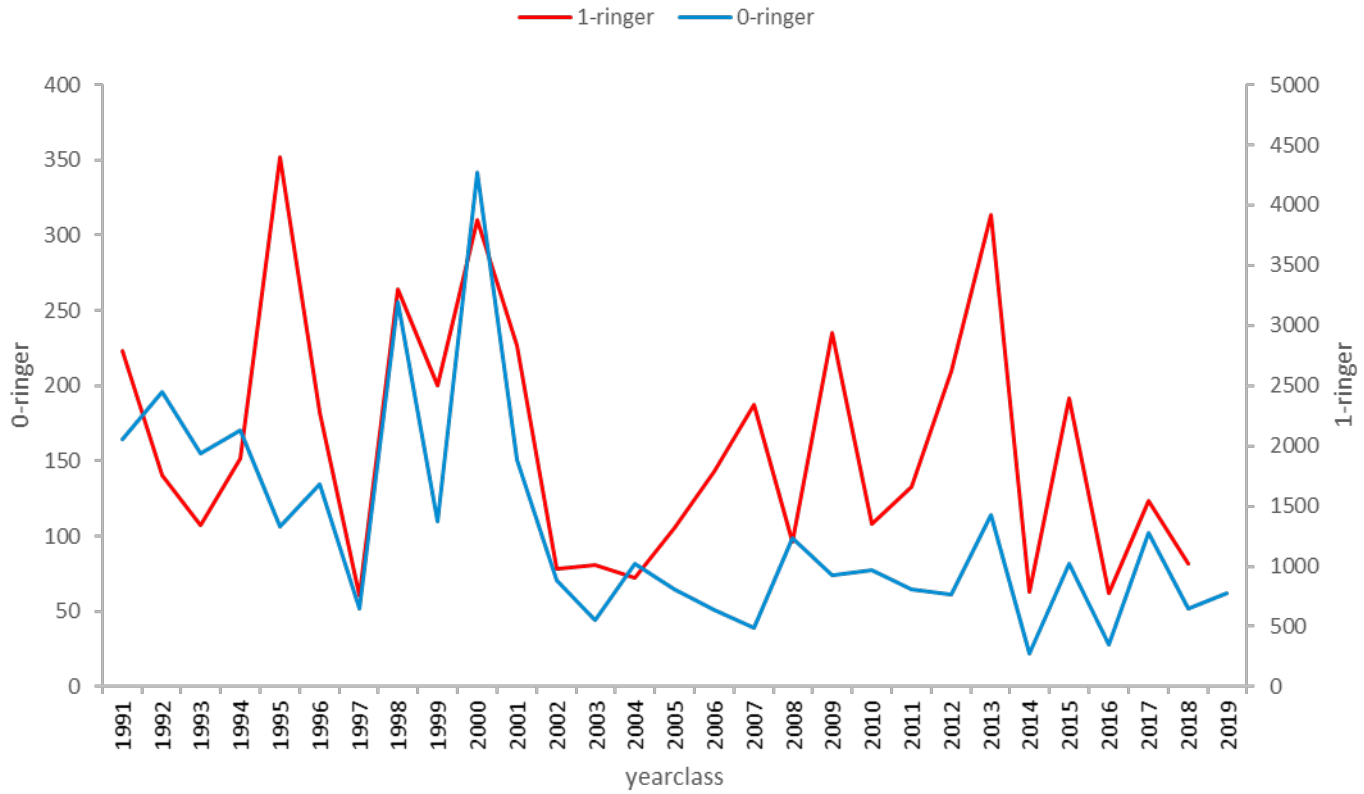
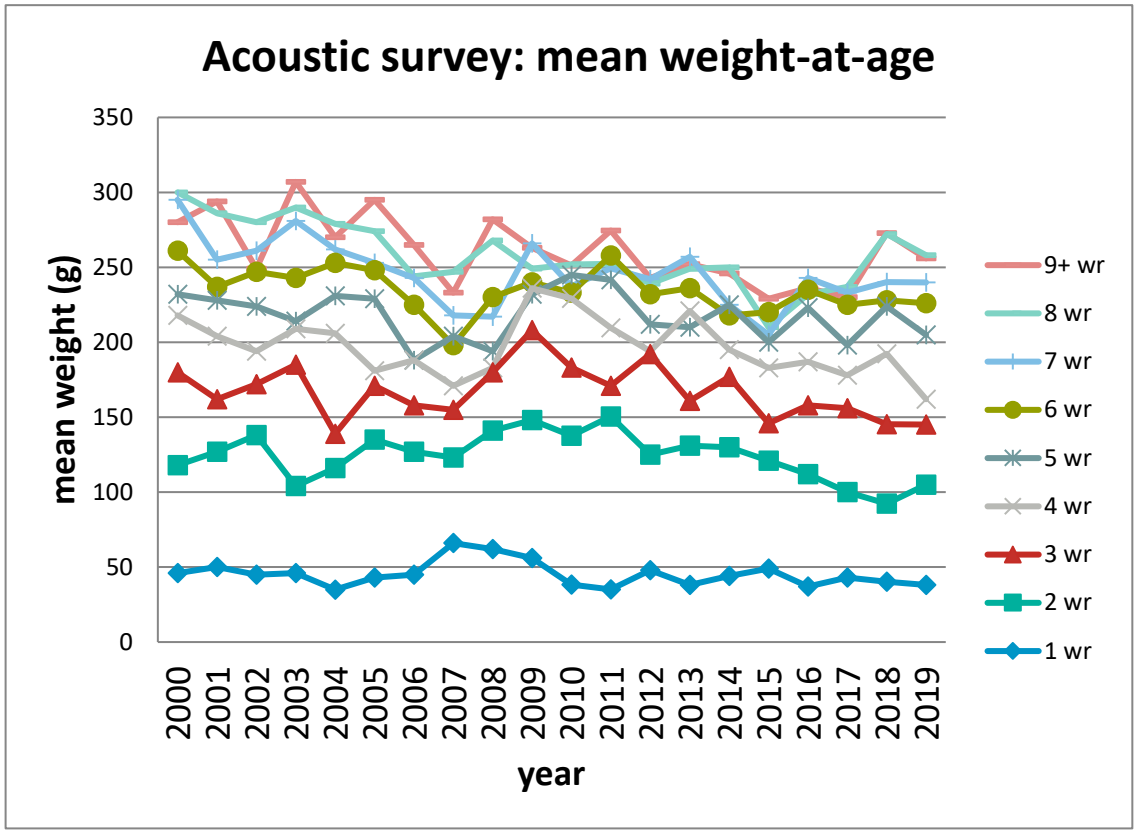


Figure 2.3.3.4. North Sea herring. Time-series of 0-ringer, and 1-ringer indices (red). Year classes 1991 to 2019 for 0-ringers, year classes 1991–2018 for 1-ringers. The new 0-ringer index only covers the 1991–2019 year classes


Acoustic survey: mean weight-at-age
mean weight (g)
0
50
100
150
200
250
300
350
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
year
9+ wr
8 wr
7 wr
6 wr
5 wr
4 wr
3 wr
2 wr
1 wr

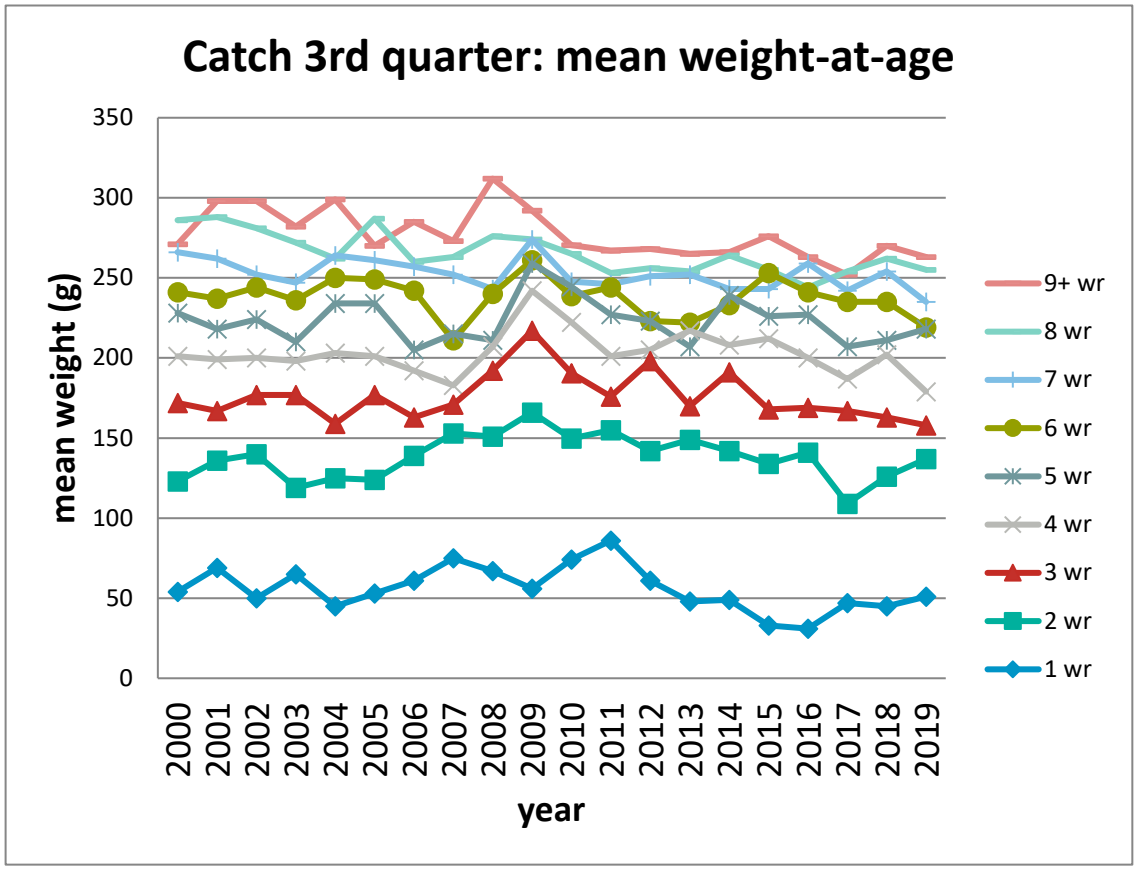

Catch 3rd quarter: mean weight-at-age
mean weight (g)
0
50
100
150
200
250
300
350
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
year
9+ wr
8 wr
7 wr
6 wr
5 wr
4 wr
3 wr
2 wr
1 wr

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.

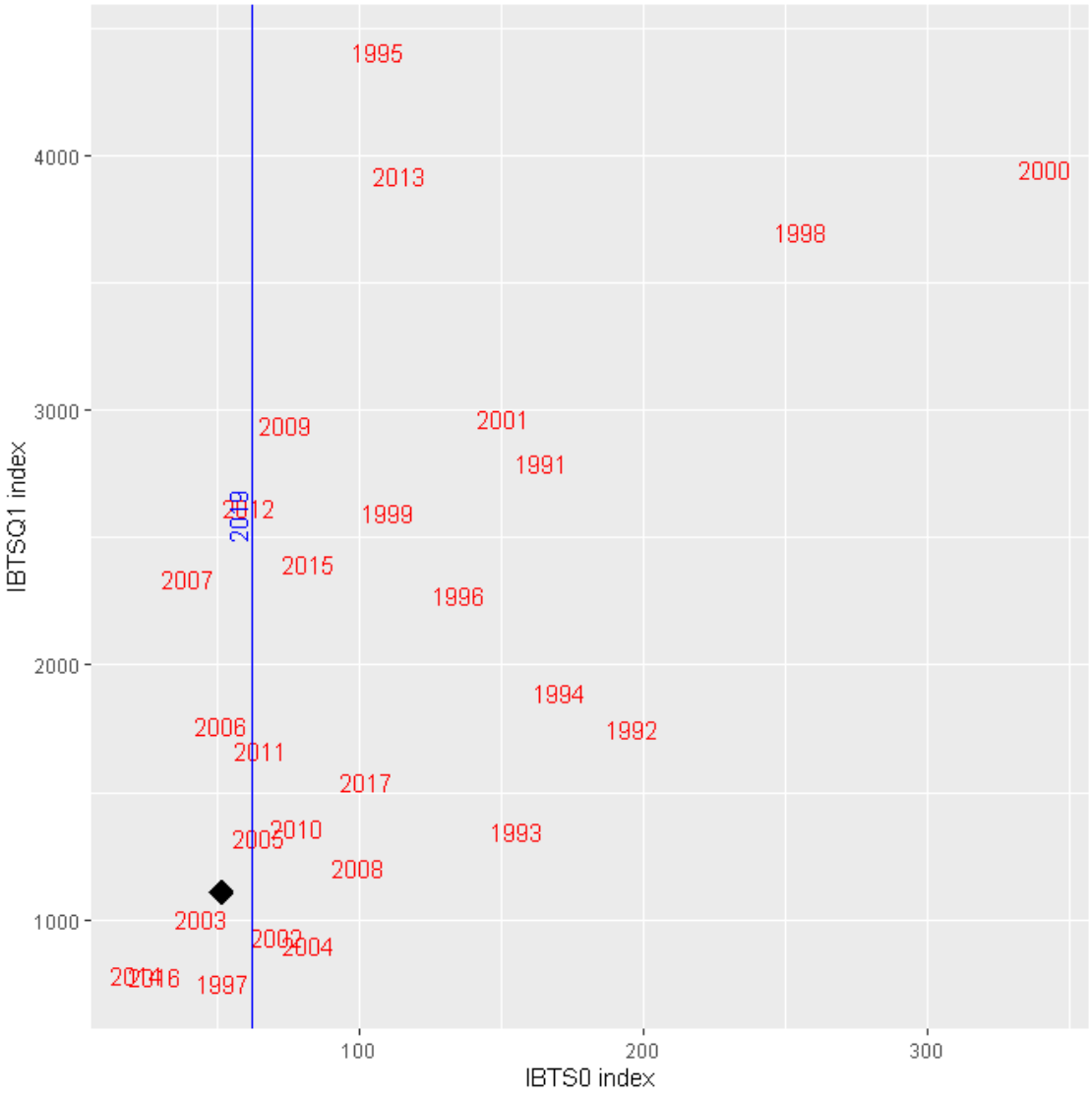


Figure 2.5.1.1 North Sea herring. Relationship between indices of 0-ringers (IBTS0) and 1-ringers (IBTS-Q1 age 1) for year classes 1991 to 2019. The diamond marker is the data point for 2018. The solid blue vertical line is where the 2019 data point will fall.

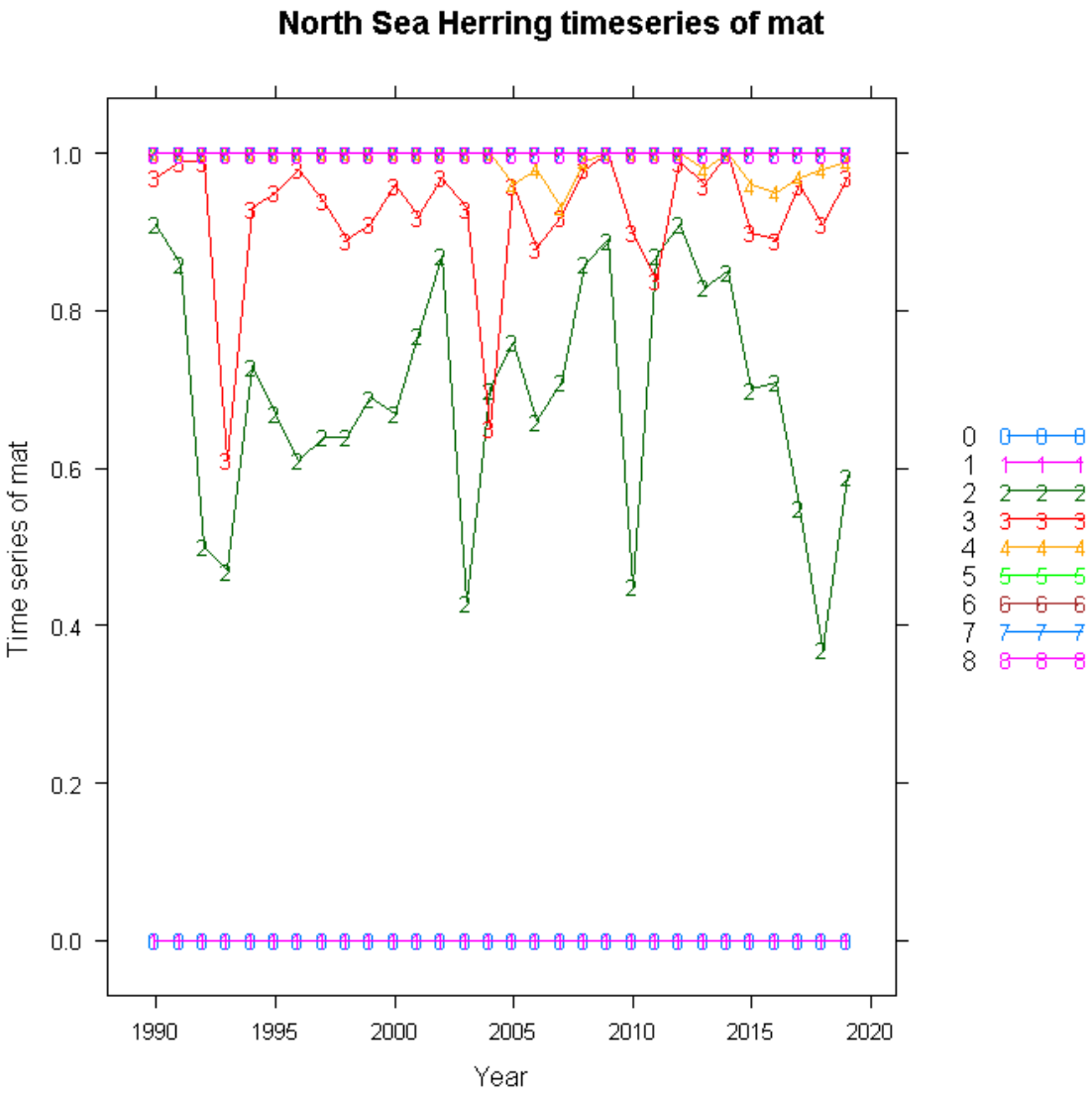


Figure 2.6.1.1. North Sea Herring. Time-series of proportion mature at ages 0 to 8+ as used in the North Sea herring assessment.

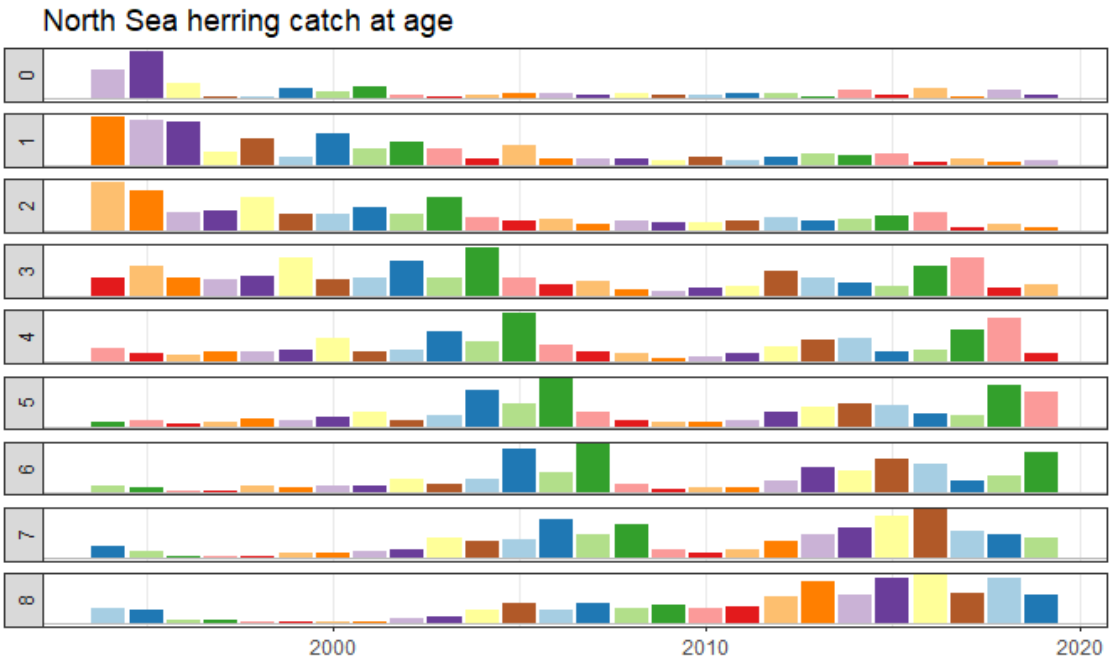


Figure 2.6.1.2. North Sea Herring. Time-series of catch-at-age proportion at ages 0–8+ as used in the North Sea herring assessment. Colours indicate year-classes. All ages are scaled independently and therefore the size of the bars can only be compared within an age.

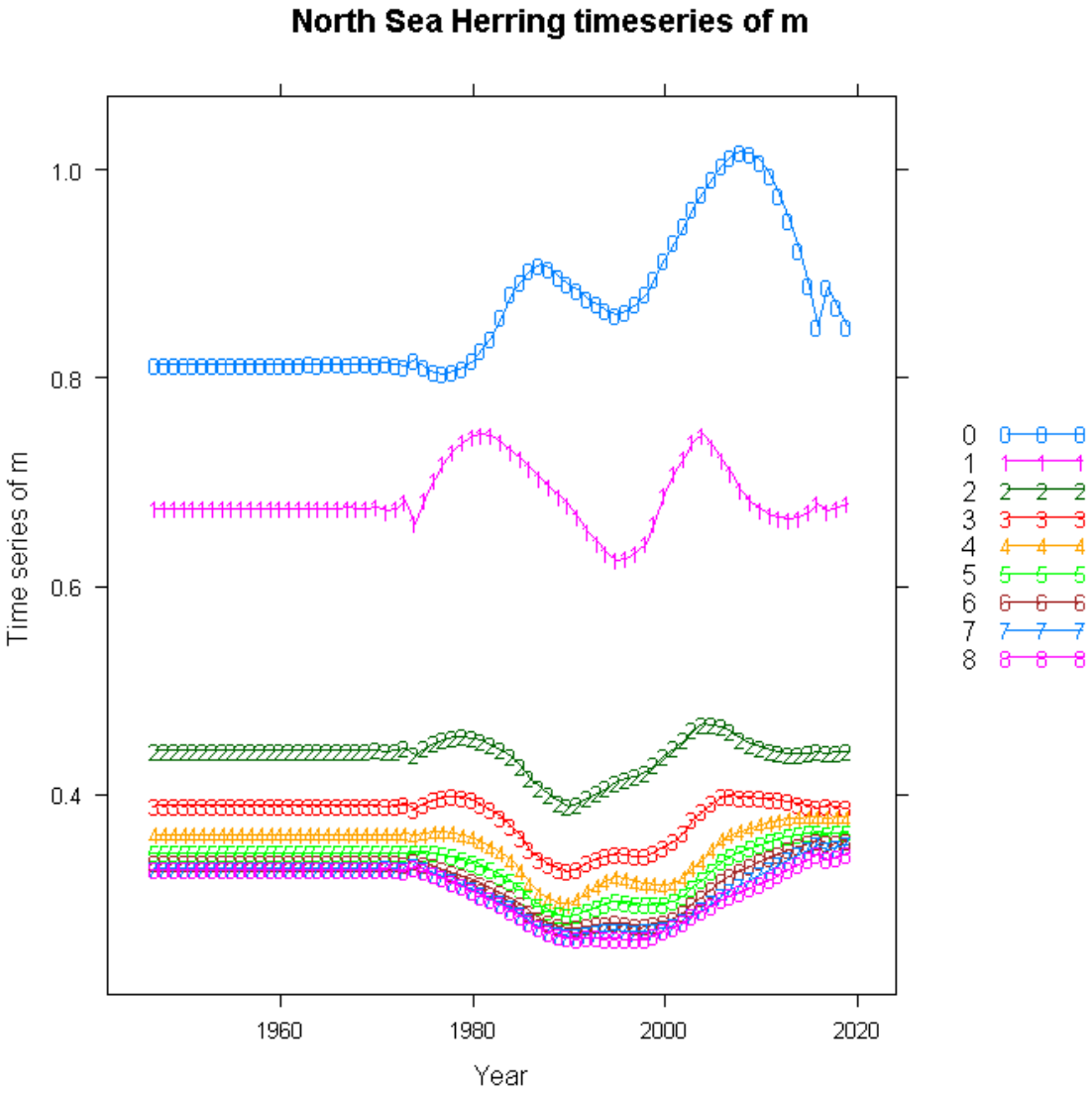


Figure 2.6.1.3. North Sea Herring. Time-series of absolute natural mortality values at age 0–8+ as used in the North Sea herring assessment. Natural mortality values are based on the 2017 North Sea key-run (ICES WGSAM, 2018).

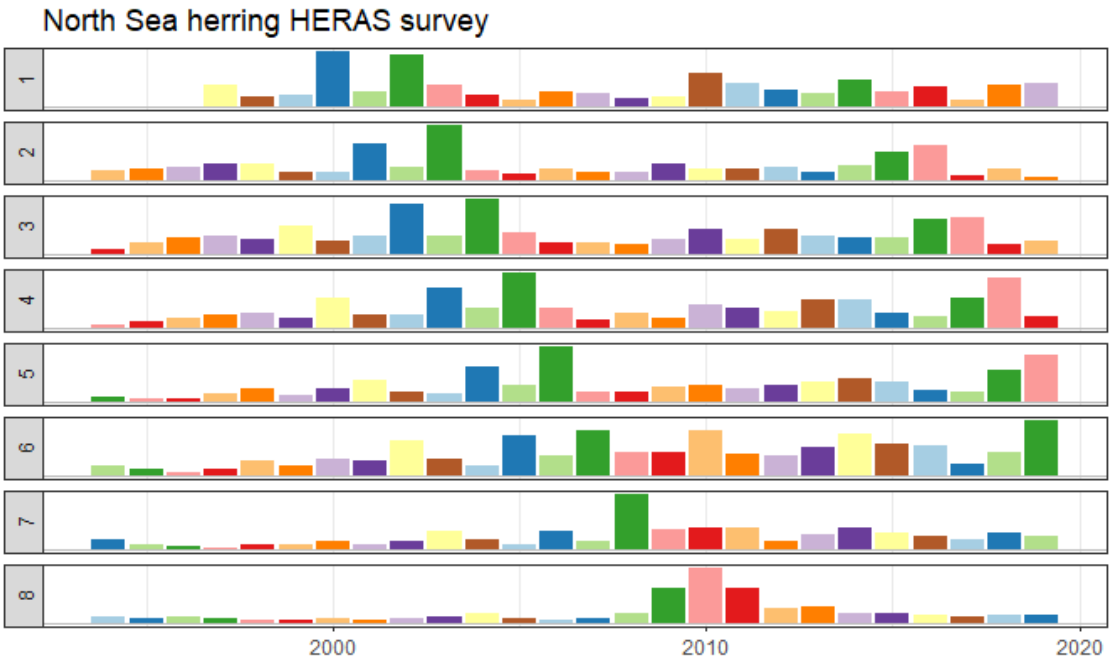


Figure 2.6.1.4. North Sea Herring. Time-series of the HERAS acoustic index by age 1–8+. Colours indicate year classes. All ages are scaled independently and cannot be compared between ages.

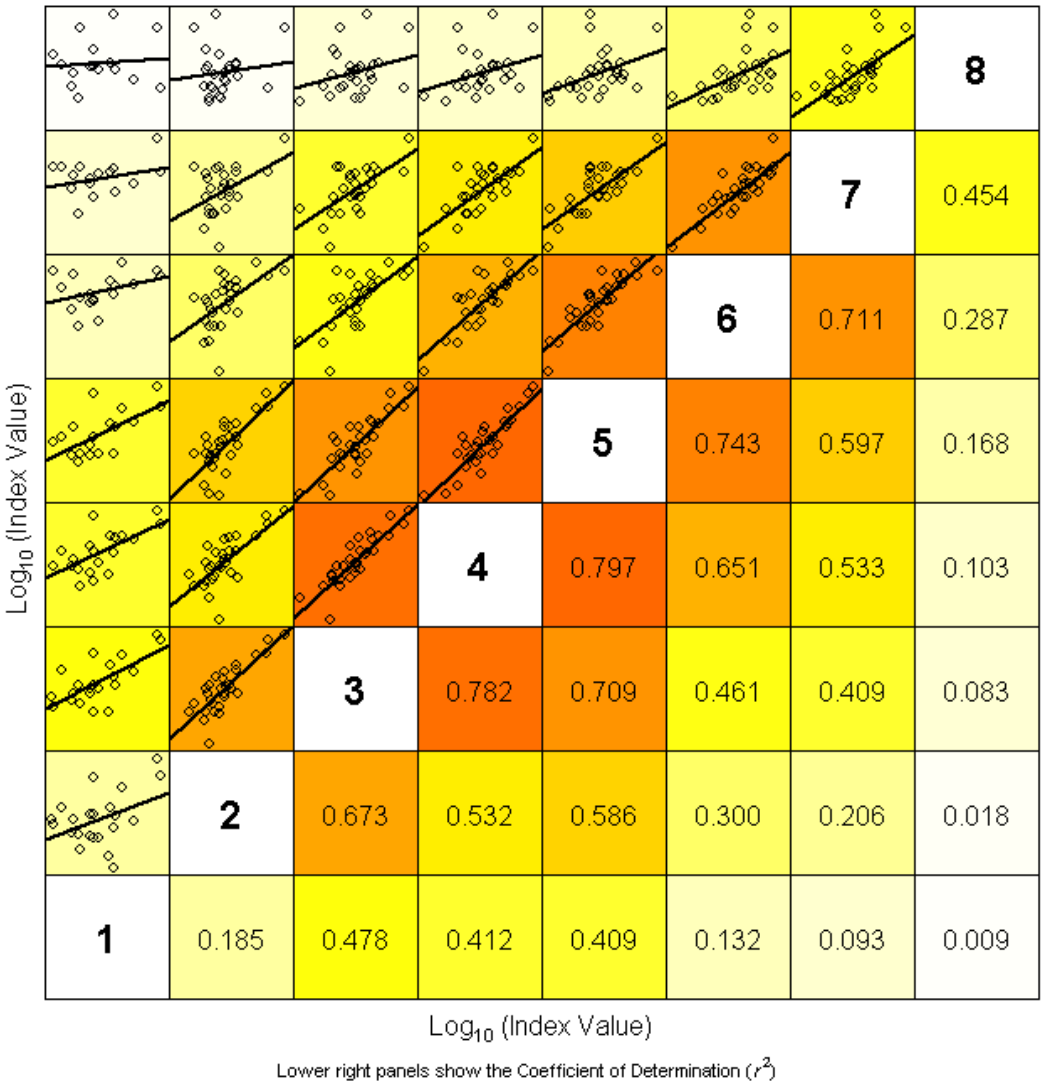


Figure 2.6.1.5. North Sea herring. Internal consistency plot of the acoustic survey (HERAS). Above the diagonal the linear regression is shown including the observations (in points) while under the diagonal the r^2 value that is associated with the linear regression is given.

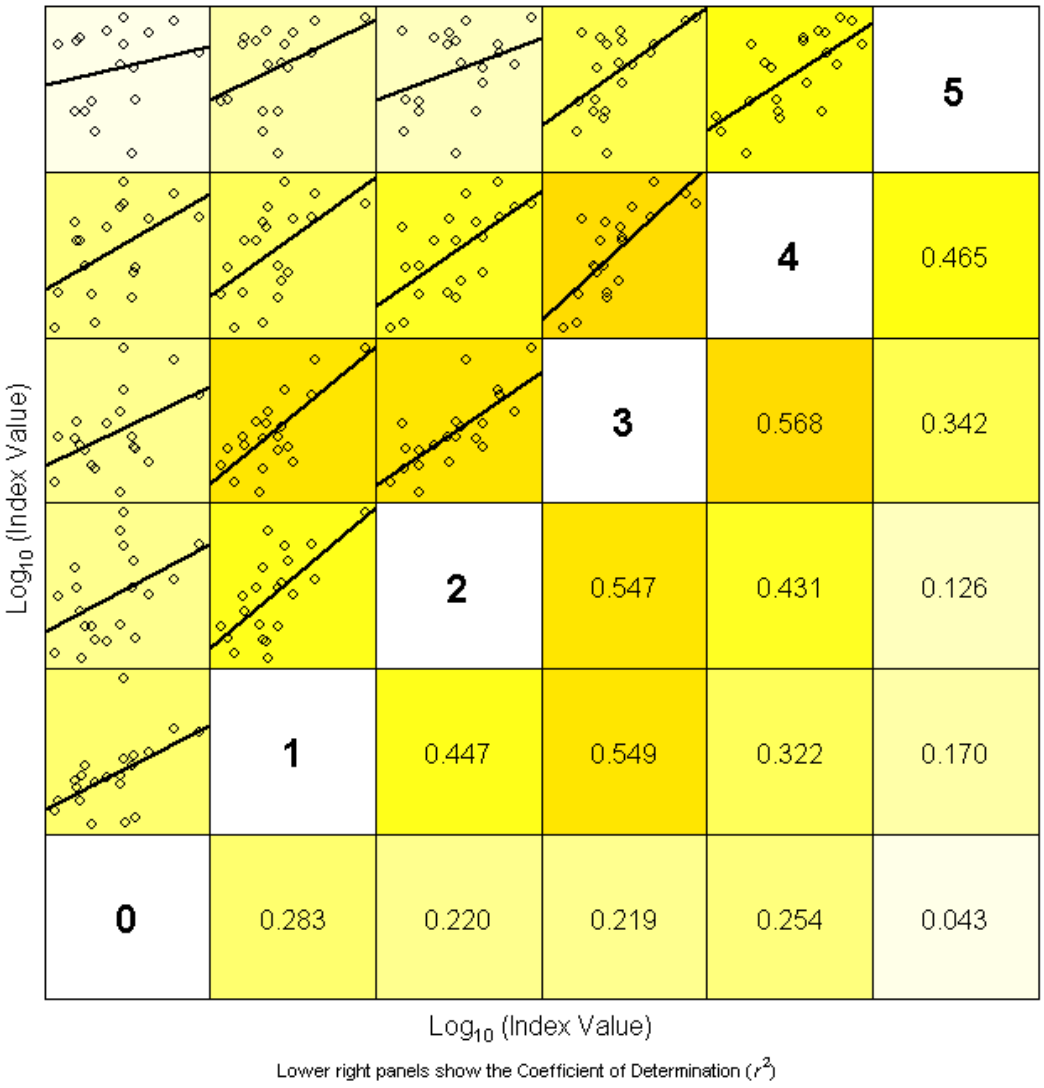


Figure 2.6.1.6. North Sea herring. Internal consistency plot of the IBTS in quarter 3. Above the diagonal the linear regression is shown including the observations (in points) while under the diagonal the r^2 value that is associated with the linear regression is given.

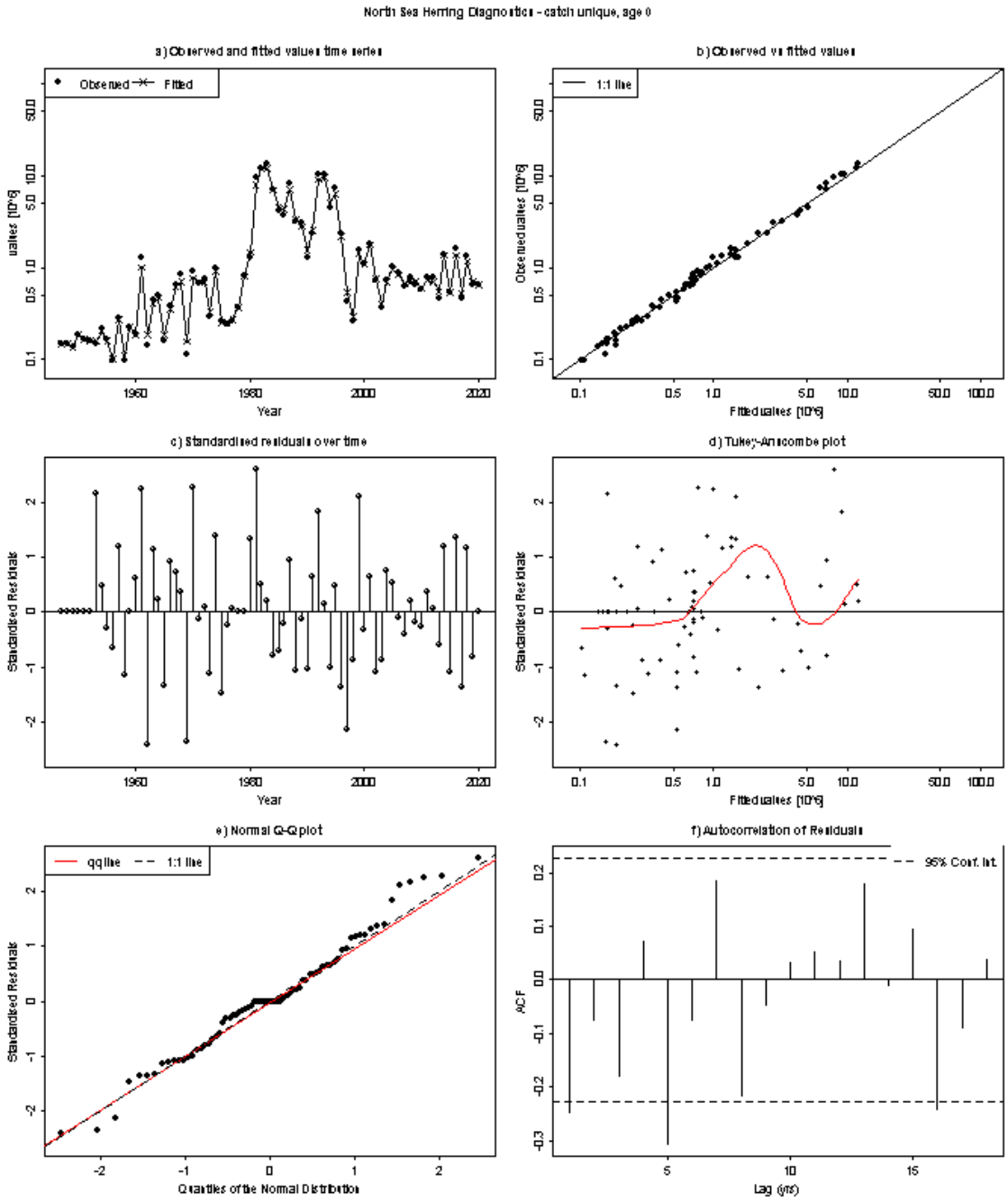
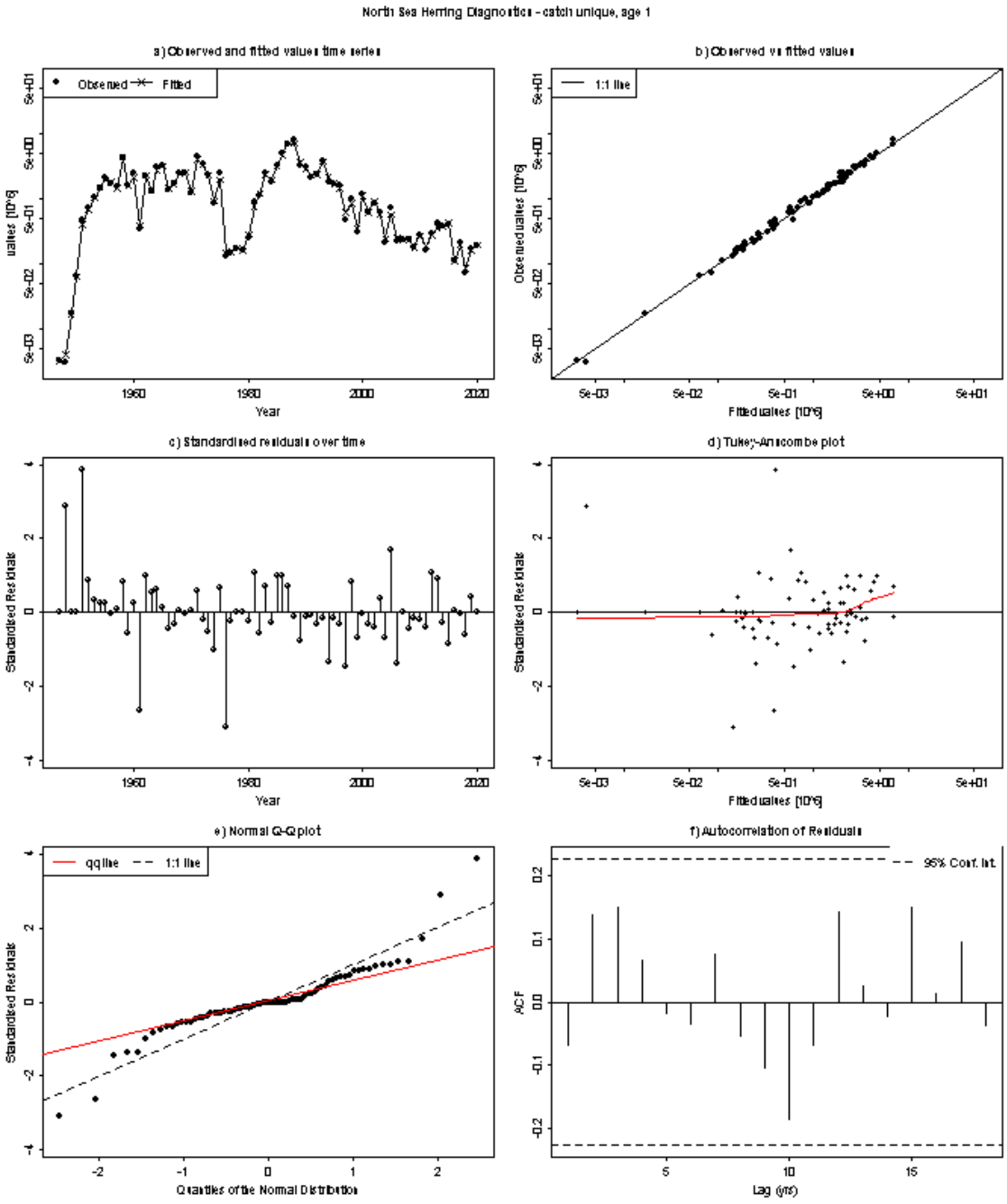


Figure 2.6.1.7 North Sea herring. Diagnostics of the assessment model fit to the catch-at-age 0 time-series. Top left: Estimates of numbers at 0 wr (line) and numbers predicted from catch abundance at 0 wr. Top right: scatterplot of catch observations vs. assessment model estimates of numbers at 0 wr with the best-fit catchability model (linear function). Middle right: catch observation vs. standardized residuals at 0 wr. Middle left: Time-series of standardized residuals of the catch at 0 wr. Bottom left: normal Q-Q plot of standardized residuals. Bottom right: Autocorrelation plot.


North Sea Herring Diagnostics - catch unique, age 1
a) Observed and fitted values time series
Observed
Fitted
Year
b) Observed vs fitted values
1:1 line
Fitted values [log]
c) Standardised residuals over time
Standardised Residuals
Year
d) Tukey-Anscombe plot
Standardised Residuals
Fitted values [log]
e) Normal Q-Q plot
qq line
1:1 line
Standardised Residuals
Quantiles of the Normal Distribution
f) Autocorrelation of Residuals
95% Conf. Int.
ACF
Lag (yrs)

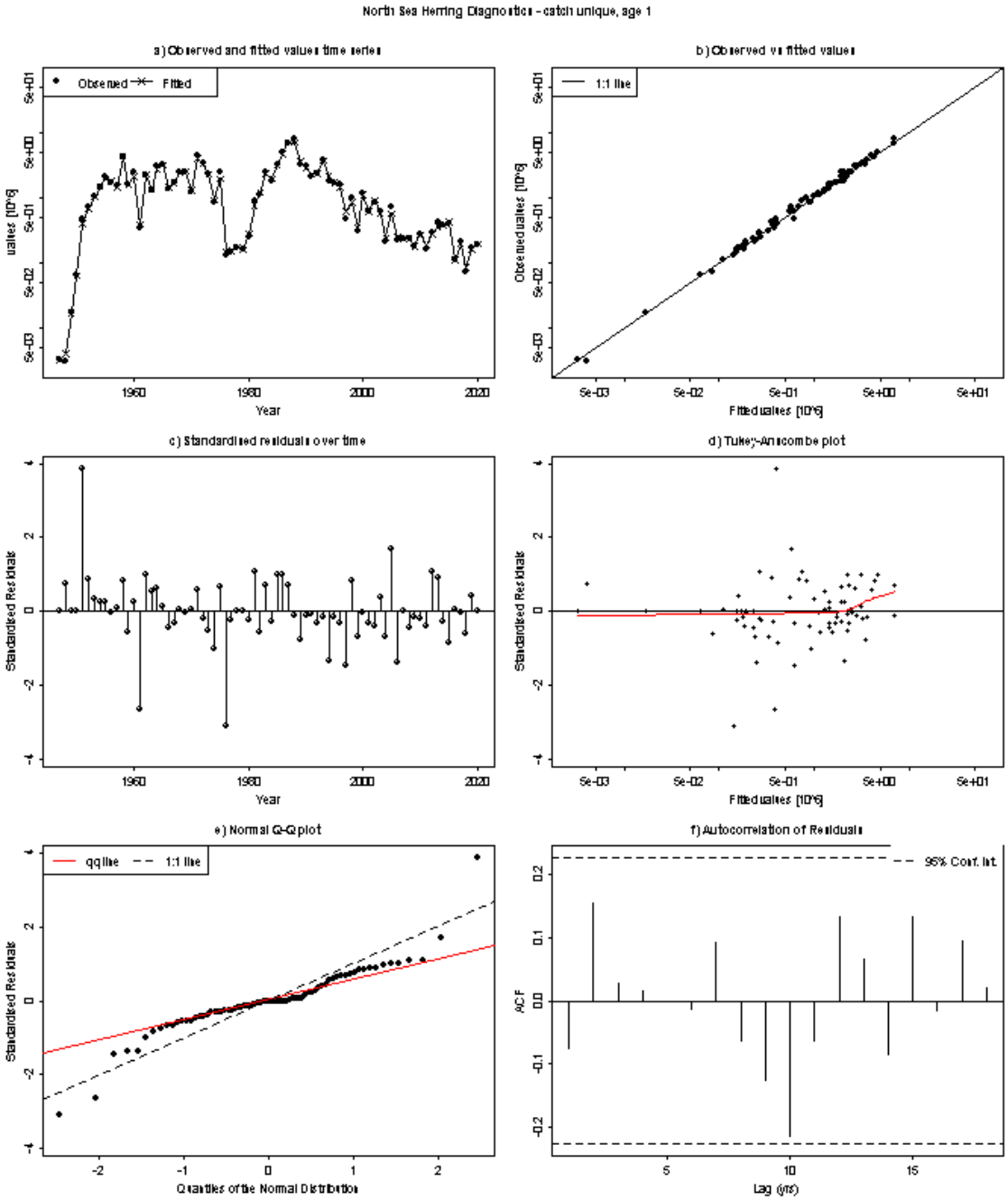
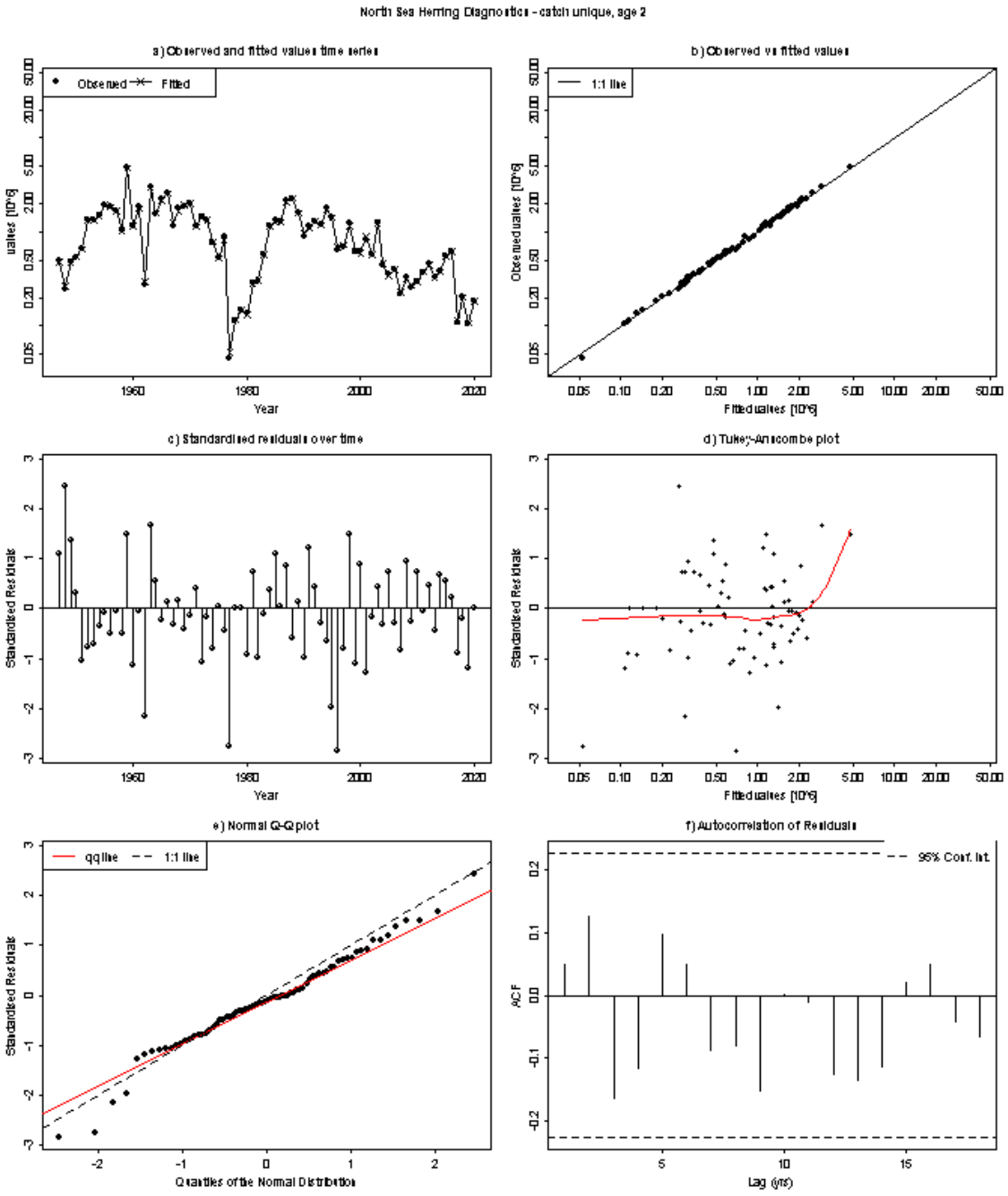


Figure 2.6.1.8. North Sea herring. Diagnostics of the assessment model fit to the catch-at-age 1 time-series. Top left: Estimates of numbers at 1 wr (line) and numbers predicted from catch abundance at 1 wr. Top right: scatterplot of catch observations vs. assessment model estimates of numbers at 1 wr with the best-fit catchability model (linear function). Middle right: catch observation vs. standardized residuals at 1 wr. Middle left: Time-series of standardized residuals of the catch at 1 wr. Bottom left: normal Q-Q plot of standardized residuals. Bottom right: Autocorrelation plot.


North Sea Herring Diagnostics - catch unique, age 2
a) Observed and fitted values time series
Observed
Fitted
Year
b) Observed vs fitted values
1:1 line
Fitted values [1000s]
c) Standardised residuals over time
Standardised Residuals
Year
d) Tukey-Anscombe plot
Standardised Residuals
Fitted values [1000s]
e) Normal Q-Q plot
qq line
1:1 line
Standardised Residuals
Quantiles of the Normal Distribution
f) Autocorrelation of Residuals
95% Conf. Int.
ACF
Lag (yrs)

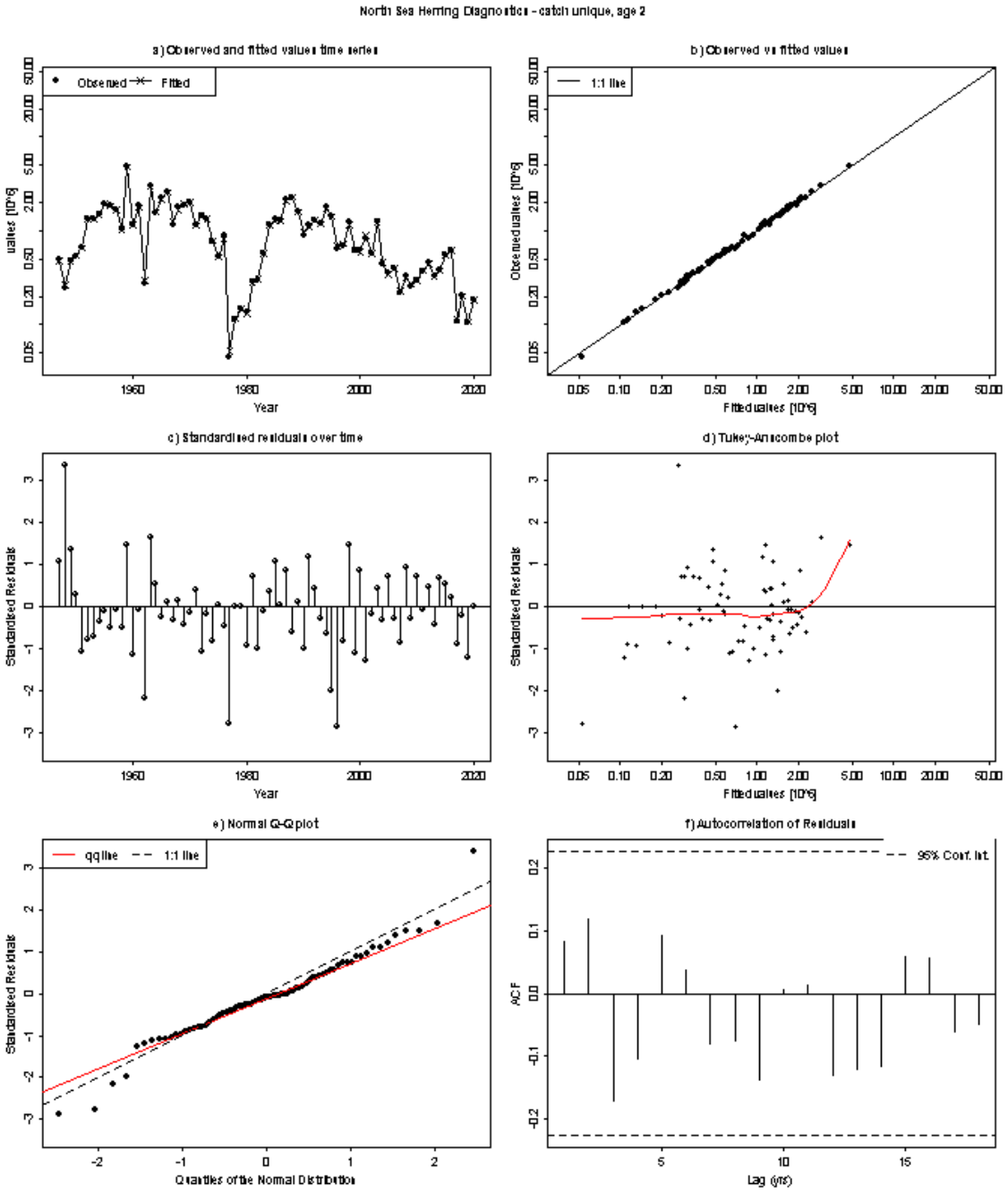
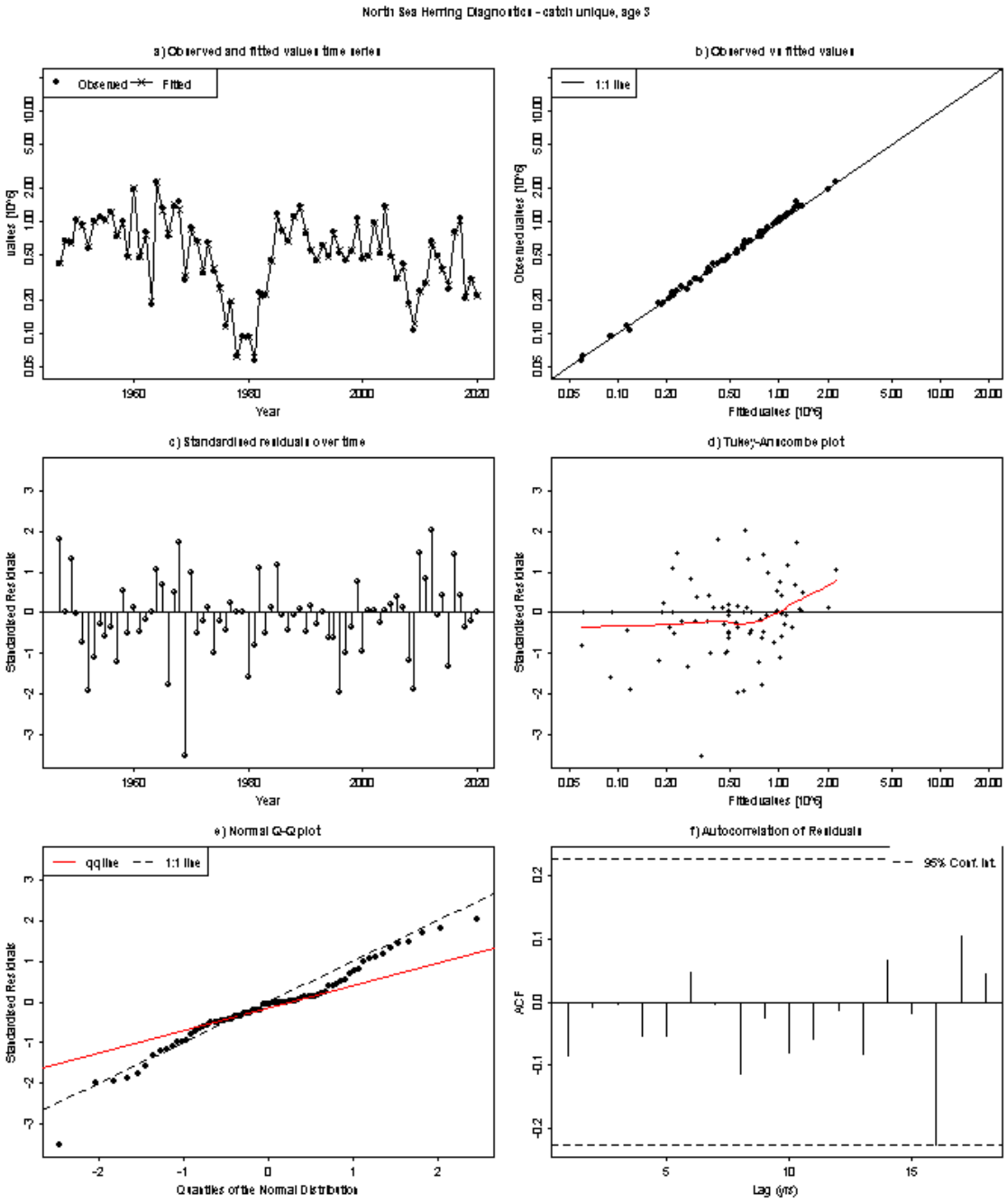


Figure 2.6.1.9. North Sea herring. Diagnostics of the assessment model fit to the catch-at-age 2 time-series. Top left: Estimates of numbers at 2 wr (line) and numbers predicted from catch abundance at 2 wr. Top right: scatterplot of catch observations vs. assessment model estimates of numbers at 2 wr with the best-fit catchability model (linear function). Middle right: catch observation vs. standardized residuals at 2 wr. Middle left: Time-series of standardized residuals of the catch at 2 wr. Bottom left: normal Q-Q plot of standardized residuals. Bottom right: Autocorrelation plot.


North Sea Herring Diagnostics - catch unique, age 3
a) Observed and fitted values time series
Observed
Fitted
Year
b) Observed vs fitted values
1:1 line
Observed values [10^6]
Fitted values [10^6]
c) Standardised residuals over time
Standardised Residuals
Year
d) Tukey-Anscombe plot
Standardised Residuals
Fitted values [10^6]
e) Normal Q-Q plot
qq line
1:1 line
Standardised Residuals
Quantiles of the Normal Distribution
f) Autocorrelation of Residuals
95% Conf. Int.
ACF
Lag (yrs)

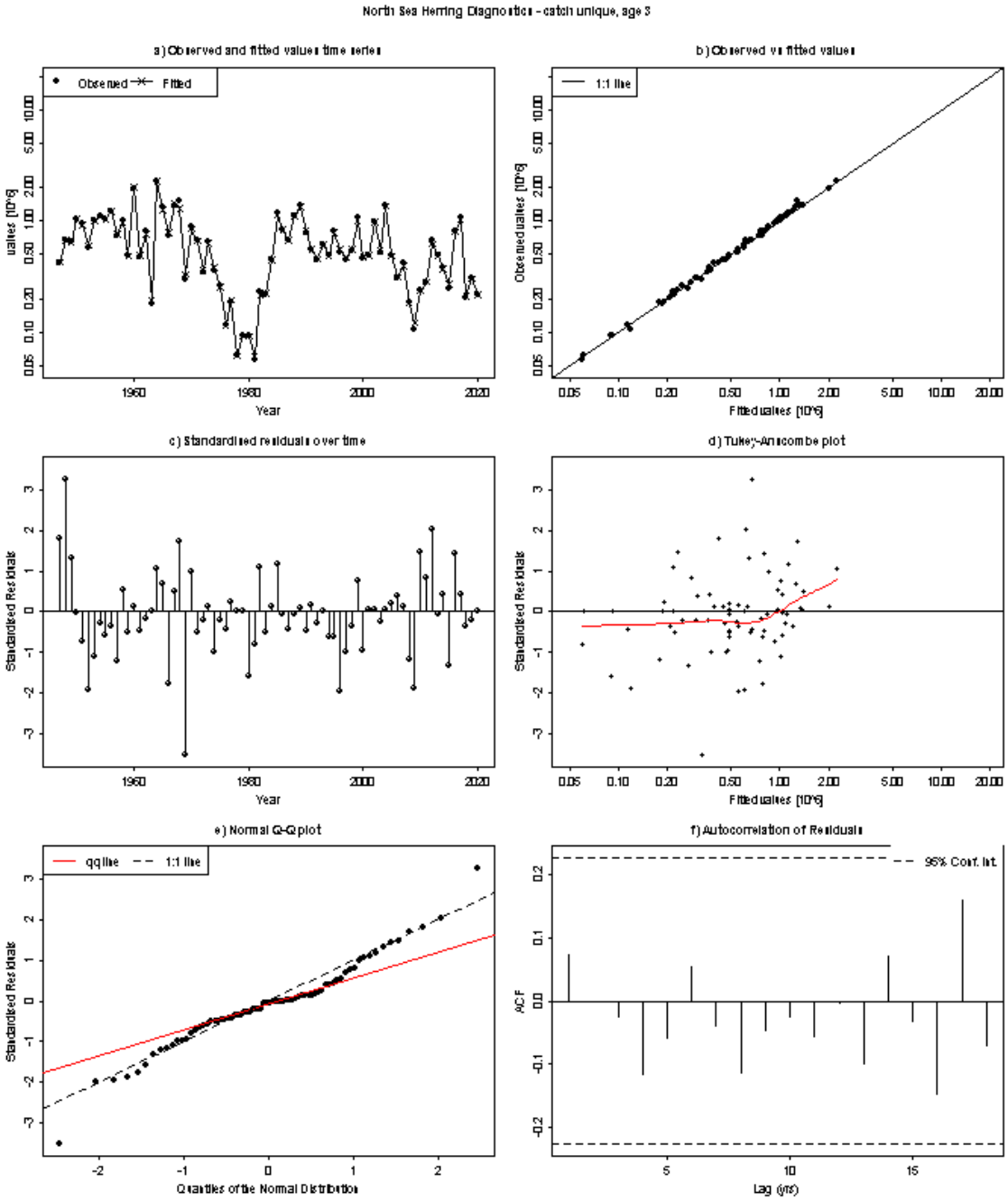
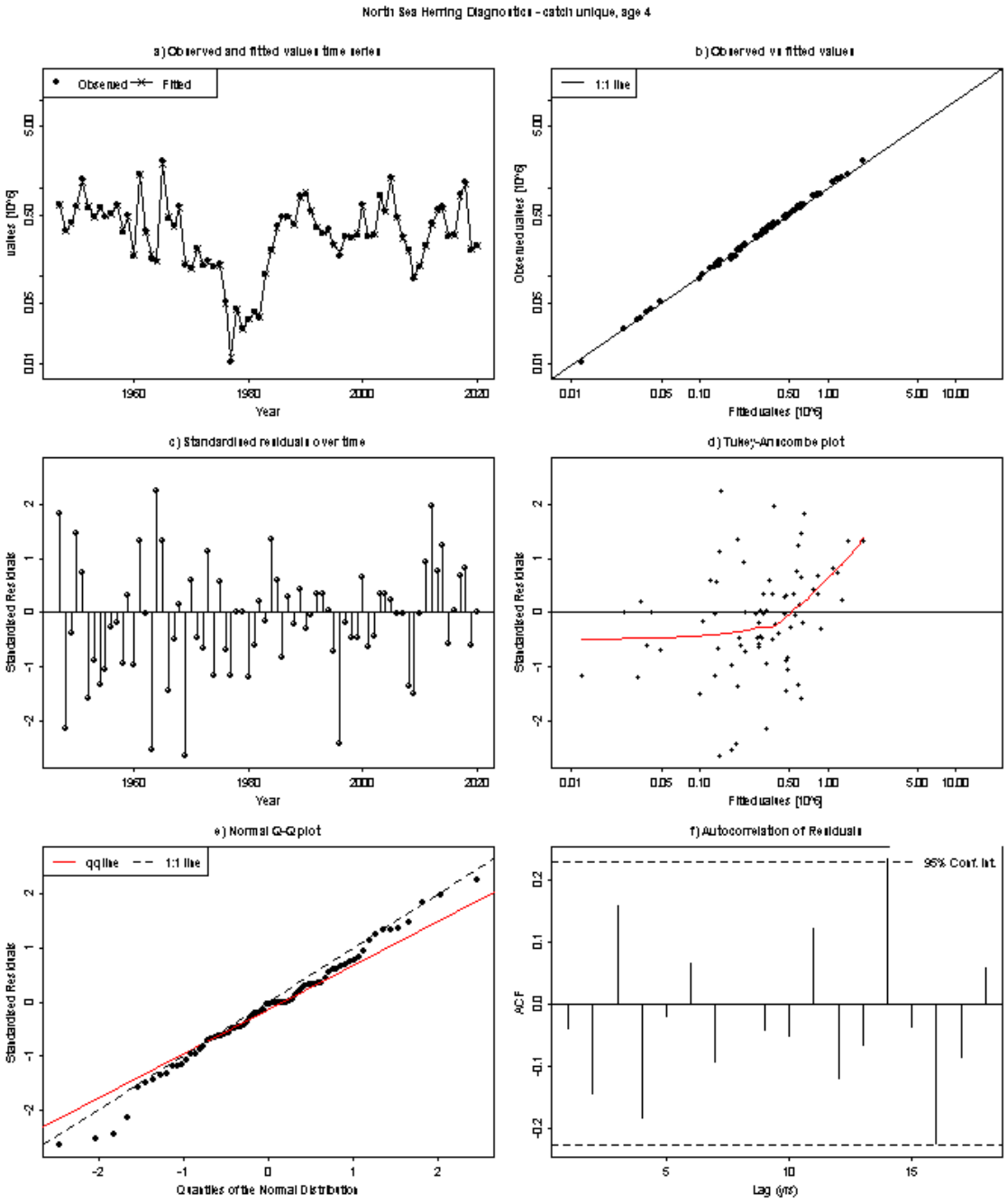


Figure 2.6.1.10. North Sea herring. Diagnostics of the assessment model fit to the catch-at-age 3 time-series. Top left: Estimates of numbers at 3 wr (line) and numbers predicted from catch abundance at 3 wr. Top right: scatterplot of catch observations vs. assessment model estimates of numbers at 3 wr with the best-fit catchability model (linear function). Middle right: catch observation vs. standardized residuals at 3 wr. Middle left: Time-series of standardized residuals of the catch at 3 wr. Bottom left: normal Q-Q plot of standardized residuals. Bottom right: Autocorrelation plot.


North Sea Herring Diagnostics - catch unique, age 4
a) Observed and fitted values time series
Observed
Fitted
Year
b) Observed vs fitted values
1:1 line
Fitted values [10^6]
c) Standardised residuals over time
Standardised Residuals
d) Tukey-Anscombe plot
e) Normal Q-Q plot
qq line
1:1 line
Quantiles of the Normal Distribution
f) Autocorrelation of Residuals
95% Conf. Int.
ACF
Lag (yrs)

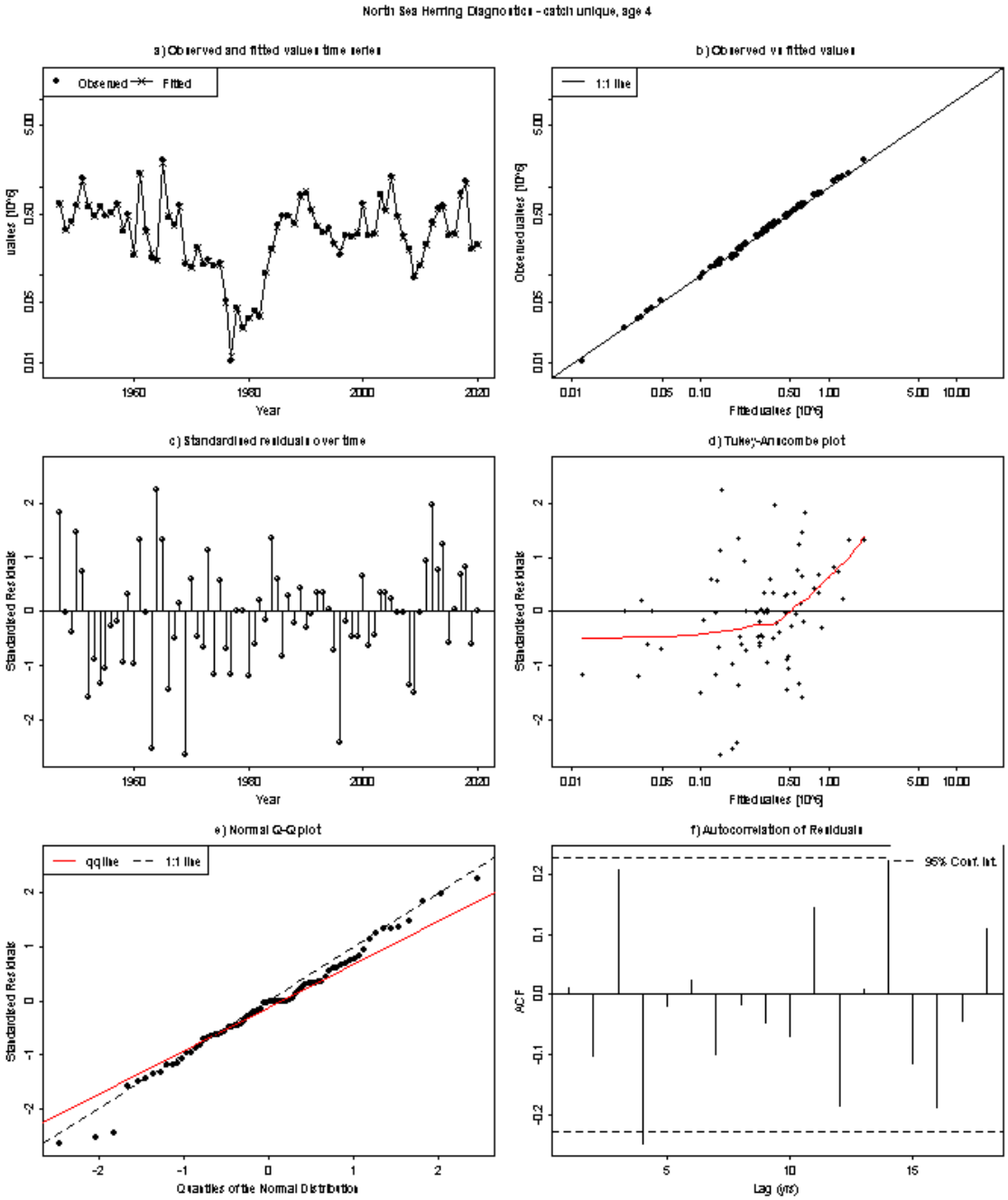
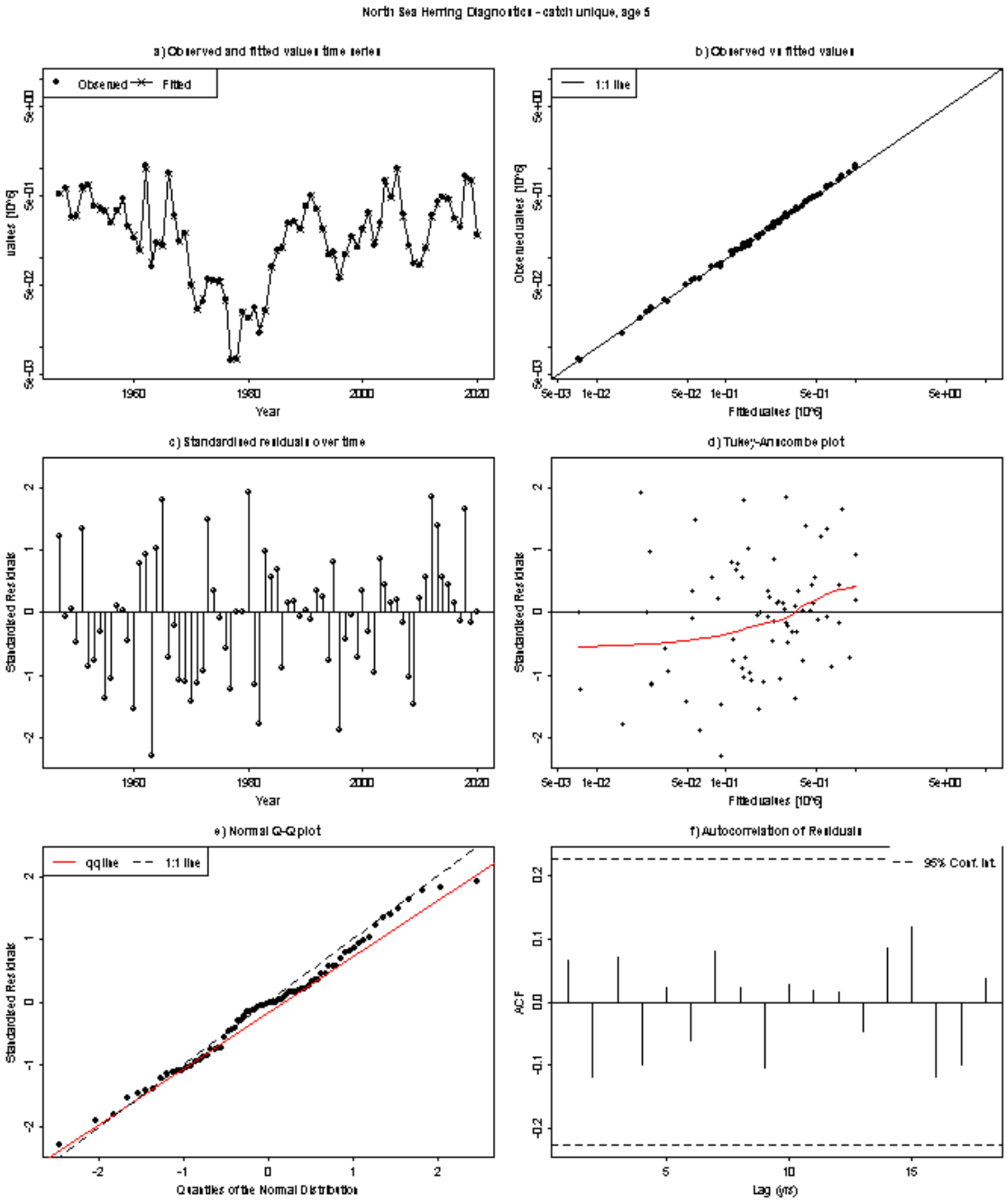


Figure 2.6.1.11. North Sea herring. Diagnostics of the assessment model fit to the catch-at-age 4 time-series. Top left: Estimates of numbers at 4 wr (line) and numbers predicted from catch abundance at 4 wr. Top right: scatterplot of catch observations vs. assessment model estimates of numbers at 4 wr with the best-fit catchability model (linear function). Middle right: catch observation vs. standardized residuals at 4 wr. Middle left: Time-series of standardized residuals of the catch at 4 wr. Bottom left: normal Q-Q plot of standardized residuals. Bottom right: Autocorrelation plot.


North Sea Herring Diagnostics - catch unique, age 5
a) Observed and fitted values time series
Observed
Fitted
Year
b) Observed vs fitted values
1:1 line
Fitted values [1000]
c) Standardised residuals over time
Standardised Residuals
d) Tukey-Anscombe plot
e) Normal Q-Q plot
qq line
1:1 line
Quantiles of the Normal Distribution
f) Autocorrelation of Residuals
95% Conf. Int.
ACF
Lag (yrs)

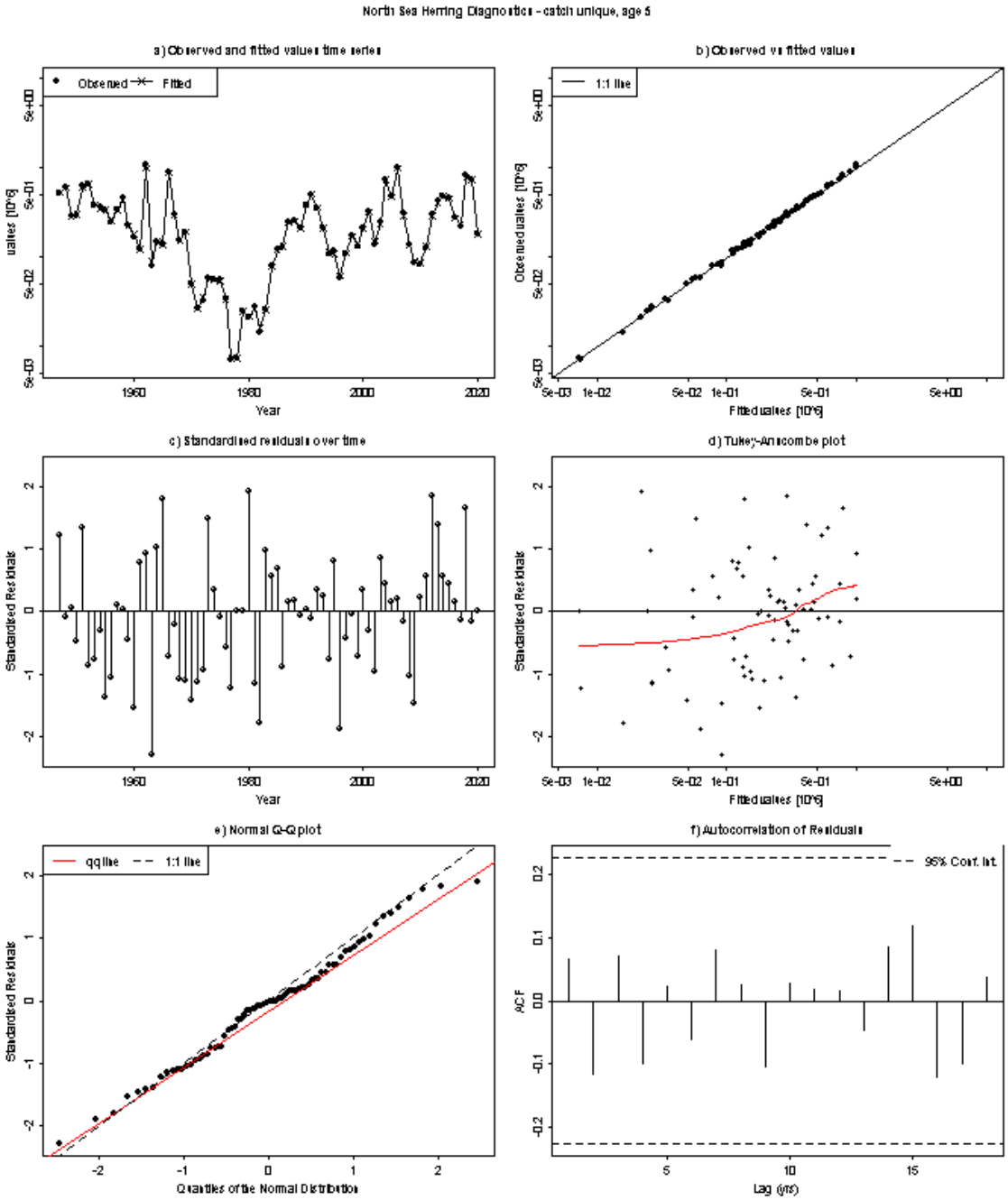
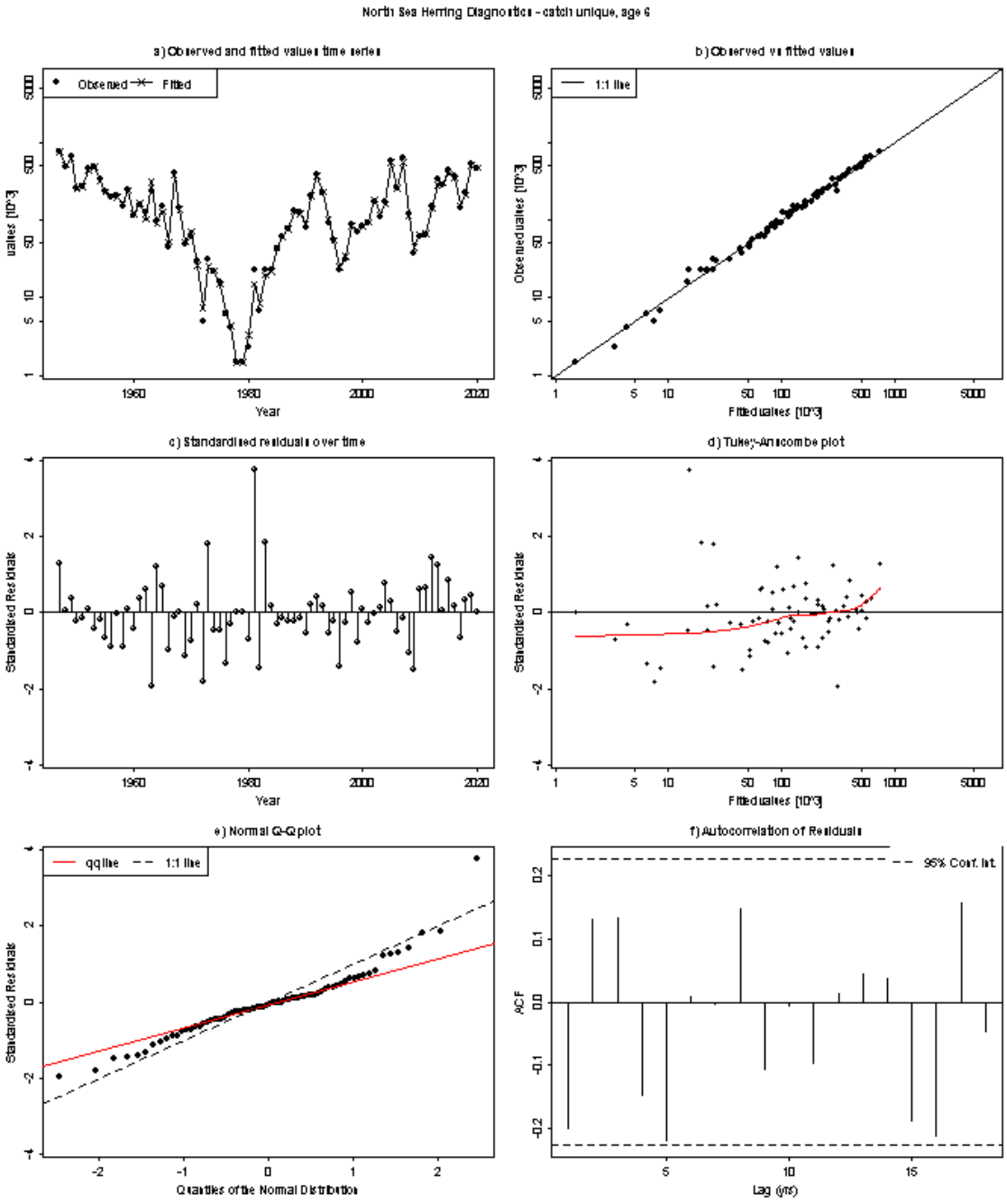


Figure 2.6.1.12. North Sea herring. Diagnostics of the assessment model fit to the catch-at-age 5 time-series. Top left: Estimates of numbers at 5 wr (line) and numbers predicted from catch abundance at 5 wr. Top right: scatterplot of catch observations vs. assessment model estimates of numbers at 5 wr with the best-fit catchability model (linear function). Middle right: catch observation vs. standardized residuals at 5 wr. Middle left: Time-series of standardized residuals of the catch at 5 wr. Bottom left: normal Q-Q plot of standardized residuals. Bottom right: Autocorrelation plot.


North Sea Herring Diagnostics - catch unique, age 6
a) Observed and fitted values time series
Observed
Fitted
Year
b) Observed vs fitted values
1:1 line
Fitted values [10^3]
c) Standardised residuals over time
Standardised Residuals
Year
d) Tukey-Anscombe plot
Standardised Residuals
Fitted values [10^3]
e) Normal Q-Q plot
qq line
1:1 line
Standardised Residuals
Quantiles of the Normal Distribution
f) Autocorrelation of Residuals
95% Conf. Int.
ACF
Lag (yrs)

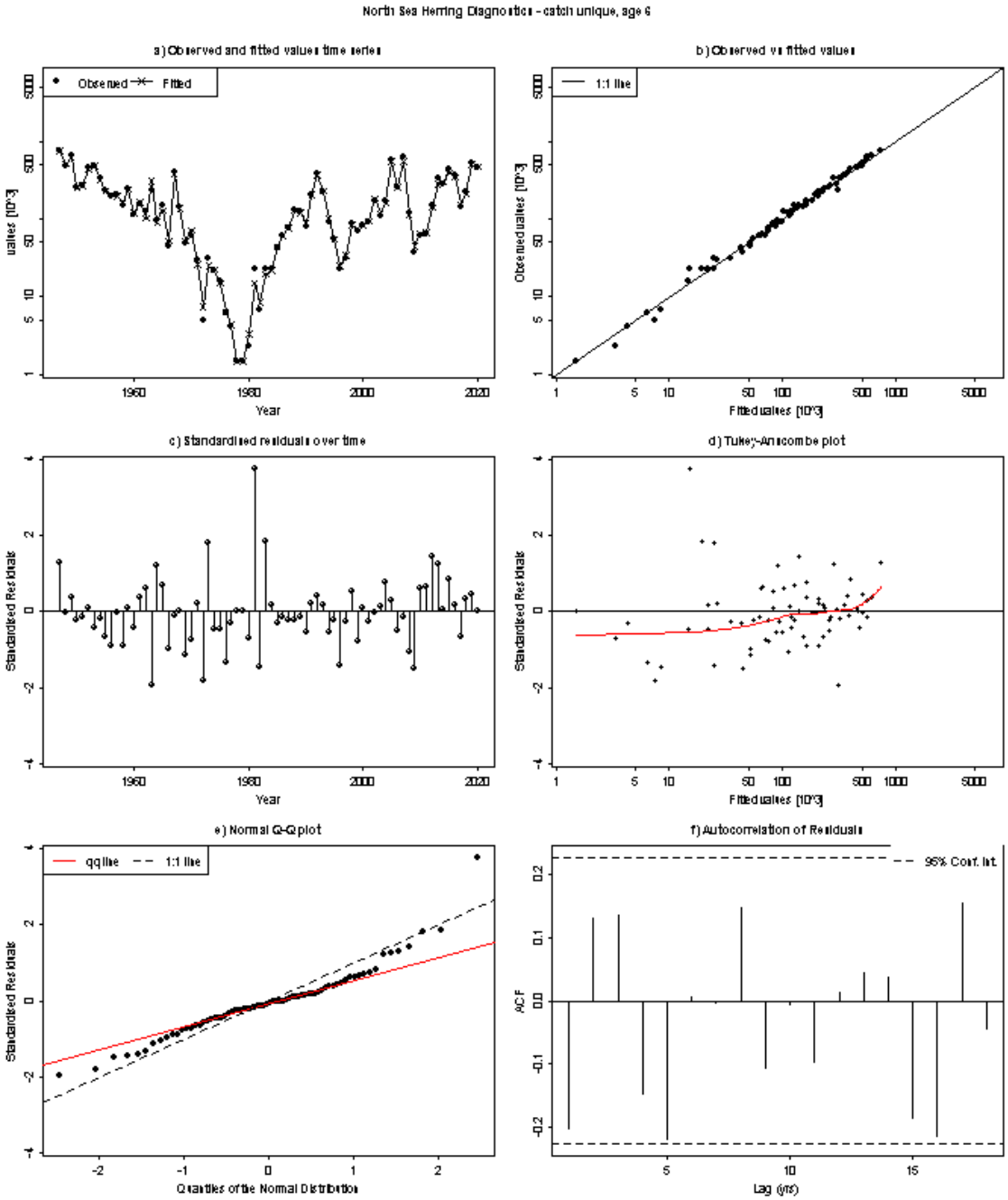
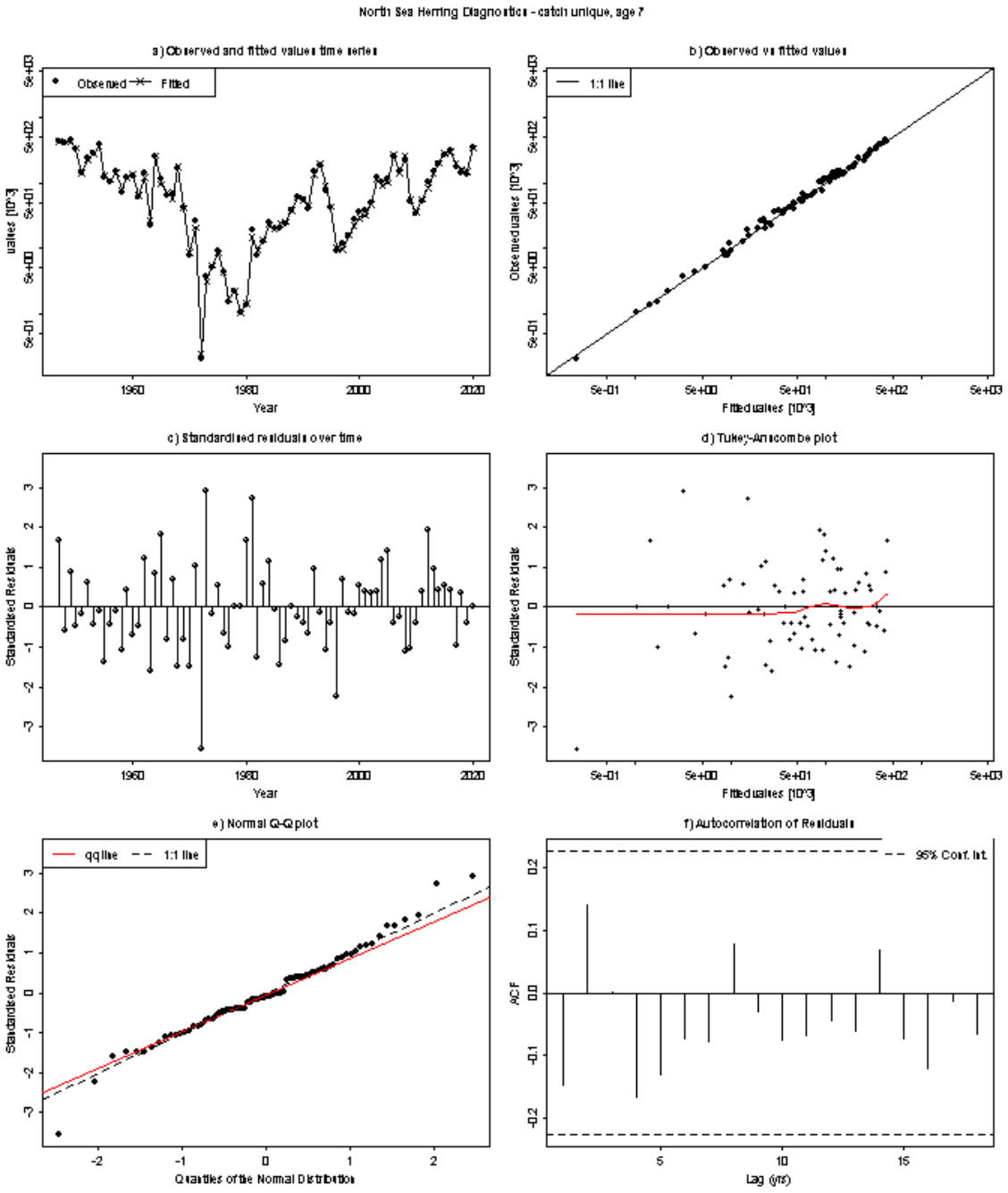


Figure 2.6.1.13. North Sea herring. Diagnostics of the assessment model fit to the catch-at-age 6 time-series. Top left: Estimates of numbers at 6 wr (line) and numbers predicted from catch abundance at 6 wr. Top right: scatterplot of catch observations vs. assessment model estimates of numbers at 6 wr with the best-fit catchability model (linear function). Middle right: catch observation vs. standardized residuals at 6 wr. Middle left: Time-series of standardized residuals of the catch at 6 wr. Bottom left: normal Q-Q plot of standardized residuals. Bottom right: Autocorrelation plot.


North Sea Herring Diagnostics - catch unique, age 7
a) Observed and fitted values time series
Observed
Fitted
Year
b) Observed vs fitted values
1:1 line
Fitted values [10^3]
c) Standardised residuals over time
Standardised Residuals
Year
d) Tukey-Anscombe plot
Standardised Residuals
Fitted values [10^3]
e) Normal Q-Q plot
qq line
1:1 line
Standardised Residuals
Quantiles of the Normal Distribution
f) Autocorrelation of Residuals
95% Conf. Int.
ACF
Lag (yrs)

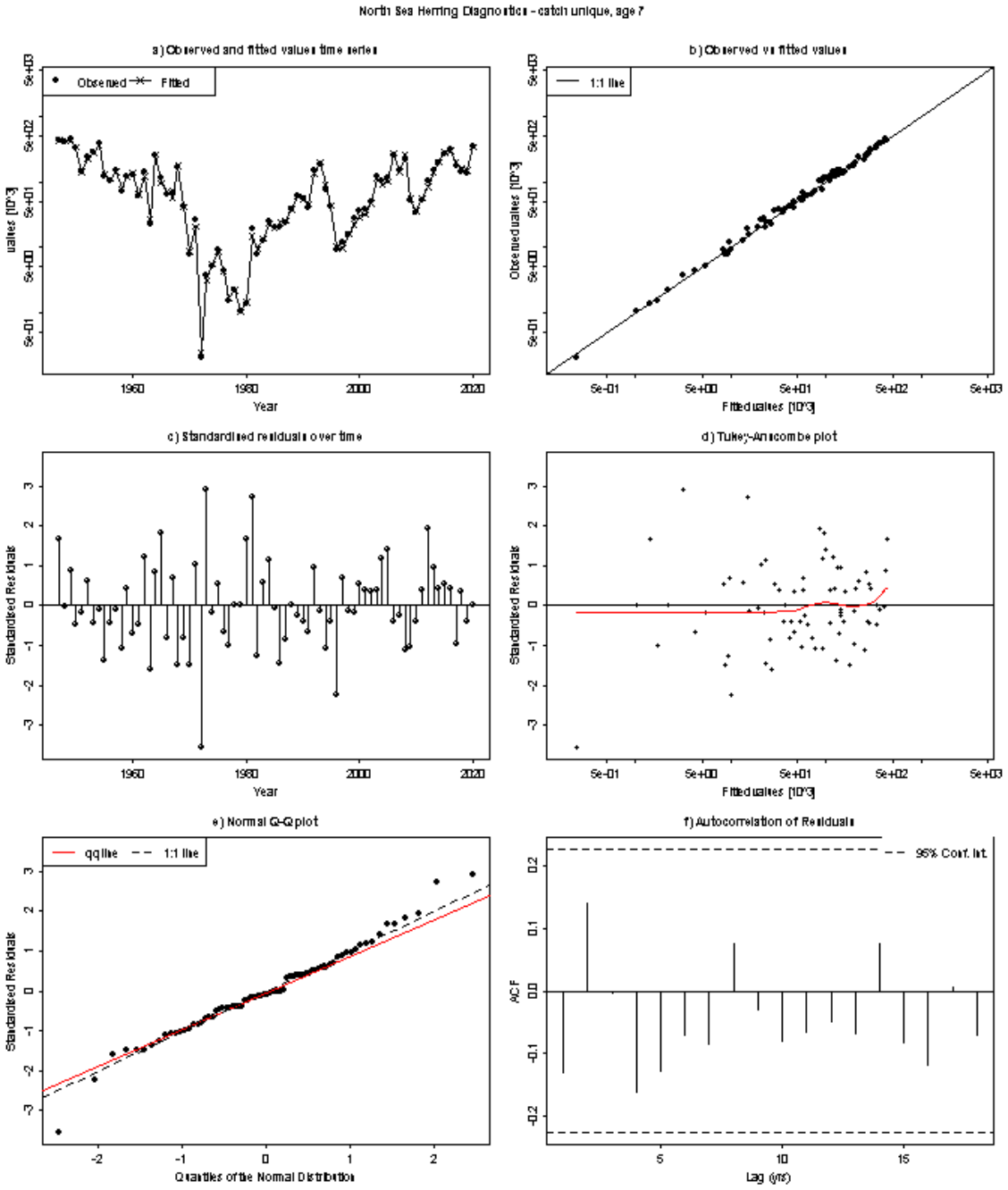
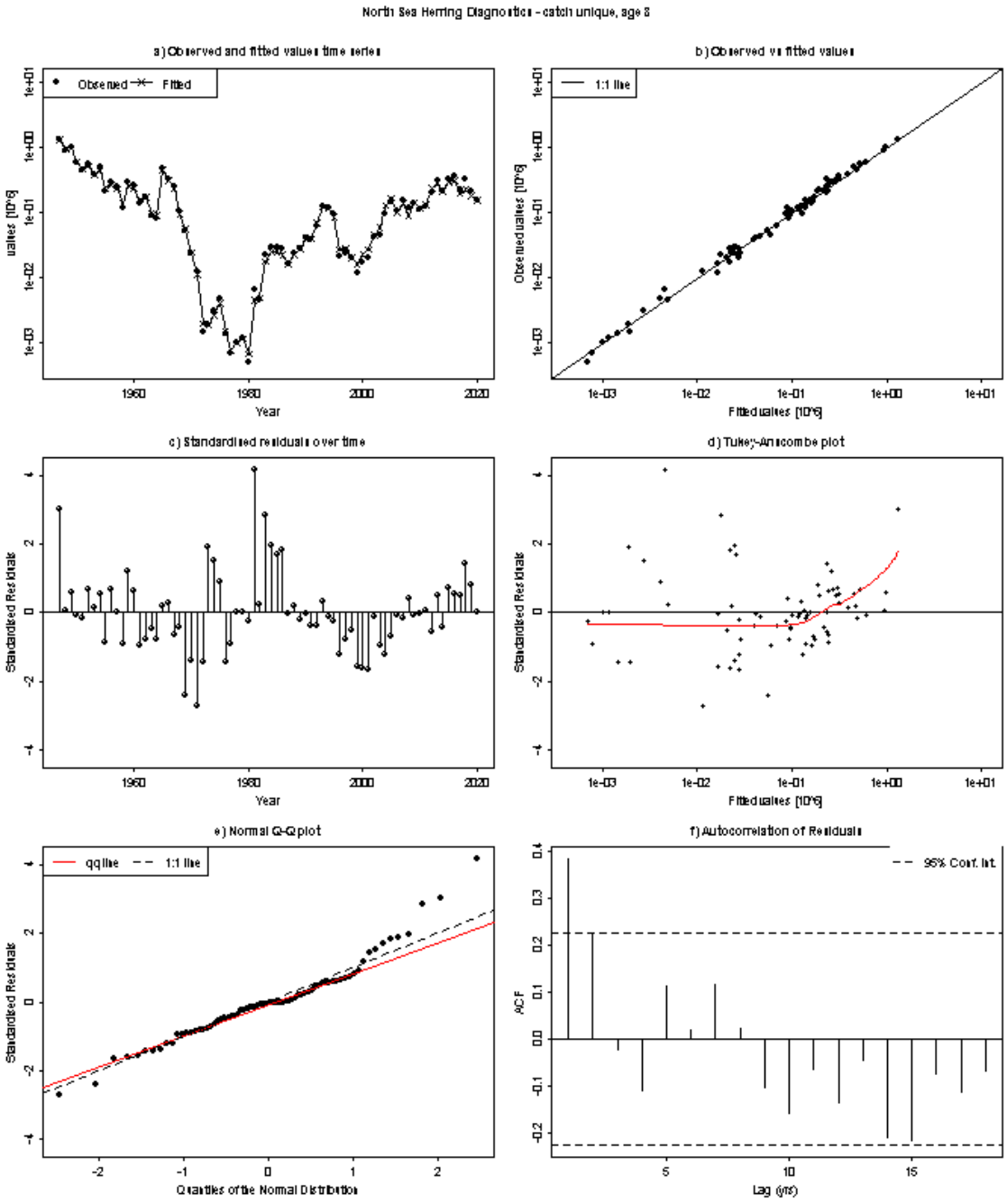


Figure 2.6.1.14. North Sea herring. Diagnostics of the assessment model fit to the catch-at-age 7 time-series. Top left: Estimates of numbers at 7 wr (line) and numbers predicted from catch abundance at 7 wr. Top right: scatterplot of catch observations vs. assessment model estimates of numbers at 7 wr with the best-fit catchability model (linear function). Middle right: catch observation vs. standardized residuals at 7 wr. Middle left: Time-series of standardized residuals of the catch at 7 wr. Bottom left: normal Q-Q plot of standardized residuals. Bottom right: Autocorrelation plot.


North Sea Herring Diagnostics - catch unique, age 3
a) Observed and fitted values time series
Observed
Fitted
Year
b) Observed vs fitted values
1:1 line
Fitted values [10^6]
c) Standardised residuals over time
Standardised Residuals
d) Tukey-Anscombe plot
e) Normal Q-Q plot
qq line
1:1 line
Quantiles of the Normal Distribution
f) Autocorrelation of Residuals
95% Conf. Int.
ACF
Lag (yrs)

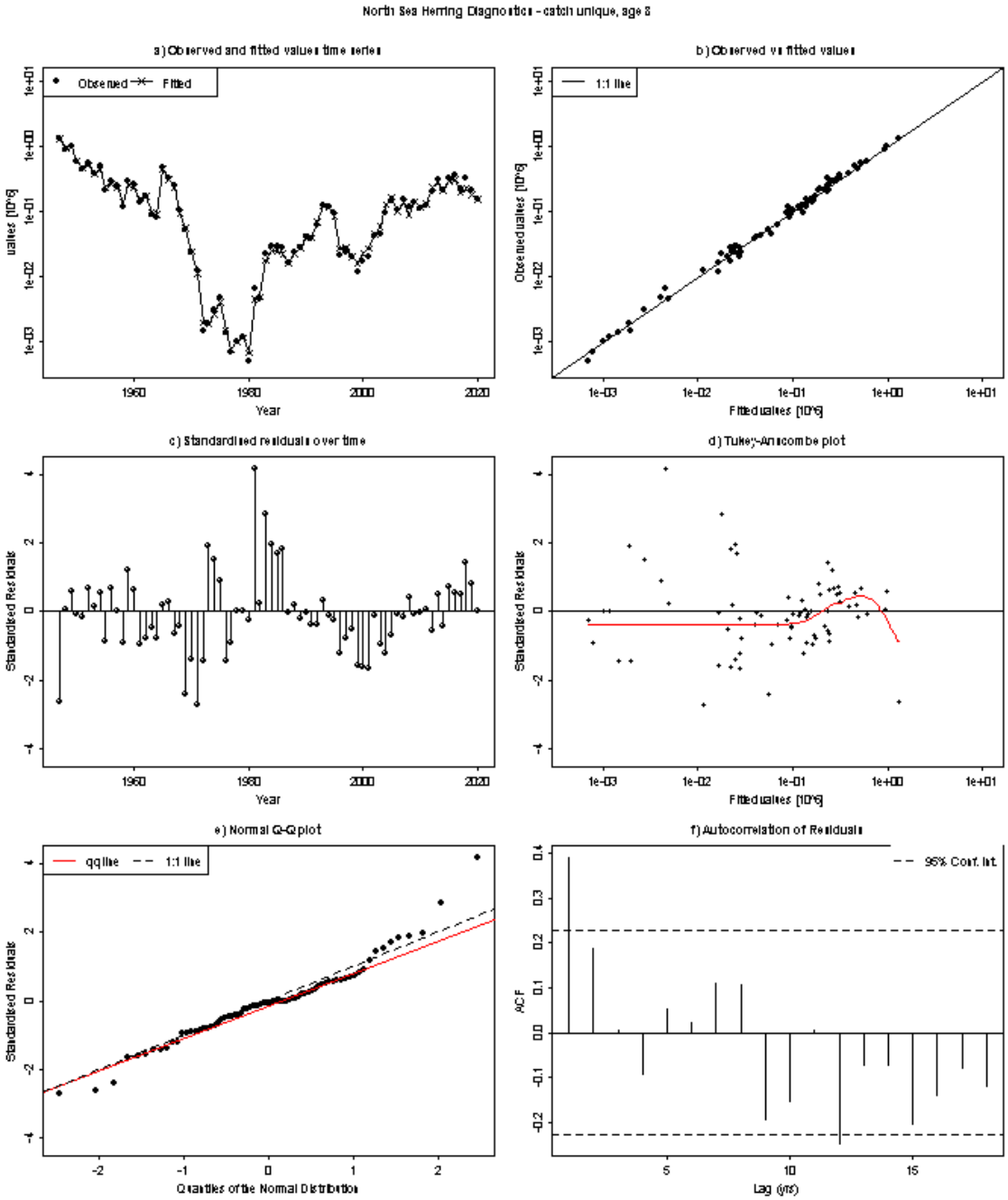
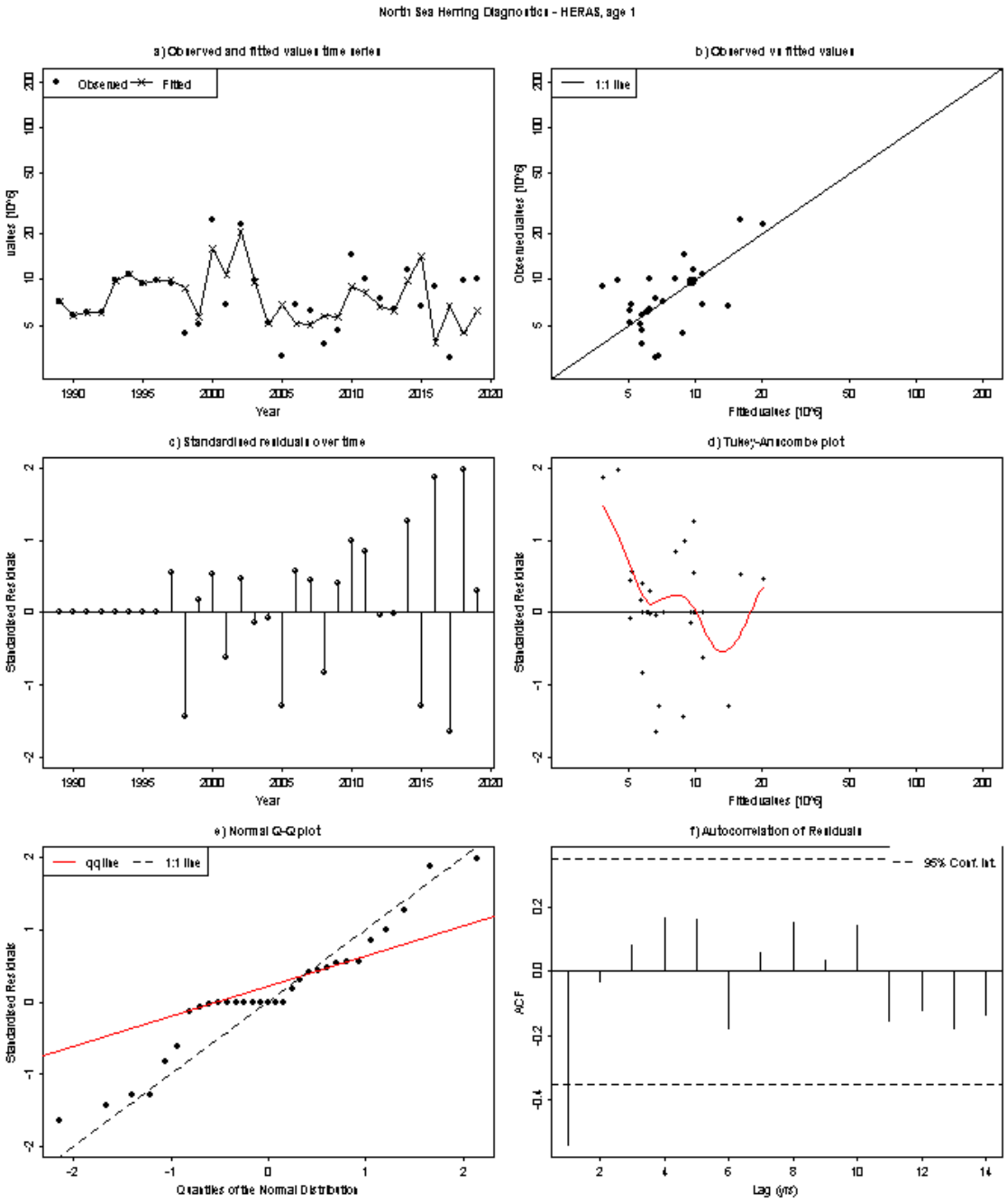


Figure 2.6.1.15. North Sea herring. Diagnostics of the assessment model fit to the catch-at-age 8+ time-series. Top left: Estimates of numbers at 8+ wr (line) and numbers predicted from catch abundance at 8+ wr. Top right: scatterplot of catch observations vs. assessment model estimates of numbers at 8+ wr with the best-fit catchability model (linear function). Middle right: catch observation vs. standardized residuals at 8+ wr. Middle left: Time-series of standardized residuals of the catch at 8+ wr. Bottom left: normal Q-Q plot of standardized residuals. Bottom right: Autocorrelation plot.


North Sea Herring Diagnostics - HERAS, age 1
a) Observed and fitted values time series
Observed
Fitted
Year
b) Observed vs fitted values
1:1 line
Fitted values [10^6]
c) Standardised residuals over time
Standardised Residuals
d) Tukey-Anscombe plot
e) Normal Q-Q plot
qq line
1:1 line
Quantiles of the Normal Distribution
f) Autocorrelation of Residuals
95% Conf. Int.
ACF
Lag (yrs)

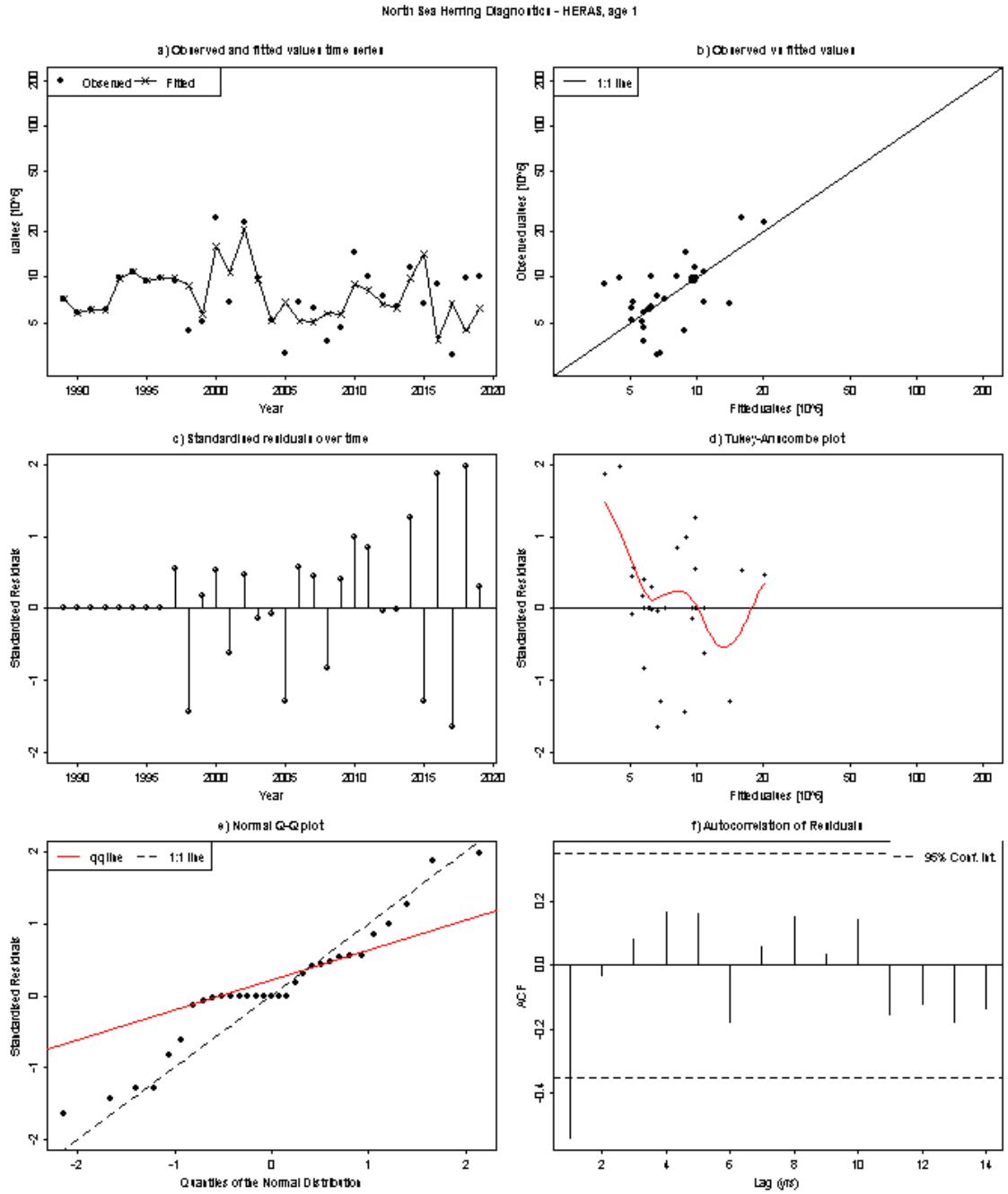
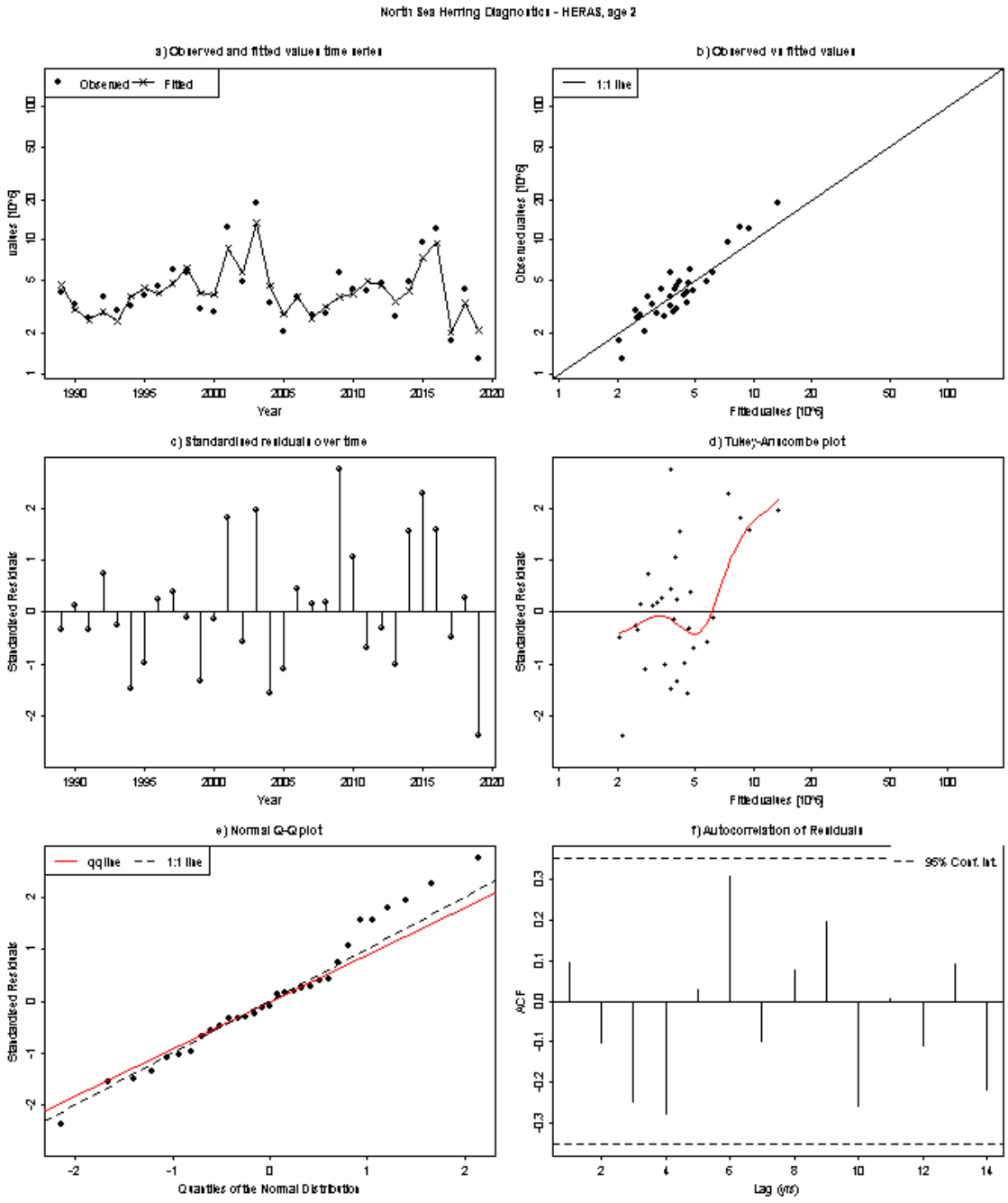


Figure 2.6.1.16. North Sea herring. Diagnostics of the assessment model fit to the HERAS index at age 1 wr time-series. Top left: Estimates of numbers at 1 wr (line) and numbers predicted from index abundance at 1 wr. Top right: scatterplot of index observations vs. assessment model estimates of numbers at 1 wr with the best-fit catchability model (linear function). Middle right: index observation vs. standardized residuals at 1 wr. Middle left: Time-series of standardized residuals of the index at 1 wr. Bottom left: normal Q-Q plot of standardized residuals. Bottom right: Autocorrelation plot.


North Sea Herring Diagnostics - HERAS, age 2
a) Observed and fitted values time series
Observed
Fitted
Year
b) Observed vs fitted values
1:1 line
Observed values [10^6]
Fitted values [10^6]
c) Standardised residuals over time
Standardised Residuals
Year
d) Tukey-Anscombe plot
Standardised Residuals
Fitted values [10^6]
e) Normal Q-Q plot
qq line
1:1 line
Standardised Residuals
Quantiles of the Normal Distribution
f) Autocorrelation of Residuals
95% Conf. Int.
ACF
Lag (yrs)

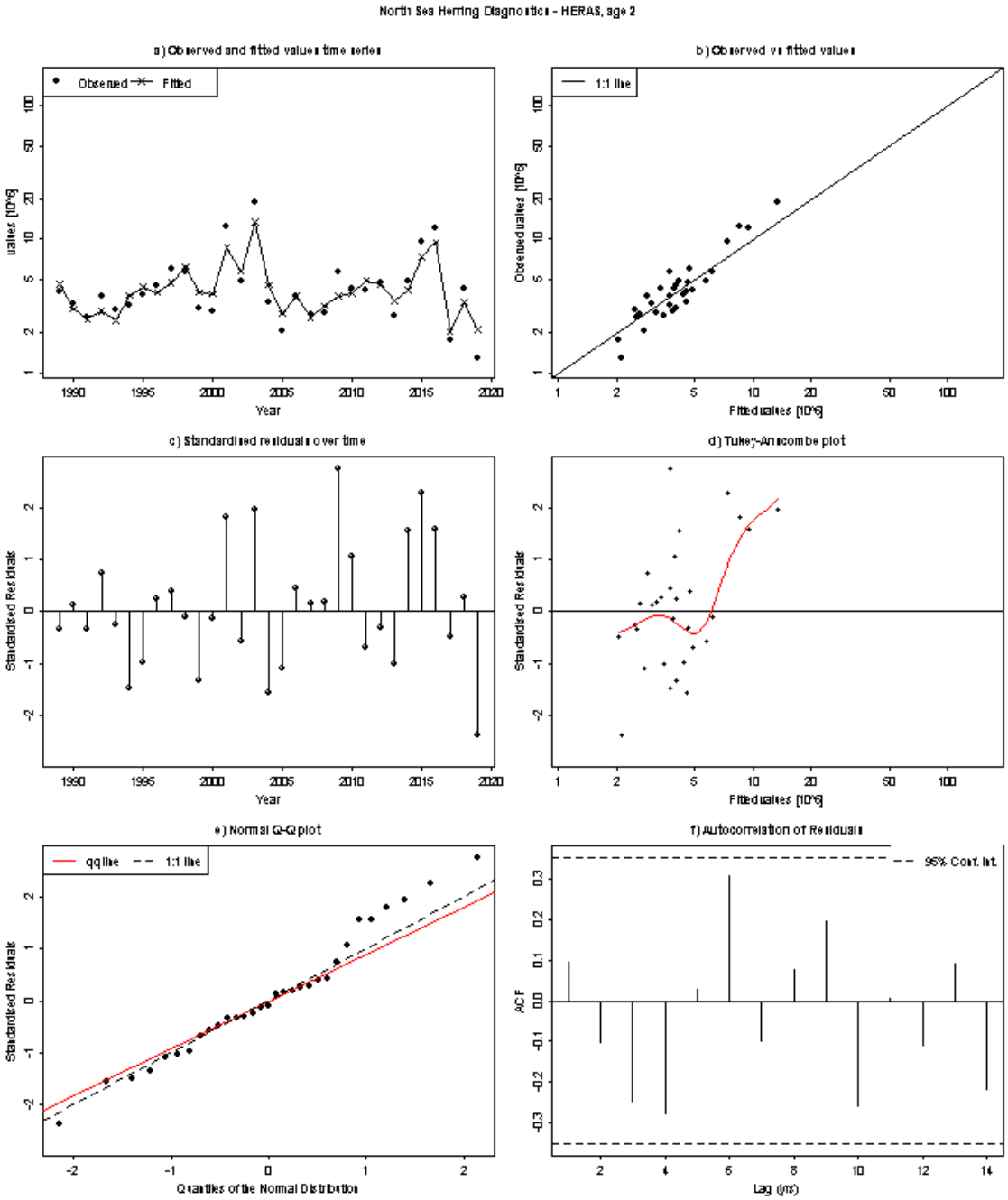
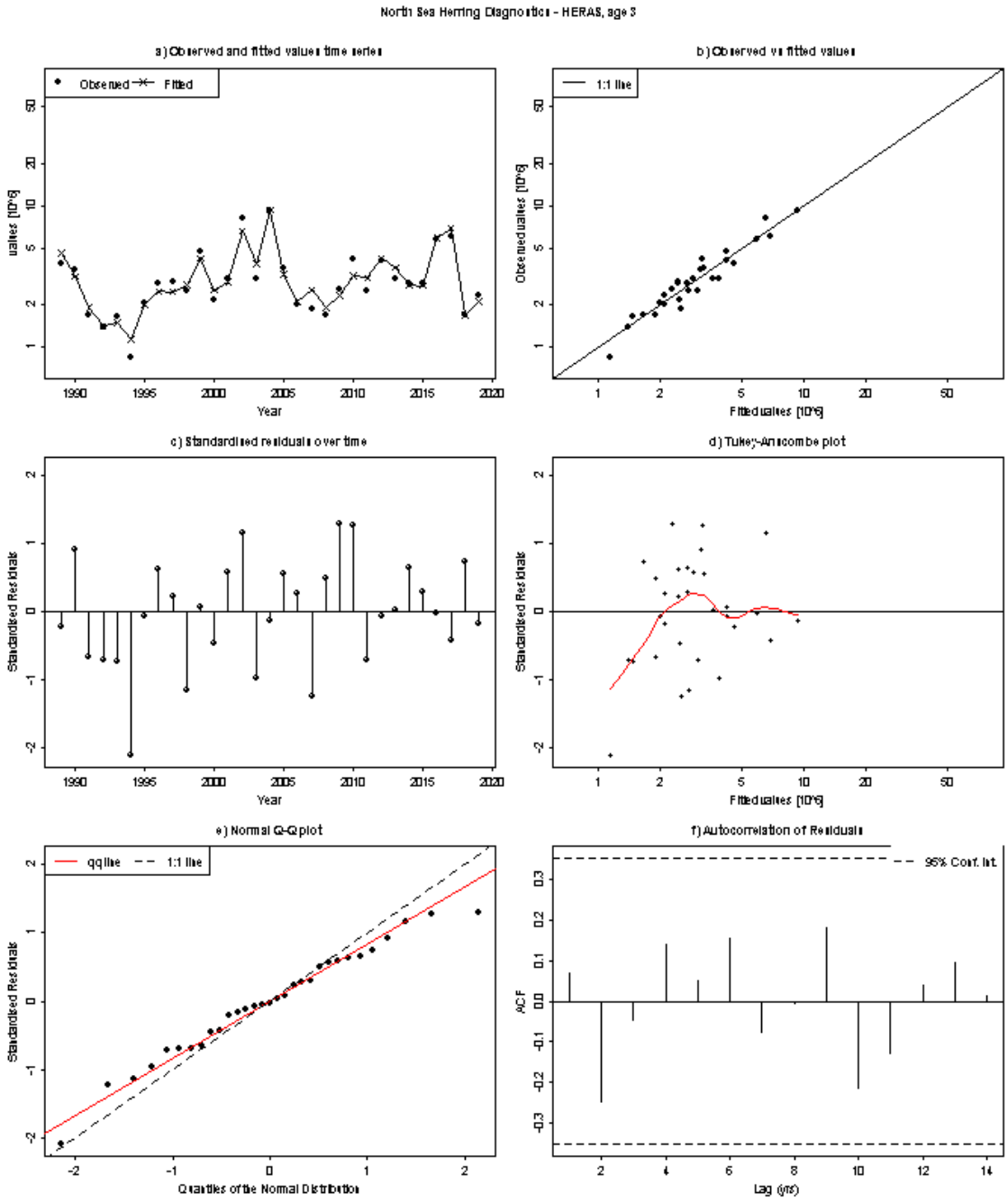


Figure 2.6.1.17. North Sea herring. Diagnostics of the assessment model fit to the HERAS index at age 2 wr time-series. Top left: Estimates of numbers at 2 wr (line) and numbers predicted from index abundance at 2 wr. Top right: scatterplot of index observations vs. assessment model estimates of numbers at 2 wr with the best-fit catchability model (linear function). Middle right: index observation vs. standardized residuals at 2 wr. Middle left: Time-series of standardized residuals of the index at 2 wr. Bottom left: normal Q-Q plot of standardized residuals. Bottom right: Autocorrelation plot.


North Sea Herring Diagnostics - HERAS, age 3
a) Observed and fitted values time series
Observed
Fitted
Year
b) Observed vs fitted values
1:1 line
Fitted values [10^6]
c) Standardised residuals over time
Standardised Residuals
Year
d) Tukey-Anscombe plot
Standardised Residuals
Fitted values [10^6]
e) Normal Q-Q plot
qq line
1:1 line
Standardised Residuals
Quantiles of the Normal Distribution
f) Autocorrelation of Residuals
95% Conf. Int.
ACF
Lag (yrs)

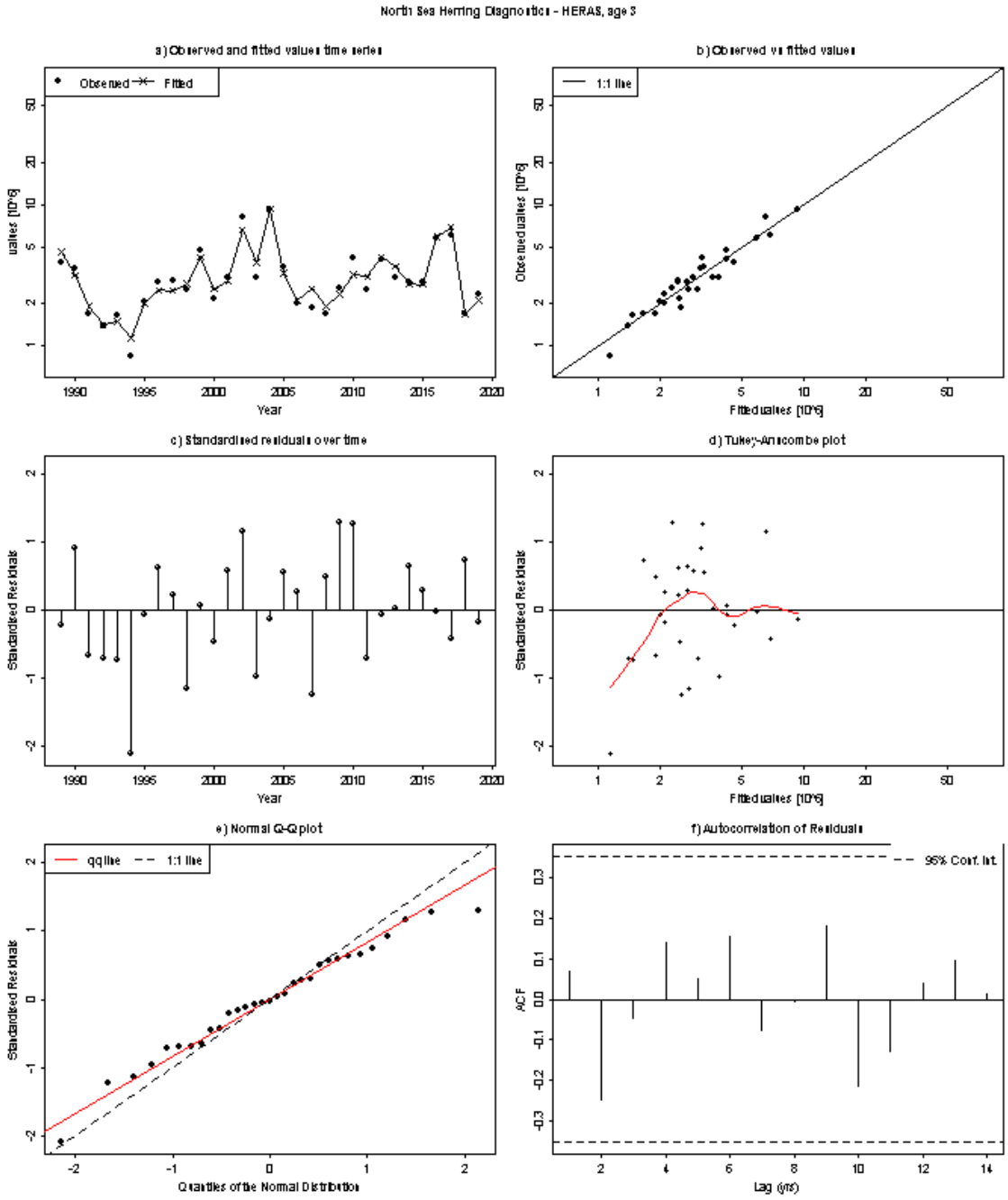
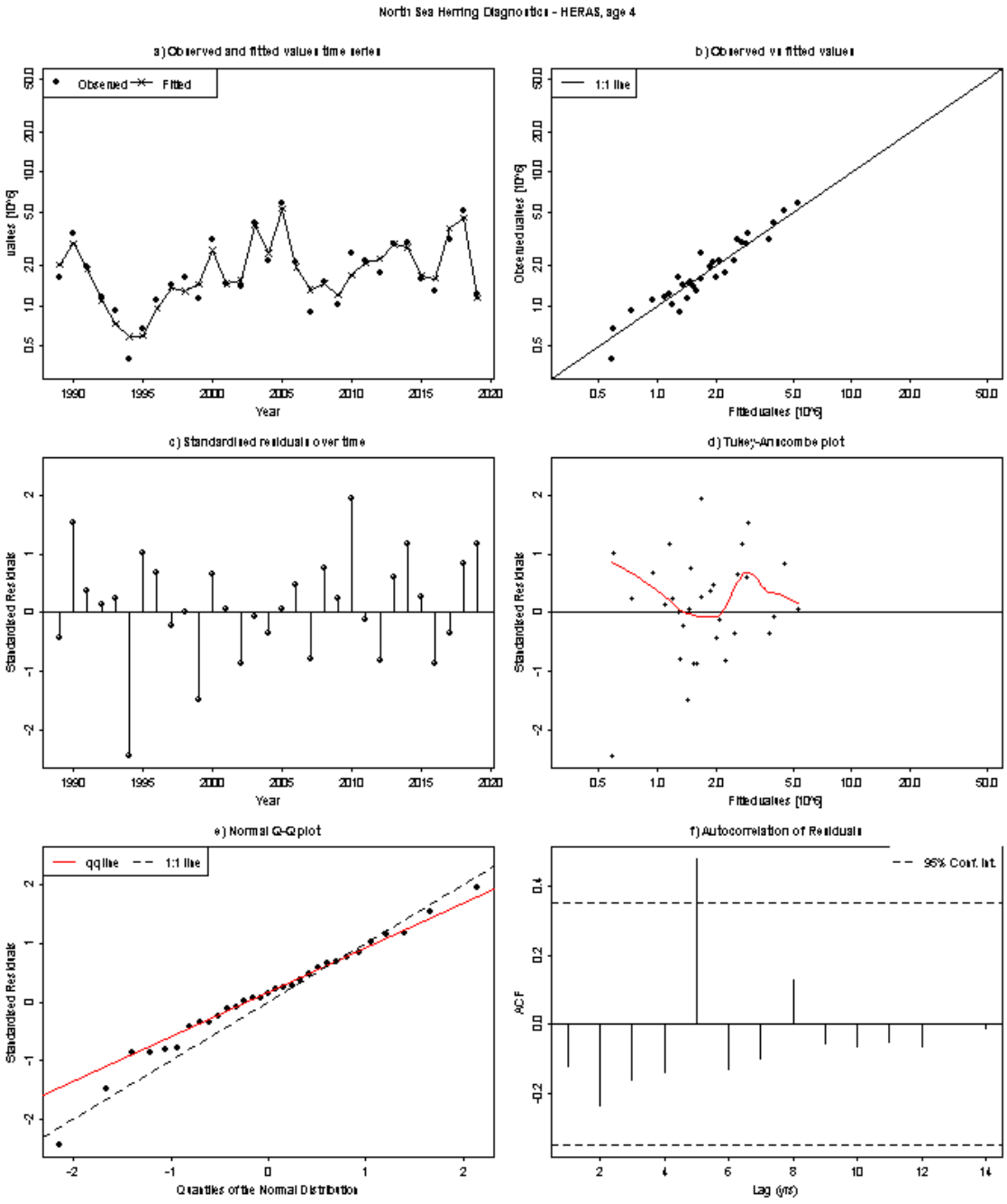


Figure 2.6.1.18. North Sea herring. Diagnostics of the assessment model fit to the HERAS index at age 3 wr time-series. Top left: Estimates of numbers at 3 wr (line) and numbers predicted from index abundance at 3 wr. Top right: scatterplot of index observations vs. assessment model estimates of numbers at 3 wr with the best-fit catchability model (linear function). Middle right: index observation vs. standardized residuals at 3 wr. Middle left: Time-series of standardized residuals of the index at 3 wr. Bottom left: normal Q-Q plot of standardized residuals. Bottom right: Autocorrelation plot.


North Sea Herring Diagnostics - HERAS, age 4
a) Observed and fitted values time series
Observed
Fitted
Year
b) Observed vs fitted values
1:1 line
Fitted values [10^6]
c) Standardised residuals over time
Standardised Residuals
Year
d) Tukey-Anscombe plot
Standardised Residuals
Fitted values [10^6]
e) Normal Q-Q plot
qq line
1:1 line
Standardised Residuals
Quantiles of the Normal Distribution
f) Autocorrelation of Residuals
95% Conf. Int.
ACF
Lag (yrs)

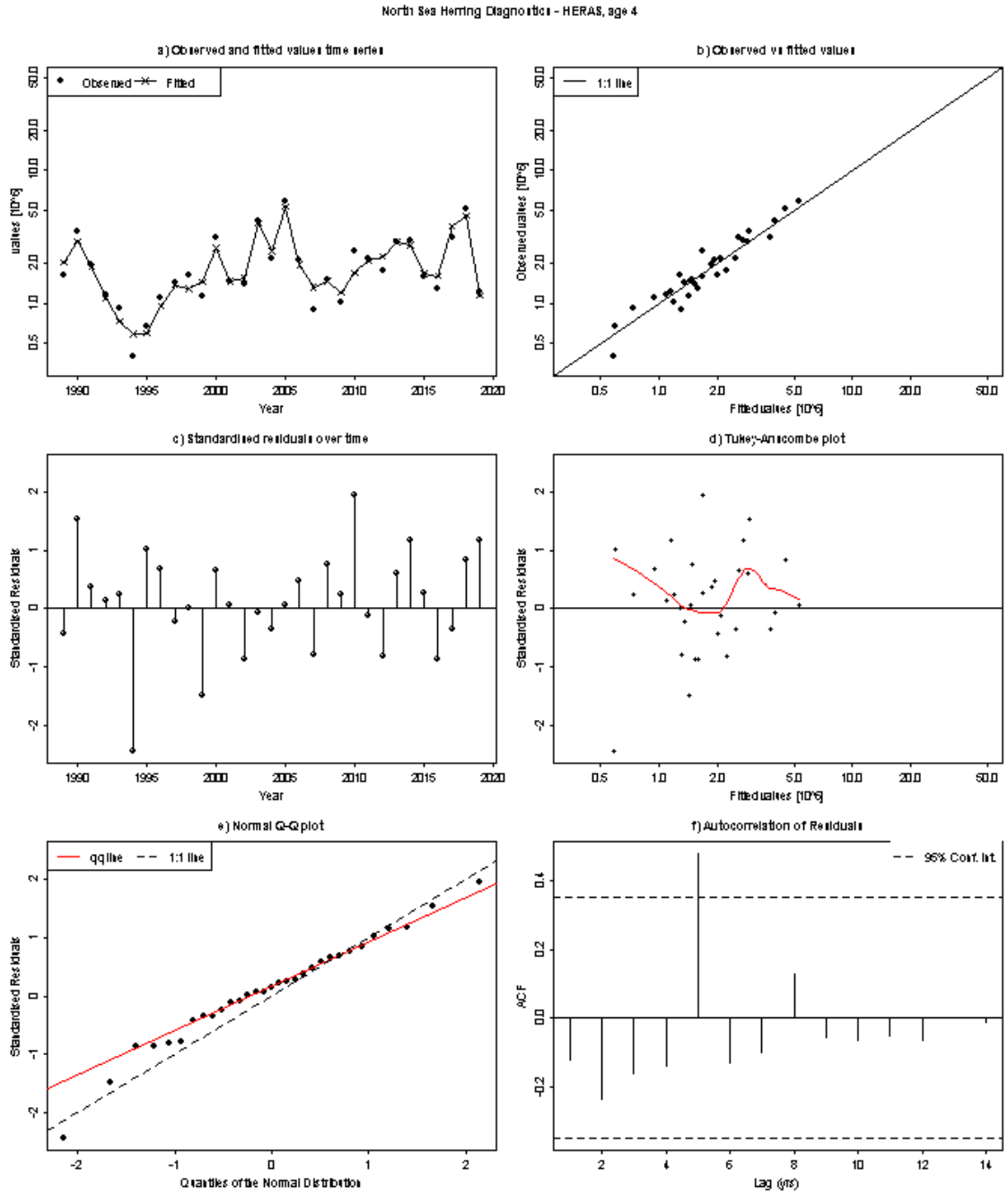
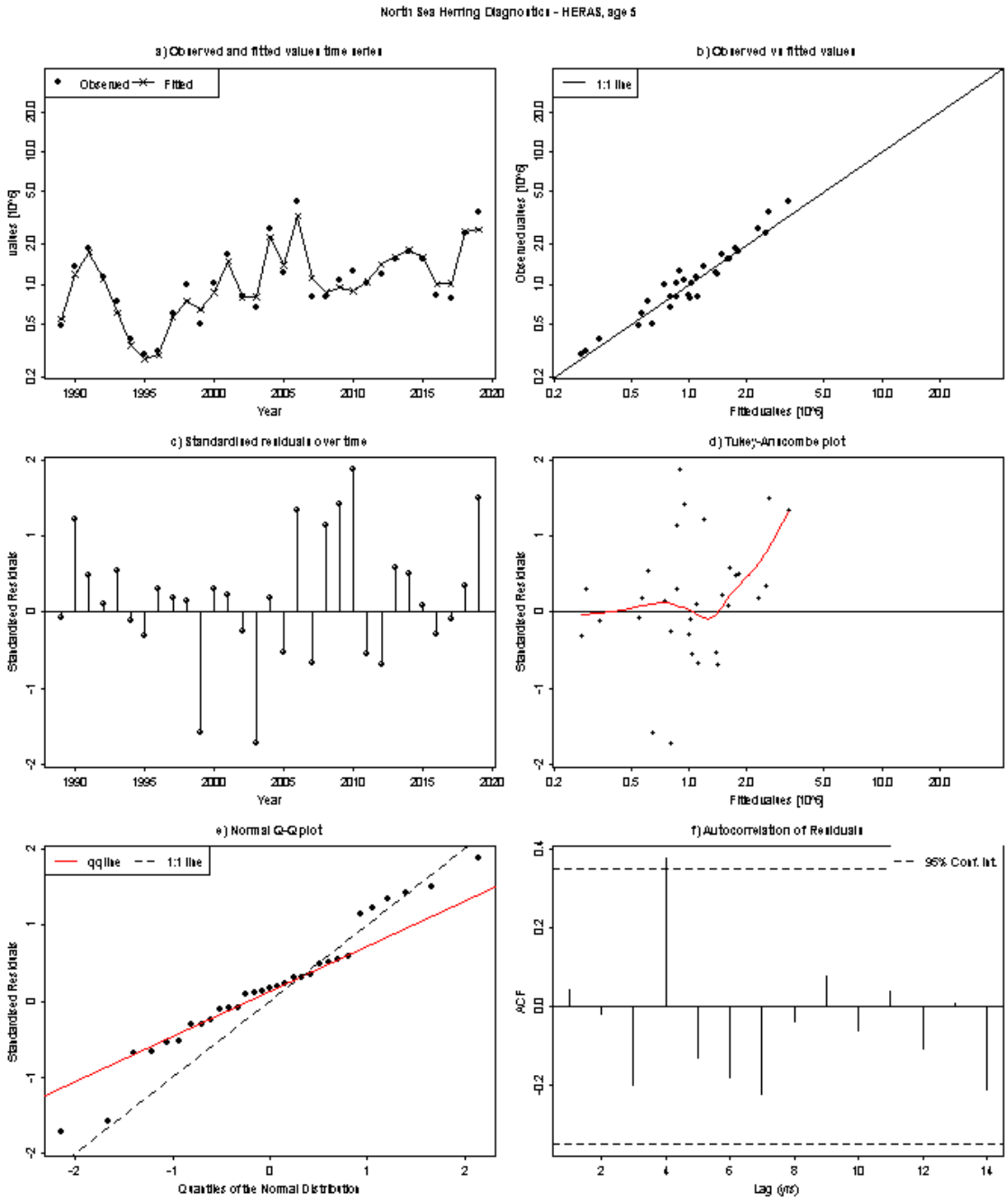


Figure 2.6.1.19. North Sea herring. Diagnostics of the assessment model fit to the HERAS index at age 4 wr time-series. Top left: Estimates of numbers at 4 wr (line) and numbers predicted from index abundance at 4 wr. Top right: scatterplot of index observations vs. assessment model estimates of numbers at 4 wr with the best-fit catchability model (linear function). Middle right: index observation vs. standardized residuals at 4 wr. Middle left: Time-series of standardized residuals of the index at 4 wr. Bottom left: normal Q-Q plot of standardized residuals. Bottom right: Autocorrelation plot.


North Sea Herring Diagnostics - HERAS, age 5
a) Observed and fitted values time series
Observed
Fitted
Year
b) Observed vs fitted values
1:1 line
Fitted values [10^6]
c) Standardised residuals over time
Standardised Residuals
Year
d) Tukey-Anscombe plot
Standardised Residuals
Fitted values [10^6]
e) Normal Q-Q plot
qq line
1:1 line
Standardised Residuals
Quantiles of the Normal Distribution
f) Autocorrelation of Residuals
95% Conf. Int.
ACF
Lag (yrs)

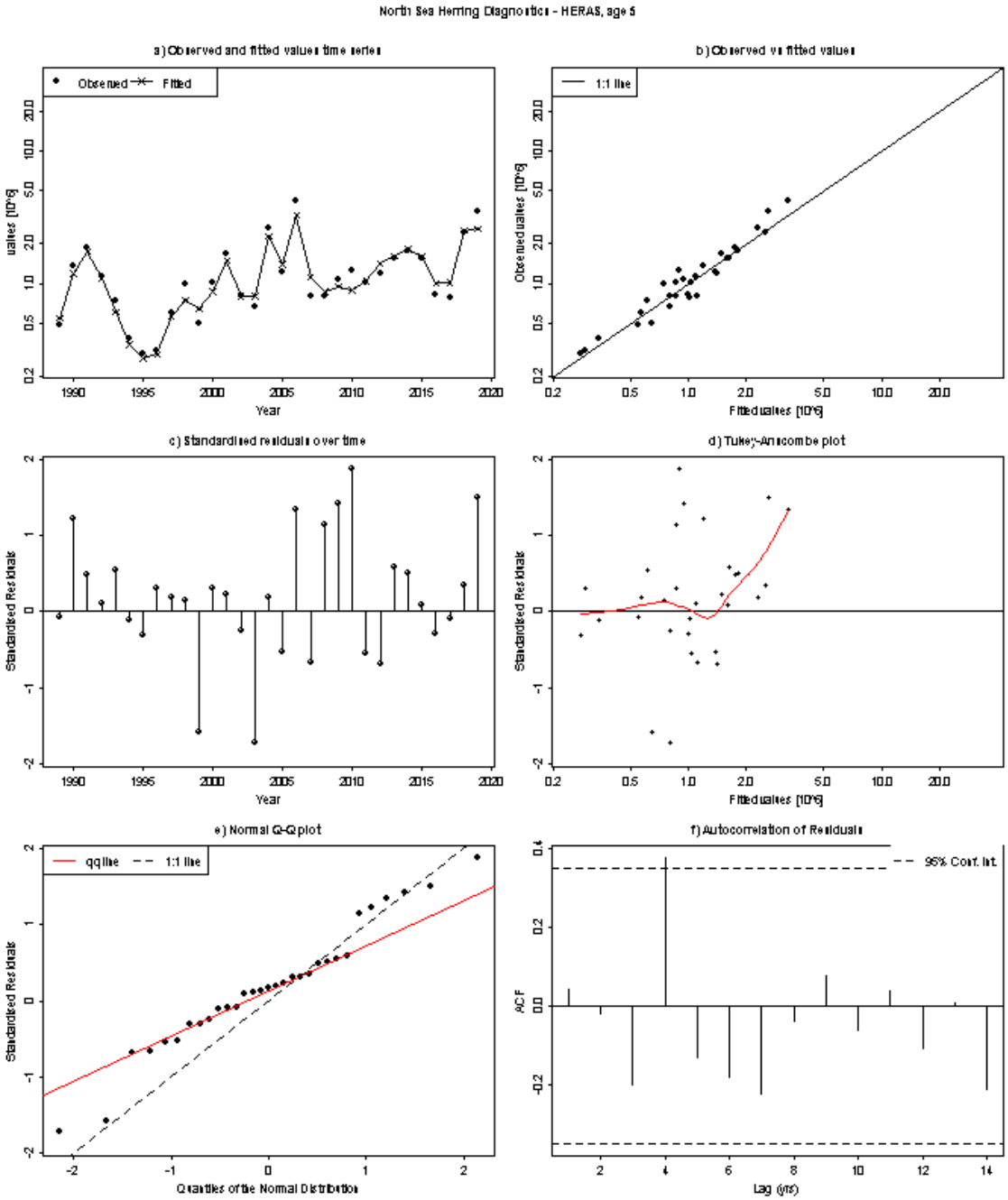
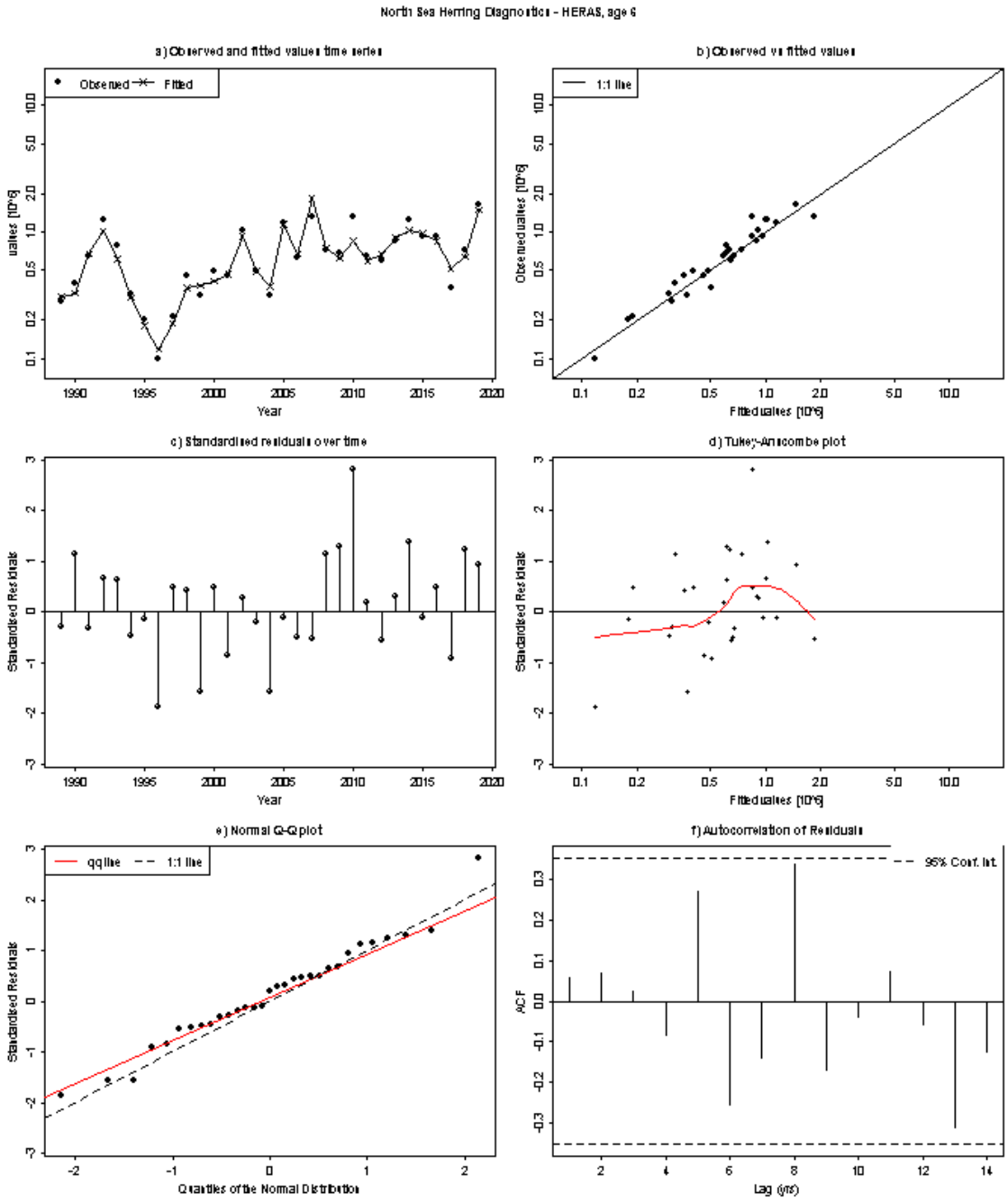


Figure 2.6.1.20. North Sea herring. Diagnostics of the assessment model fit to the HERAS index at age 5 wr time-series. Top left: Estimates of numbers at 5 wr (line) and numbers predicted from index abundance at 5 wr. Top right: scatterplot of index observations vs. assessment model estimates of numbers at 5 wr with the best-fit catchability model (linear function). Middle right: index observation vs. standardized residuals at 5 wr. Middle left: Time-series of standardized residuals of the index at 5 wr. Bottom left: normal Q-Q plot of standardized residuals. Bottom right: Autocorrelation plot.


North Sea Herring Diagnostics - HERAS, age 6
a) Observed and fitted values time series
Observed
Fitted
Year
b) Observed vs fitted values
1:1 line
Fitted values [10^6]
c) Standardised residuals over time
Standardised Residuals
Year
d) Tukey-Anscombe plot
Standardised Residuals
Fitted values [10^6]
e) Normal Q-Q plot
qq line
1:1 line
Standardised Residuals
Quantiles of the Normal Distribution
f) Autocorrelation of Residuals
95% Conf. Int.
ACF
Lag (yrs)

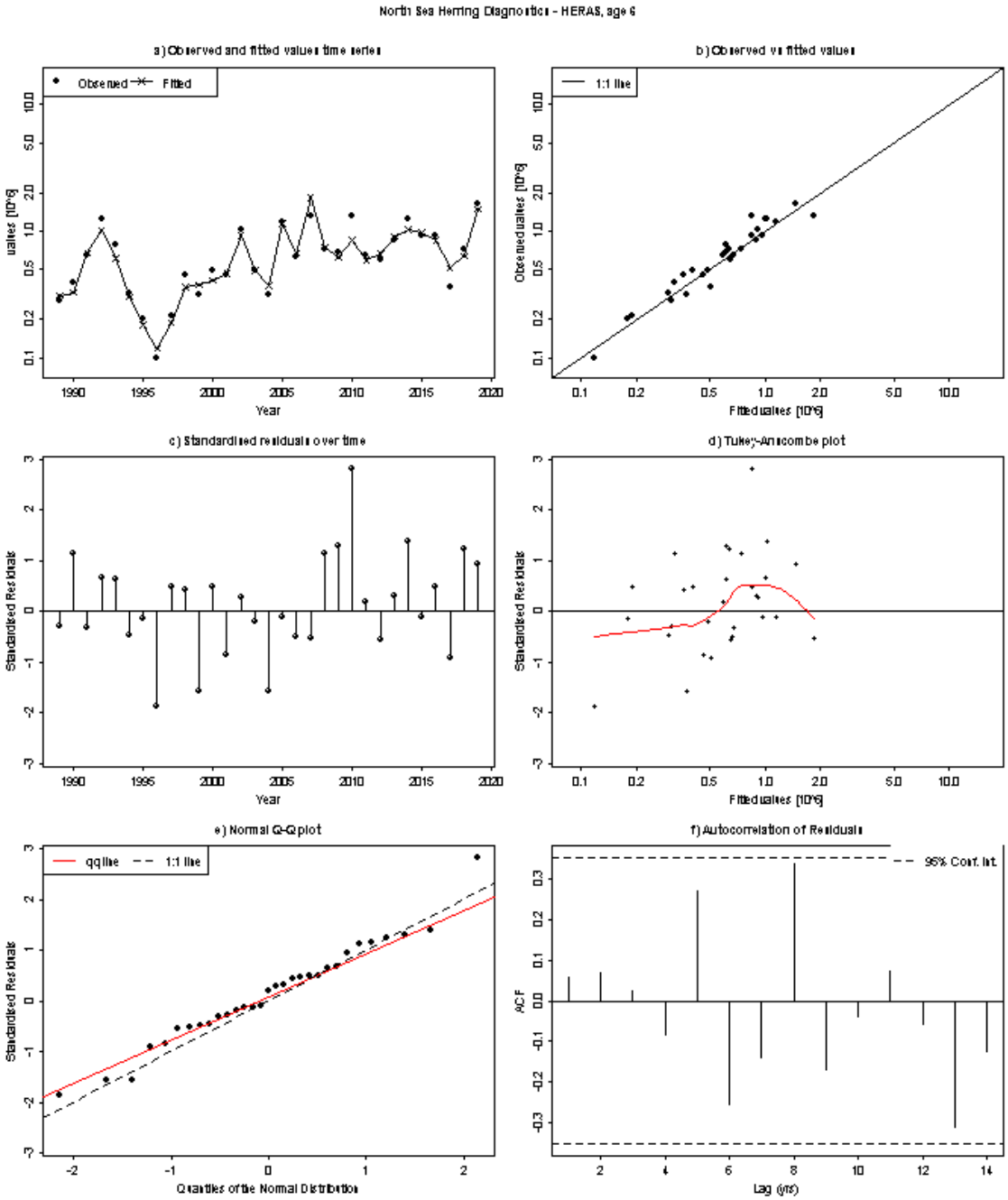
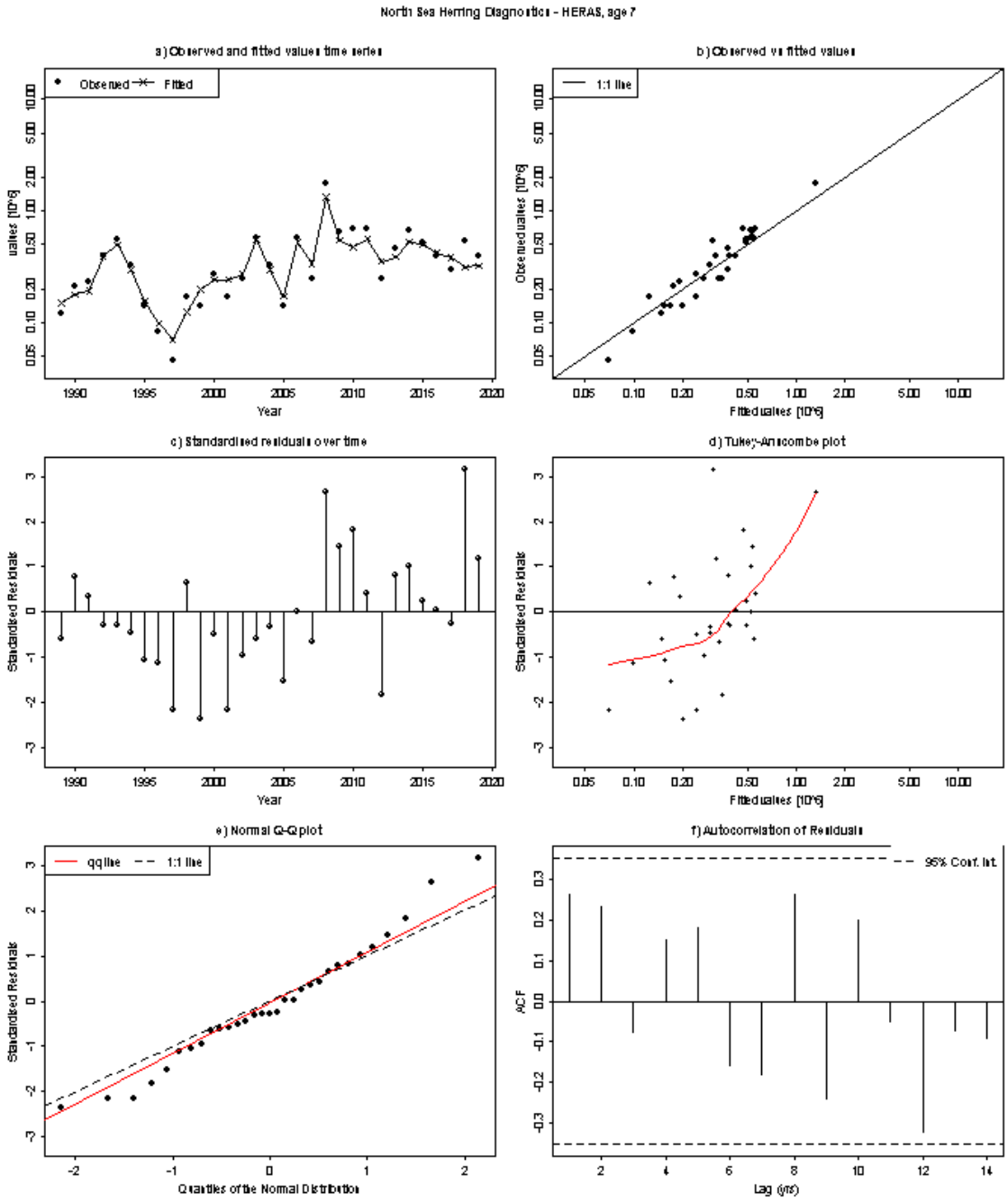


Figure 2.6.1.21. North Sea herring. Diagnostics of the assessment model fit to the HERAS index at age 6 wr time-series. Top left: Estimates of numbers at 6 wr (line) and numbers predicted from index abundance at 6 wr. Top right: scatterplot of index observations vs. assessment model estimates of numbers at 6 wr with the best-fit catchability model (linear function). Middle right: index observation vs. standardized residuals at 6 wr. Middle left: Time-series of standardized residuals of the index at 6 wr. Bottom left: normal Q-Q plot of standardized residuals. Bottom right: Autocorrelation plot.


North Sea Herring Diagnostics - HERAS, age 7
a) Observed and fitted values time series
Observed
Fitted
Year
b) Observed vs fitted values
1:1 line
Fitted values [10^6]
c) Standardised residuals over time
Standardised Residuals
d) Tukey-Anscombe plot
e) Normal Q-Q plot
qq line
1:1 line
Quantiles of the Normal Distribution
f) Autocorrelation of Residuals
95% Conf. Int.
ACF
Lag (yrs)

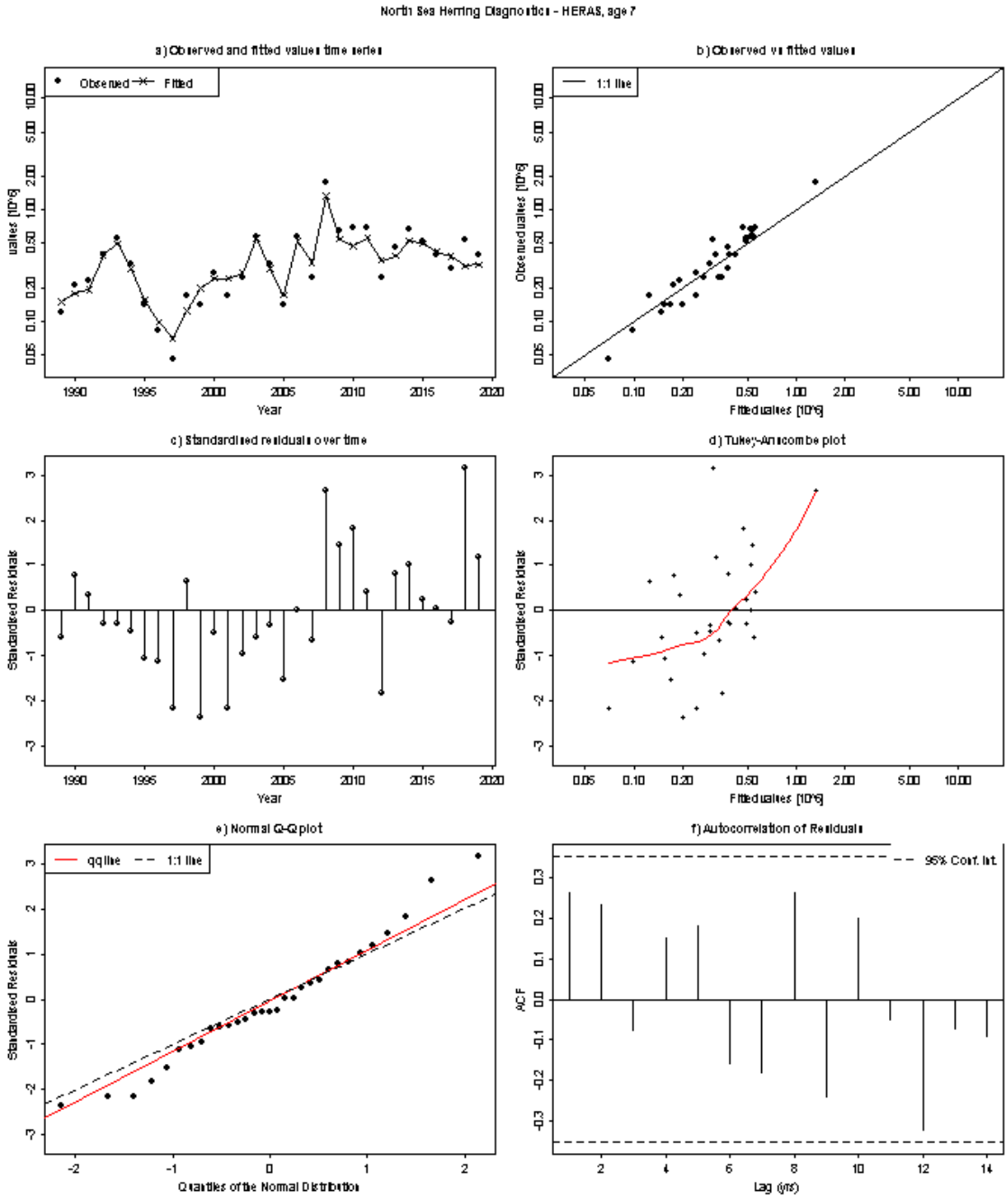
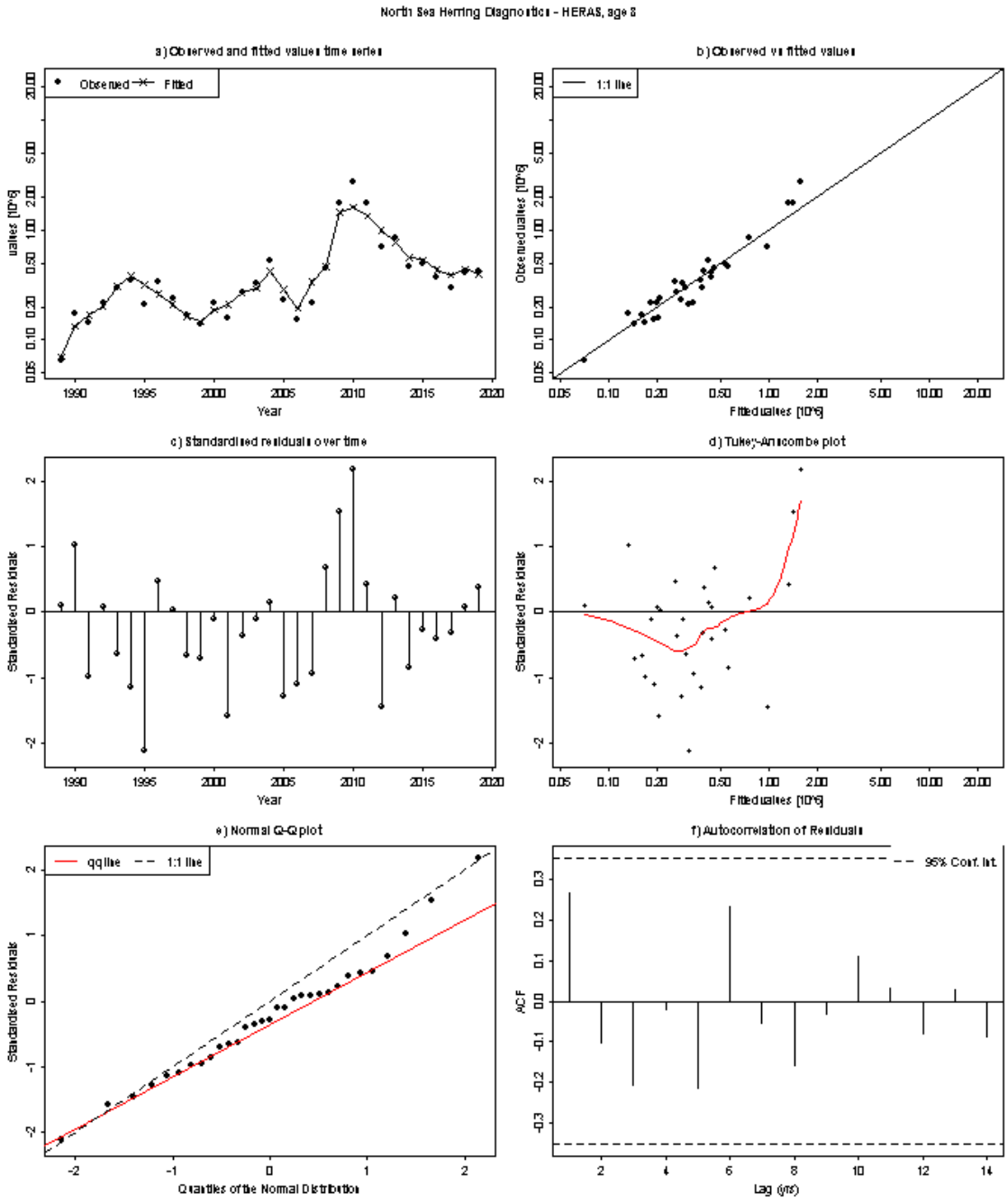


Figure 2.6.1.22. North Sea herring. Diagnostics of the assessment model fit to the HERAS index at age 7 wr time-series. Top left: Estimates of numbers at 7 wr (line) and numbers predicted from index abundance at 7 wr. Top right: scatterplot of index observations vs. assessment model estimates of numbers at 7 wr with the best-fit catchability model (linear function). Middle right: index observation vs. standardized residuals at 7 wr. Middle left: Time-series of standardized residuals of the index at 7 wr. Bottom left: normal Q-Q plot of standardized residuals. Bottom right: Autocorrelation plot.


North Sea Herring Diagnostics - HERAS, age 3
a) Observed and fitted values time series
Observed
Fitted
Year
b) Observed vs fitted values
1:1 line
Fitted values [1000s]
c) Standardised residuals over time
Standardised Residuals
d) Tukey-Anscombe plot
e) Normal Q-Q plot
qq line
1:1 line
Quantiles of the Normal Distribution
f) Autocorrelation of Residuals
95% Conf. Int.
ACF
Lag (yrs)

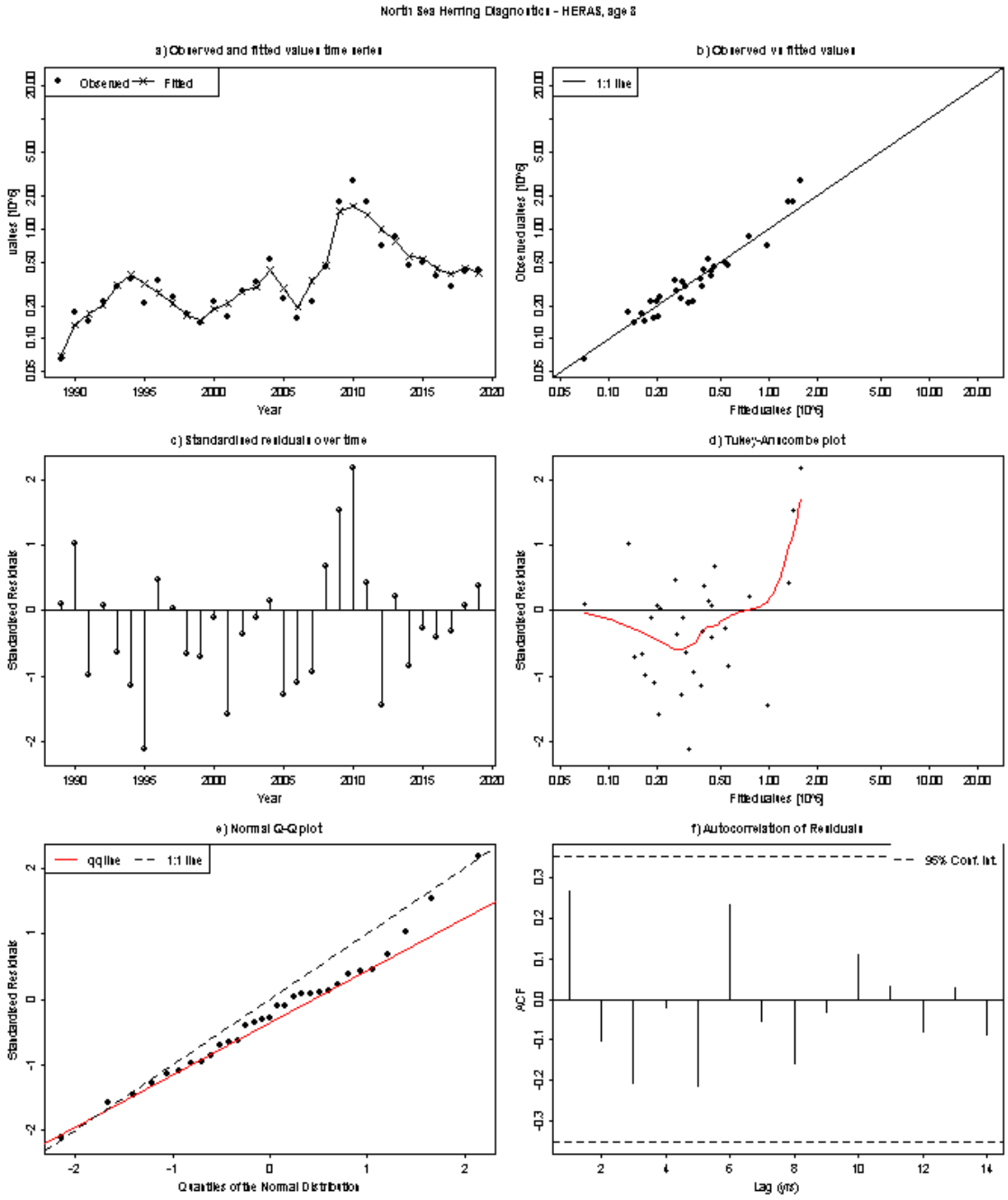
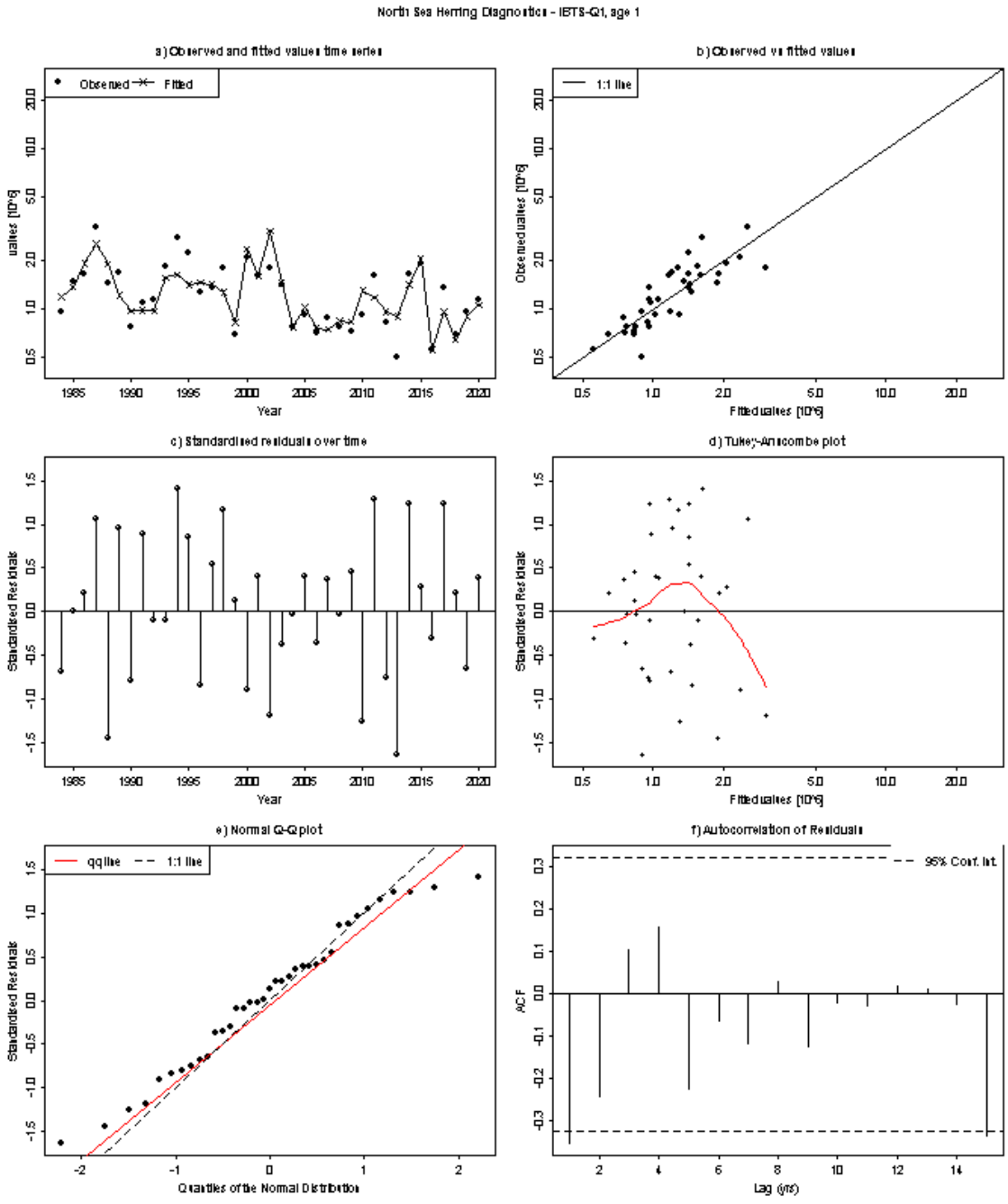


Figure 2.6.1.23. North Sea herring. Diagnostics of the assessment model fit to the HERAS index at age 8+ wr time-series. Top left: Estimates of numbers at 8+ wr (line) and numbers predicted from index abundance at 8+ wr. Top right: scatter-plot of index observations vs. assessment model estimates of numbers at 8+ wr with the best-fit catchability model (linear function). Middle right: index observation vs. standardized residuals at 8+ wr. Middle left: Time-series of standardized residuals of the index at 8+ wr. Bottom left: normal Q-Q plot of standardized residuals. Bottom right: Autocorrelation plot.


North Sea Herring Diagnostics - IBTS-Q1, age 1
a) Observed and fitted values time series
Observed
Fitted
Year
b) Observed vs fitted values
1:1 line
Fitted values [10^6]
c) Standardised residuals over time
Standardised Residuals
Year
d) Tukey-Anscombe plot
Standardised Residuals
Fitted values [10^6]
e) Normal Q-Q plot
qq line
1:1 line
Standardised Residuals
Quantiles of the Normal Distribution
f) Autocorrelation of Residuals
95% Conf. Int.
ACF
Lag (yrs)

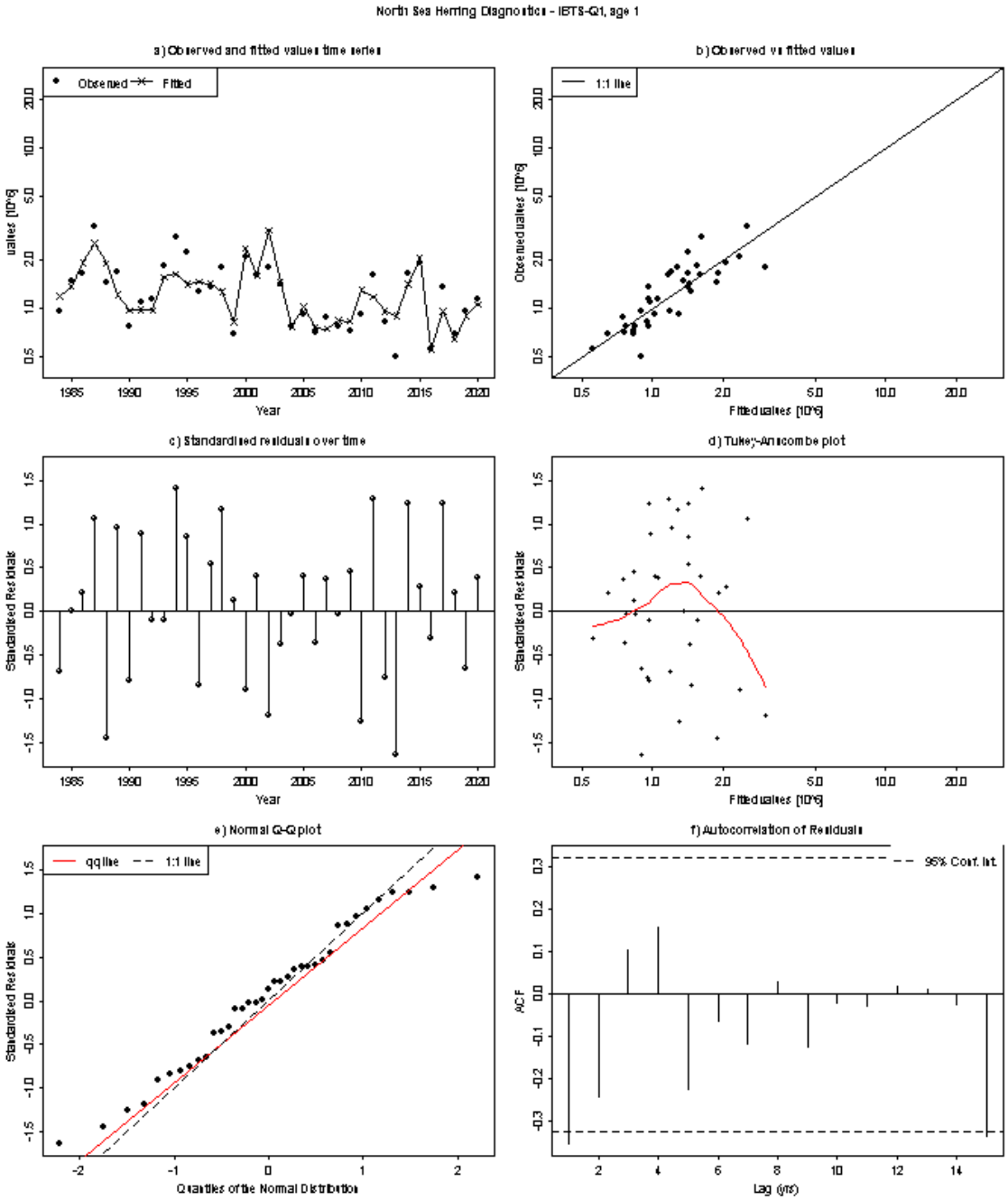
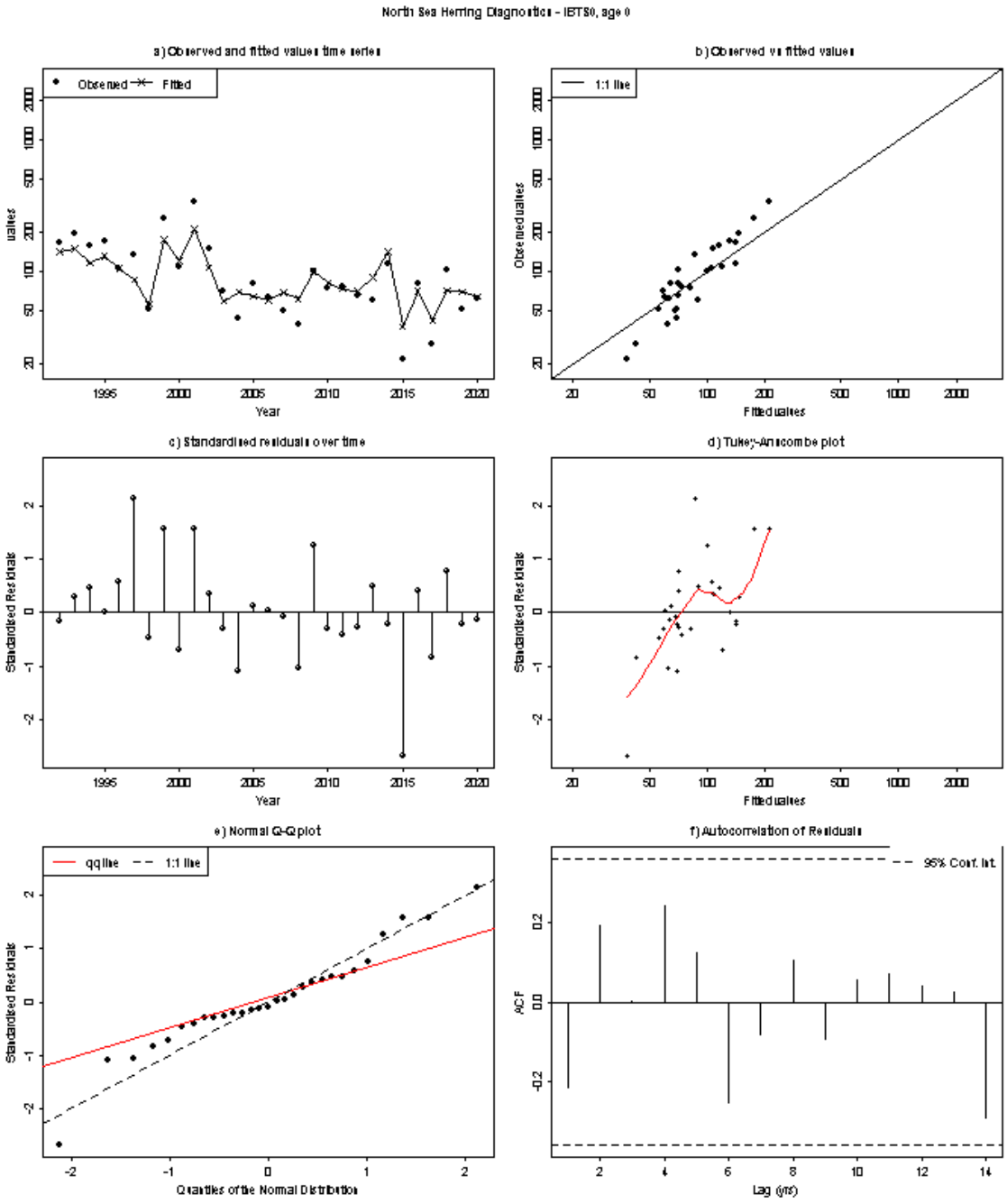


Figure 2.6.1.24. North Sea herring. Diagnostics of the assessment model fit to the IBTS-Q1 index at age 1 wr time-series. Top left: Estimates of numbers at 1 wr (line) and numbers predicted from index abundance at 1 wr. Top right: scatterplot of index observations vs. assessment model estimates of numbers at 1 wr with the best-fit catchability model (linear function). Middle right: index observation vs. standardized residuals at 1 wr. Middle left: Time-series of standardized residuals of the index at 1 wr. Bottom left: normal Q-Q plot of standardized residuals. Bottom right: Autocorrelation plot.


North Sea Herring Diagnostics - IBTS0, age 0
a) Observed and fitted values time series
Observed
Fitted
Year
b) Observed vs fitted values
1:1 line
Observed values
Fitted values
c) Standardised residuals over time
Standardised Residuals
Year
d) Tukey-Anscombe plot
Standardised Residuals
Fitted values
e) Normal Q-Q plot
qq line
1:1 line
Standardised Residuals
Quantiles of the Normal Distribution
f) Autocorrelation of Residuals
95% Conf. Int.
ACF
Lag (yrs)

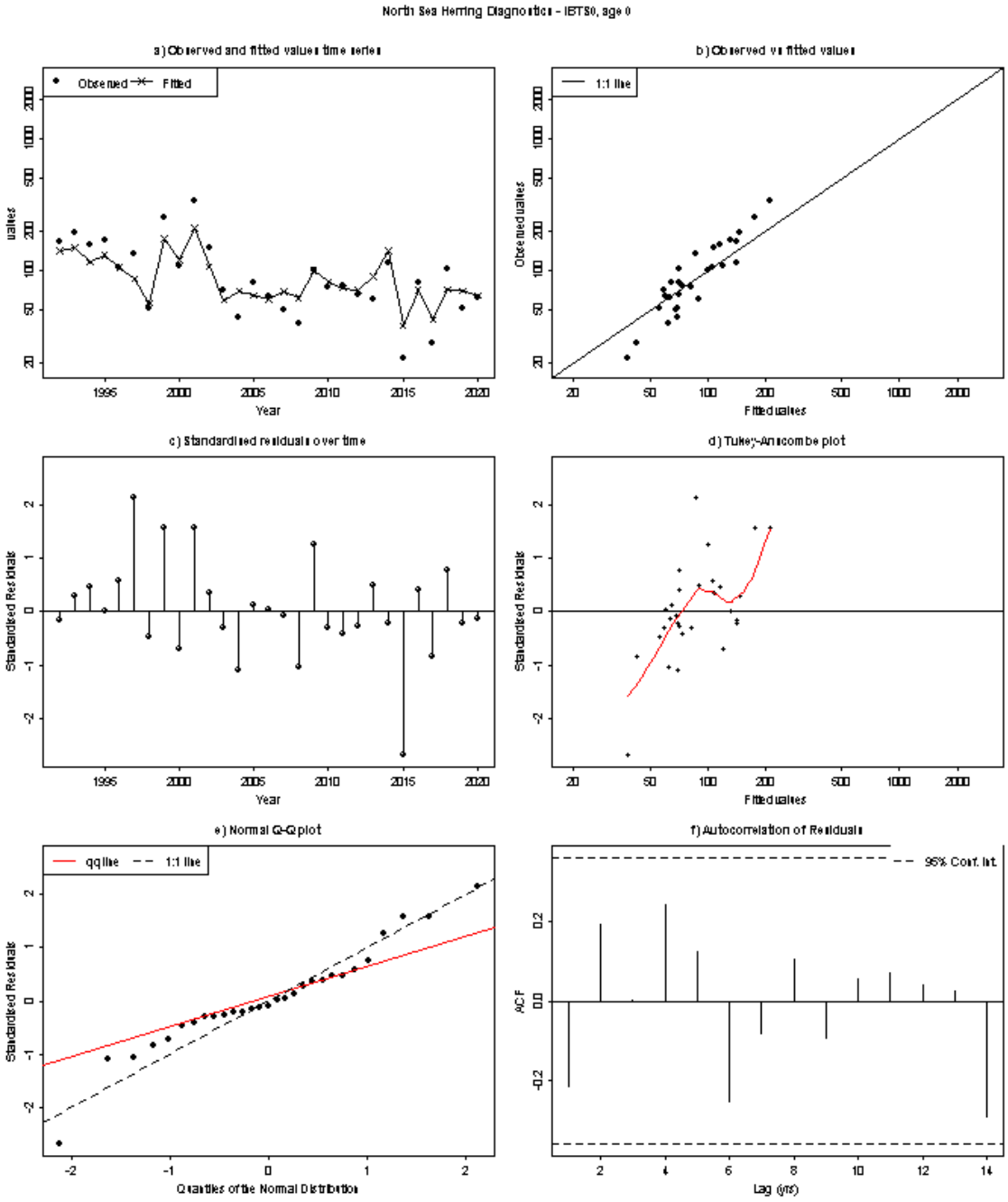


Figure 2.6.1.25. North Sea herring. Diagnostics of the assessment model fit to the IBTS0 index at age 0 wr time-series. Top left: Estimates of numbers at 0 wr (line) and numbers predicted from index abundance at 0 wr. Top right: scatterplot of index observations vs. assessment model estimates of numbers at 0 wr with the best-fit catchability model (linear function). Middle right: index observation vs. standardized residuals at 0 wr. Middle left: Time-series of standardized residuals of the index at 0 wr. Bottom left: normal Q-Q plot of standardized residuals. Bottom right: Autocorrelation plot.

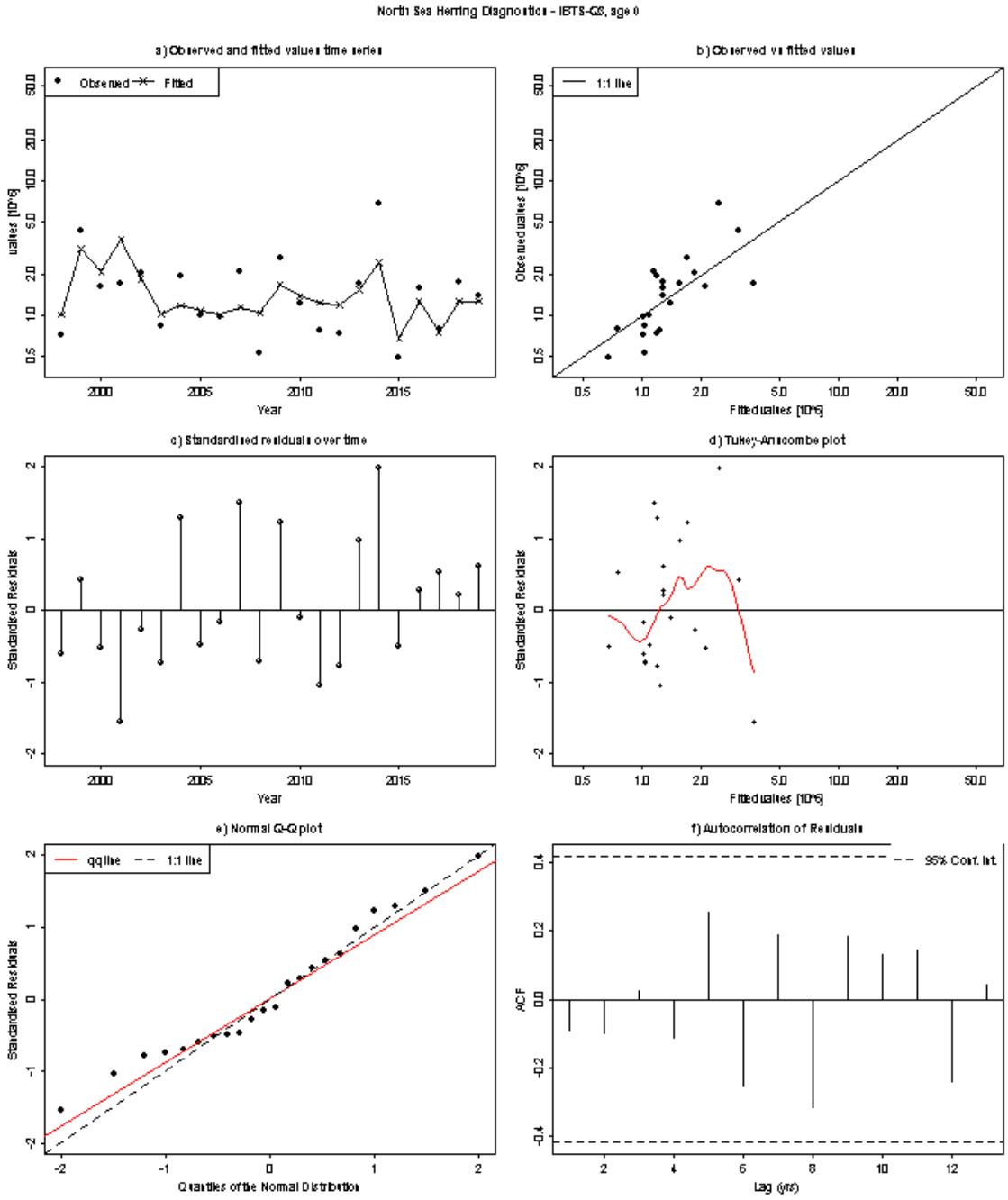


Figure 2.6.1.26. North Sea herring. Diagnostics of the assessment model fit to the IBTS-Q3 index at age 0 wr time-series. Top left: Estimates of numbers at 0 wr (line) and numbers predicted from index abundance at 0 wr. Top right: scatterplot of index observations vs. assessment model estimates of numbers at 0 wr with the best-fit catchability model (linear function). Middle right: index observation vs. standardized residuals at 0 wr. Middle left: Time-series of standardized residuals of the index at 0 wr. Bottom left: normal Q-Q plot of standardized residuals. Bottom right: Autocorrelation plot.

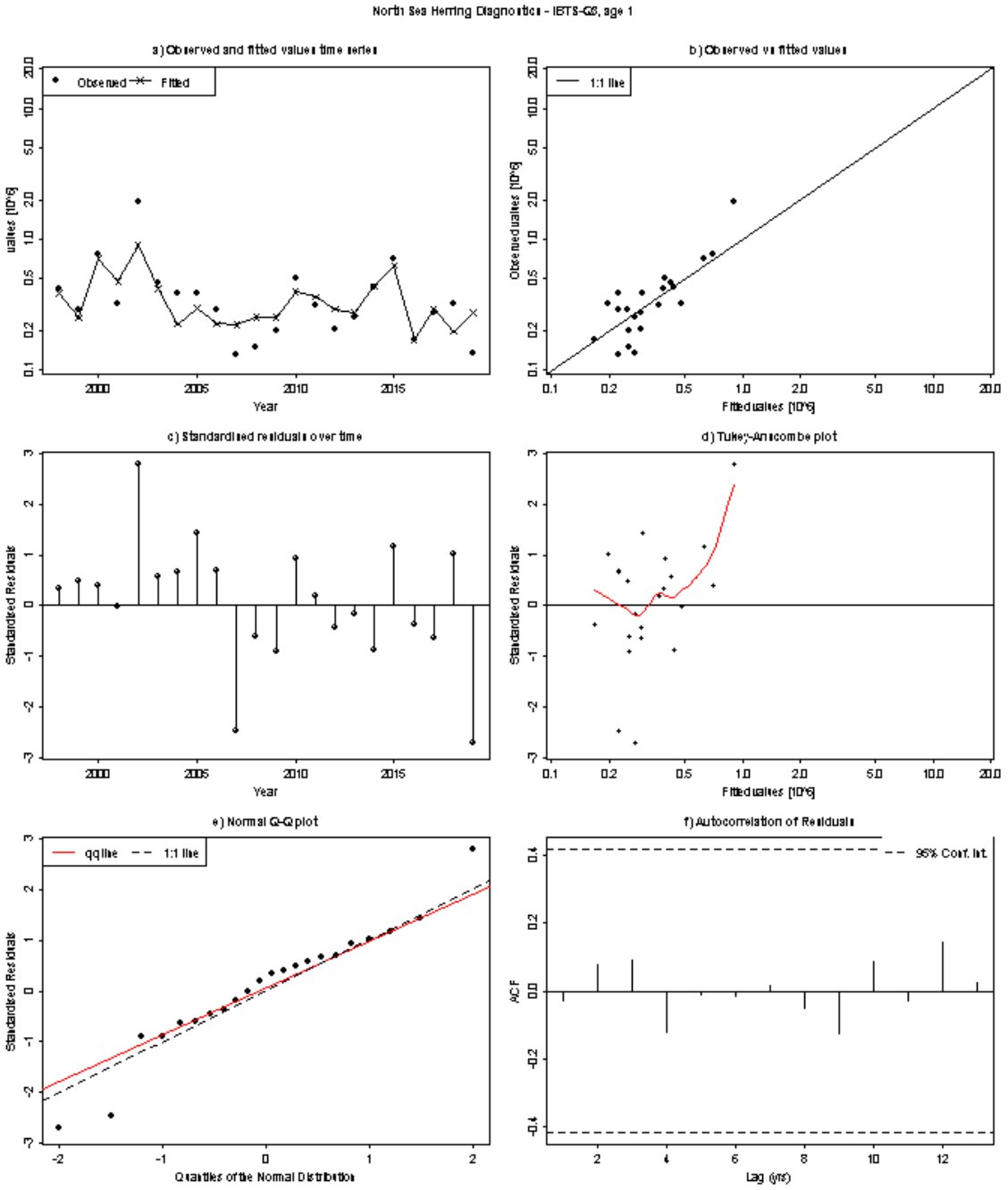


Figure 2.6.1.27. North Sea herring. Diagnostics of the assessment model fit to the IBTS-Q3 index at age 1 wr time-series. Top left: Estimates of numbers at 0 wr (line) and numbers predicted from index abundance at 0 wr. Top right: scatterplot of index observations vs. assessment model estimates of numbers at 0 wr with the best-fit catchability model (linear function). Middle right: index observation vs. standardized residuals at 0 wr. Middle left: Time-series of standardized residuals of the index at 0 wr. Bottom left: normal Q-Q plot of standardized residuals. Bottom right: Autocorrelation plot.

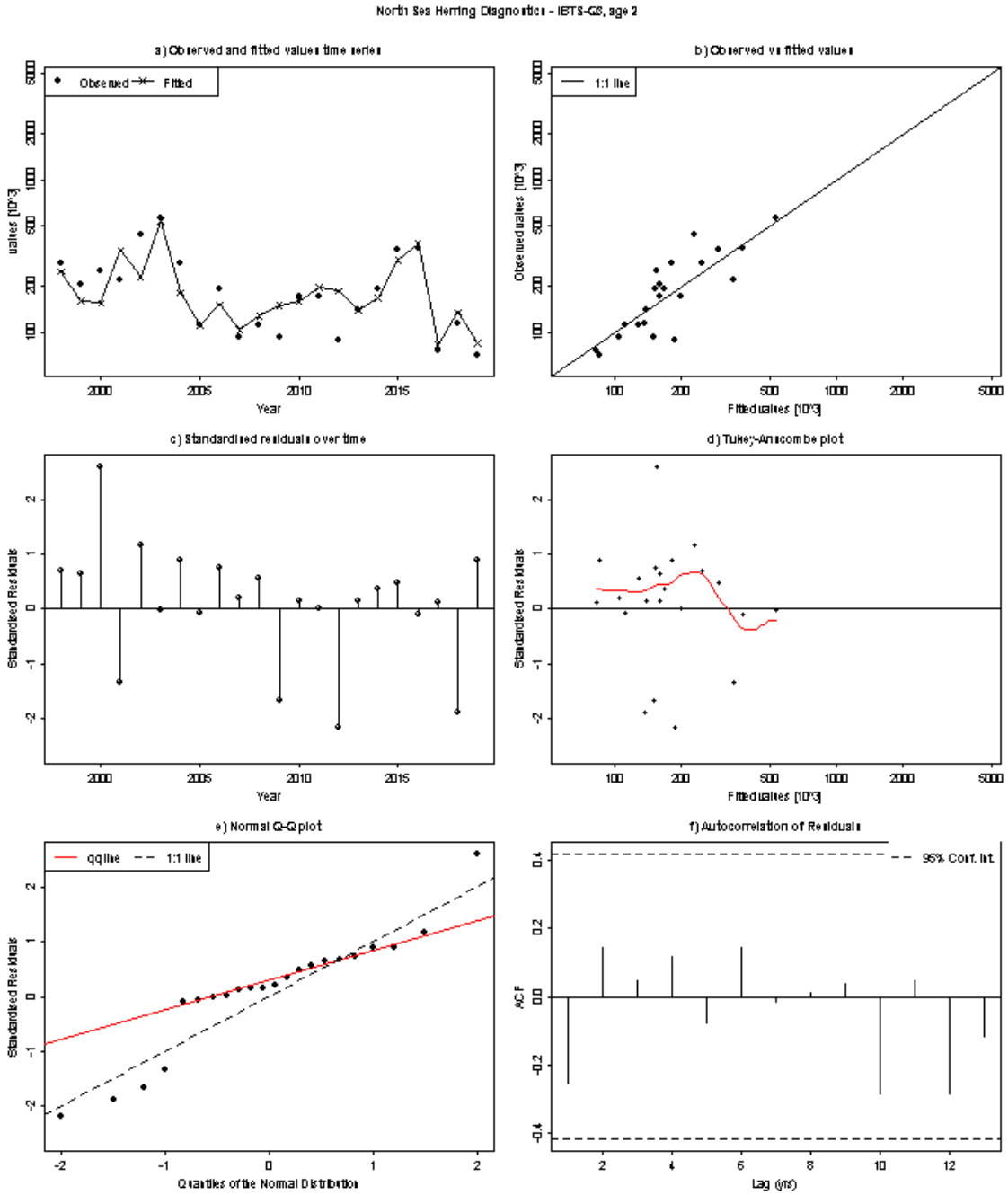


Figure 2.6.1.28. North Sea herring. Diagnostics of the assessment model fit to the IBTS-Q3 index at age 2 wr time-series. Top left: Estimates of numbers at 0 wr (line) and numbers predicted from index abundance at 0 wr. Top right: scatterplot of index observations vs. assessment model estimates of numbers at 0 wr with the best-fit catchability model (linear function). Middle right: index observation vs. standardized residuals at 0 wr. Middle left: Time-series of standardized residuals of the index at 0 wr. Bottom left: normal Q-Q plot of standardized residuals. Bottom right: Autocorrelation plot.

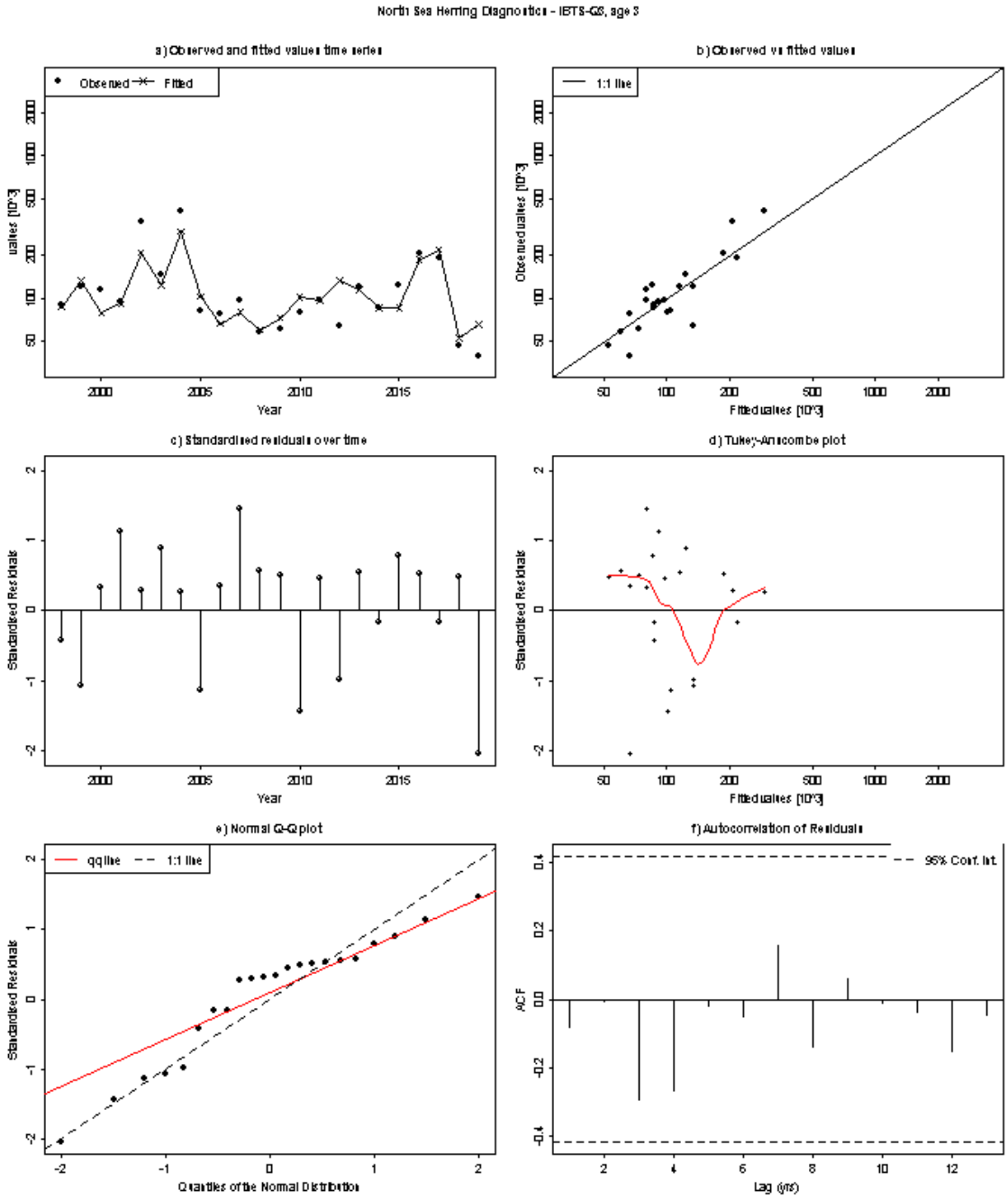


Figure 2.6.1.29. North Sea herring. Diagnostics of the assessment model fit to the IBTS-Q3 index at age 3 wr time-series. Top left: Estimates of numbers at 0 wr (line) and numbers predicted from index abundance at 0 wr. Top right: scatterplot of index observations vs. assessment model estimates of numbers at 0 wr with the best-fit catchability model (linear function). Middle right: index observation vs. standardized residuals at 0 wr. Middle left: Time-series of standardized residuals of the index at 0 wr. Bottom left: normal Q-Q plot of standardized residuals. Bottom right: Autocorrelation plot.

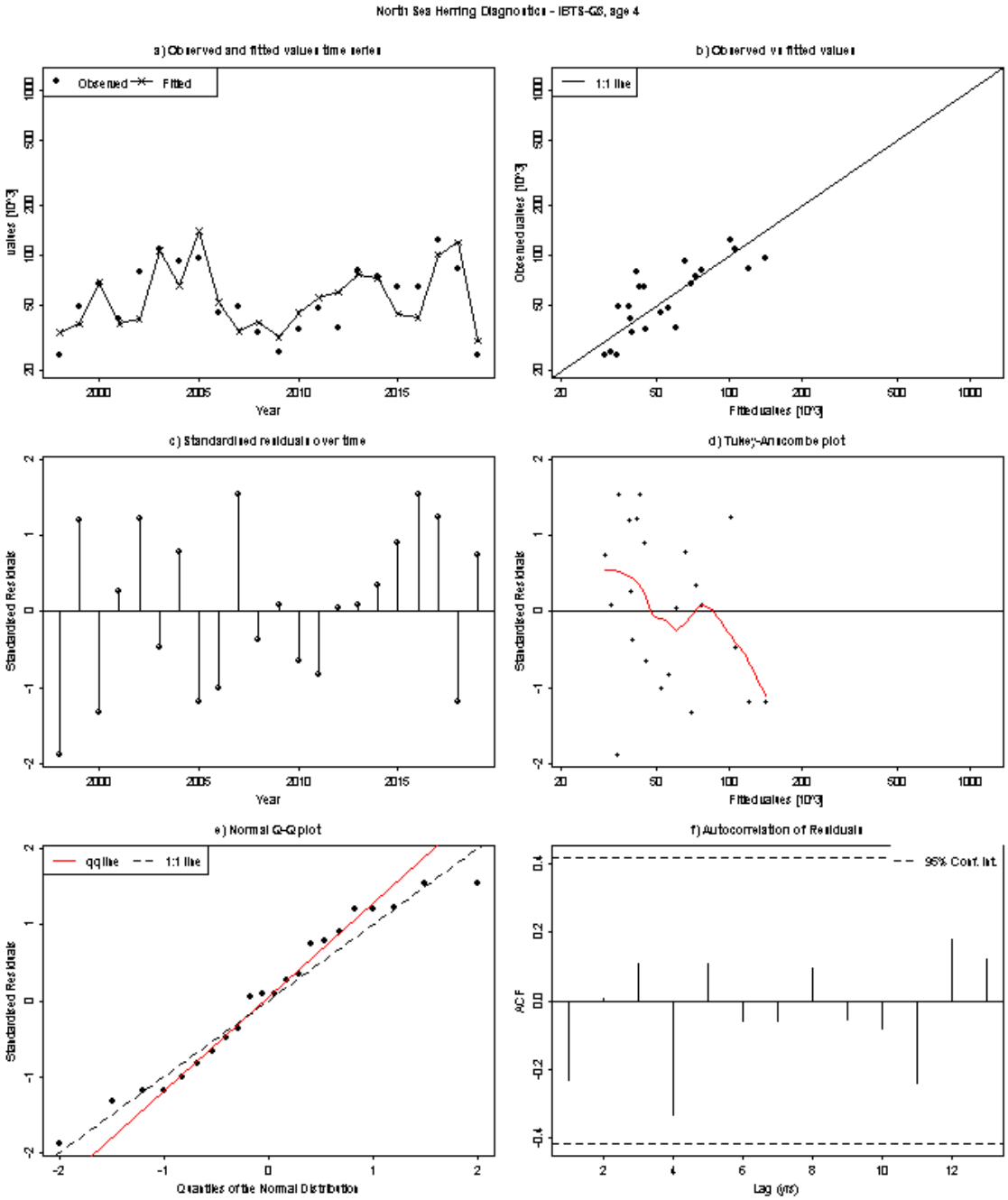


Figure 2.6.1.30. North Sea herring. Diagnostics of the assessment model fit to the IBTS-Q3 index at age 4 wr time-series. Top left: Estimates of numbers at 0 wr (line) and numbers predicted from index abundance at 0 wr. Top right: scatterplot of index observations vs. assessment model estimates of numbers at 0 wr with the best-fit catchability model (linear function). Middle right: index observation vs. standardized residuals at 0 wr. Middle left: Time-series of standardized residuals of the index at 0 wr. Bottom left: normal Q-Q plot of standardized residuals. Bottom right: Autocorrelation plot.

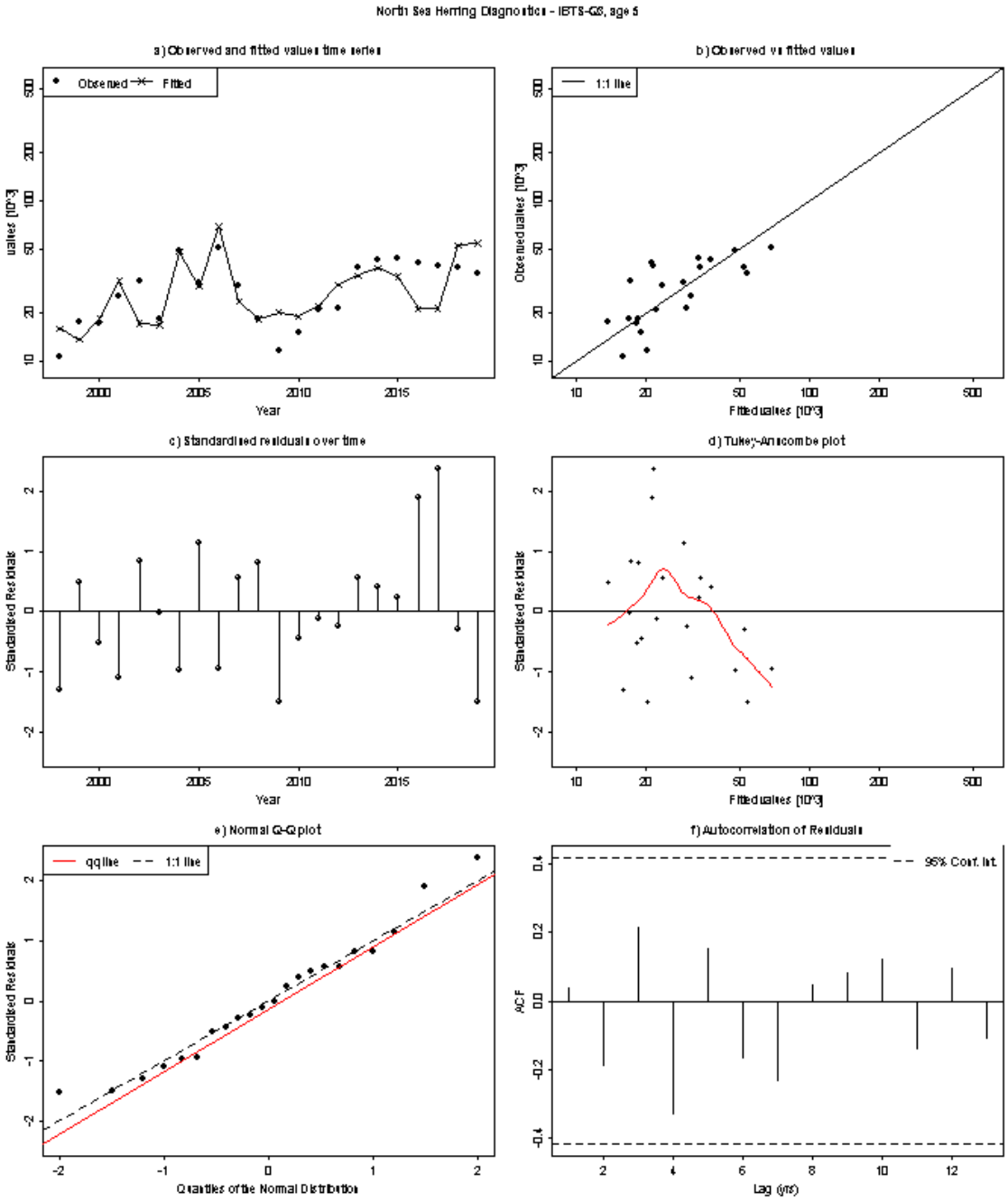
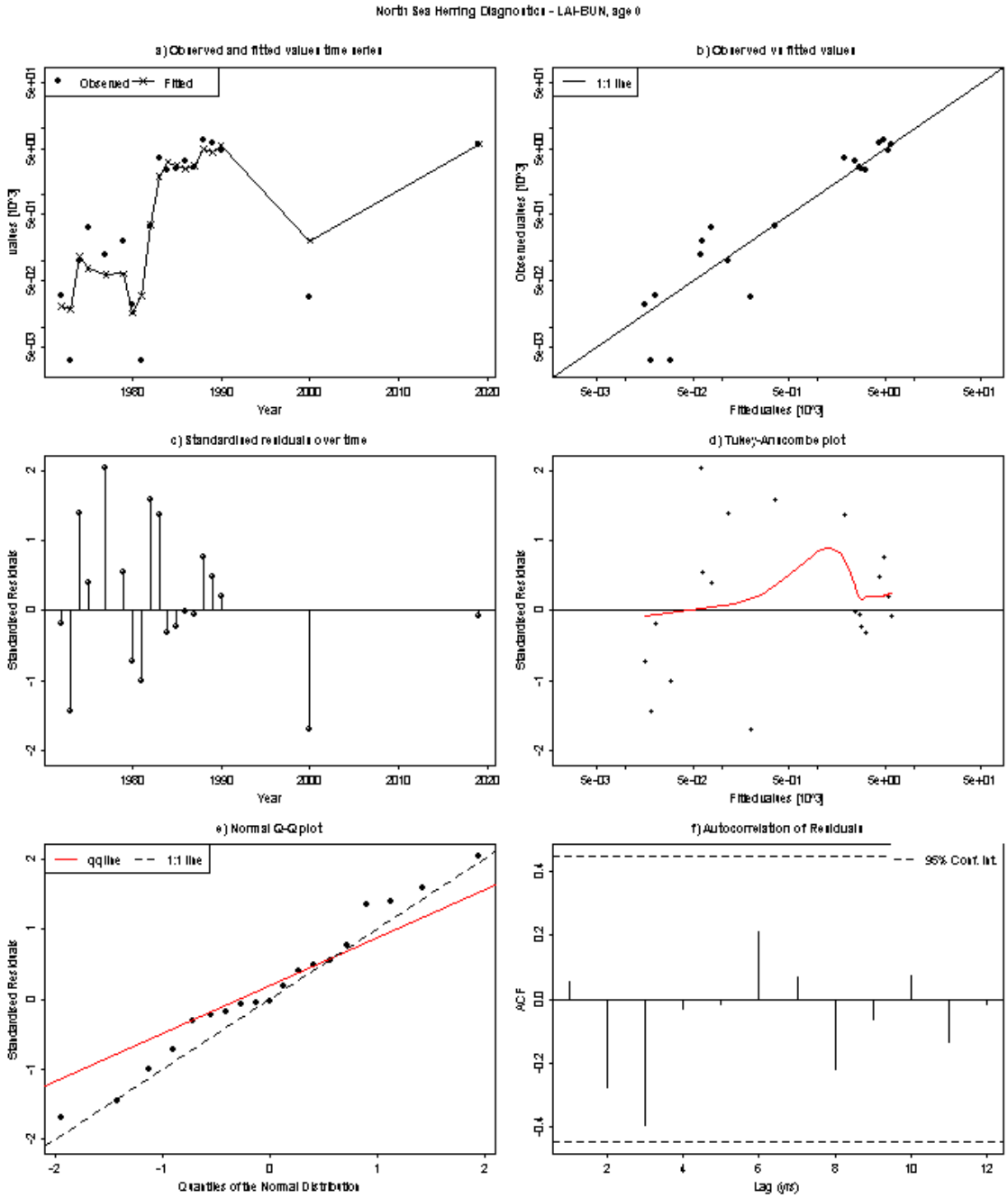


Figure 2.6.1.31. North Sea herring. Diagnostics of the assessment model fit to the IBTS-Q3 index at age 5 wr time-series. Top left: Estimates of numbers at 0 wr (line) and numbers predicted from index abundance at 0 wr. Top right: scatterplot of index observations vs. assessment model estimates of numbers at 0 wr with the best-fit catchability model (linear function). Middle right: index observation vs. standardized residuals at 0 wr. Middle left: Time-series of standardized residuals of the index at 0 wr. Bottom left: normal Q-Q plot of standardized residuals. Bottom right: Autocorrelation plot.


North Sea Herring Diagnostics - LAI-BUN, age 0
a) Observed and fitted values time series
Observed
Fitted
Year
b) Observed vs fitted values
1:1 line
Fitted values [10^3]
c) Standardised residuals over time
Standardised Residuals
d) Tukey-Anscombe plot
e) Normal Q-Q plot
qq line
1:1 line
Quantiles of the Normal Distribution
f) Autocorrelation of Residuals
95% Conf. Int.
ACF
Lag (yrs)

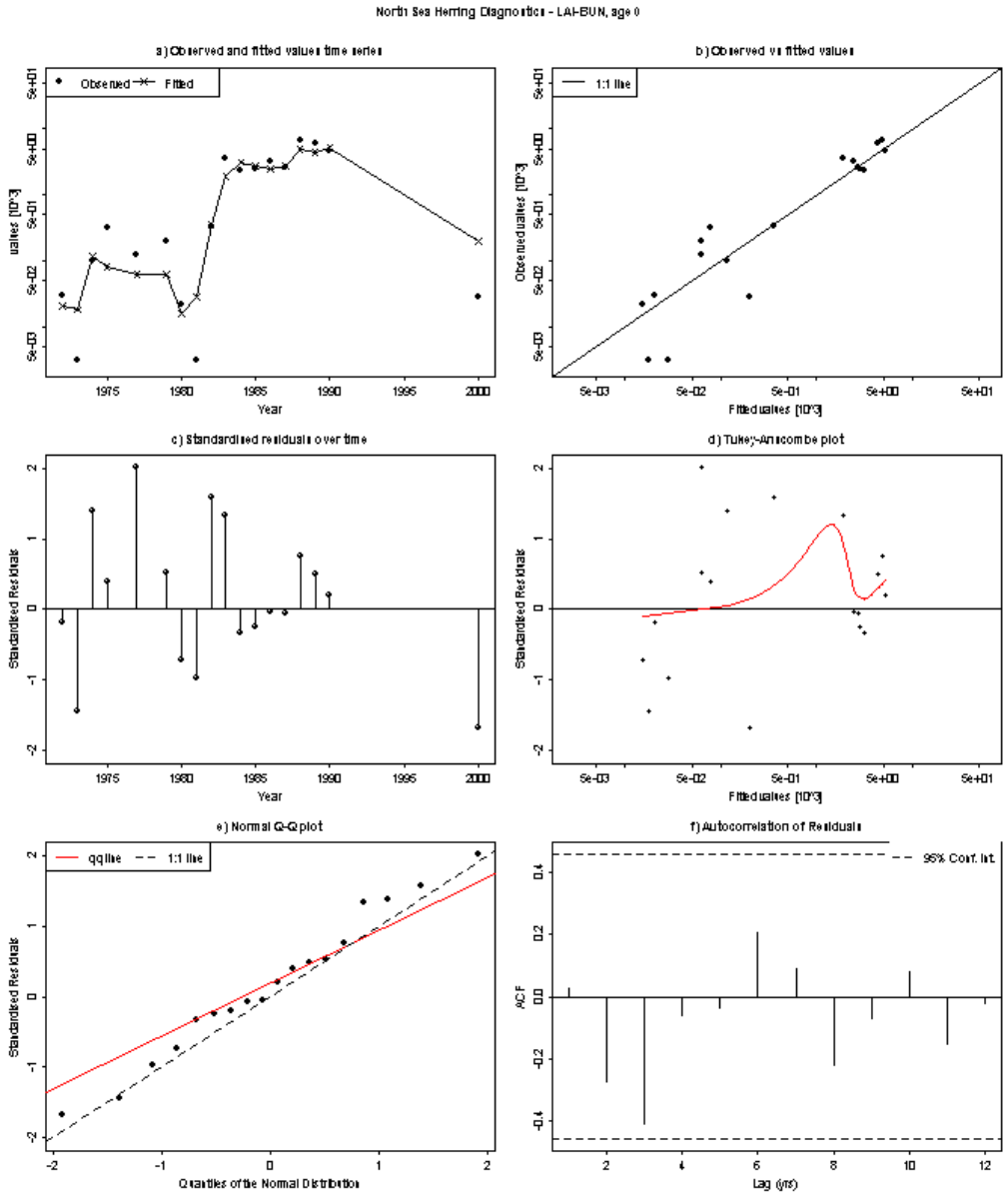
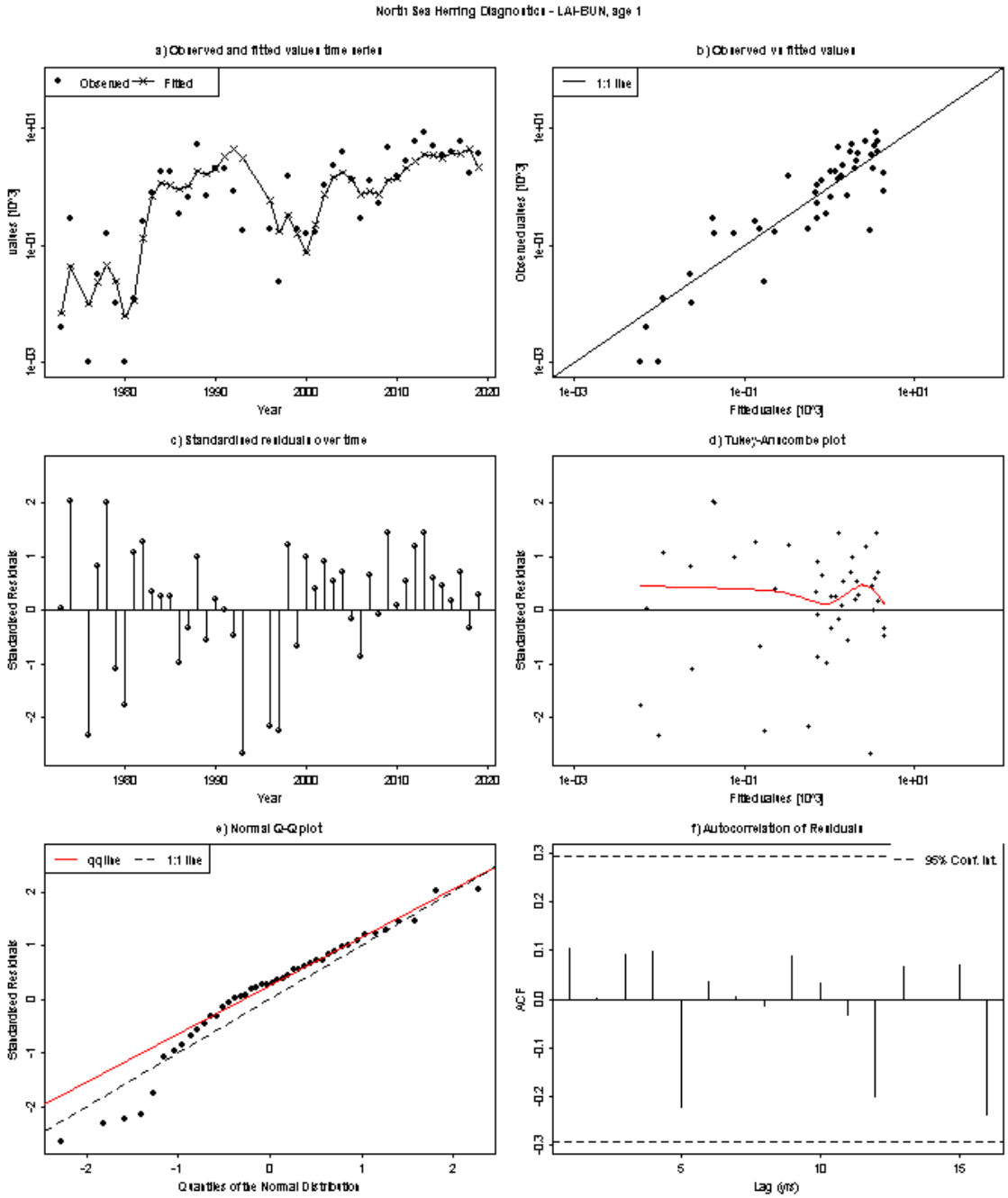


Figure 2.6.1.32. North Sea herring. Diagnostics of the assessment model fit to the LAI index in the Buchan area for the first week time-series available for this component. Top left: Estimates of numbers at 0 wr (line) and numbers predicted from index abundance at 0 wr. Top right: scatterplot of index observations vs. assessment model estimates of numbers at 0 wr with the best-fit catchability model (linear function). Middle right: index observation vs. standardized residuals at 0 wr. Middle left: Time-series of standardized residuals of the index at 0 wr. Bottom left: normal Q-Q plot of standardized residuals. Bottom right: Autocorrelation plot.


North Sea Herring Diagnostics - LAI-BUN, age 1
a) Observed and fitted values time series
Observed
Fitted
Year
b) Observed vs fitted values
1:1 line
Observed values [10^3]
Fitted values [10^3]
c) Standardised residuals over time
Standardised Residuals
Year
d) Tukey-Anscombe plot
Standardised Residuals
Fitted values [10^3]
e) Normal Q-Q plot
qq line
1:1 line
Standardised Residuals
Quantiles of the Normal Distribution
f) Autocorrelation of Residuals
95% Conf. Int.
ACF
Lag (yrs)

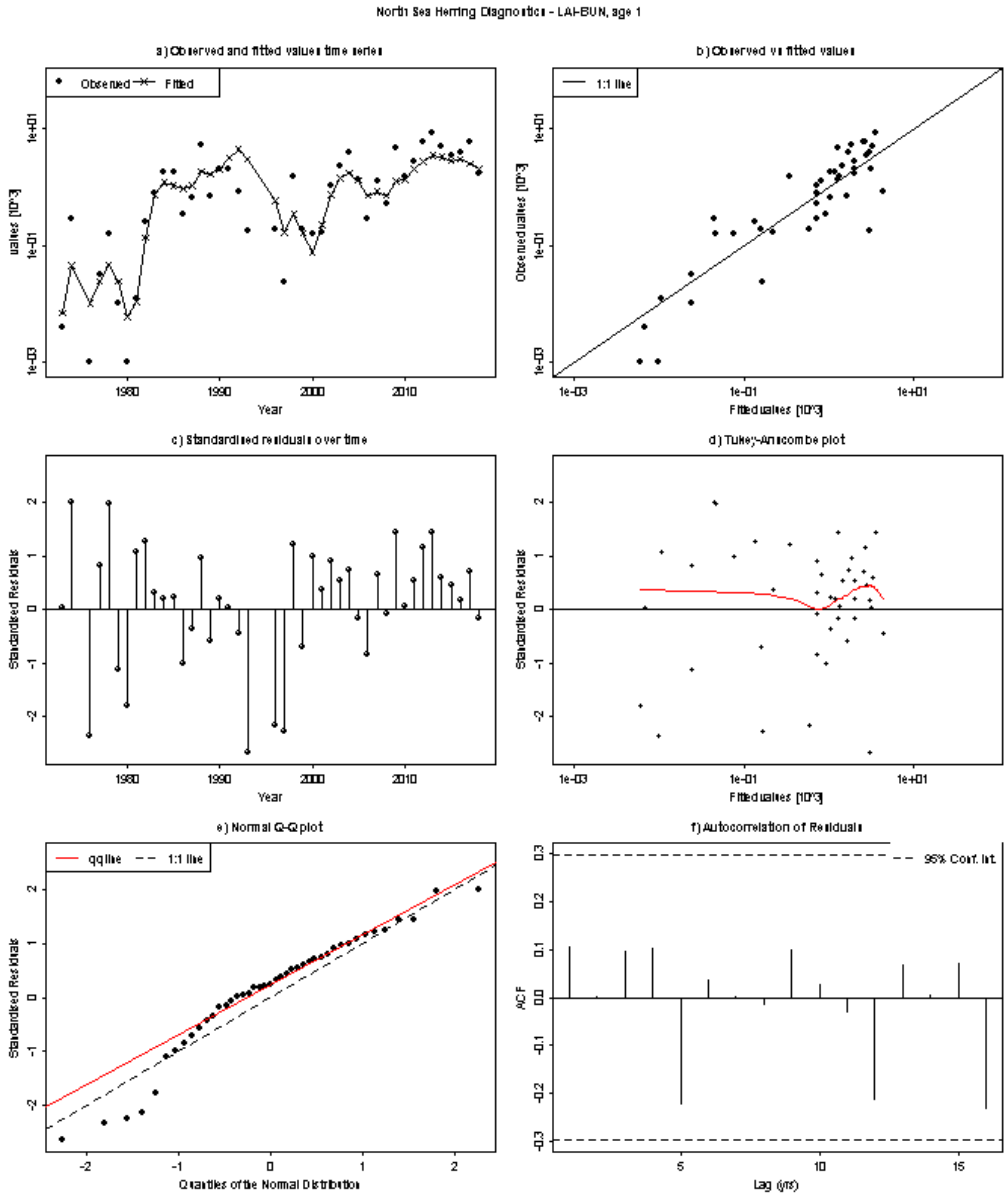
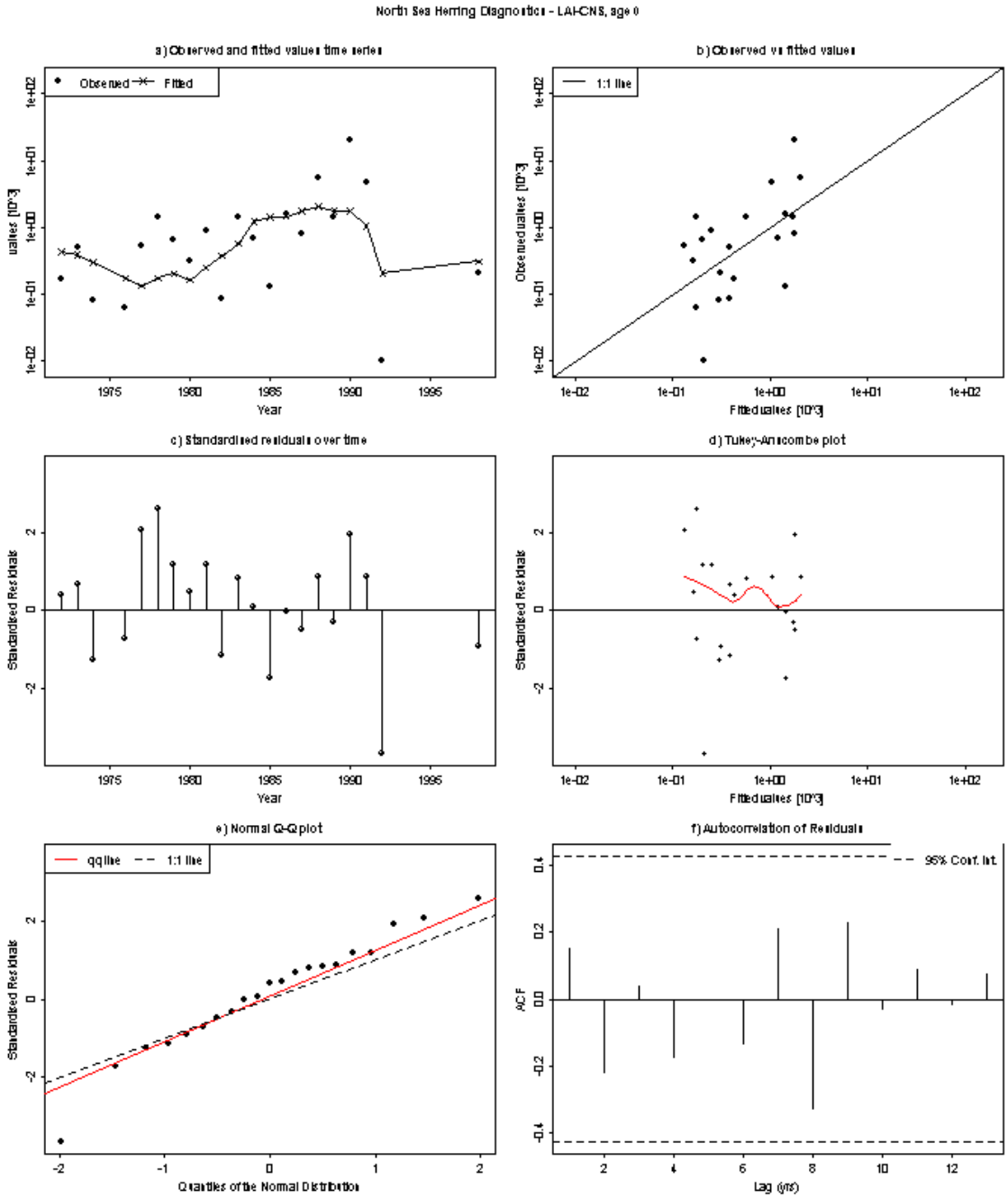


Figure 2.6.1.33. North Sea herring. Diagnostics of the assessment model fit to the LAI index in the Buchan area for the second week time-series available for this component. Top left: Estimates of numbers at 0 wr (line) and numbers predicted from index abundance at 0 wr. Top right: scatterplot of index observations vs. assessment model estimates of numbers at 0 wr with the best-fit catchability model (linear function). Middle right: index observation vs. standardized residuals at 0 wr. Middle left: Time-series of standardized residuals of the index at 0 wr. Bottom left: normal Q-Q plot of standardized residuals. Bottom right: Autocorrelation plot.


North Sea Herring Diagnostics - LAI-CNS, age 0
a) Observed and fitted values time series
Observed
Fitted
Year
b) Observed vs fitted values
1:1 line
Fitted values [10^3]
c) Standardised residuals over time
Standardised Residuals
Year
d) Tukey-Anscombe plot
Standardised Residuals
Fitted values [10^3]
e) Normal Q-Q plot
qq line
1:1 line
Standardised Residuals
Quantiles of the Normal Distribution
f) Autocorrelation of Residuals
95% Conf. Int.
ACF
Lag (yrs)

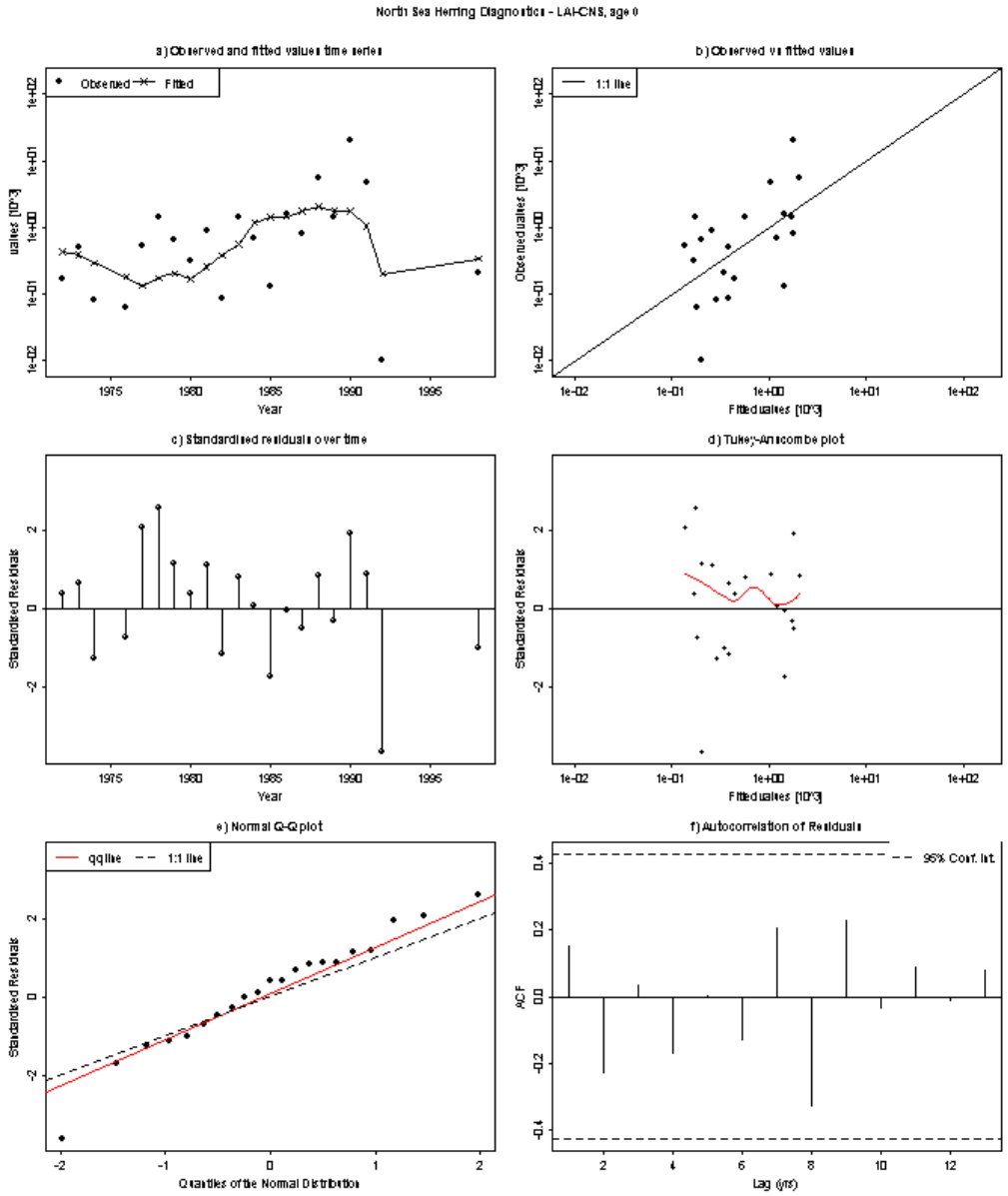
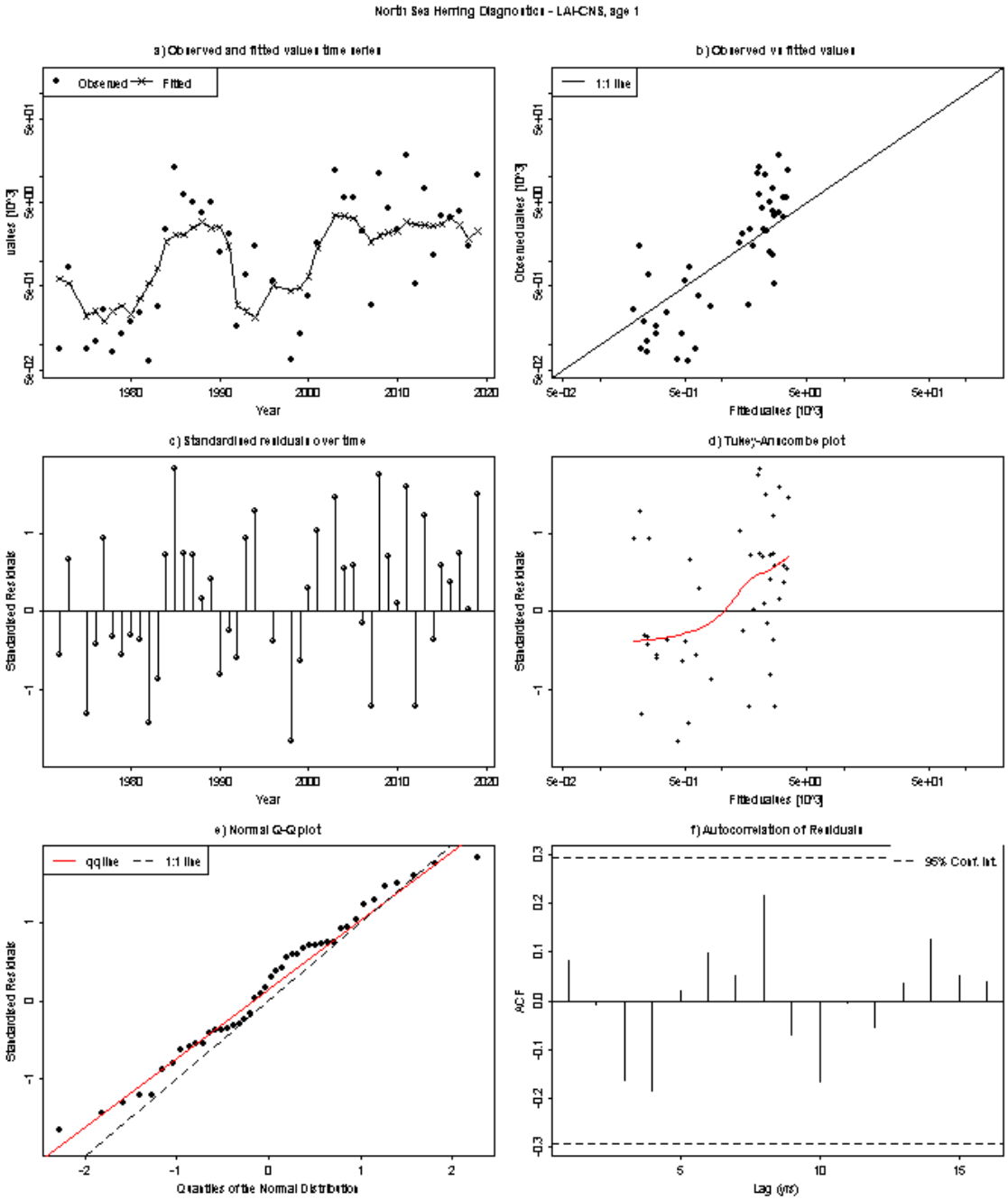


Figure 2.6.1.34. North Sea herring. Diagnostics of the assessment model fit to the LAI index in the Banks area for the first week time-series available for this component. Top left: Estimates of numbers at 0 wr (line) and numbers predicted from index abundance at 0 wr. Top right: scatterplot of index observations vs. assessment model estimates of numbers at 0 wr with the best-fit catchability model (linear function). Middle right: index observation vs. standardized residuals at 0 wr. Middle left: Time-series of standardized residuals of the index at 0 wr. Bottom left: normal Q-Q plot of standardized residuals. Bottom right: Autocorrelation plot.


North Sea Herring Diagnostics - LAI-CNS, age 1
a) Observed and fitted values time series
Observed
Fitted
Year
b) Observed vs fitted values
1:1 line
Fitted values [10^3]
c) Standardised residuals over time
Standardised Residuals
d) Tukey-Anscombe plot
e) Normal Q-Q plot
qq line
1:1 line
Quantiles of the Normal Distribution
f) Autocorrelation of Residuals
95% Conf. Int.
ACF
Lag (yrs)

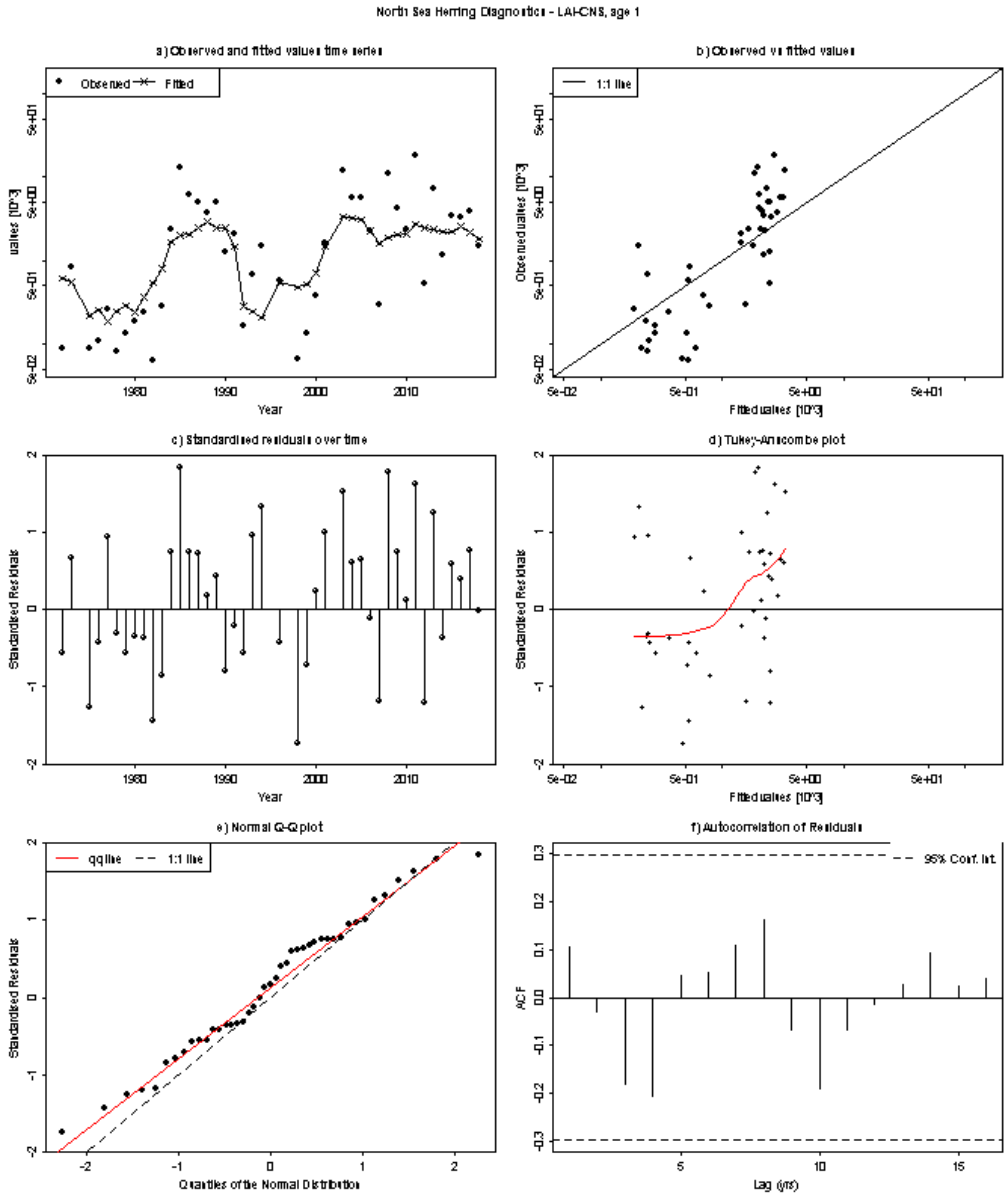
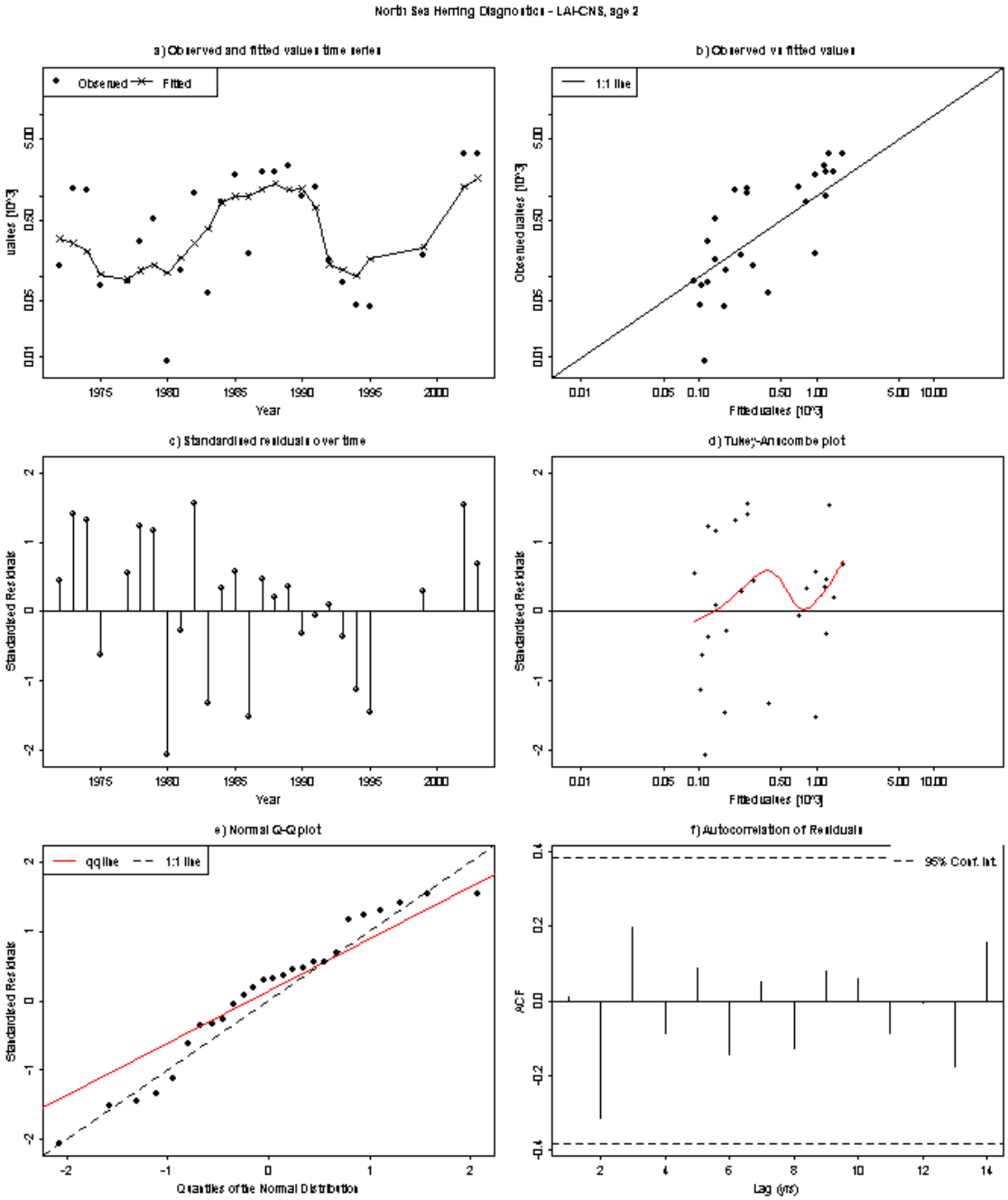


Figure 2.6.1.35. North Sea herring. Diagnostics of the assessment model fit to the LAI index in the Banks area for the second week time-series available for this component. Top left: Estimates of numbers at 0 wr (line) and numbers predicted from index abundance at 0 wr. Top right: scatterplot of index observations vs. assessment model estimates of numbers at 0 wr with the best-fit catchability model (linear function). Middle right: index observation vs. standardized residuals at 0 wr. Middle left: Time-series of standardized residuals of the index at 0 wr. Bottom left: normal Q-Q plot of standardized residuals. Bottom right: Autocorrelation plot.


North Sea Herring Diagnostics - LAI-CNS, age 2
a) Observed and fitted values time series
Observed
Fitted
Year
b) Observed vs fitted values
1:1 line
Observed values [10^3]
Fitted values [10^3]
c) Standardised residuals over time
Standardised Residuals
Year
d) Tukey-Anscombe plot
Standardised Residuals
Fitted values [10^3]
e) Normal Q-Q plot
qq line
1:1 line
Standardised Residuals
Quantiles of the Normal Distribution
f) Autocorrelation of Residuals
95% Conf. Int.
ACF
Lag (yrs)

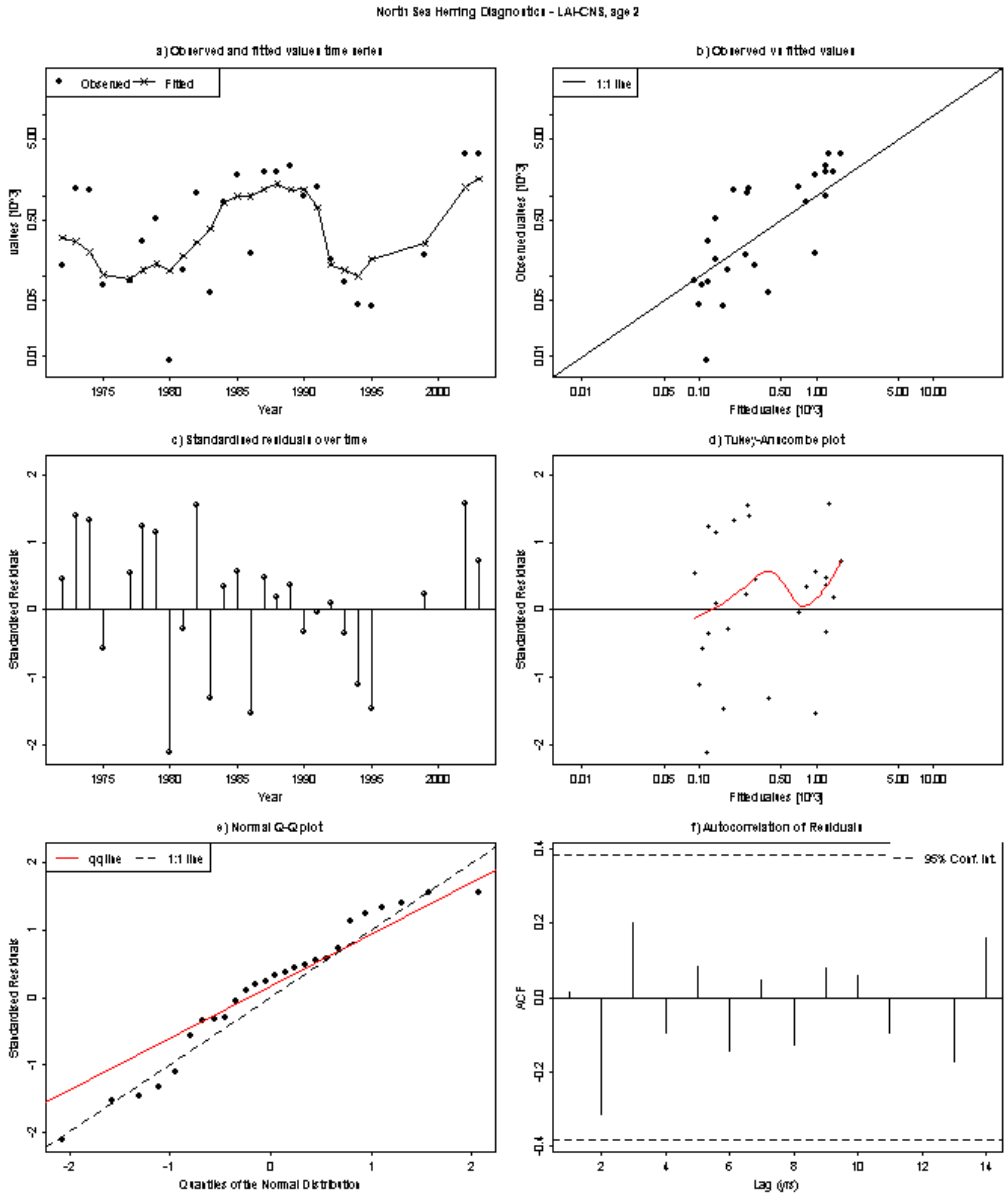
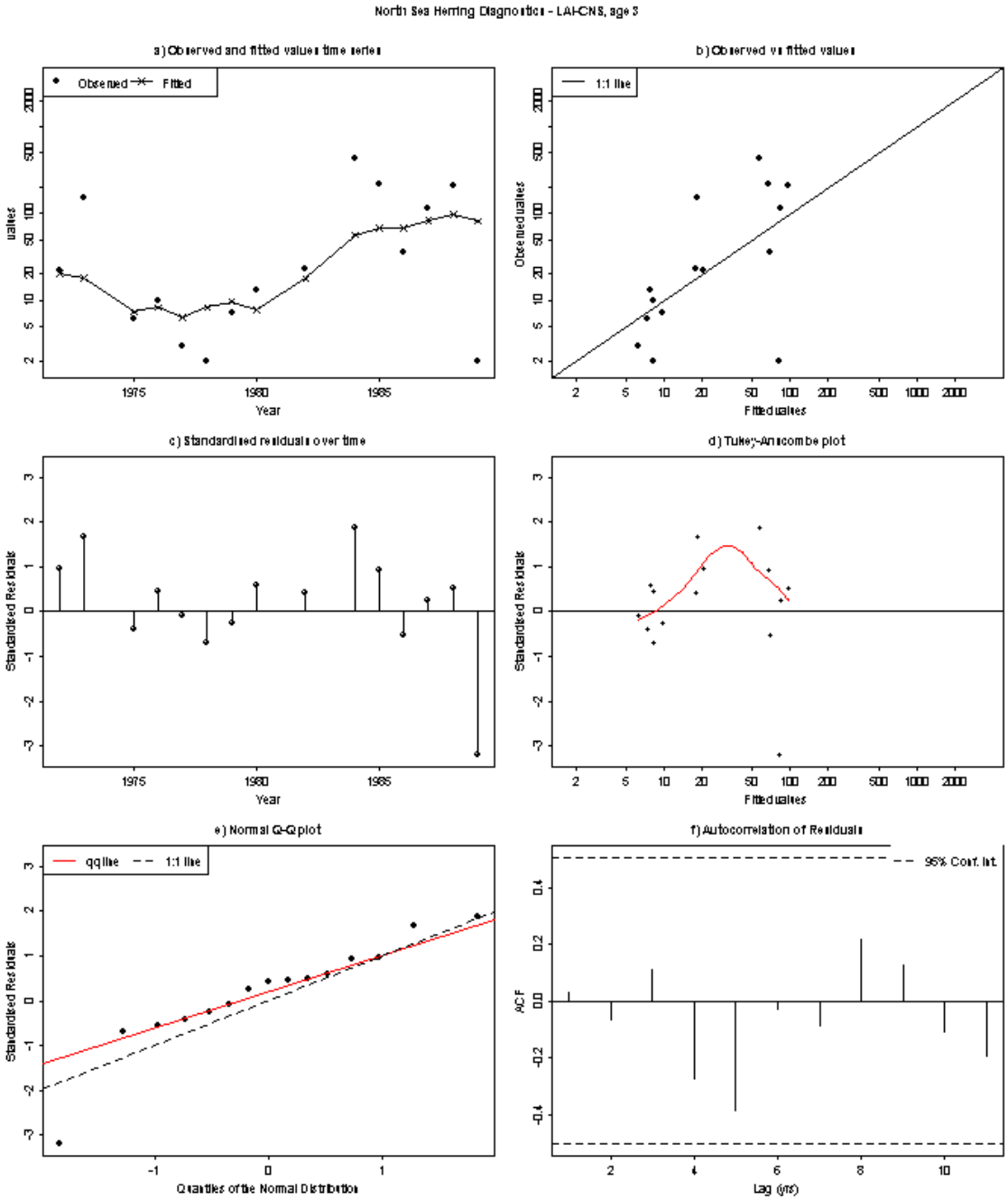


Figure 2.6.1.36. North Sea herring. Diagnostics of the assessment model fit to the LAI index in the Banks area for the third week time-series available for this component. Top left: Estimates of numbers at 0 wr (line) and numbers predicted from index abundance at 0 wr. Top right: scatterplot of index observations vs. assessment model estimates of numbers at 0 wr with the best-fit catchability model (linear function). Middle right: index observation vs. standardized residuals at 0 wr. Middle left: Time-series of standardized residuals of the index at 0 wr. Bottom left: normal Q-Q plot of standardized residuals. Bottom right: Autocorrelation plot.


North Sea Herring Diagnostics - LAI-CNS, age 3
a) Observed and fitted values time series
Observed
Fitted
Year
b) Observed vs fitted values
1:1 line
Observed values
Fitted values
c) Standardised residuals over time
Standardised Residuals
Year
d) Tukey-Anscombe plot
Standardised Residuals
Fitted values
e) Normal Q-Q plot
qq line
1:1 line
Standardised Residuals
Quantiles of the Normal Distribution
f) Autocorrelation of Residuals
95% Conf. Int.
ACF
Lag (yrs)

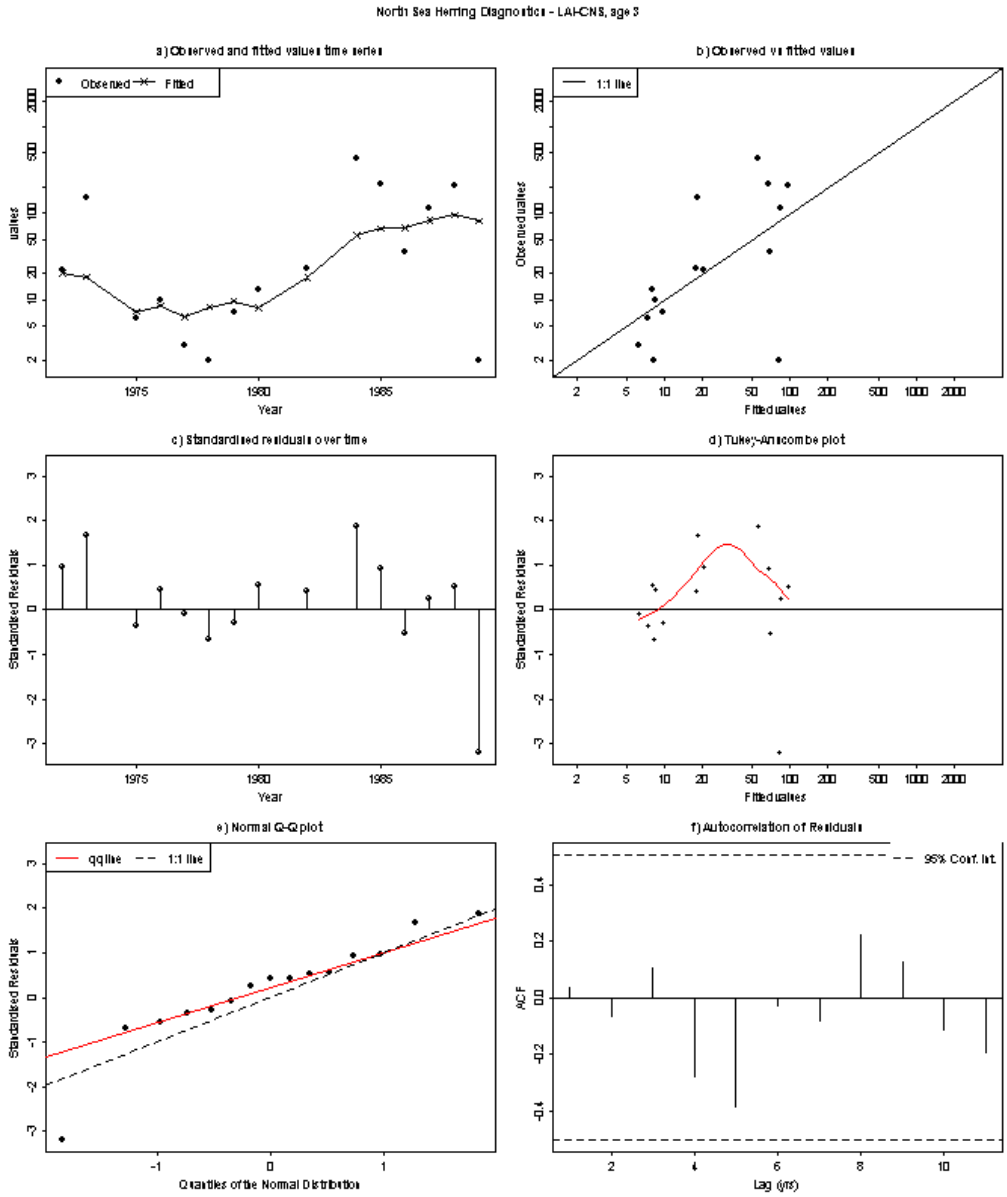
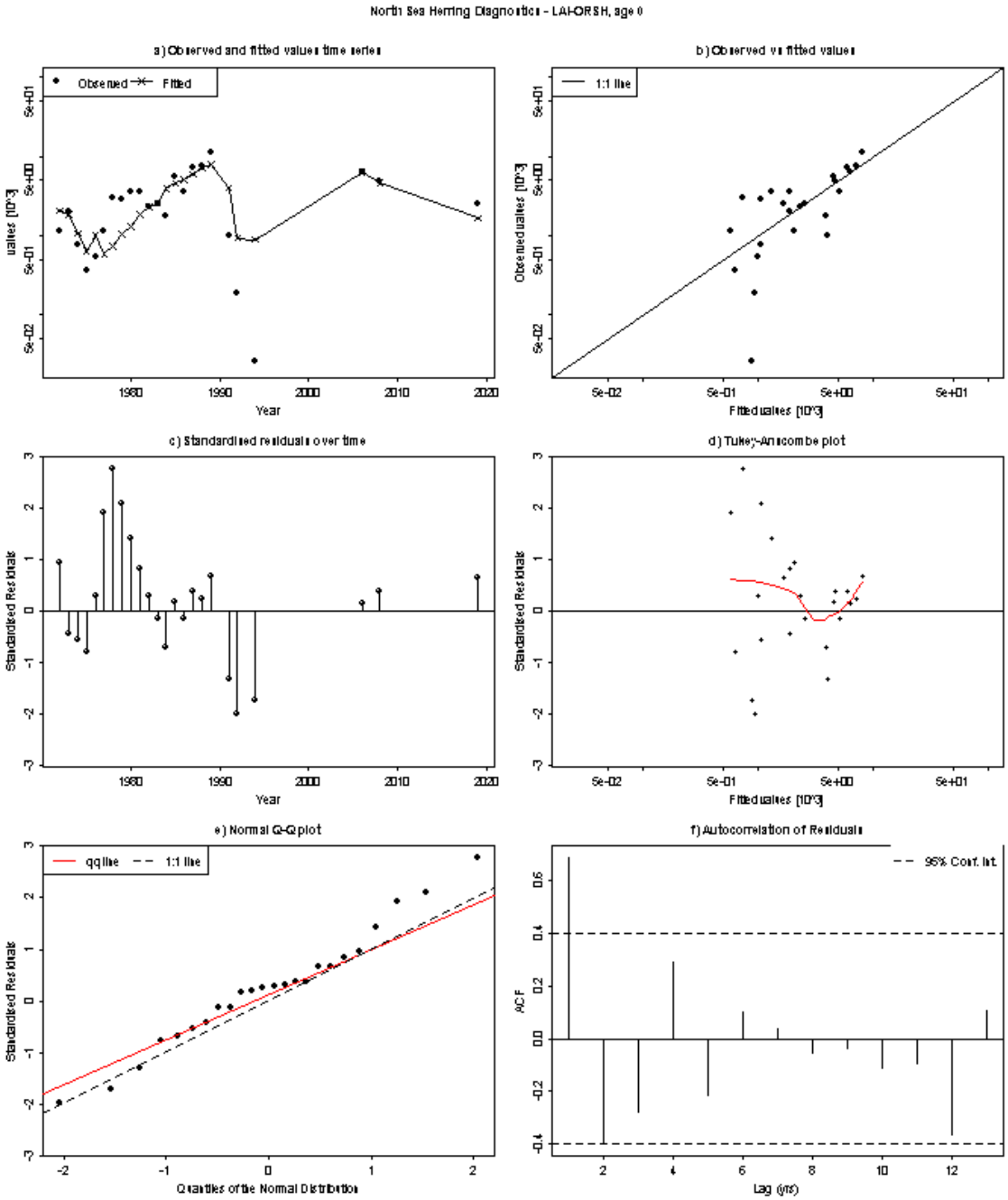


Figure 2.6.1.37. North Sea herring. Diagnostics of the assessment model fit to the LAI index in the Banks area for the fourth week time-series available for this component. Top left: Estimates of numbers at 0 wr (line) and numbers predicted from index abundance at 0 wr. Top right: scatterplot of index observations vs. assessment model estimates of numbers at 0 wr with the best-fit catchability model (linear function). Middle right: index observation vs. standardized residuals at 0 wr. Middle left: Time-series of standardized residuals of the index at 0 wr. Bottom left: normal Q-Q plot of standardized residuals. Bottom right: Autocorrelation plot.


North Sea Herring Diagnostics - LAI-ORSH, age 0
a) Observed and fitted values time series
Observed
Fitted
Year
b) Observed vs fitted values
1:1 line
Observed values [10^3]
Fitted values [10^3]
c) Standardised residuals over time
Standardised Residuals
Year
d) Tukey-Anscombe plot
Standardised Residuals
Fitted values [10^3]
e) Normal Q-Q plot
qq line
1:1 line
Standardised Residuals
Quantiles of the Normal Distribution
f) Autocorrelation of Residuals
95% Conf. Int.
ACF
Lag (yrs)

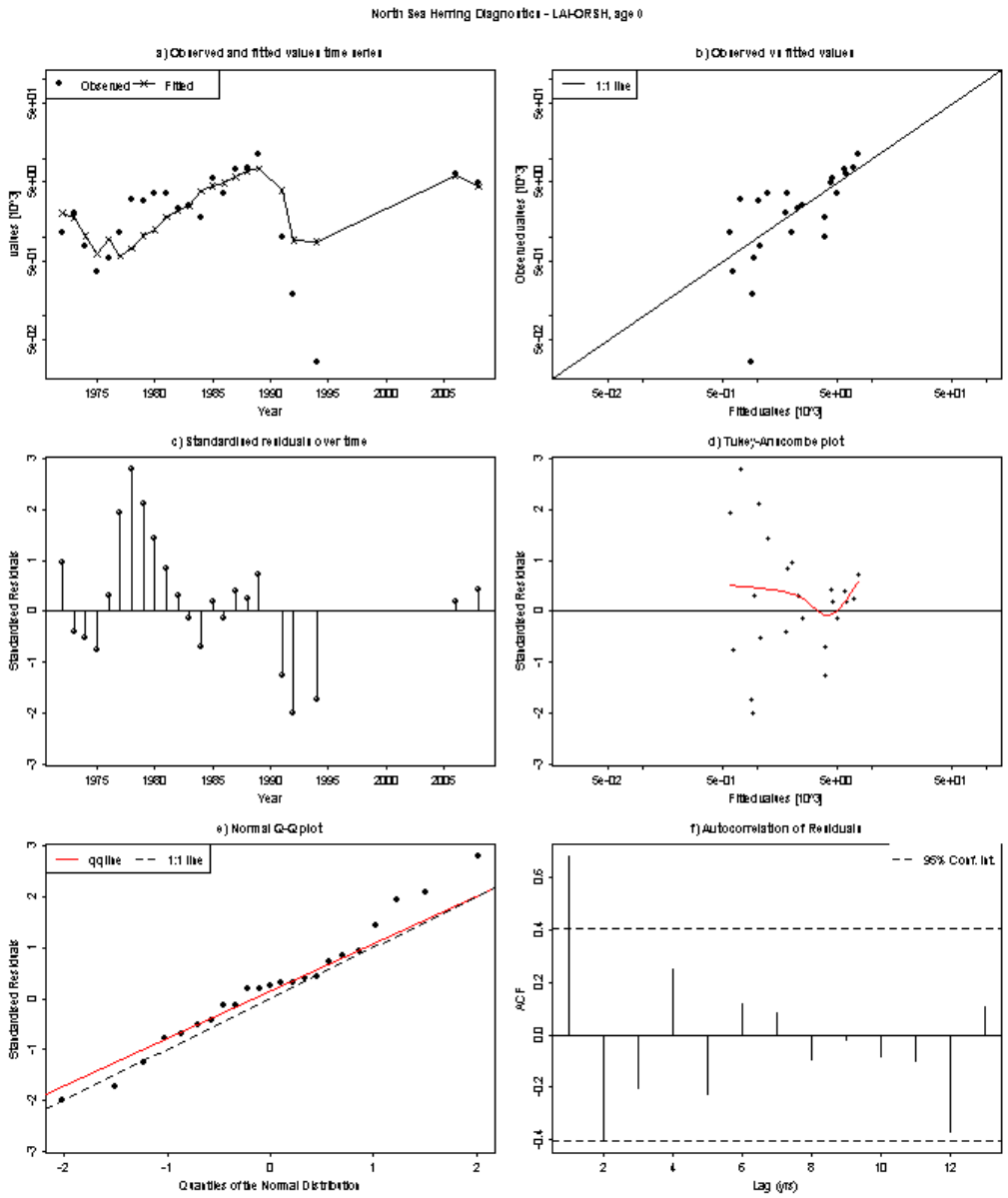
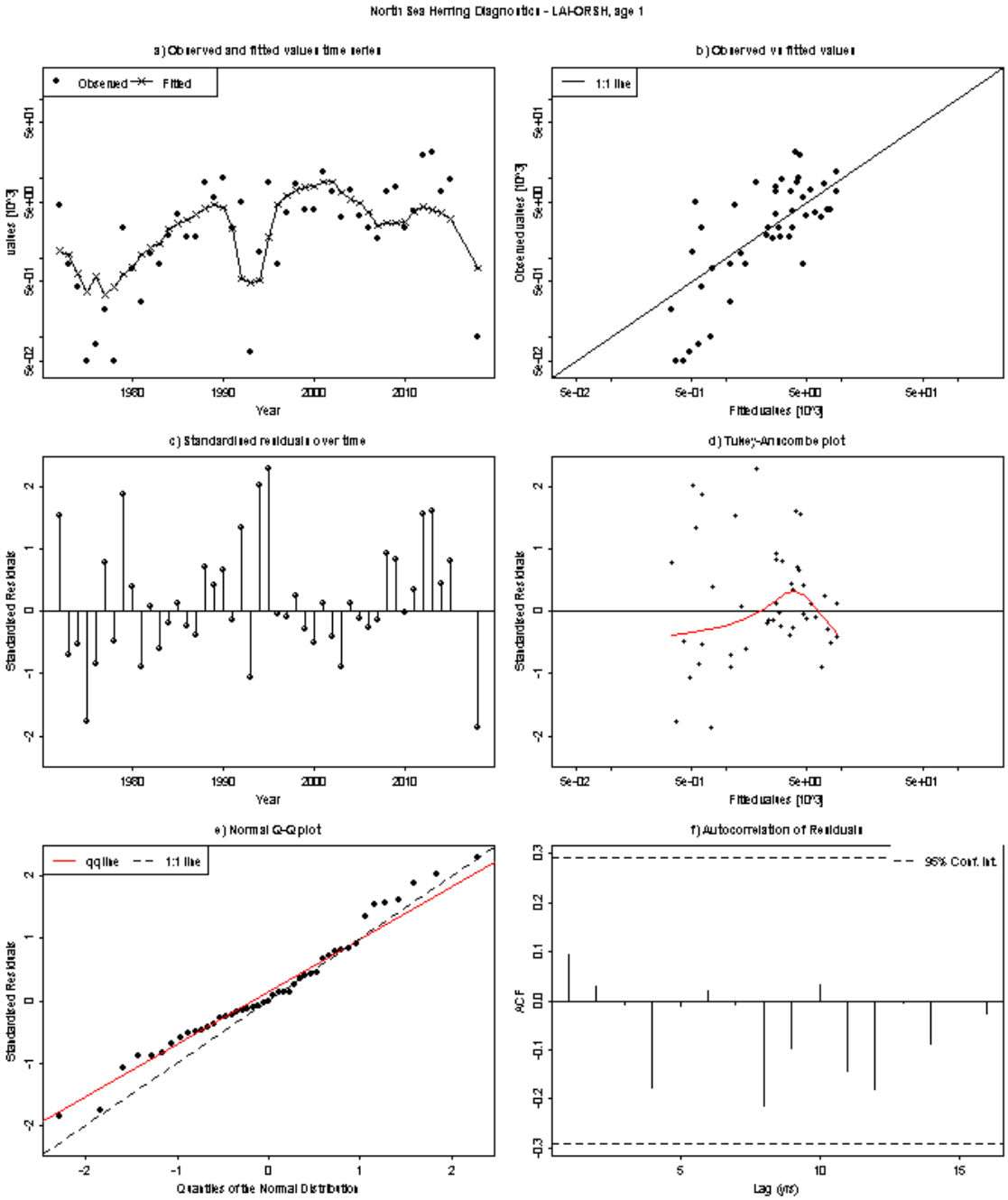


Figure 2.6.1.38. North Sea herring. Diagnostics of the assessment model fit to the LAI index in the Orkney/Shetland area for the first week time-series available for this component. Top left: Estimates of numbers at 0 wr (line) and numbers predicted from index abundance at 0 wr. Top right: scatterplot of index observations vs. assessment model estimates of numbers at 0 wr with the best-fit catchability model (linear function). Middle right: index observation vs. standardized residuals at 0 wr. Middle left: Time-series of standardized residuals of the index at 0 wr. Bottom left: normal Q-Q plot of standardized residuals. Bottom right: Autocorrelation plot.


North Sea Herring Diagnostics - LAI-ORSH, age 1
a) Observed and fitted values time series
Observed
Fitted
Year
b) Observed vs fitted values
1:1 line
Fitted values [10^3]
c) Standardised residuals over time
Standardised Residuals
d) Tukey-Anscombe plot
e) Normal Q-Q plot
qq line
1:1 line
Quantiles of the Normal Distribution
f) Autocorrelation of Residuals
95% Conf. Int.
ACF
Lag (yrs)

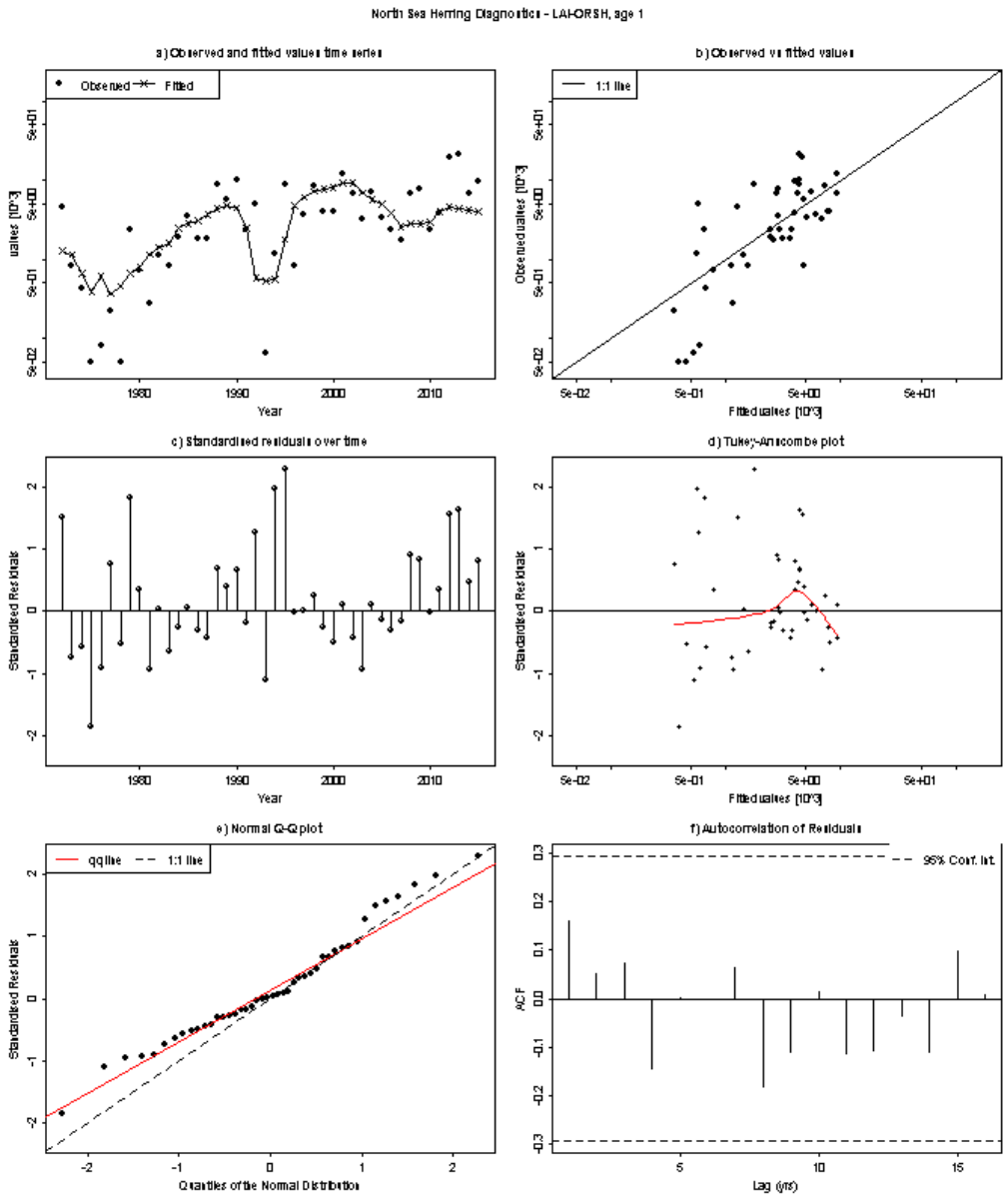
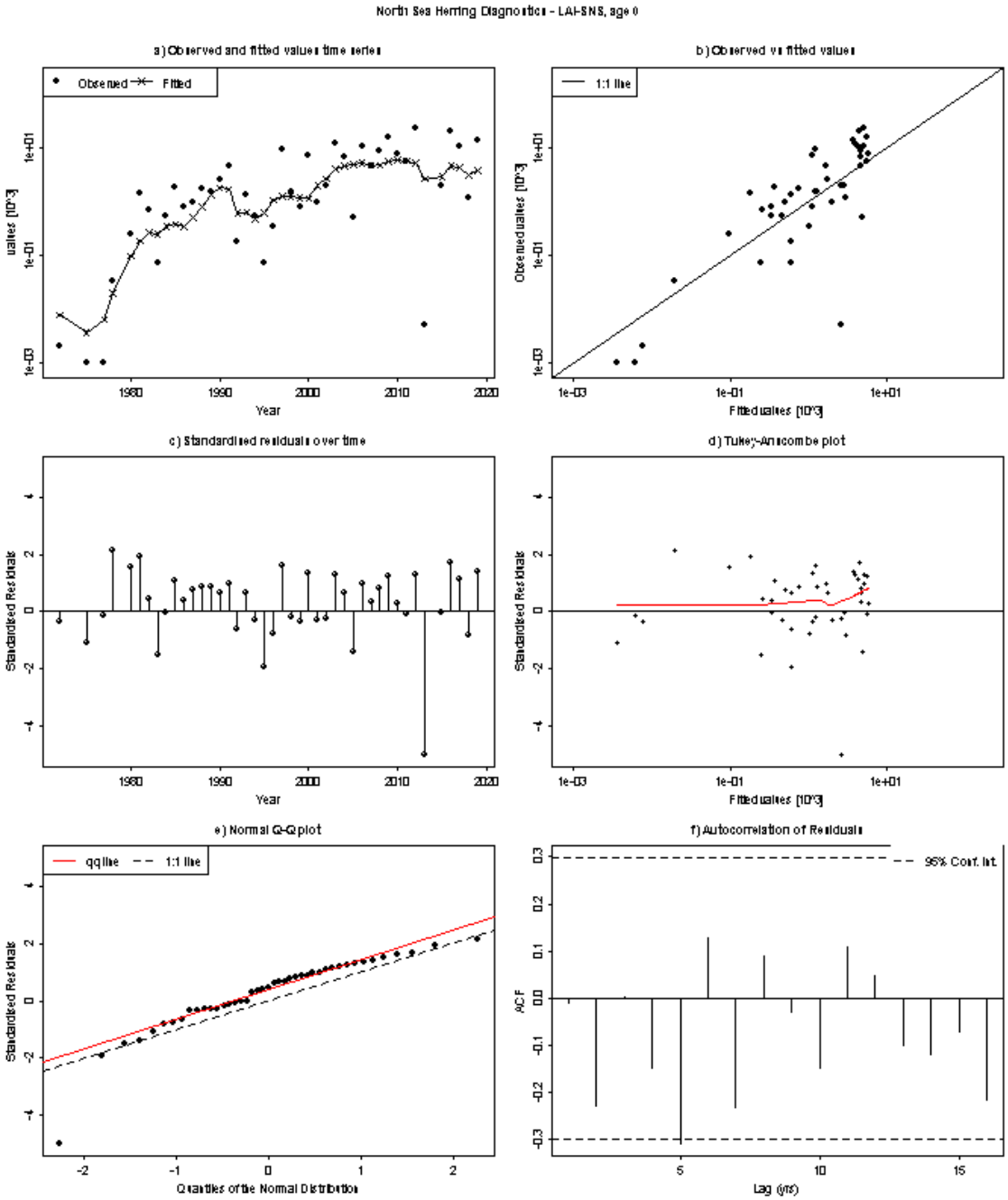


Figure 2.6.1.39. North Sea herring. Diagnostics of the assessment model fit to the LAI index in the Orkney/Shetland area for the second week time-series available for this component. Top left: Estimates of numbers at 0 wr (line) and numbers predicted from index abundance at 0 wr. Top right: scatterplot of index observations vs. assessment model estimates of numbers at 0 wr with the best-fit catchability model (linear function). Middle right: index observation vs. standardized residuals at 0 wr. Middle left: Time-series of standardized residuals of the index at 0 wr. Bottom left: normal Q-Q plot of standardized residuals. Bottom right: Autocorrelation plot.


North Sea Herring Diagnostics - LAI-SNS, age 0
a) Observed and fitted values time series
Observed
Fitted
Year
b) Observed vs fitted values
1:1 line
Fitted values [10^3]
c) Standardised residuals over time
Standardised Residuals
d) Tukey-Anscombe plot
e) Normal Q-Q plot
qq line
1:1 line
Quantiles of the Normal Distribution
f) Autocorrelation of Residuals
95% Conf. Int.
ACF
Lag (yrs)

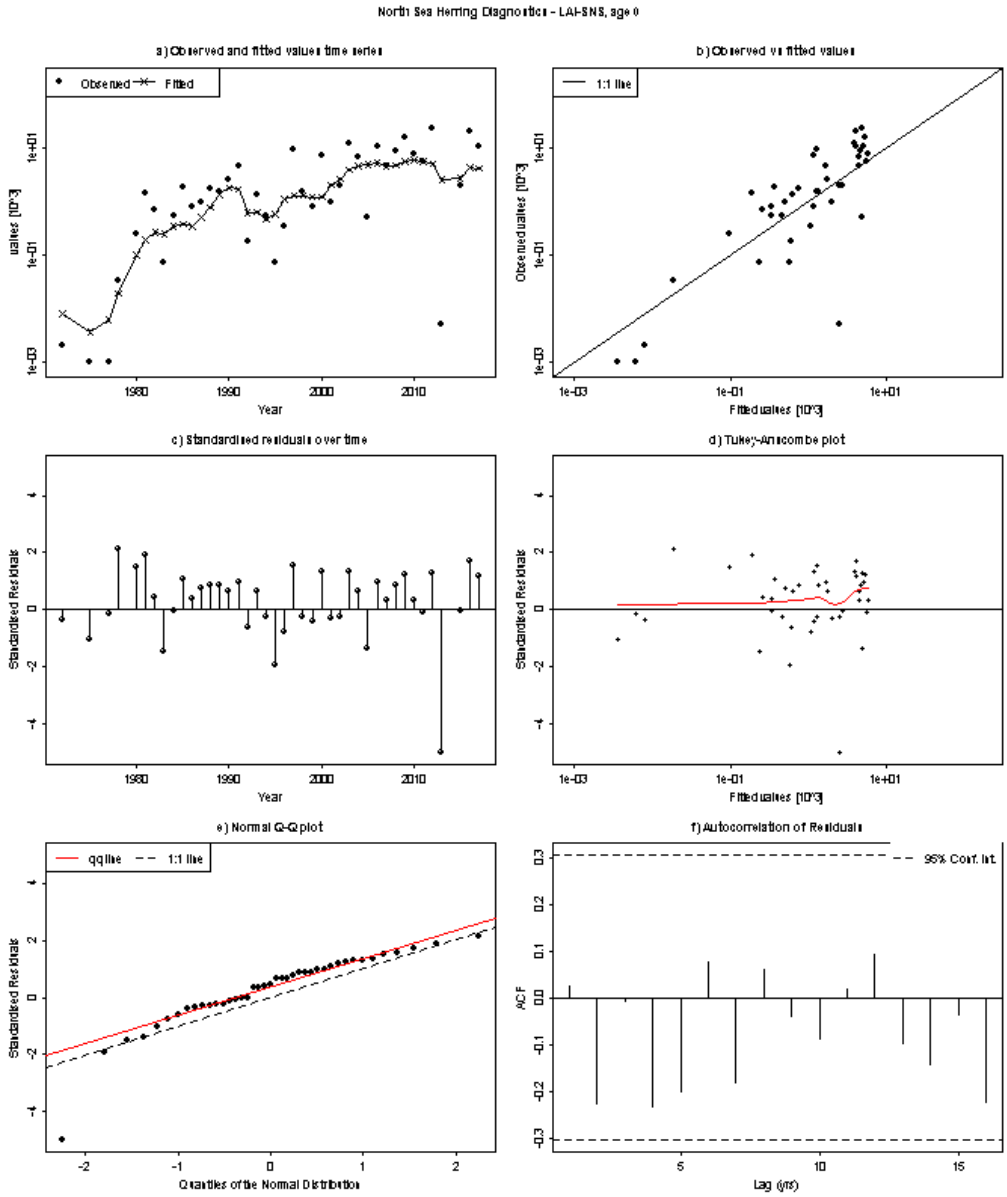
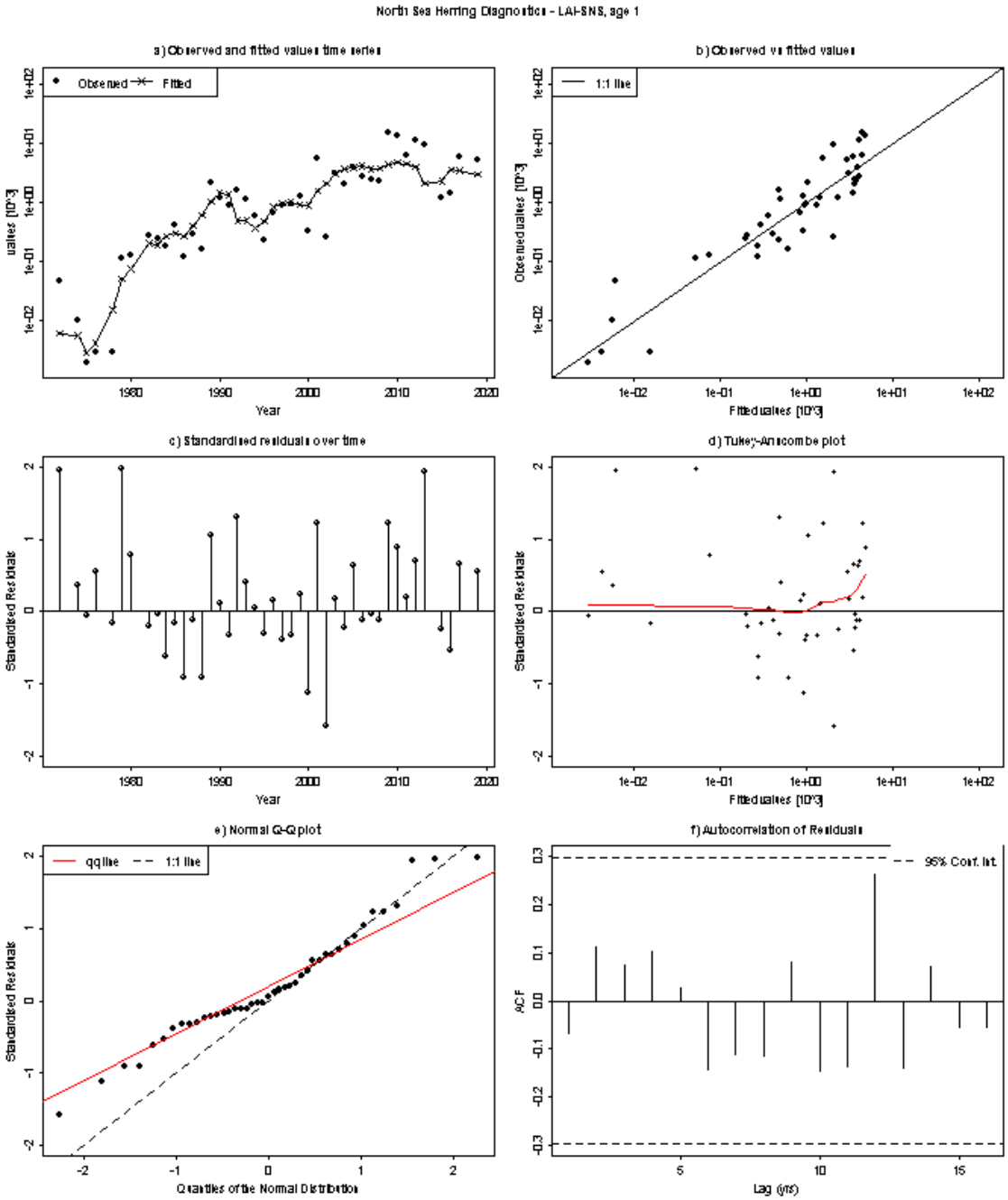


Figure 2.6.1.40. North Sea herring. Diagnostics of the assessment model fit to the LAI index in the Downs area for the first week time-series available for this component. Top left: Estimates of numbers at 0 wr (line) and numbers predicted from index abundance at 0 wr. Top right: scatterplot of index observations vs. assessment model estimates of numbers at 0 wr with the best-fit catchability model (linear function). Middle right: index observation vs. standardized residuals at 0 wr. Middle left: Time-series of standardized residuals of the index at 0 wr. Bottom left: normal Q-Q plot of standardized residuals. Bottom right: Autocorrelation plot.


North Sea Herring Diagnostics - LAI-SNS, age 1
a) Observed and fitted values time series
Observed
Fitted
Year
b) Observed vs fitted values
1:1 line
Fitted values [10^3]
c) Standardised residuals over time
Standardised Residuals
d) Tukey-Anscombe plot
e) Normal Q-Q plot
qq line
1:1 line
Quantiles of the Normal Distribution
f) Autocorrelation of Residuals
95% Conf. Int.
ACF
Lag (yrs)

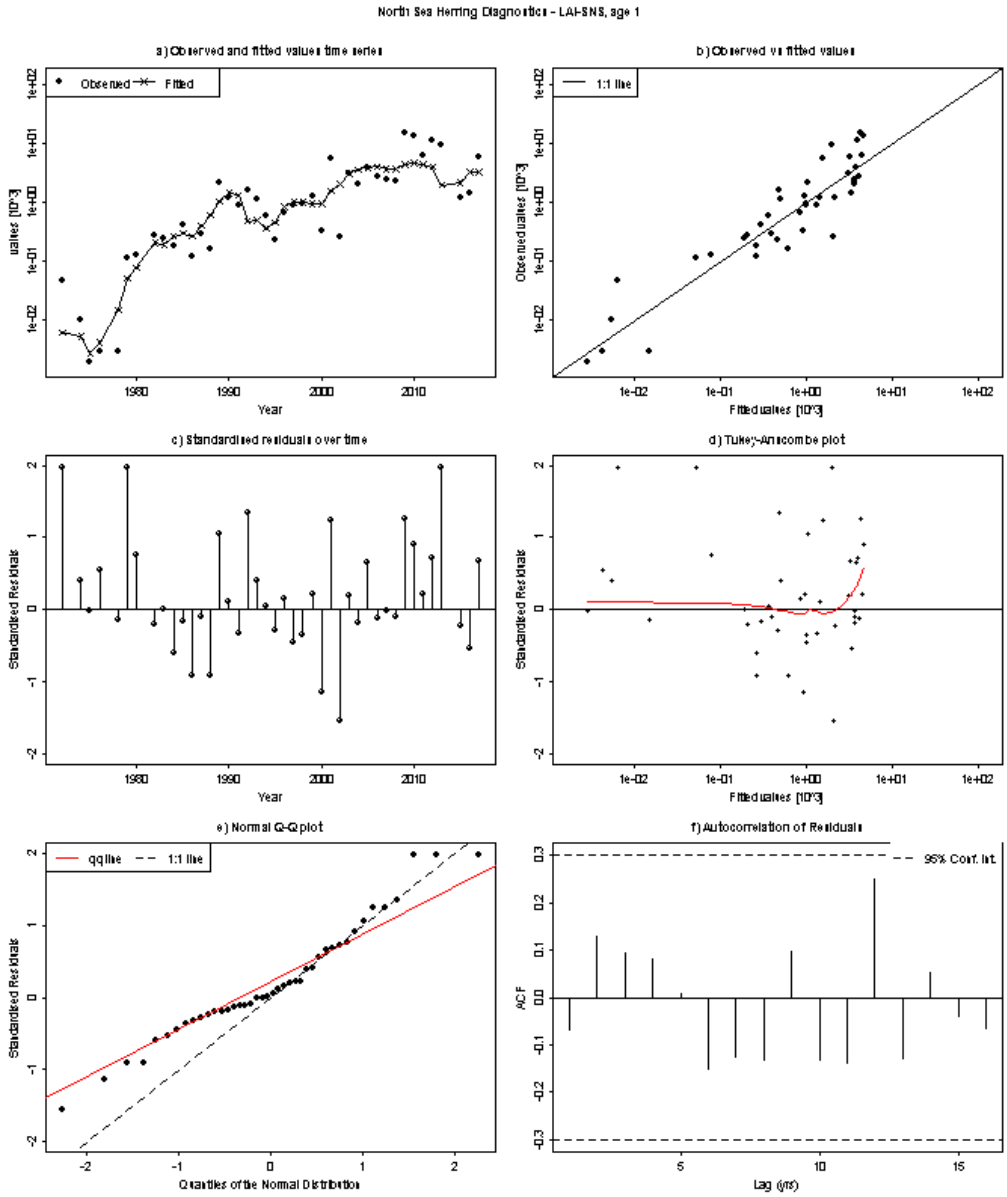
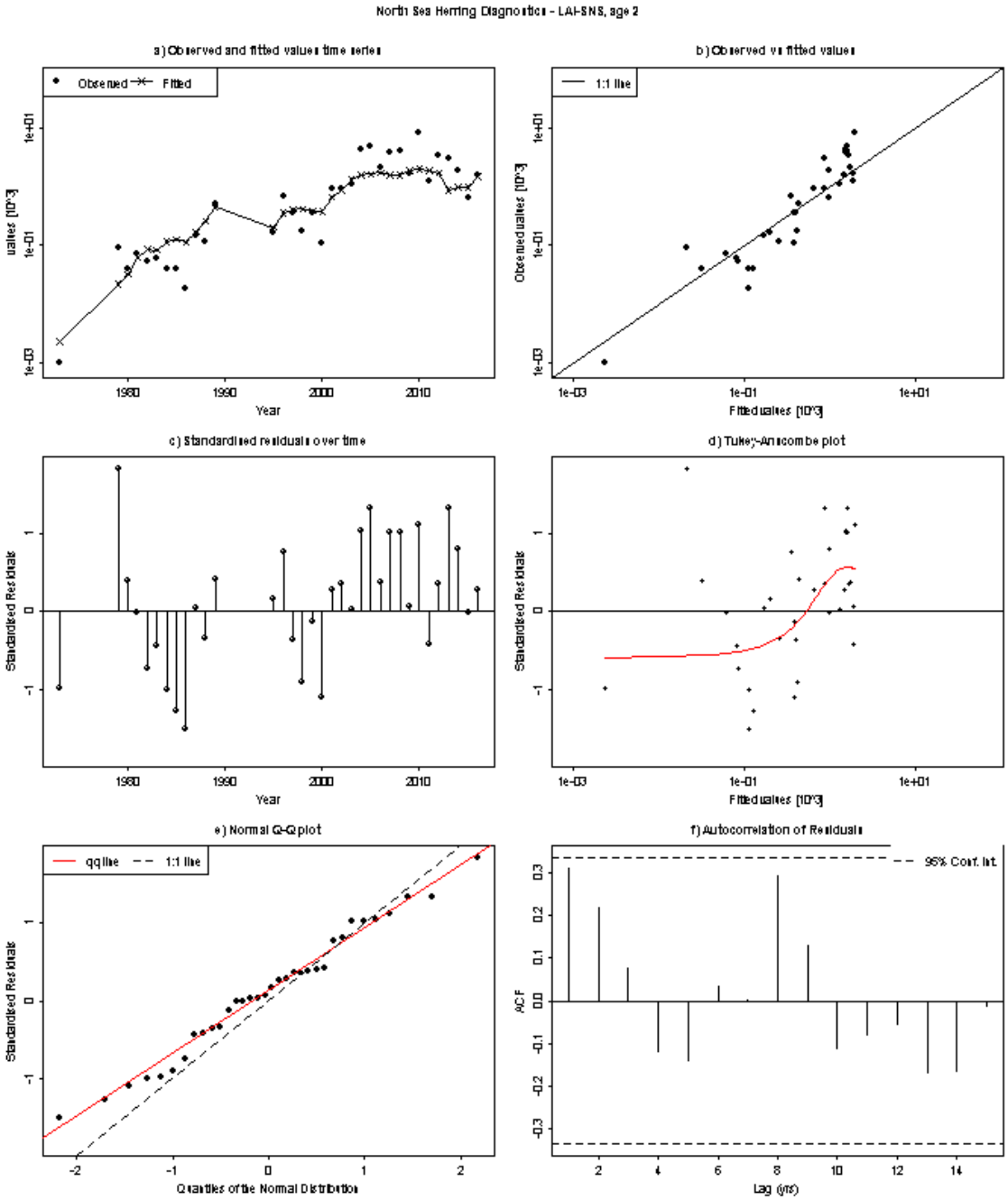


Figure 2.6.1.41. North Sea herring. Diagnostics of the assessment model fit to the LAI index in the Downs area for the second week time-series available for this component. Top left: Estimates of numbers at 0 wr (line) and numbers predicted from index abundance at 0 wr. Top right: scatterplot of index observations vs. assessment model estimates of numbers at 0 wr with the best-fit catchability model (linear function). Middle right: index observation vs. standardized residuals at 0 wr. Middle left: Time-series of standardized residuals of the index at 0 wr. Bottom left: normal Q-Q plot of standardized residuals. Bottom right: Autocorrelation plot.


North Sea Herring Diagnostics - LAI-SNS, age 2
a) Observed and fitted values time series
Observed
Fitted
Year
b) Observed vs fitted values
1:1 line
Fitted values [10^3]
c) Standardised residuals over time
Standardised Residuals
d) Tukey-Anscombe plot
e) Normal Q-Q plot
qq line
1:1 line
Quantiles of the Normal Distribution
f) Autocorrelation of Residuals
95% Conf. Int.
ACF
Lag (yrs)

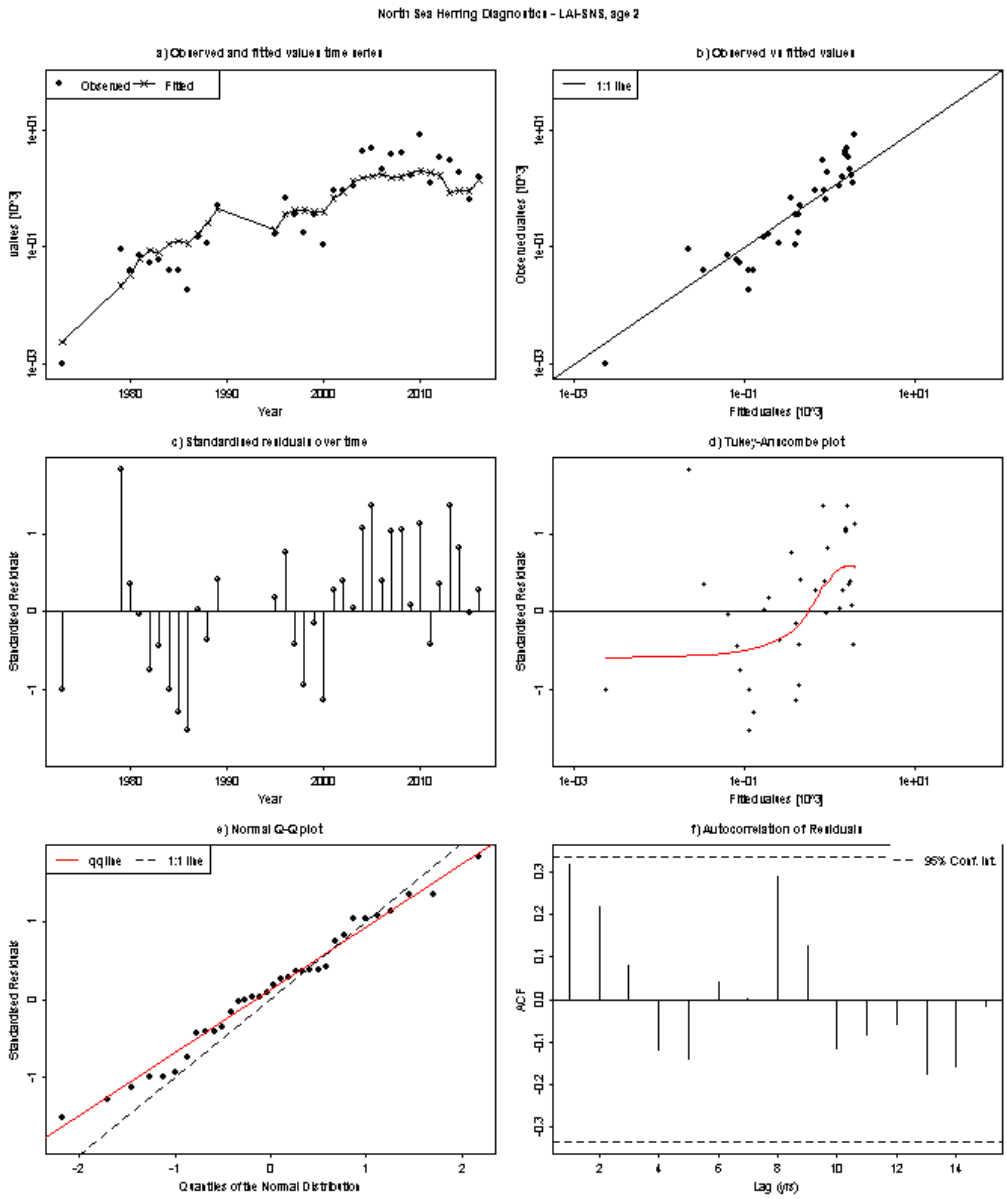


Figure 2.6.1.42. North Sea herring. Diagnostics of the assessment model fit to the LAI index in the Downs area for the third week time-series available for this component. Top left: Estimates of numbers at 0 wr (line) and numbers predicted from index abundance at 0 wr. Top right: scatterplot of index observations vs. assessment model estimates of numbers at 0 wr with the best-fit catchability model (linear function). Middle right: index observation vs. standardized residuals at 0 wr. Middle left: Time-series of standardized residuals of the index at 0 wr. Bottom left: normal Q-Q plot of standardized residuals. Bottom right: Autocorrelation plot.

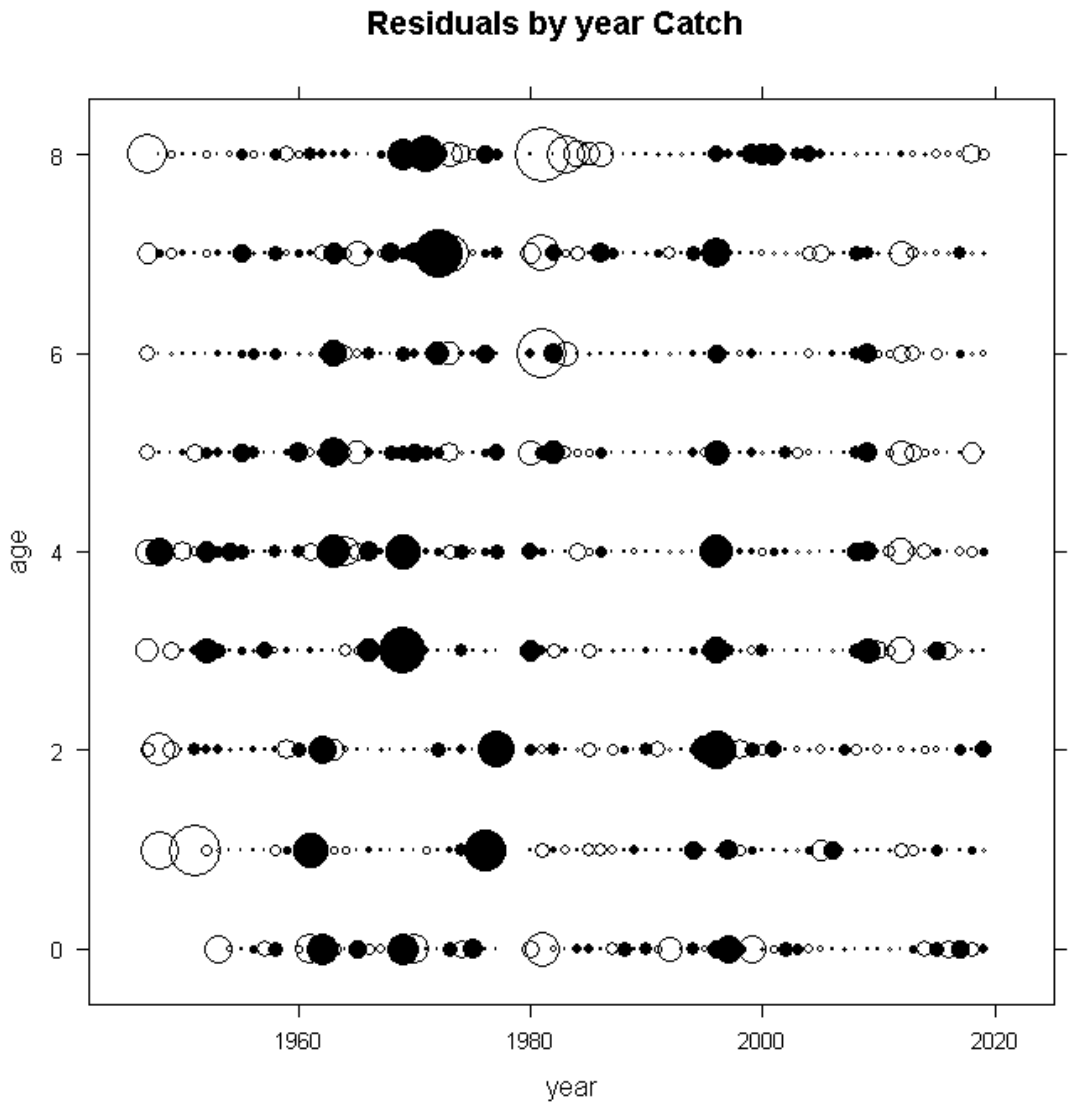


Figure 2.6.1.43. North Sea herring. Bubble plot of standardized catch residual.

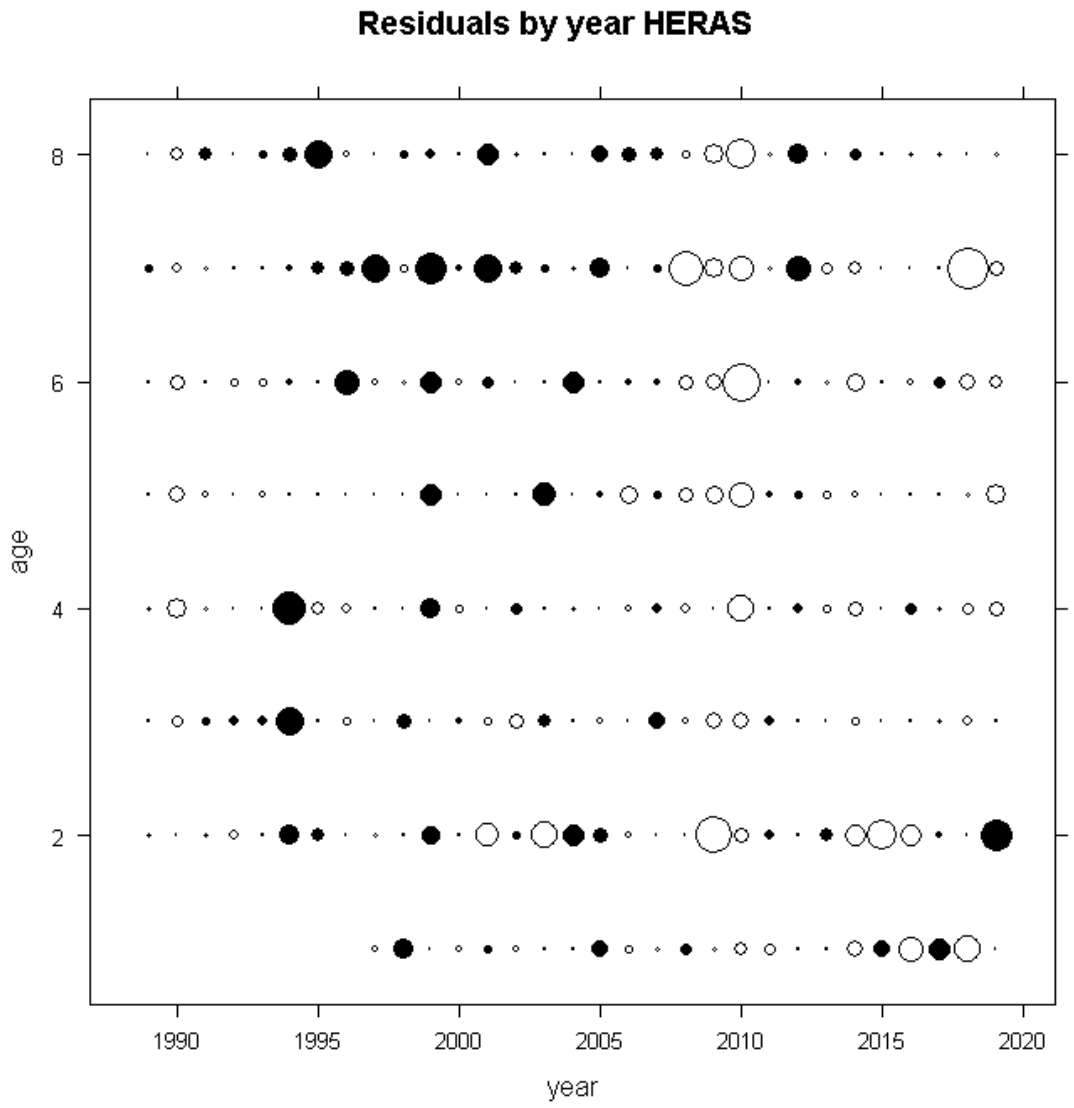


Figure 2.6.1.44. North Sea herring. Bubble plot of standardized acoustic survey residuals.

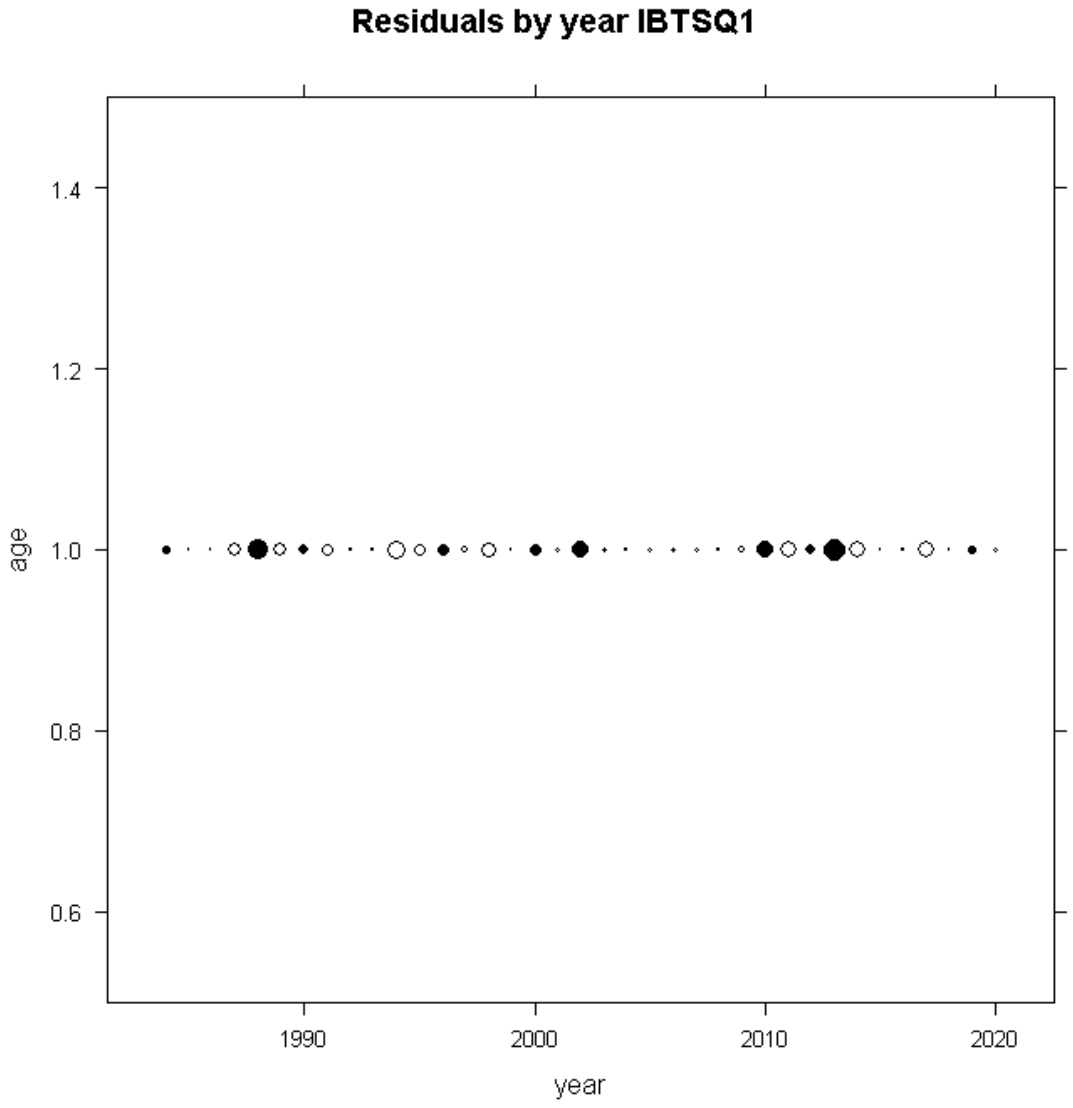


Figure 2.6.1.45. North Sea herring. Bubble plot of standardized IBTSQ1 residuals.

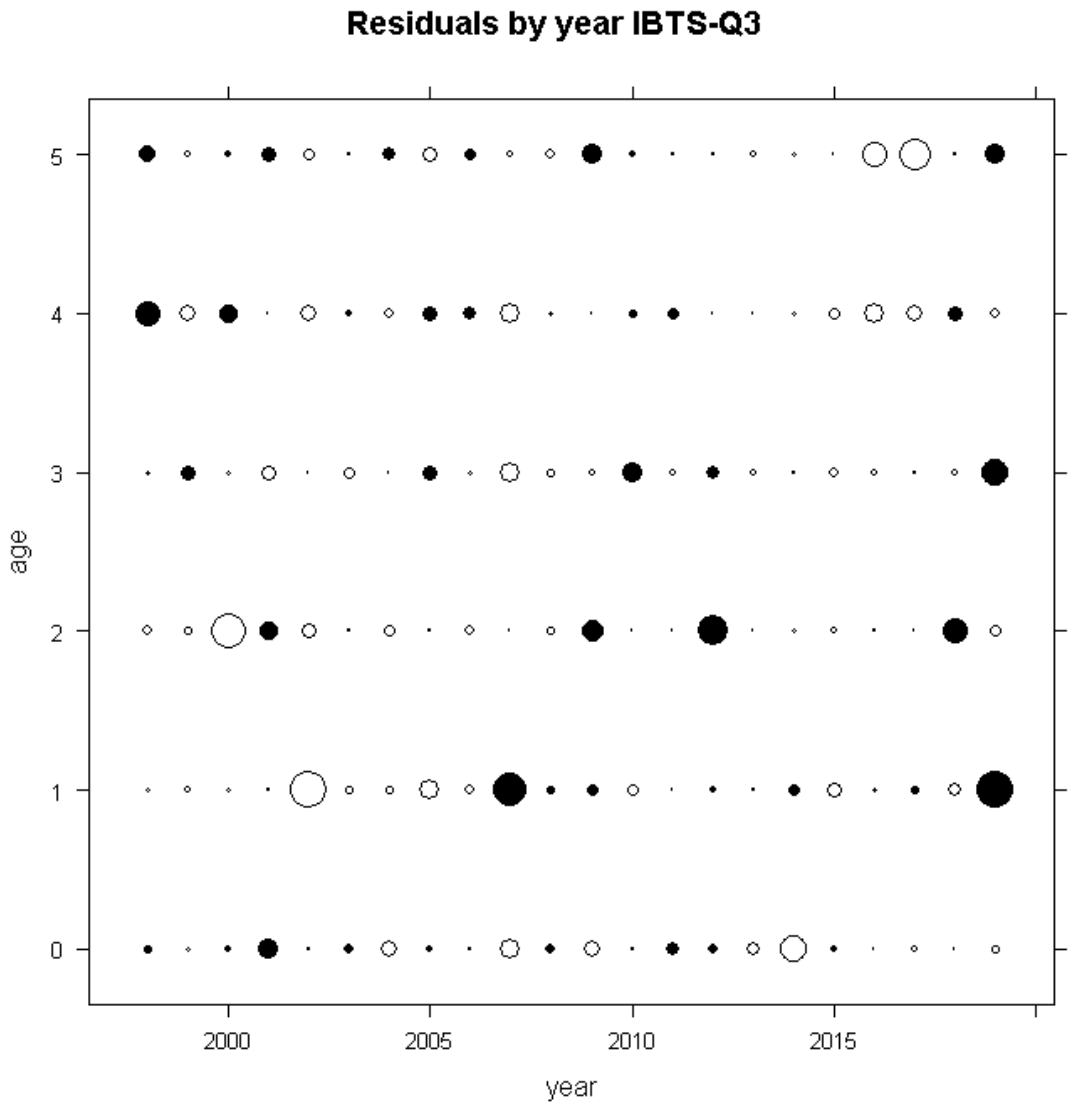


Figure 2.6.1.46. North Sea herring. Bubble plot of standardized IBTSQ3 residuals.

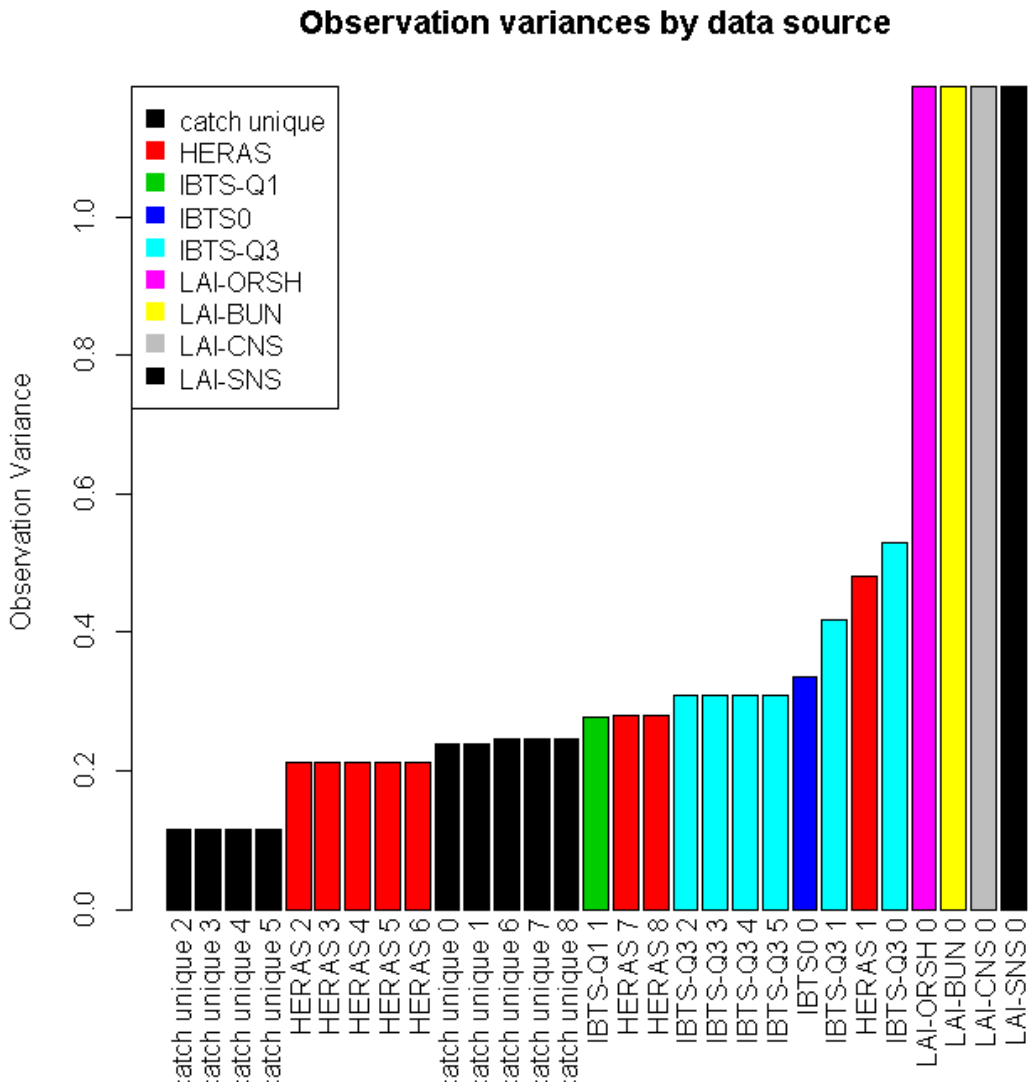


Figure 2.6.1.47. North Sea herring. Observation variance by data source as estimated by the assessment model. Observation variance is ordered from least (left) to most (right). Colours indicate the different data sources. Observation variance is not individually estimated for each data source thereby reducing the parameters needed to be estimated in the assessment model. In these cases of parameter bindings, observation variances have equal values.

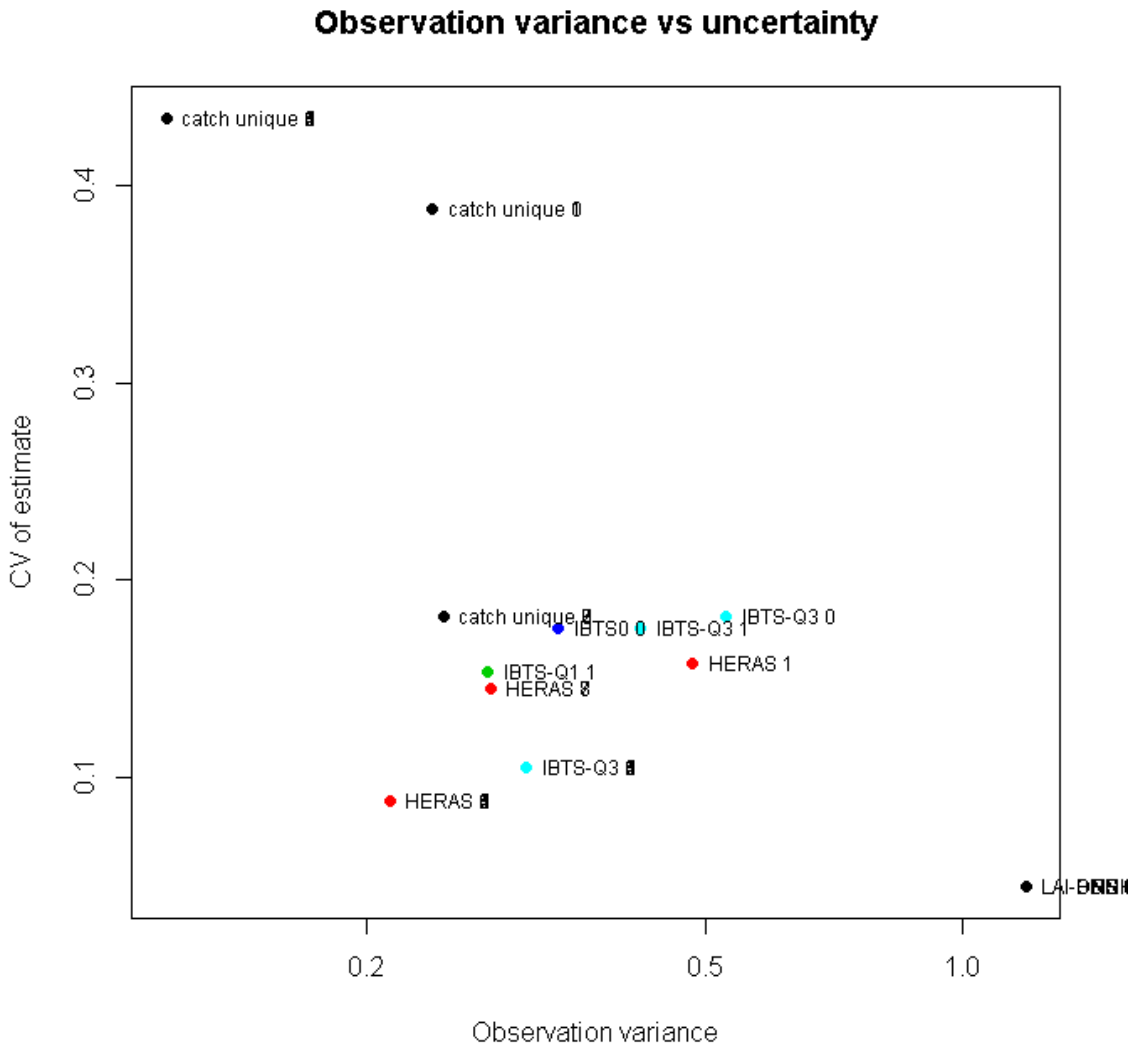


Figure 2.6.1.48. North Sea herring. Observation variance by data source as estimated by the assessment model plotted against the CV estimate of the observation variance parameter.

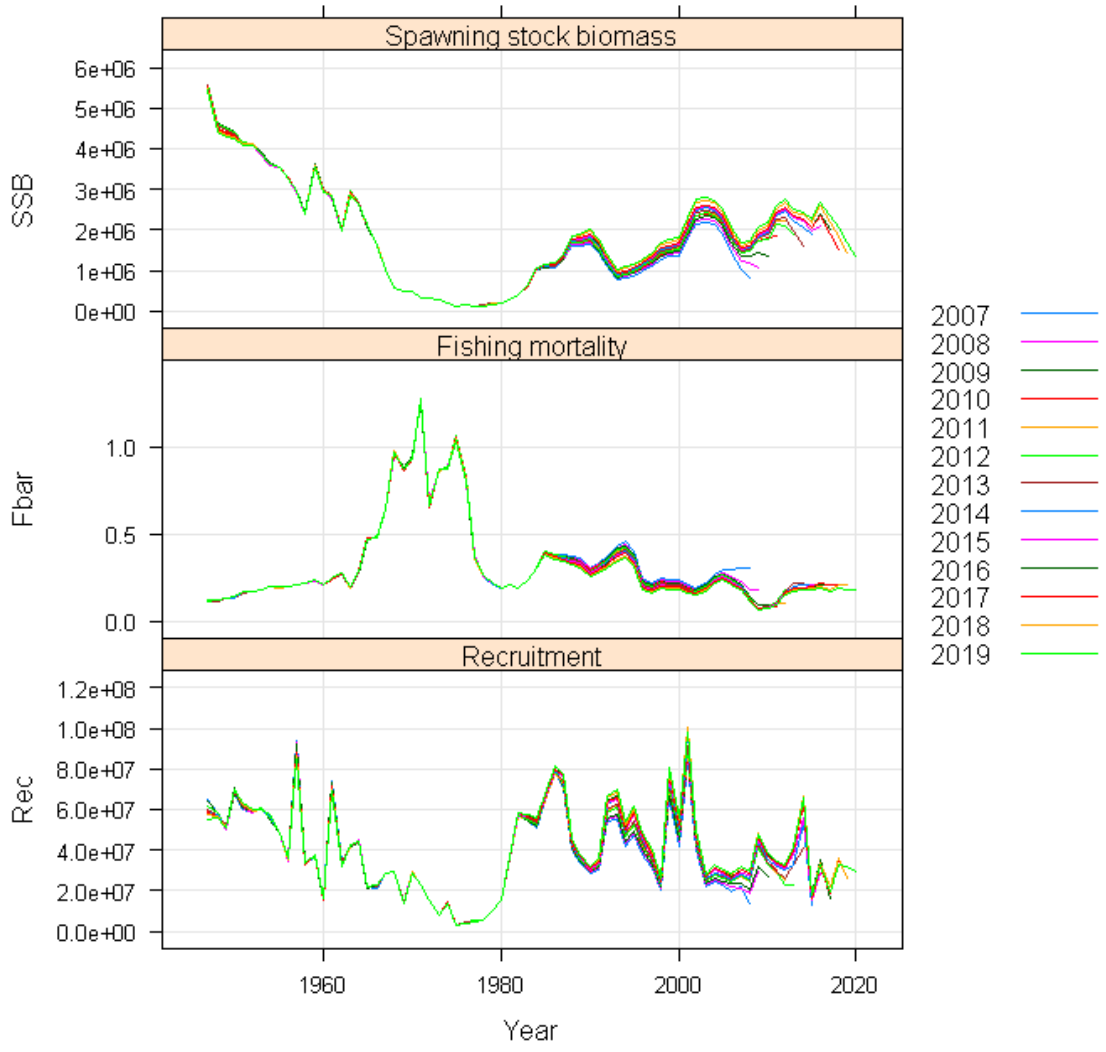


Figure 2.6.1.49. North Sea herring. Assessments retrospective pattern of SSB (top panel) F (middle panel) and recruitment (bottom panel) from 2011 to 2018.

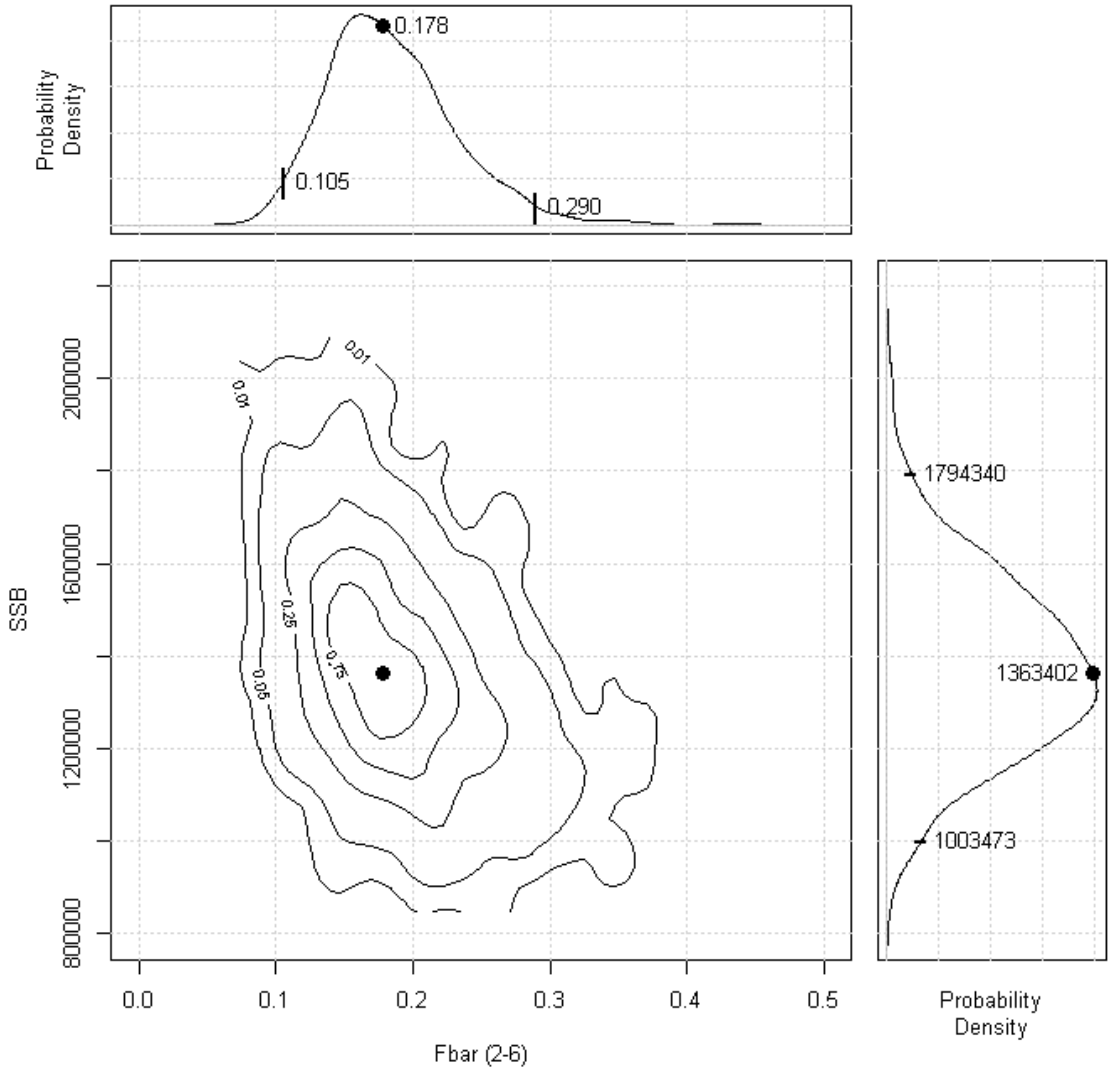


Figure 2.6.1.50. North Sea herring. Model uncertainty; distribution and quantiles of estimated SSB and $F_{2\text{-}6}$ in the terminal year of the assessment. Estimates of precision are based on a parametric bootstrap from the FLSAM estimated variance / covariance estimates from the model.

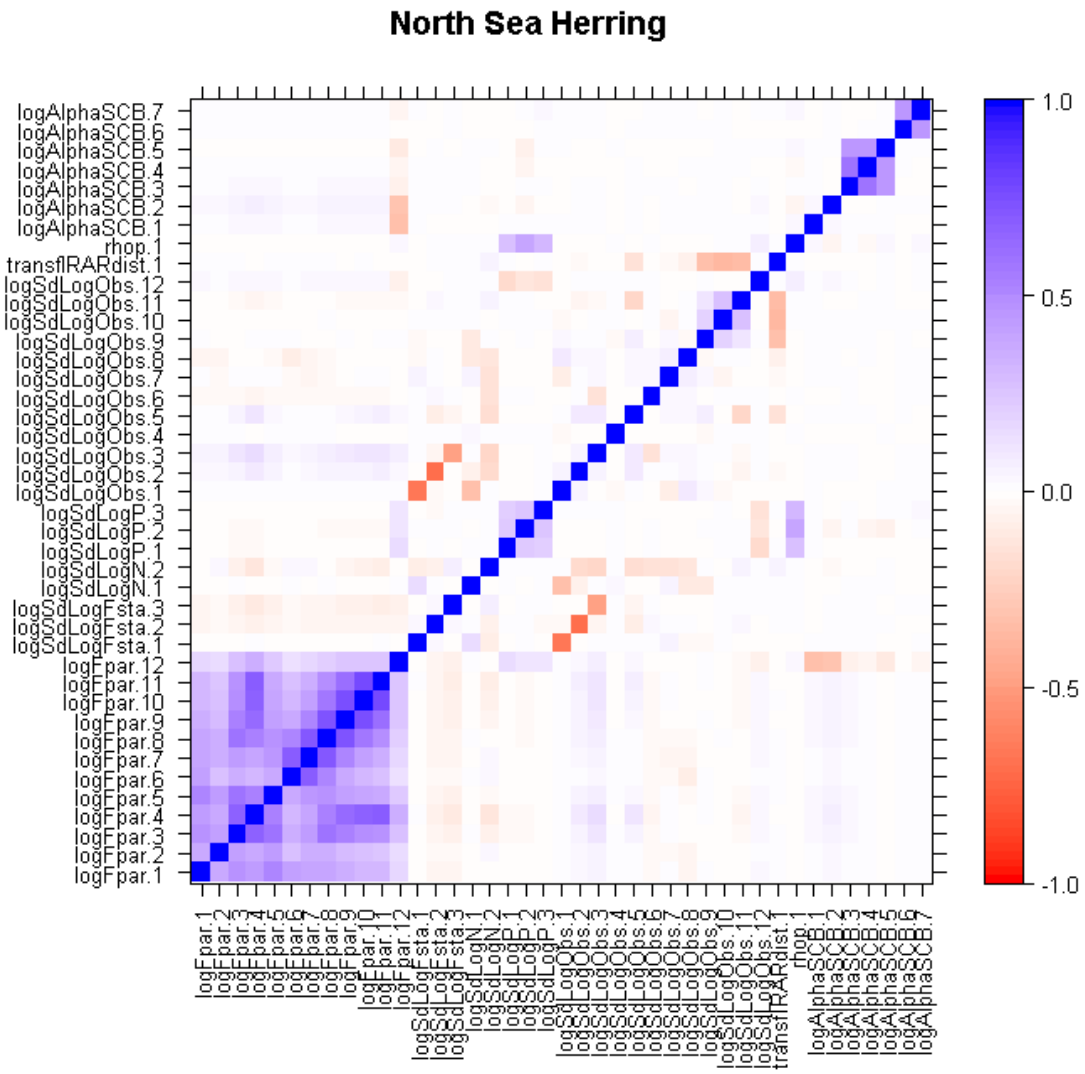


Figure 2.6.1.51. North Sea herring. Correlation plot of the FLSAM assessment model with the final set of parameters estimated in the model. The diagonal represents the correlation with the data source itself.

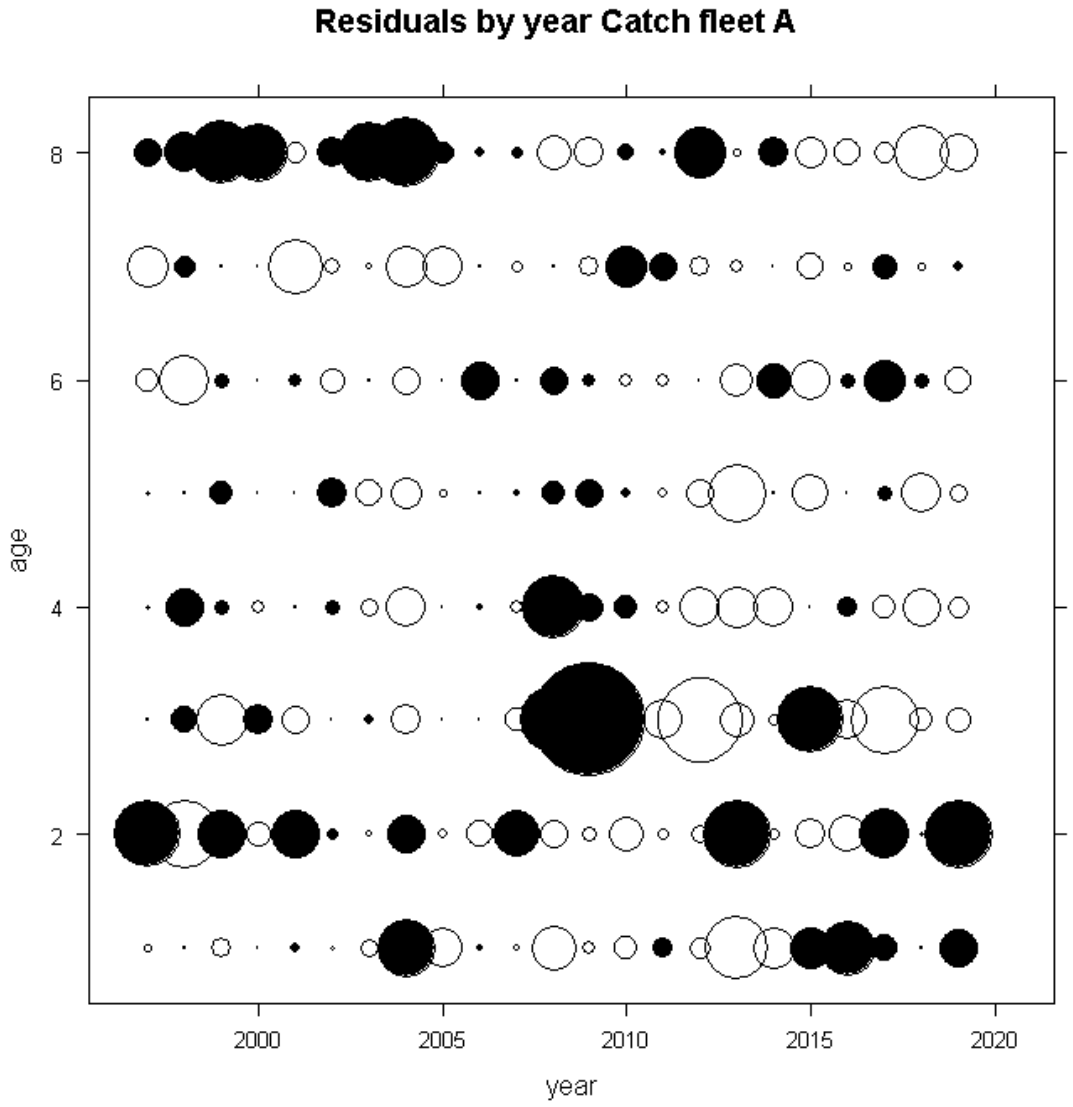


Figure 2.6.2.1. North Sea herring multifleet assessment model. Bubble plot of standardized residuals for catches of fleet A.

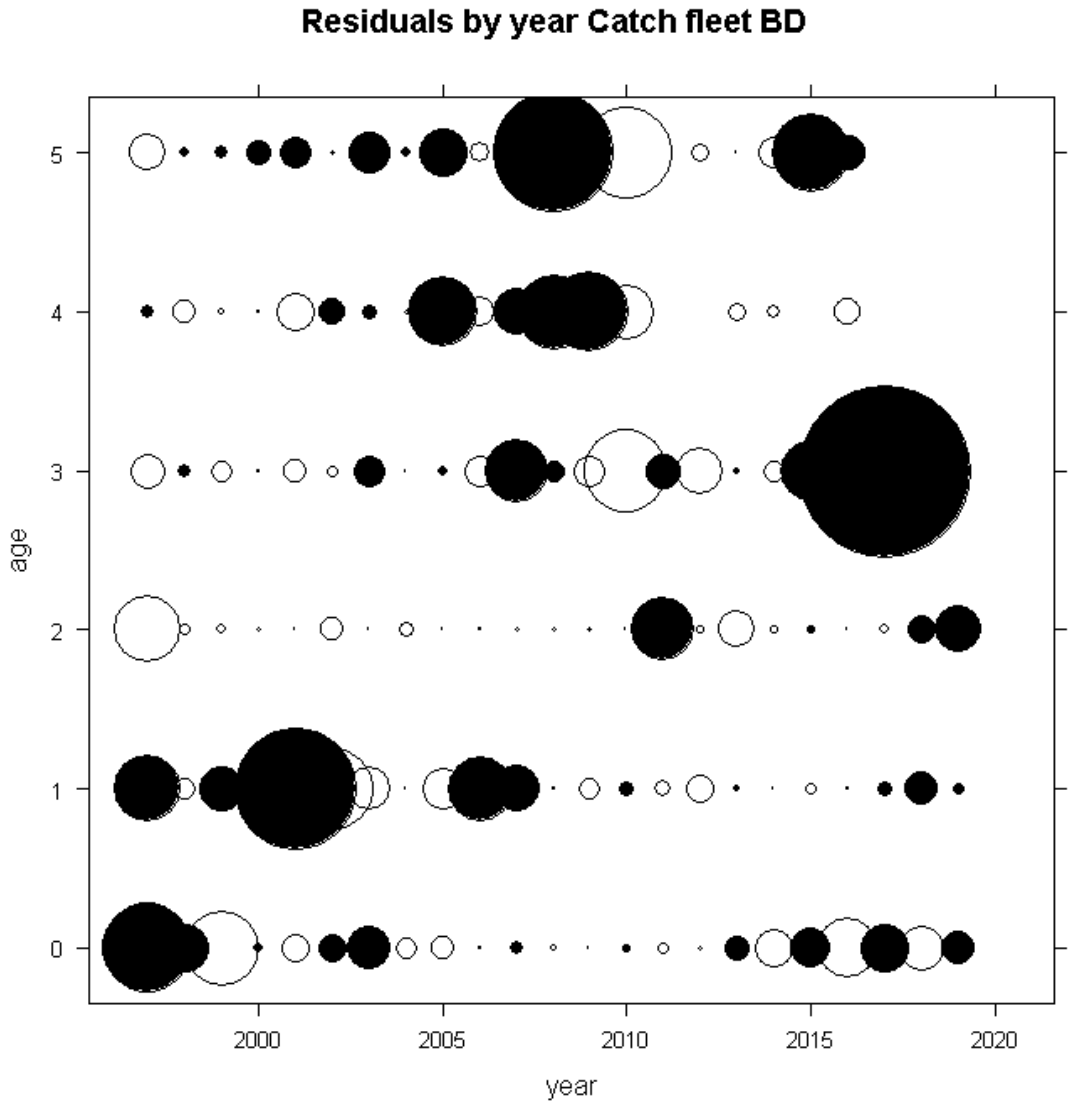


Figure 2.6.2.2. North Sea herring multifleet assessment model. Bubble plot of standardized residuals for catches of fleet B&D.

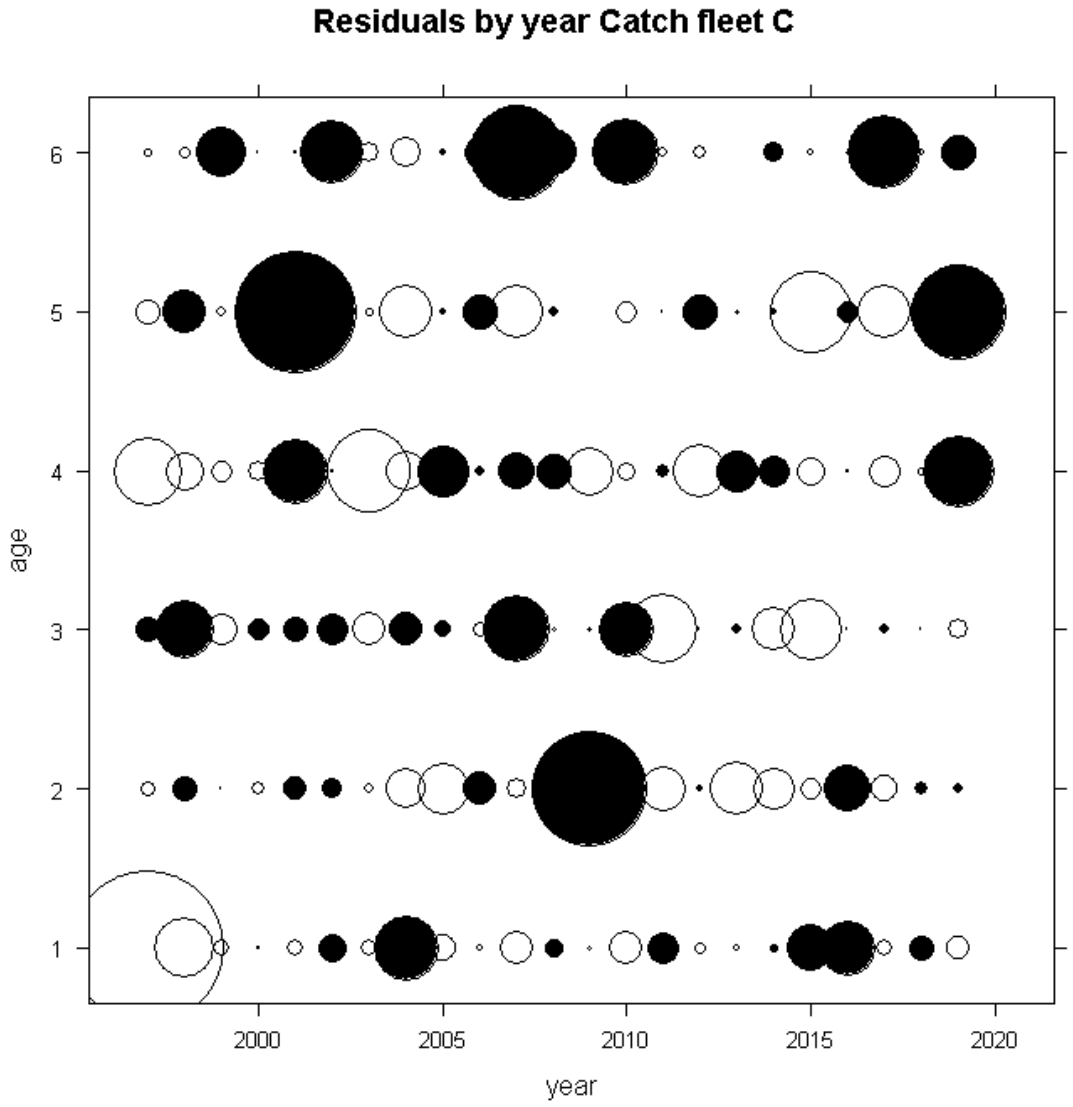


Figure 2.6.2.3. North Sea herring multifleet assessment model. Bubble plot of standardized residuals for catches of fleet C.

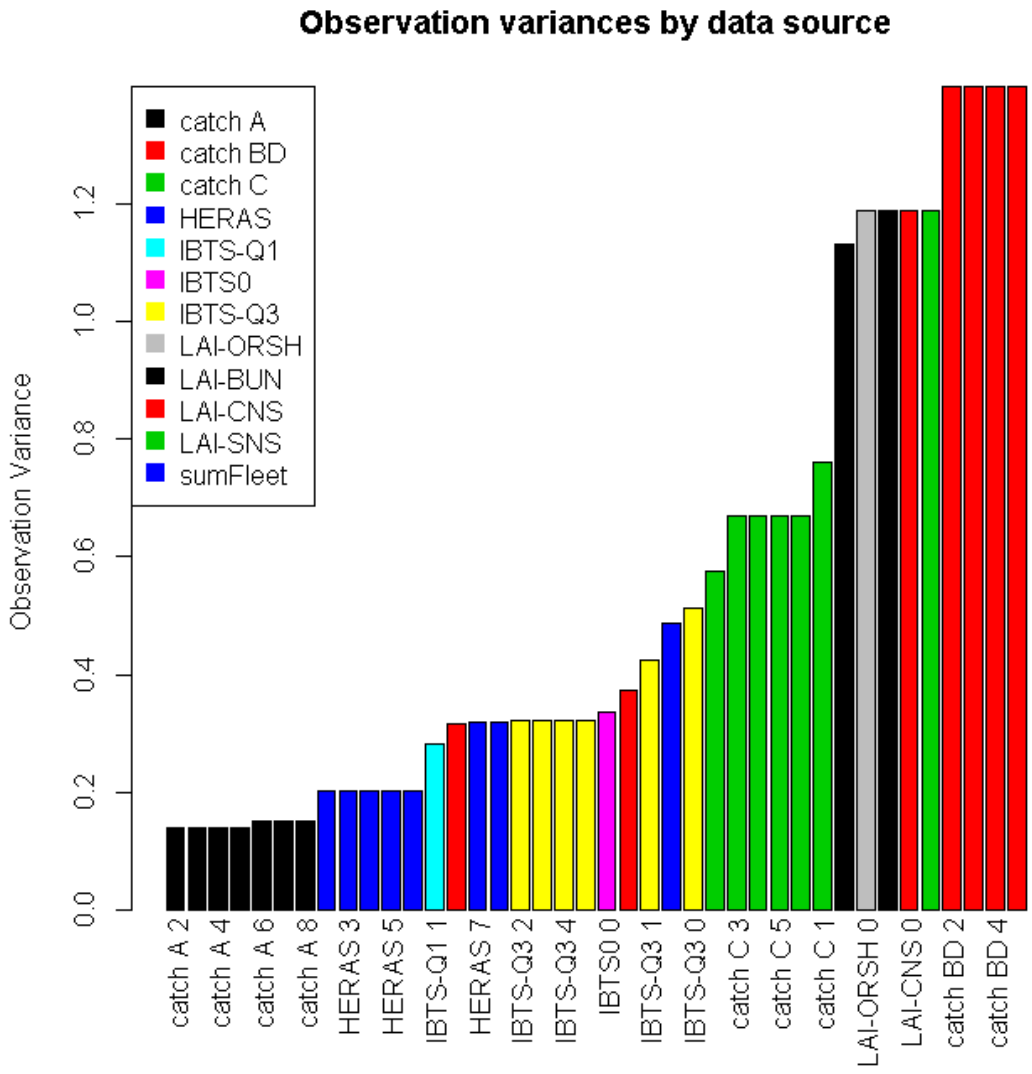


Figure 2.6.2.4. North Sea herring multifleet assessment model. Observation variance by data source as estimated by the assessment model. Observation variance is ordered from least (left) to most (right). Colours indicate the different data sources. Observation variance is not individually estimated for 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.

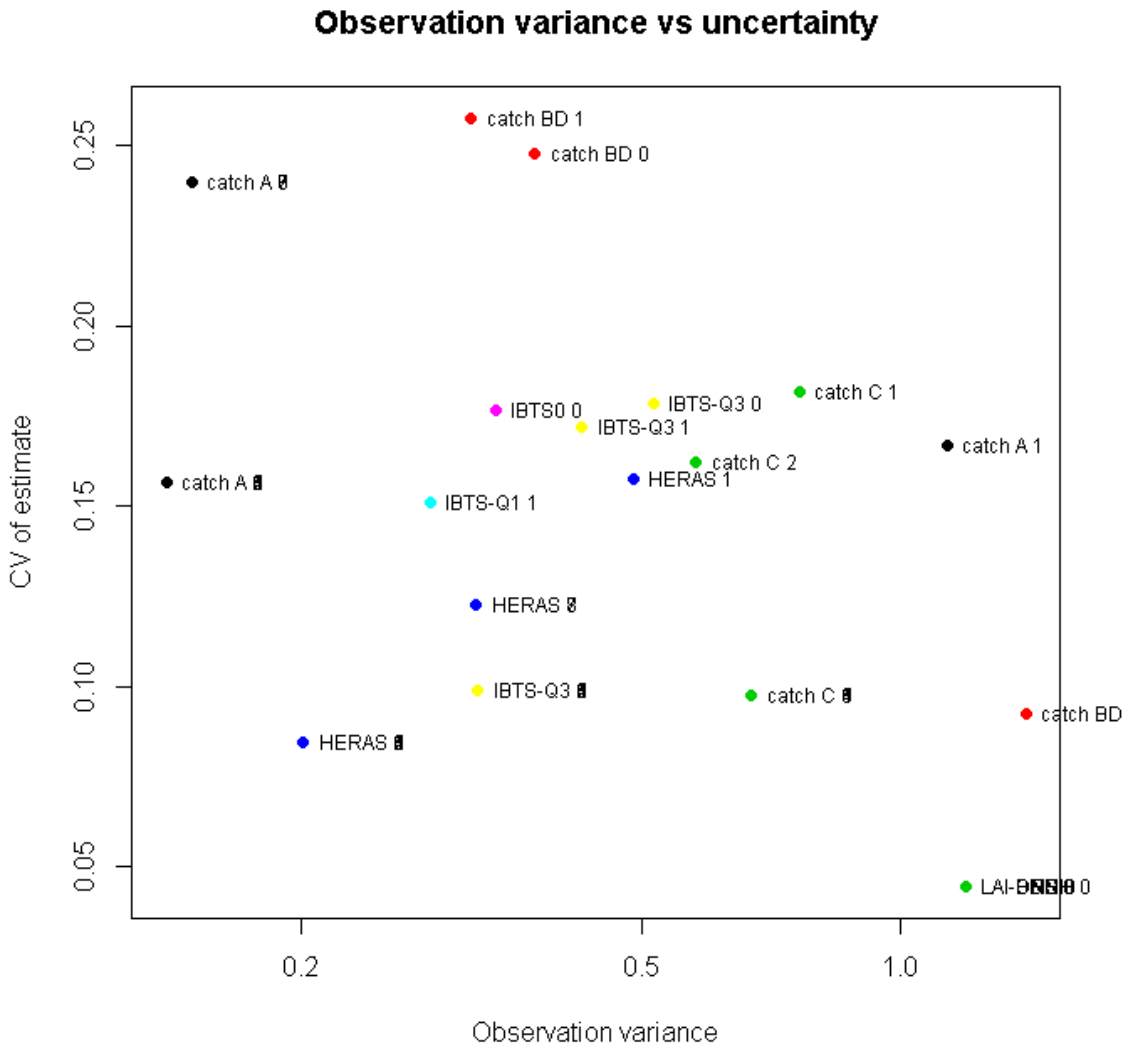


Figure 2.6.2.5. North Sea herring multifleet assessment model. Observation variance by data source as estimated by the assessment model plotted against the CV estimate of the observation variance parameter.

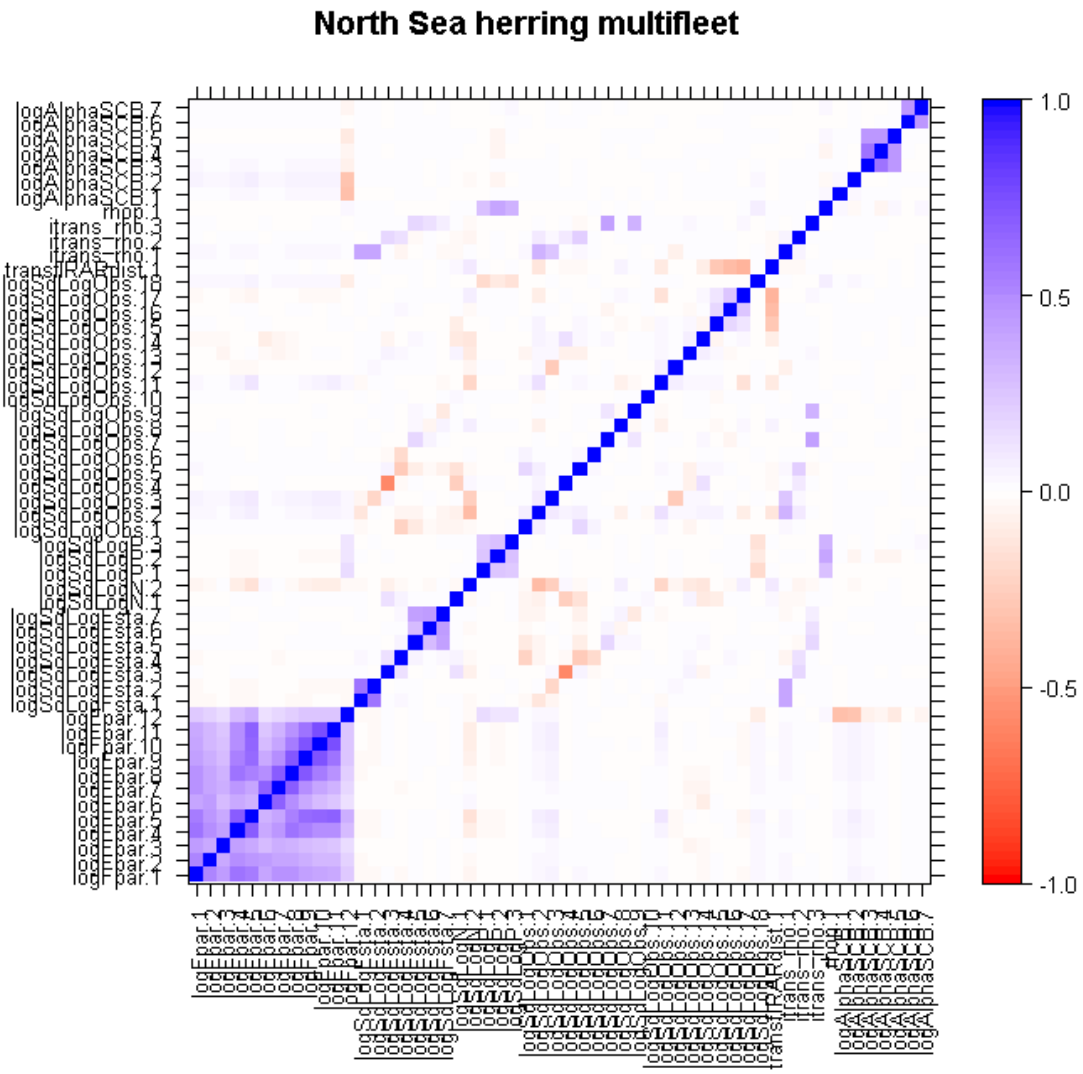


Figure 2.6.2.6. North Sea multifleet assessment model. Correlation plot of the FLSAM assessment model with the final set of parameters estimated in the model. The diagonal represents the correlation with the data source itself.

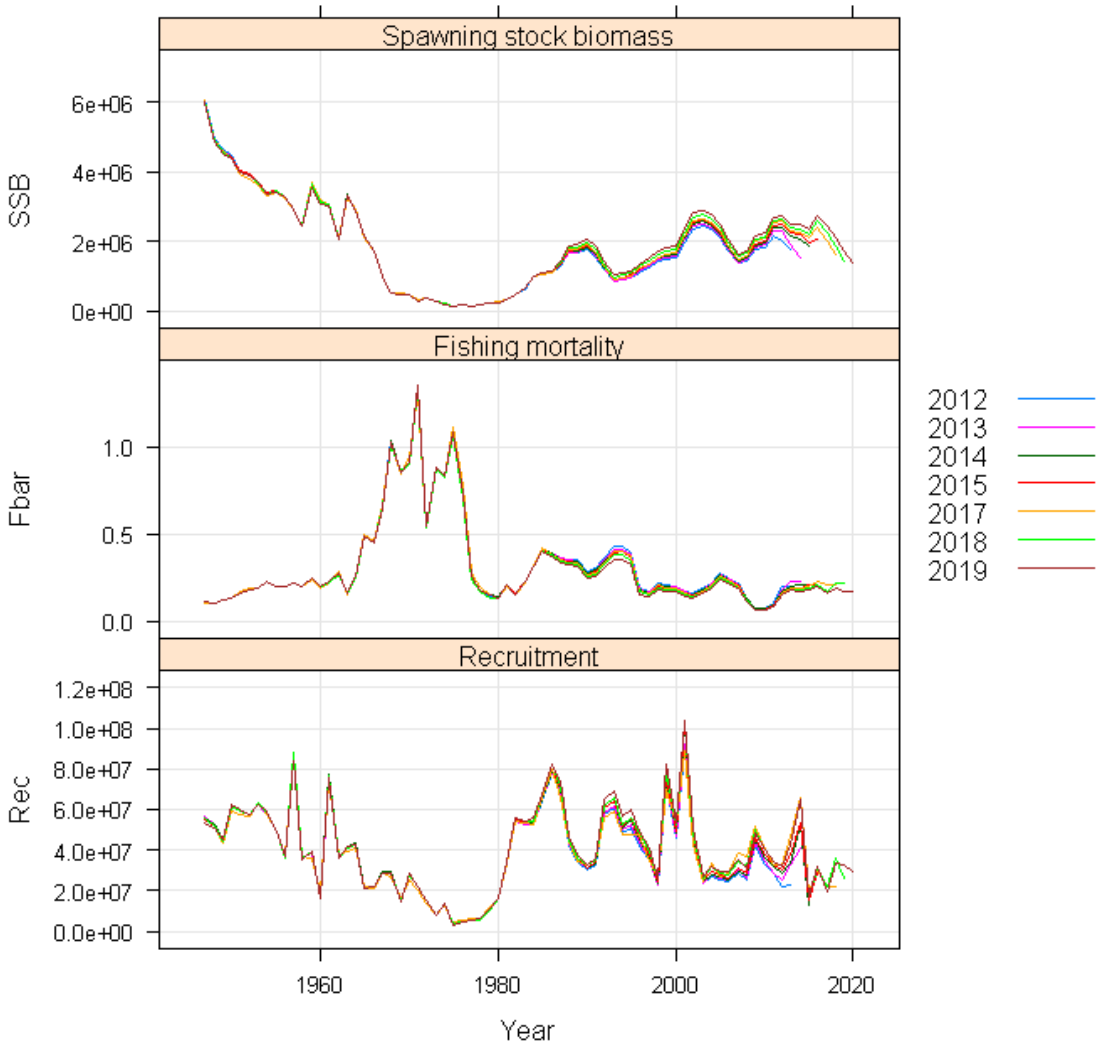


Figure 2.6.2.7. North Sea herring multifleet assessment model. Assessments retrospective pattern of SSB (top panel) F (middle panel) and recruitment (bottom panel) from 2006 to 2018.

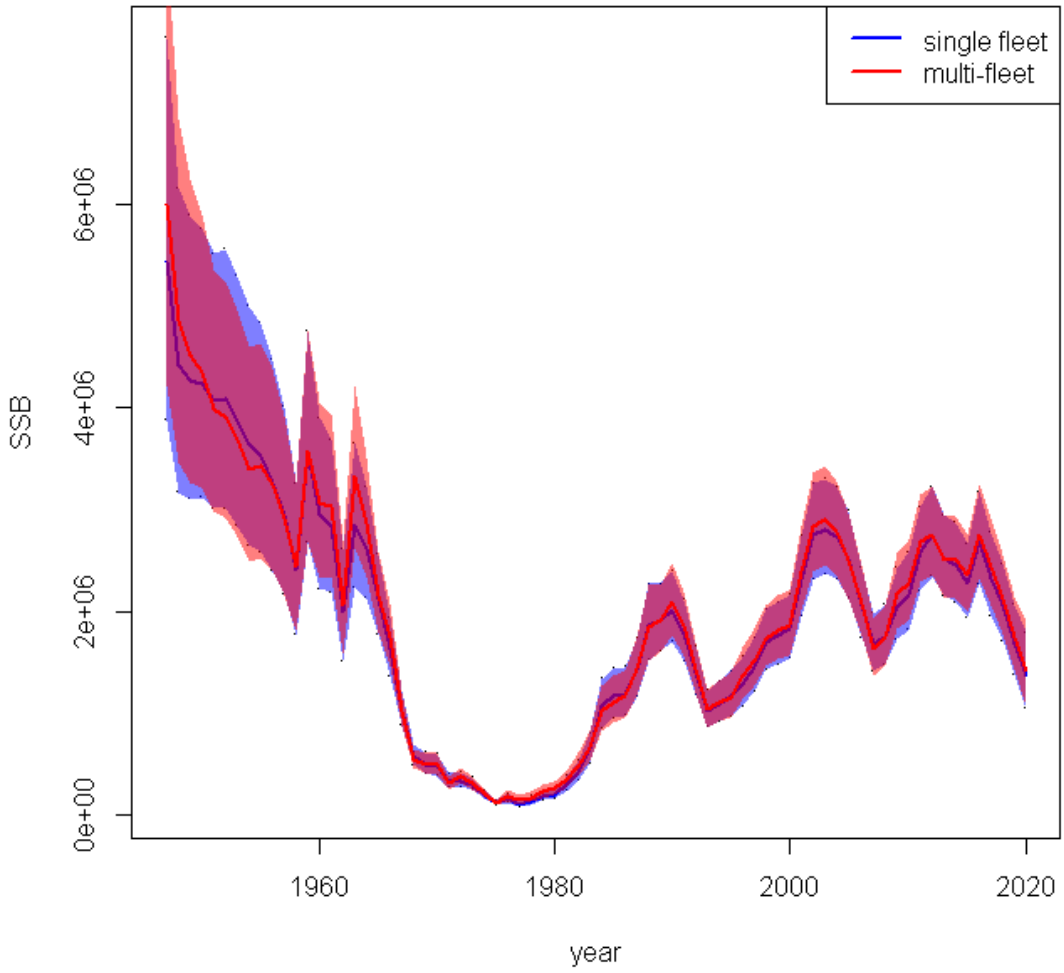


Figure 2.6.2.8. North Sea herring multifleet assessment model. Comparison of SSB for multifleet and single fleet assessment model outputs.

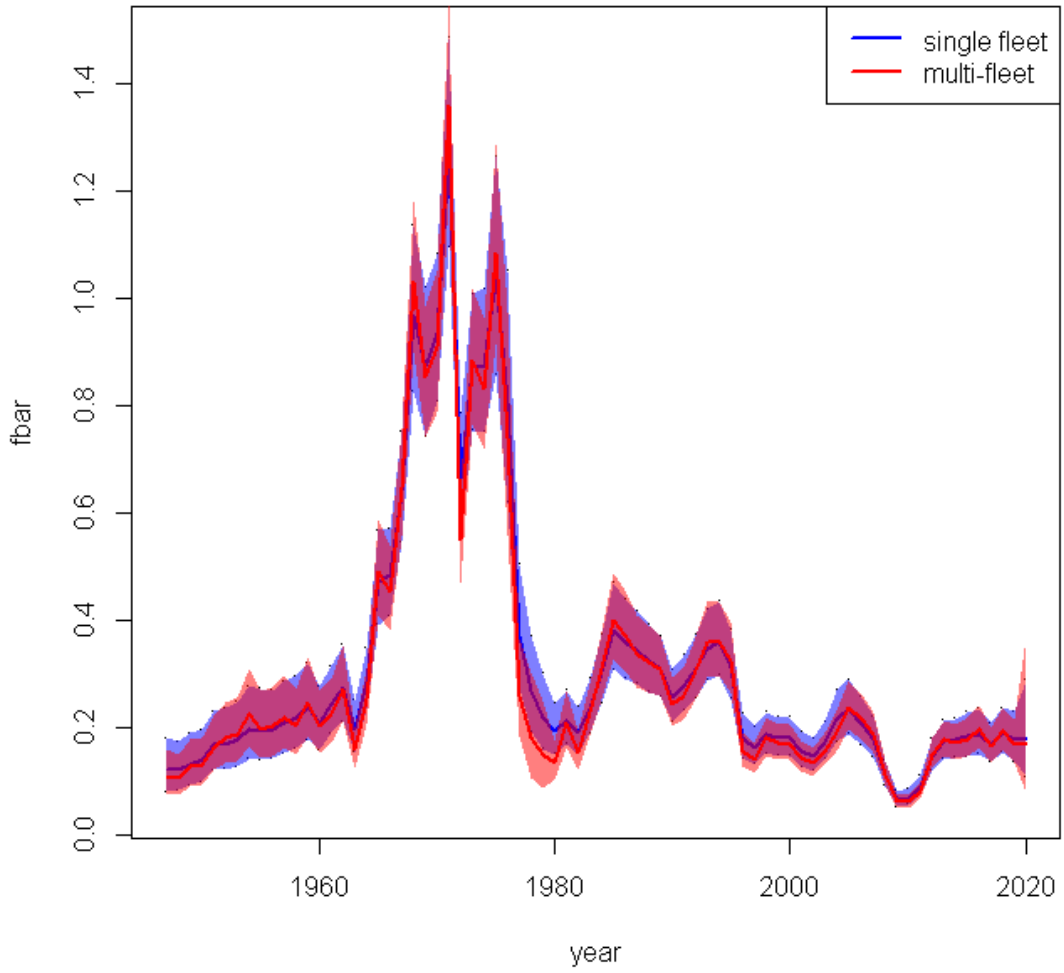


Figure 2.6.2.9. North Sea herring multifleet assessment model. Comparison of F_{bar} (across age 2 to 6) for multifleet and single fleet assessment model outputs.

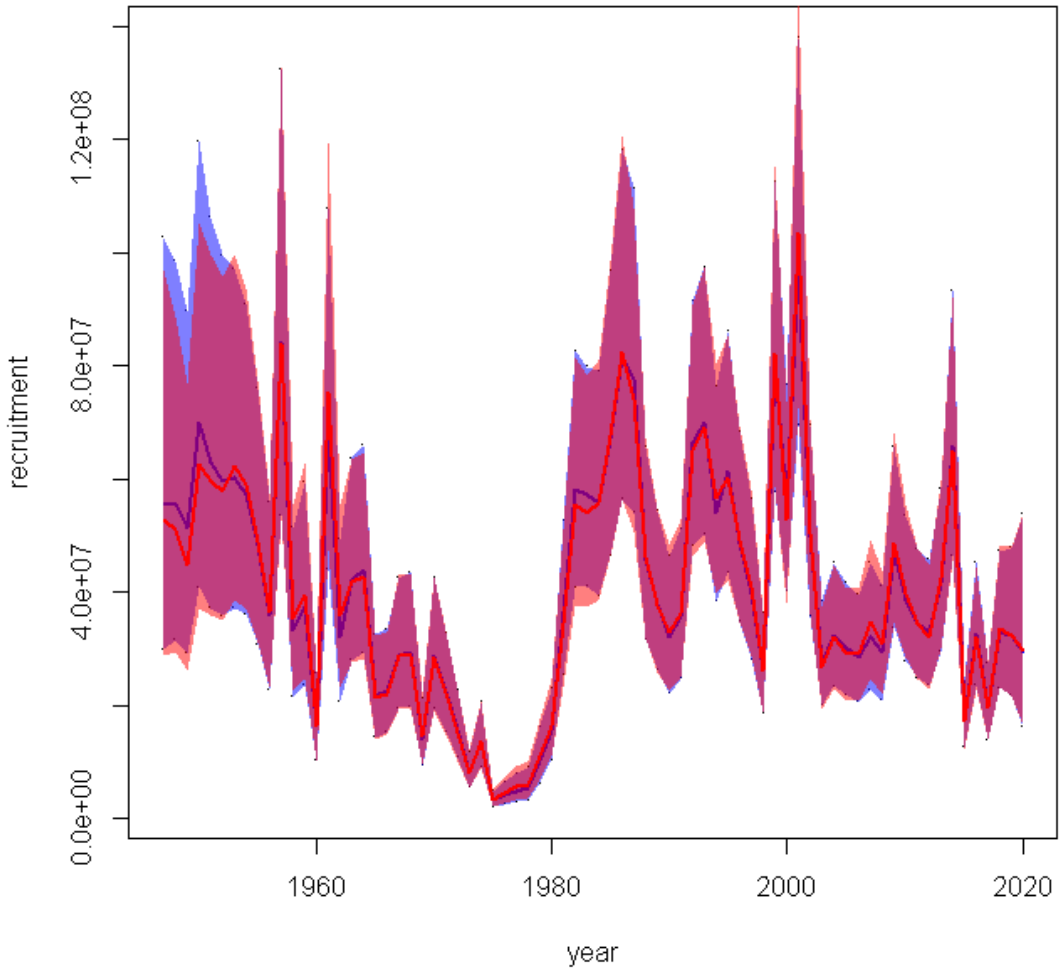


Figure 2.6.2.10. North Sea herring multifleet assessment model. Comparison of recruitment trajectories for multifleet and single fleet assessment model outputs.

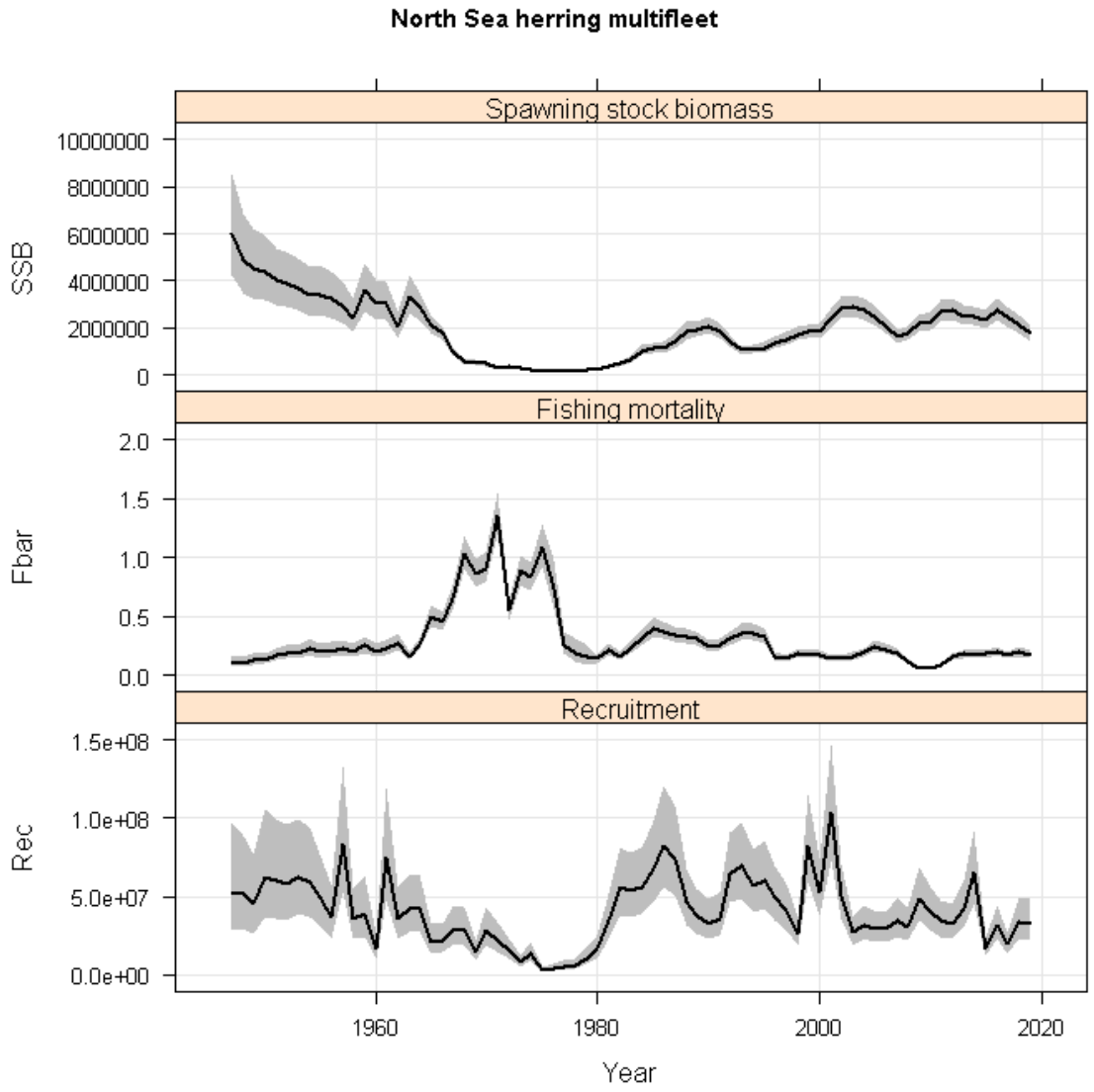


Figure 2.6.3.1 North Sea herring. Stock summary plot of North Sea herring with associated uncertainty for SSB (top panel), F ages 2–6 (middle panel) and recruitment (bottom panel).

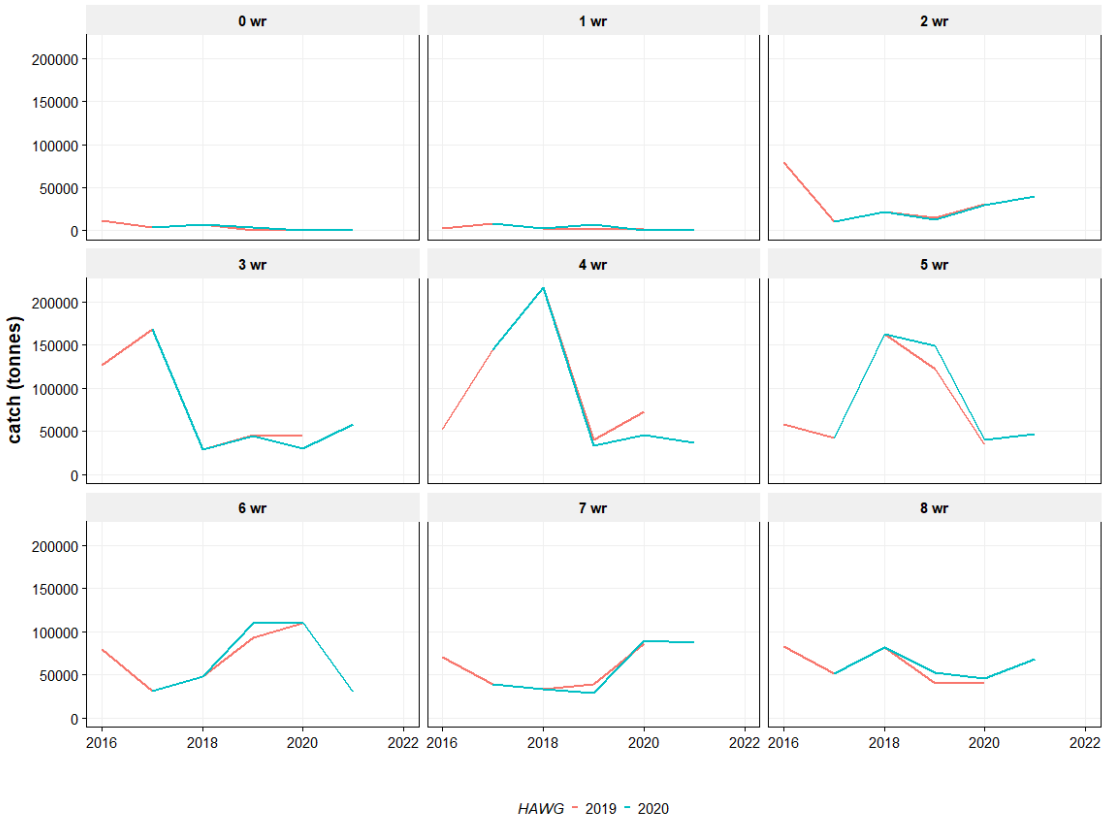


Figure 2.7.2.1. North Sea Herring. Realized and projected catch (in weight) by age (wr) between 2019 assessment (2020 as forecast year), 2020 assessment (2021 as forecast year).

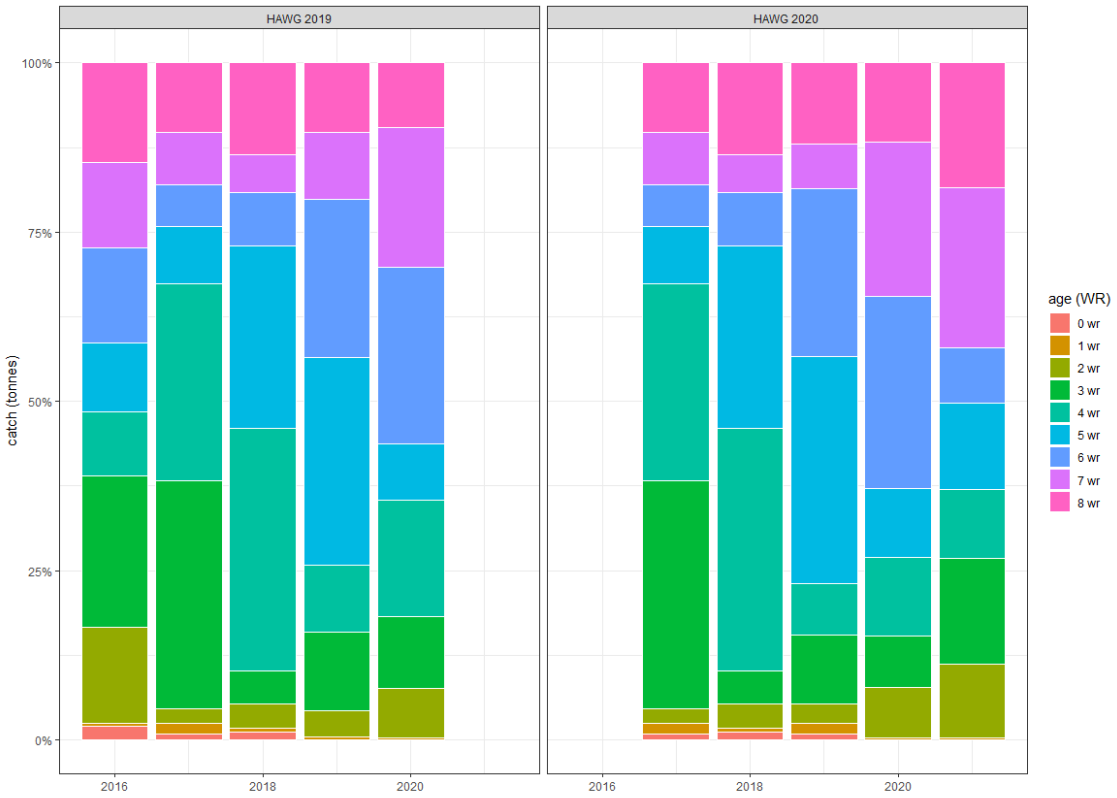


Figure 2.7.2.2. North Sea Herring. Catch proportions for the different ages between the 2019 short-term forecast (2020 as forecast year) and the 2020 short-term forecast (2012 as forecast year).

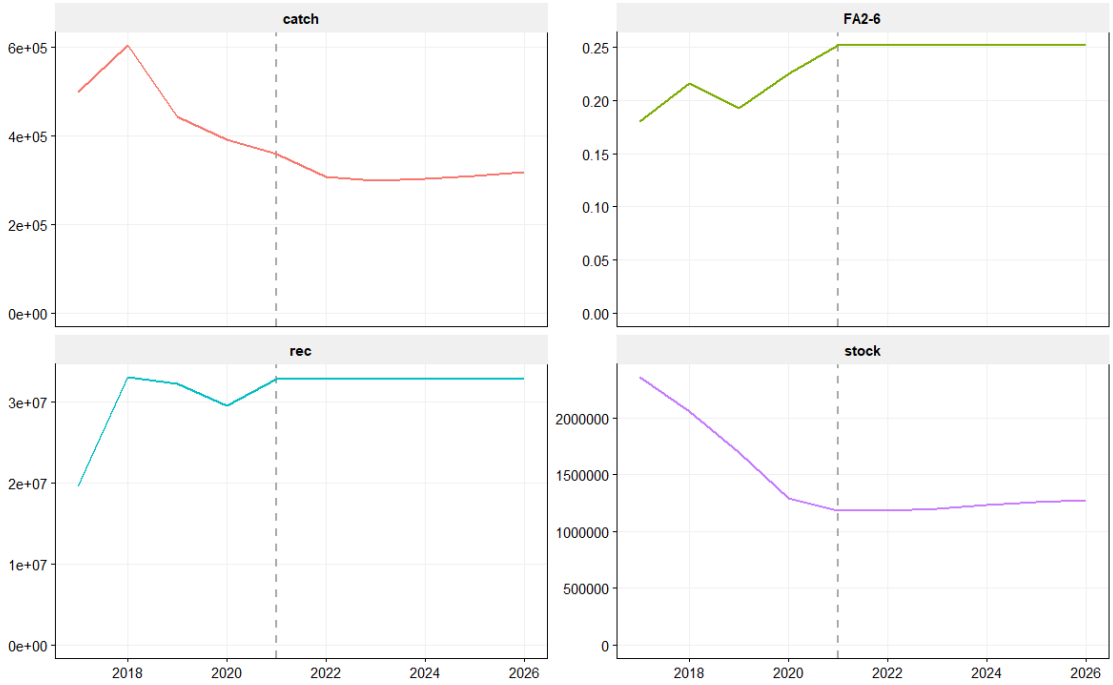


Figure 2.7.2.3. North Sea Herring. Short-term projections using an F status quo from TAC year (i.e. advice year). Intermediate year is in 2019 and the TAC year is 2020.

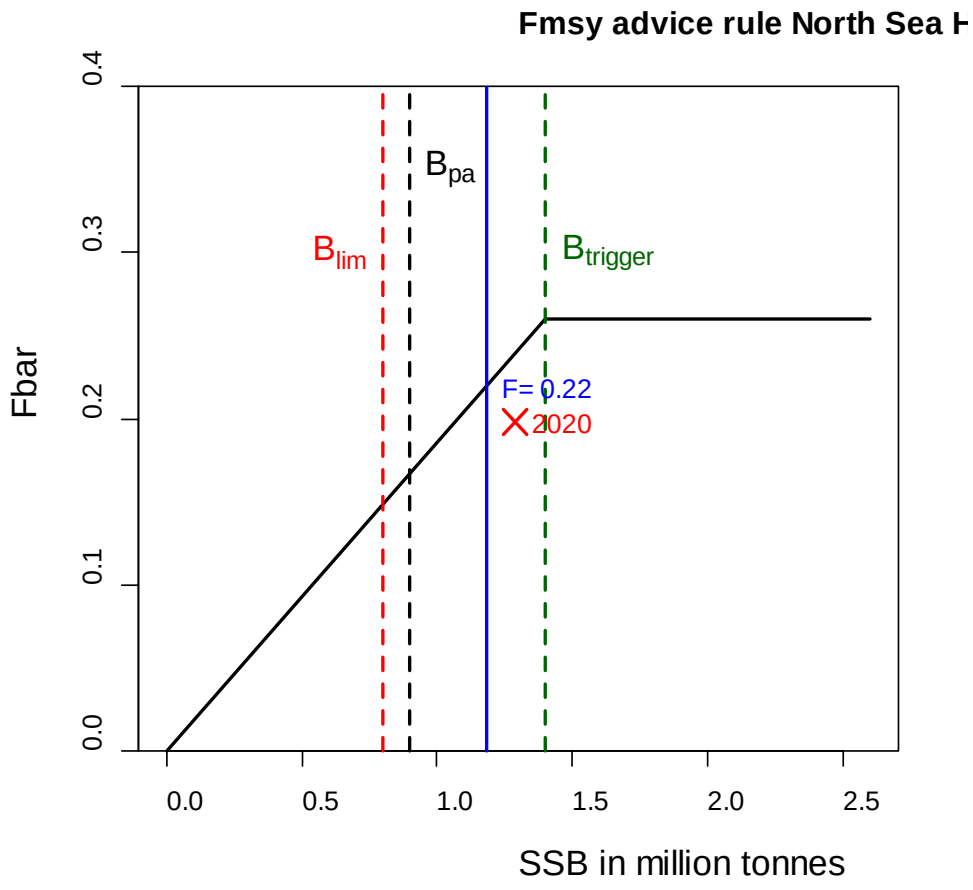


Figure 2.9.1.1. North Sea Herring. State of the stock in light of the MSY advice rule. The estimated SSB for 2021 is below MSYBtrigger (1.18 M tonnes, vertical blue line), leading to an applicable fishing mortality over age 2-6 (Fbar) of 0.22. The estimated SSB and Fbar for the intermediate year is depicted as a red cross marker.

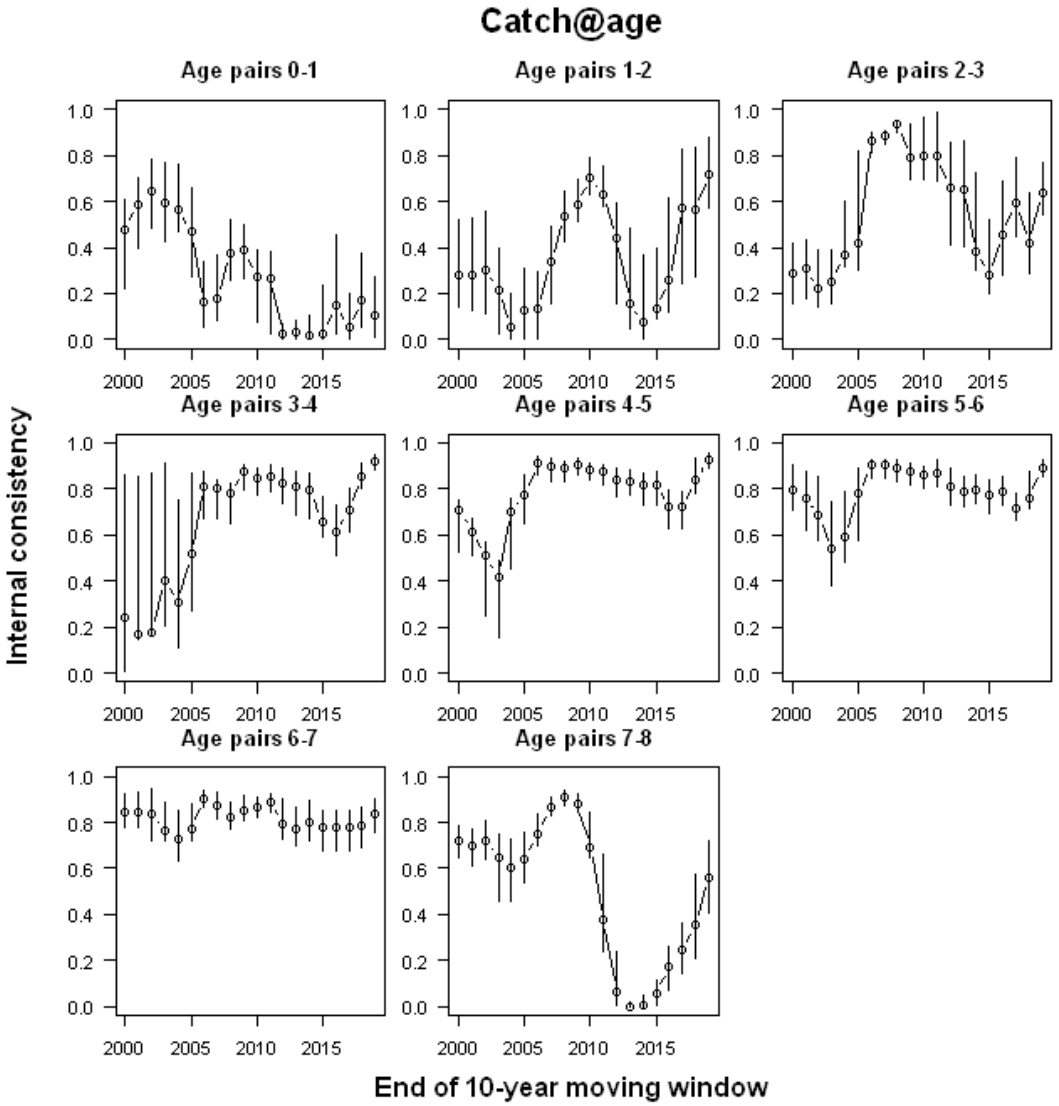


Figure 2.10.1.1. Internal consistency (R^2 of the log10-log10 linear relationship between consecutive ages in a cohort) of the catch-at-age data with a moving window of 10 years where the end-year (x-axis) denotes the last year for which data were used. Error bars show the variability of the estimate when one of the data-points is dropped (repeated 10 times without replacement).

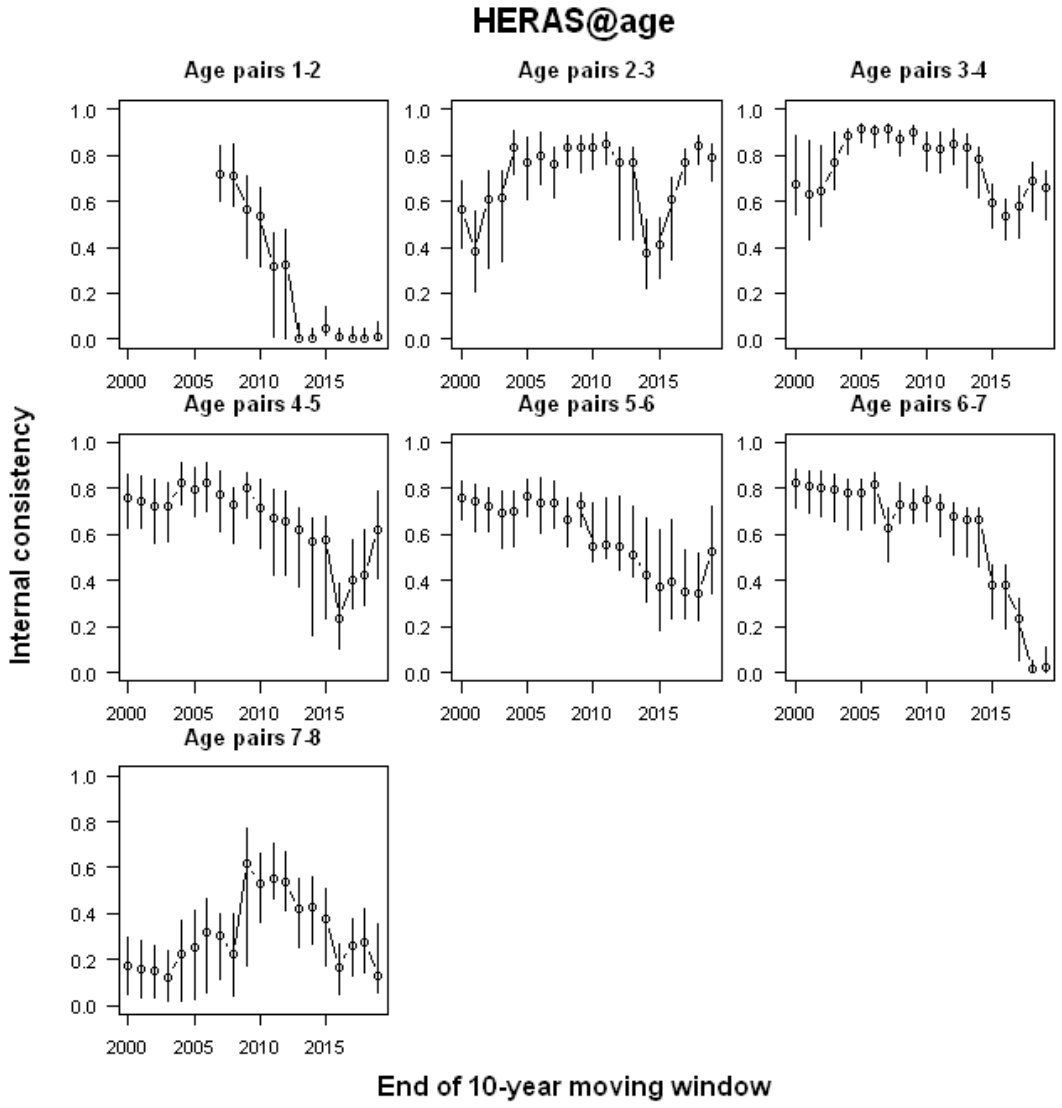


Figure 2.10.1.2. Internal consistency (R^2 of the log10-log10 linear relationship between consecutive ages in a cohort) of the HERAS-at-age data with a moving window of 10 years where the end-year (x-axis) denotes the last year for which data were used. Error bars show the variability of the estimate when one of the data-points is dropped (repeated 10 times without replacement).

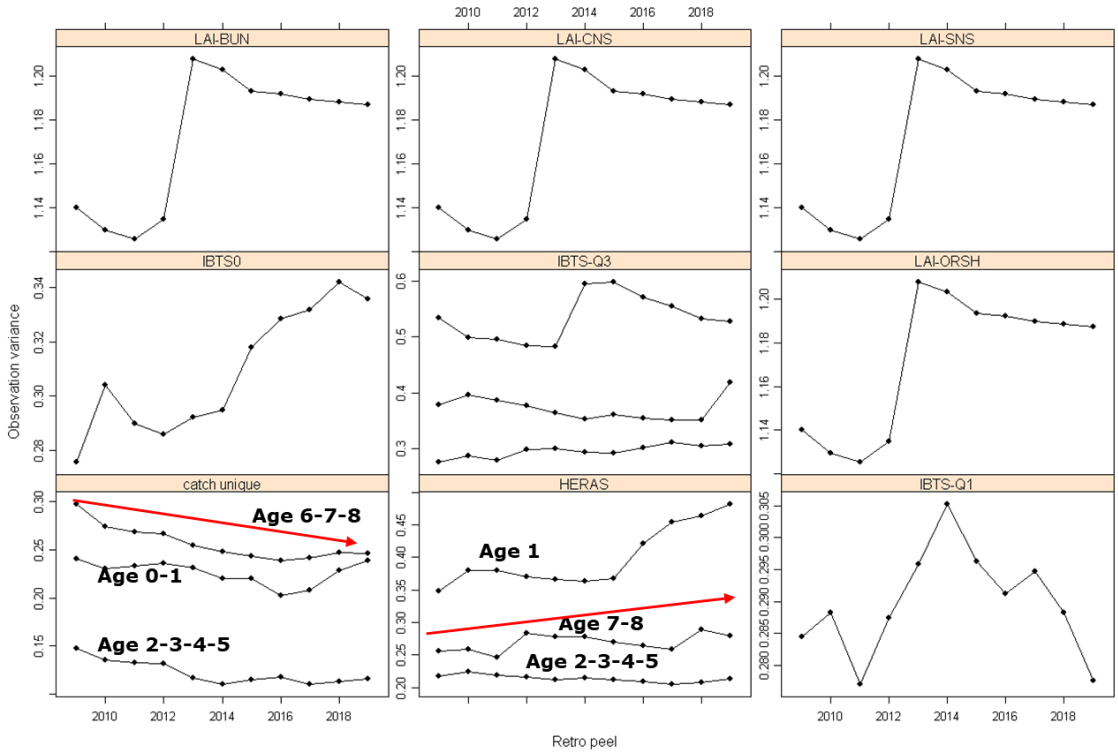
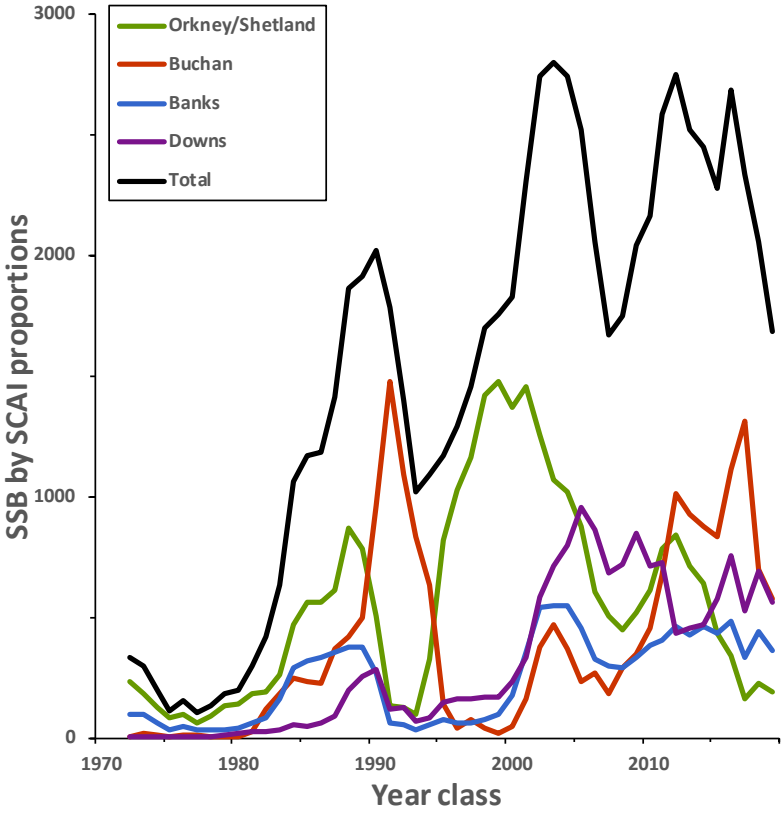


Figure 2.10.1.3. Change in observation variance for 10 retrospective peels. Patterns in the catch and in the HERAS survey are highlighted.


Orkney/Shetland
Buchan
Banks
Downs
Total
SSB by SCAI proportions
3000
2000
1000
0
1970
1980
1990
2000
2010
Year class

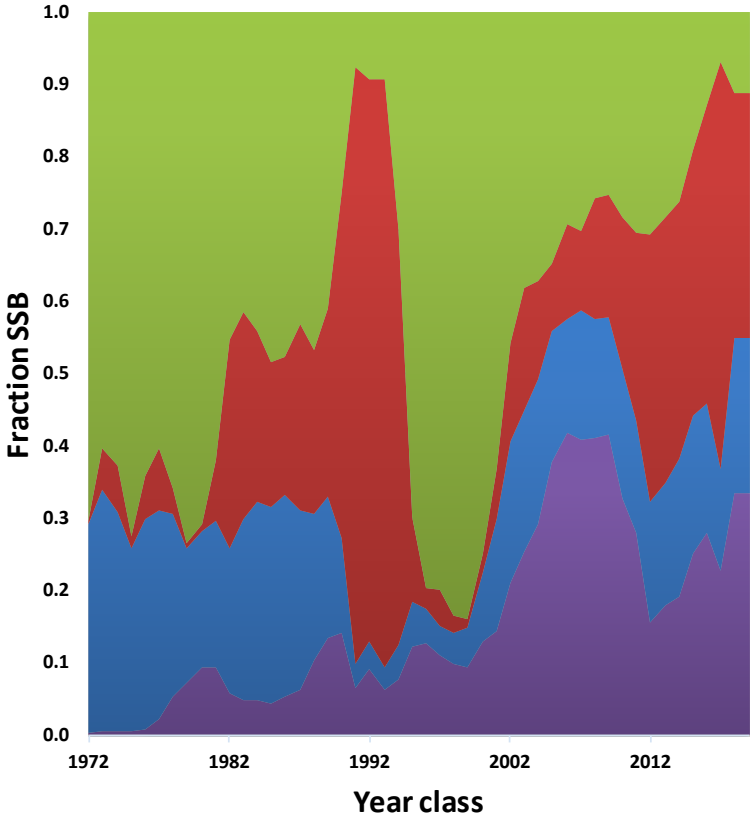

Fraction SSB
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
1972
1982
1992
2002
2012
Year class

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.

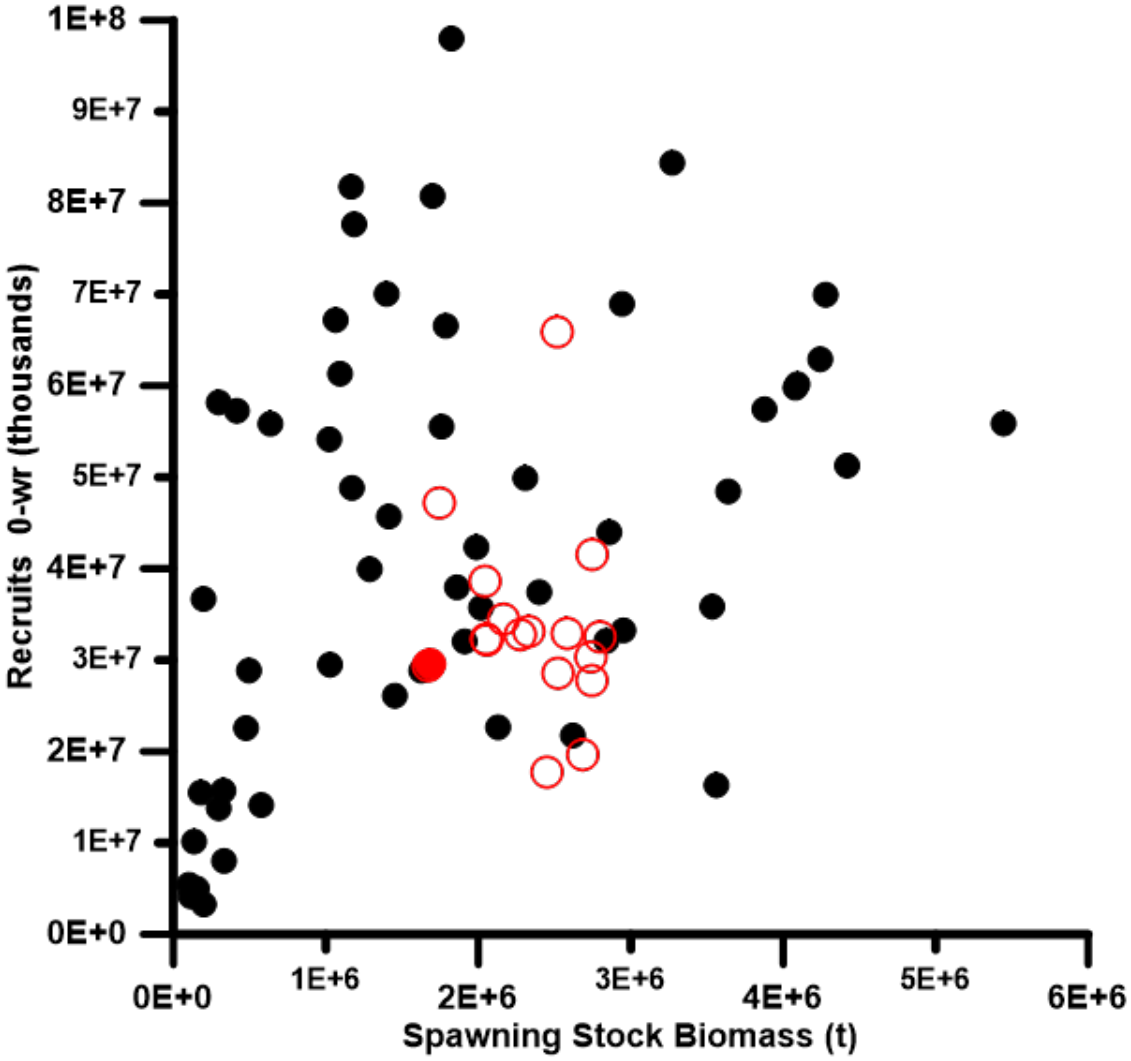


Figure 2.13.1. North Sea Autumn Spawning Herring stock recruitment curve, plotting estimated spawning-stock biomass against the resulting recruitment. Year classes spawned after 2001 are plotted with open red circles, to highlight the years of recent low recruitment. The most recent year class is plotted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

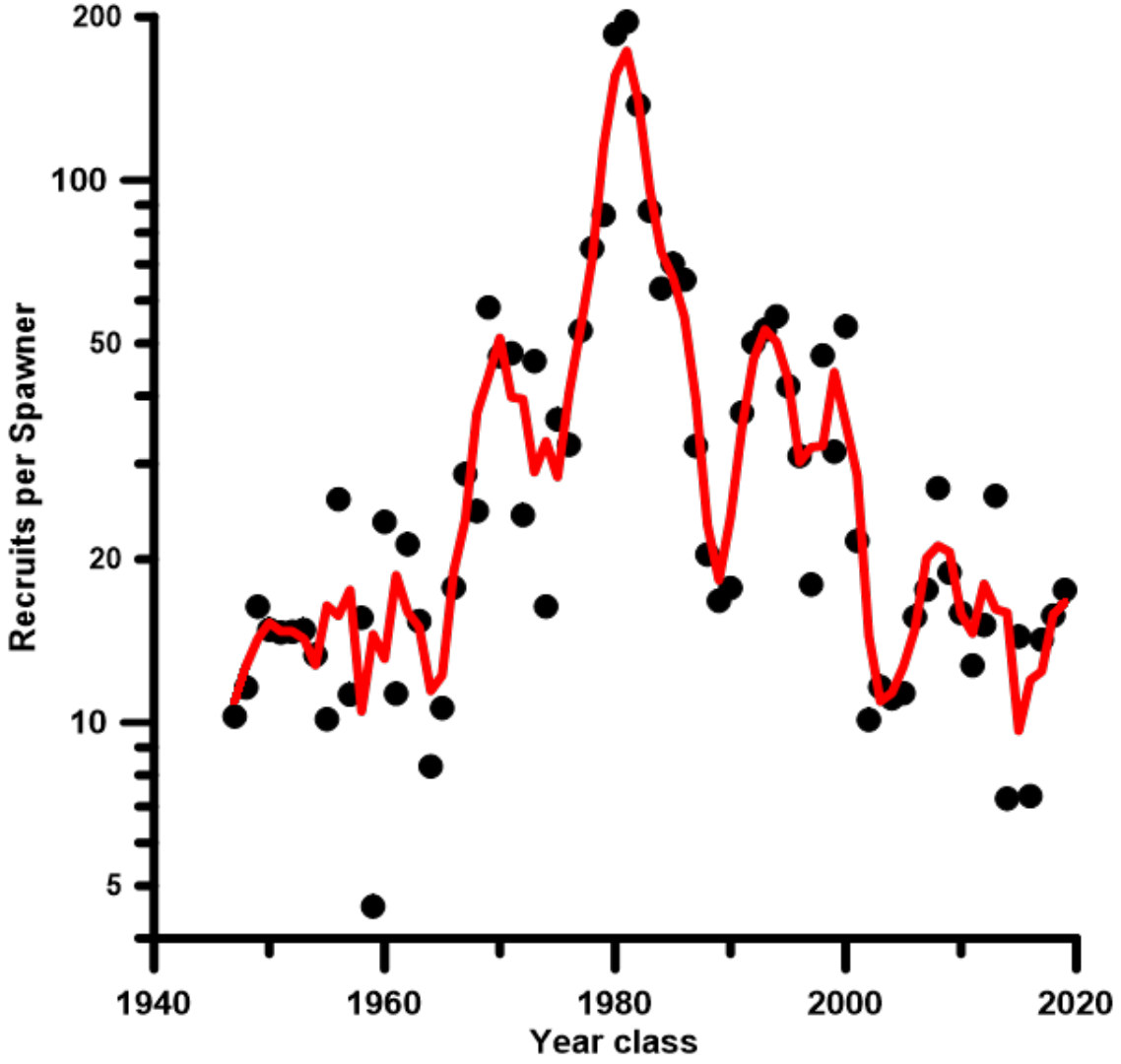


Figure 2.13.2. North Sea Autumn Spawning Herring time-series of recruits per spawner (RPS). RPS is calculated as the estimated number of recruits from the assessment divided by the estimated number of mature fish at the time of spawning and is plotted against the year in which spawning occurred. Black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

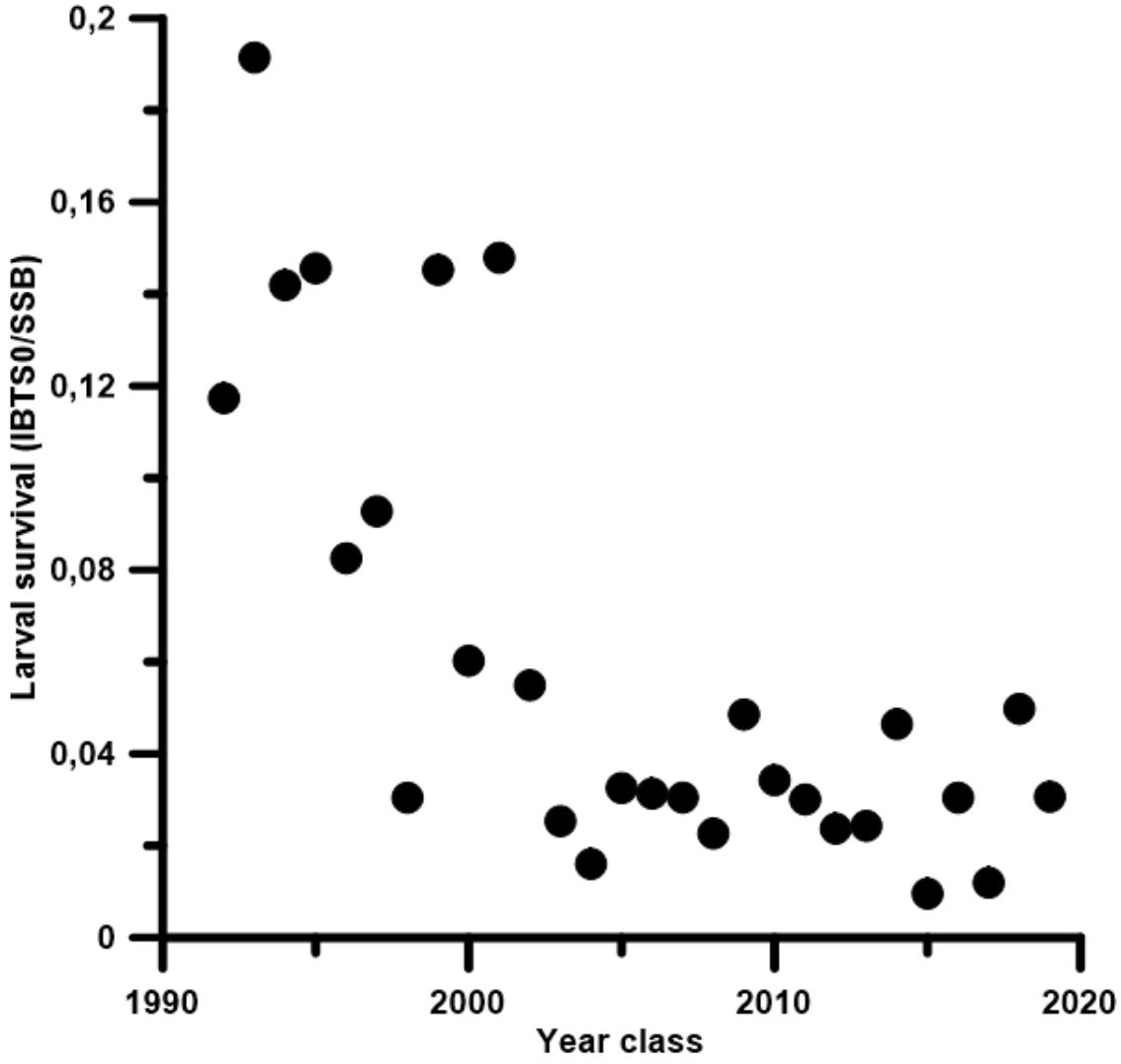


Figure 2.13.3. North Sea Autumn Spawning Herring time-series of larval survival ratio (Dickey-Collas & Nash, 2005; Payne *et al.,* 2009), defined as the ratio of the SSB larval index (representing larvae less than 10–11 mm) and the IBTS0 index (representing the late larvae, > 18 mm). Survival ratio is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

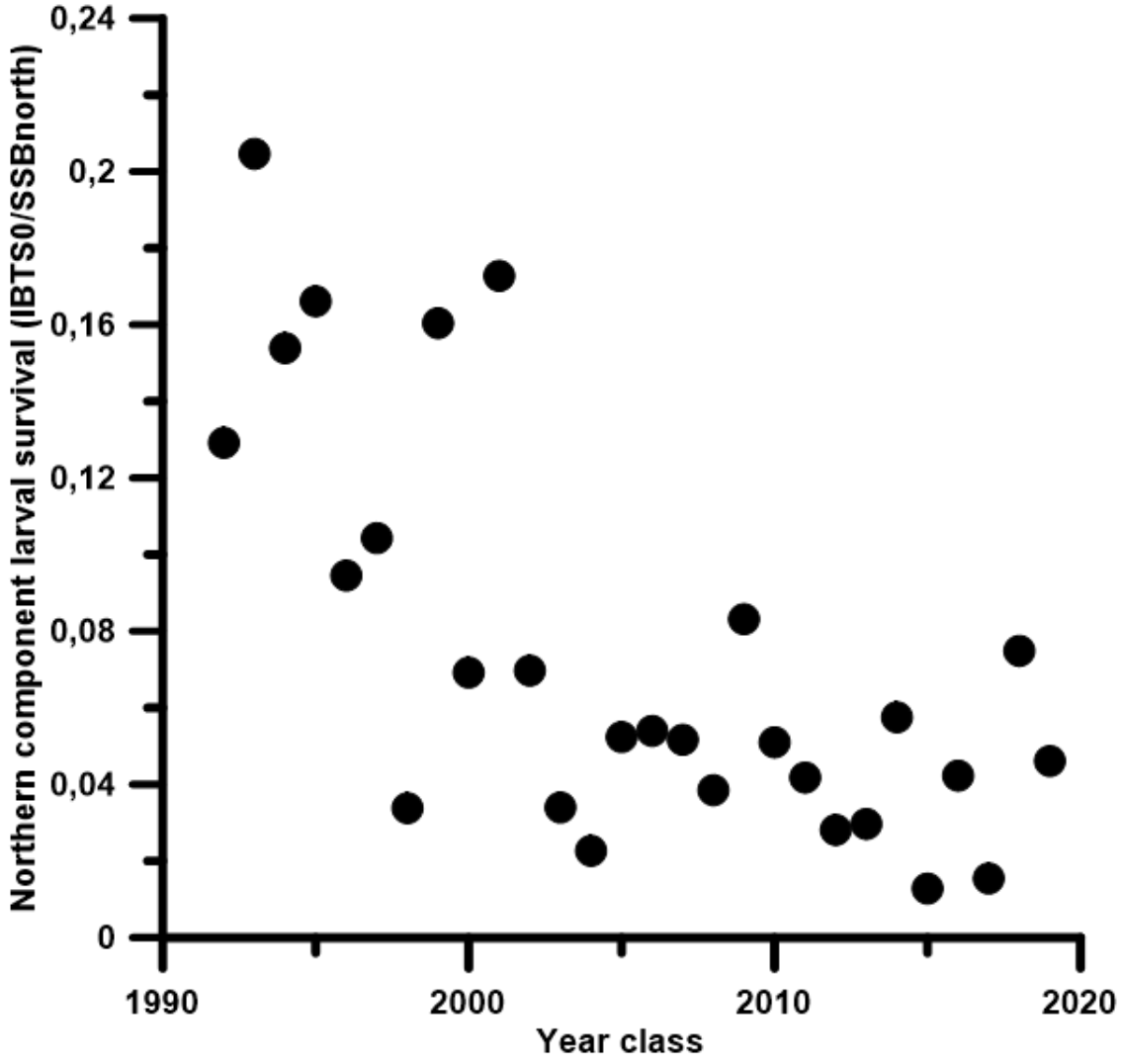


Figure 2.13.4. North Sea Autumn Spawning Herring time-series of larval survival ratio (Dickey-Collas & Nash, 2005; Payne *et al.,* 2009) for the northern-most spawning components (Banks, Buchan, Orkney-Shetland), defined as the ratio of the sum of the larvae indices for these components (representing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