Contents

4 Cod in 7.a (Irish Sea)

Situated between Ireland and Great Britain the Irish Sea (7.a) is connected by to the Celtic Sea (7.g) at its southern extreme by the St George's Channel and in north is linked to sea region West of Scotland (6.a) by the Northern Channel. The average depth is 50m but the area is contrasted between a deeper channel, in the west, and shallower bays in the east. The channel has a maximum depth exceeding 275m whilst the eastern bays have depths less than 50 m. Distinct habitat patches result from a combination of bathymetry, topographical features and hydrography. The sea bed of the eastern Irish Sea is dominated by fine sediment plains with some small areas of areas of mud habitat, the fine sediments graduate to more coarse material in central areas. A large well defined deep-water mud basin is located in the northwestern region in close to the Northern Irish and Irish coast.

Irish Sea fisheries are predominantly demersal trawling and seining with demersal trawling for *Nephrops* dominating effort with vessels using mesh in the range 70–99 mm. Effort using fishing gear with ≥100 mm mesh sizes is currently at a low level compared to historic activity, a considerable decline in effort was observed between 2003 and 2007 and has continued since. The species composition of catches by vessels in using ≥100 mm mesh consists primarily of haddock, with lower quantities of hake. At present there is no commercial towed gear fishery for cod permitted. Beam trawls are operating within the Irish Sea with mesh sizes in the range 80–119 mm, targeting sole, plaice, and rays. A seasonal pelagic and gillnet herring fishery operates in late summer–early autumn in the pre and post spawning period. Dredge fisheries target king and queen scallops, with king scallops in coastal areas with the queen scallop fishery operating in the central area south of the Isle of Man, to a lesser extent queen scallops are also targeted using trawl nets, during the late summer when swimming activity is most pronounced.

There is a recreational fishery which catches cod and with declining commercial rates has become a more important aspect of the total catch. At the last benchmark in February 2022 (ICES, 2023a) the recreational fishery was included in the assessment for the first time, however uncertainties in the data resulted in the exclusion of data from the assessments.

Type of assessment

The stock was benchmarked in February 2022 (ICES, 2023a) and a Stock Synthesis (SS3) fully analytical model is now being used in the cod assessment.

ICES advice applicable to 2023

ICES advised on the basis of precautionary approaches that there should be no directed fisheries, and bycatch and discards should be minimized in 2023. Advice for 2023 was zero catch under the MSY approach.

ICES advice applicable to 2024

ICES advised on the basis of the MSY and precautionary approach that there should be zero catches in 2024 as SSB will be below Blim in 2024 and 2025 (ICES 2023b).

4.1 General

Stock description and management units

The stock and the management unit are both ICES Division 7.a (Irish Sea).

4.1.1 Management applicable to 2023

Table 1: Fishing opportunities (TAC) for 2023 for cod in 27.7.a

	TAC	Landed
Belgium	2	1.3
France	6	0
Ireland	82	18.6
Netherlands	1	0
Union	91	20
United Kingdom	74	36
Total	165	56

https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2022.104.01.0001.01.ENG

4.1.2 Fishery in 2023

Landings remained below the set TAC for 2023 of 165 tonnes.

Since 2009, Irish landings of cod reported from ICES rectangles immediately north of the Irish Sea/Celtic Sea boundary (ICES rectangles 33E2 and 33E3) have been reallocated into the Celtic Sea as they represent a combination of inaccurate area reporting and catches of cod considered by ICES to be part of the Celtic Sea stock (ICES, 2009). The amount of Irish landings transferred from 7a to 7e–k by year is shown below. Total official landings for this stock in 2023 were 19 tonnes after this re-allocation and total catches in the area were 75t.

Table 2: Transfers from ICES rectangles 33E2 and 33E3

Year	Tonnes
2004	108
2005	54
2006	103
2007	527
2008	558
2009	193
2010	143
2011	147
2012	130
2013	75
2014	24

Year	Tonnes
2015	39
2016	40
2017	19
2018	20
2019	37
2020	71
2021	52
2022	30
2023	19

The majority of landings in 2023 were taken by the Nephrops fleet, while the demersal fleet only contributed with 33% to the landings. Landings and discards by métier and country can be seen in Table 8. Total uptake of cod TAC was at just 34%.

A Fishery–Science Partnership Survey (FSP) was repeated in the western Irish Sea in spring 2023 in the western Irish Sea using semi-pelagic gear on commercial vessels. This survey attempts to address the lack of sampling opportunities created by the diminishing TAC for cod in the Irish Sea and the resulting significant reduction of a directed whitefish fleet targeting cod.

4.1.3 InterCatch procedure

Since 2013 international landings and discards-at-age are uploaded into InterCatch. Discards are raised for unreported strata and métiers to estimate total discards-at-age.

4.1.4 Landings

The input data on fishery landings and age compositions are split into four periods:

1968–1990. Landings in this period, provided to ICES by stock coordinators from all countries, are assumed to be un-biased and are used directly as the input data to stock assessments.

1991–1999. TAC reductions in this period caused substantial misreporting of cod landings into several major ports in one country, mainly species misreporting. Landings into these ports were estimated based on observations of cod landings by different fleet sectors during regular port visits. For other national landings, the WG figures provided to ICES stock coordinators were used.

2000–2005. Cod recovery measures were considered to have caused significant problems with estimation of landings. The ICES WG landings data provided by stock coordinators for all countries are considered uncertain and estimated within an assessment model. Observations of misreported landings were available for 2000, 2001, 2002 and 2005. However, they have generally not been used to correct the reported landings but have been used to evaluate model estimates in those years.

Since 2006. The introduction of the UK buyers and sellers legislation is considered to have reduced the bias in the landings data but the level to which this has occurred is unknown. Consequently comparisons were made between the fit of the model to recorded landings under an assumption of bias and unbiased information.

2020. The Covid-19 pandemic made the collection of observer data aboard vessels impossible for Q2-Q4, making the estimation of discard data and the establishment of age structure in catches impossible for most of the year. Age structure of the stock is available from Q1 observer data and the 3 surveys, FSP, and Q1 and Q4 groundfish surveys.

2021 The continued COVID-19 situation resulted in reduced sampling; for the quarter 1 2021 the full final tow of the TR1 fleet was landed and sampled by observers ashore. There was very low sampling of cod in the *Nephrops* directed fleet, particularly in quarter 1 due to no observed trips. A raising procedure similar to the previous year was applied, in which the cod sampled in the Northern Ireland fishers self-sampling scheme were applied and raised to the full nephrops *Nephrops* catches. However, no cod were found in the provided self samples.

7) sampling by the Irish Republic did not take place in 2022 and 2023 in the Irish Sea, however there were sufficient samples to account for the missing sample data.

The annual numbers-at-age caught and the mean weights-at-age in landings (applied to the total catch) by age are given in Table 9 and Table 10; numbers of catch-at-age for 2020 are excluded due to limited discard and port sampling during the COVID-19 pandemic.

4.1.5 Discards data

The WKIrish3 (ICES, 2017) benchmark report gives details on historic raising to total national and international discards.

4.1.6 Biological data

Natural mortality

Natural mortality has been revised in WKNSCS (ICES, 2023a). M-at-age was calculated from tagging data following calculated following (Pollock, Hoenig and Jones 1989, Hoenig, Barrowman et al. 1998). Natural mortality is kept constant throughout years.

Maturity

Maturity ogive has been revised in WKIrish2 (ICES, 2016). Each year the smoother is applied to the full time-series of raw data and values are accordingly updated. Updated values after application of the smoother are in Table 12. Please refer to the stock annex for further information.

Survey data used for advice

Please refer to the stock annex (see Annex 2) for a description of the surveys and survey data.

Survey	Ages	Years
FSP survey (B7897)	2-6	2004-2023 (excluding 2014)
NIGFS-WIBTS-Q4 (G7655)	0	1995-2023
NIGFS-WIBTS-Q1 (G7144)	1-4	1995-2023

4.2 Historical stock development

The advice is based on the assessment benchmarked in 2022 (WKNSCS, ICES, 2023a) and revised in 2023 (ICES, 2023b).

4.2.1 Deviations from Stock Annex

The assessment follows the Stock Annex.

4.2.2 Final assessment:

The final assessment has been run in stock Synthesis (SS3). Available data and catch at age, discards at age and numbers at age in surveys can be seen in Figure 1–3, Figure 7 and Tables 9–13, while summary of assessment results can be seen in Table 14.

The fit of the model catch at age data and to the indices is good, showing "all green" runs tests (Figure 12 and Figure 13) as well as the individual residuals. Furthger details on the use of the Runs tests and RMSE can be found in Carvalho *et al.*, 2021. The retrospectives provide a good fit with Mohns rho for SSB and Fbar at -0.03 and -0.05 respectively (Figure 15).

The final results of the assessment can be seen in Figures 4–6.

4.3 Short-term predictions

Short term forecast was carried out in using the FLR forecast environment. Assumptions for the intermediate year can be seen in Table 3. Geometric mean for recruitment is from 2002–2021 (Final year-2), which encompasses the block where recruitment is supposedly reduced.

Table 3: Short term forecast assumptions

Variable	Value	Notes
$F_{ages\ 2–4}$ (2024)	0.02	$F_{sq} = F_{average(2021–2023)}$
SSB (2025)	6399	Short-term forecast fishing at f_{sq}; in tonnes.
$R_{age\ 0}$ (2024 and 2025)	23431	Geometric Mean (2002–2021); in thousands.
Total catch (2024)	103	Fishing at F_{sq}; in tonnes
Projected landings(2024) ((2022)((20(2022(2020)	94	Assuming average landing patterns (2021–2023); in tonnes
Projected discards (2024)	9	Assuming average discard patterns (2021–2023); in tonnes

Table 4 shows the catch scenarios, in particular the zero catch advice and the scaled MSY advices due to SSB being below MSY $B_{trigger}$ and unable to reach B_{lim} even under a no-catch scenario. F_{ECO} is also included in a scaled version. With the Sea Surface temperature Index being being high for the recent years, F_{ECO} is currently set at 0.14, at the lowest value possible.

Table 4: Catch scenarios for 2025; all weights are in tonnes.

Basis	Total catch (2025)	Projected landings (2025)	Projected discards (2025)	F_{total} (2025)	$F_{projected\ landings}$ (2025)	$F_{projected\ discards}$ (2025)	SSB (2026)	% SSB change *	% TAC change ^
MSY approach: F = 0	0	0	0	0	0	0	6311	-1.37	−100
MSY approach: F_{MSY} × SSB (2025)/MSY $B_{trigger}$	368	325	43	0.084	0.073	0.0110	5949	-7.04	123
F = 0	0	0	0	0	0	0	6311	-1.37	-100
EU MAP**: $F_{MSY\ lower}$ × SSB (2025)/MSY $B_{trigger}$	303	268	35	0.069	0.060	0.0090	6012.503	-6.04	84
EU MAP**: $F_{MSY\ lower}$	601	531	70	0.14	0.122	0.0184	5720	-10.6	264
F = F_{MSY}	727	641	86	0.171	0.149	0.0224	5598	-12.52	341
F = F_{pa}	958	844	114	0.23	0.1998	0.030	5372	-16.0	480
F = $F_{MSY\ upper}$	919	810	109	0.22	0.19	0.029	5410	-15.56	457
F = F_{2024}	88	78	10	0.019	0.017	0.0025	6224	-2.73	-47
F = F_{lim}	1294	1138	156	0.32	0.278	0.042	5048	-21	684
F=F_{ECO}	601	531	70	0.14	0.122	0.0184	5720	-10.6	264
F_{ECO} × SSB(2025)/MSY $B_{trigger}$	303	268	35	0.069	0.060	0.0090	6012	-6.04	84
Rollover TAC	165	146	19	0.0370	0.032	0.0049	6148	-3.92	0
SSB (2026) = SSB (2025)***									

* SSB 2026 relative to SSB 2025.

** EU multiannual plan (MAP) for the Western Waters (EU, 2019).

***SSB(2026) = SSB(2025), SSB (2026) = Blim and SSB(2026)= B_{pa} = MSY $B_{trigger}$ options were left blank because none of them can be achieved in 2026, even with zero catches.

^ Total advice in 2025 relative to the TAC in 2024 (165 tonnes).

4.4 Biological reference points

New reference points were defined at WKNSCS (ICES, 2023a) and were adjusted in 2023 (ICES, 2023b). The newly introduced F_{ECO} (ICES, 2023a) has been agreed and reviewed at the benchmark for a stock for the first time. FECO is an opportunity to use environmental data in forecast scenarios (ICES, 2023c). In case of cod in 7a a sea surface temperature (SST) was found to be a reasonable indicator for productivity. The F_{ECO} reference point uses the inverted SST (with a 3-year lag to account for the time from larvae stage to contribution to SSB) rescaled between zero and one which informs the status of the indicator (I_s) in the advicer year compared with previous years. The status of the indicator determines the placement of the F_{ECO} reference point within F_{MSY} ranges (ICES, 2019; 2020); for 2024 F_{ECO} is at 0.14= $F_{MSY\ lower}$, estimated as $F_{MSY\ lower}$ + (($F_{MSY\ upper}$ - $F_{MSY\ lower}$)*I_s)

Table 5: Biological reference points

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY $B_{trigger}$	13012	B_{pa}	ICES, 2023b
	F_{MSY}	0.171	Median point estimates of (F_{MSY}) EqSim with combined SR	ICES, 2023b
	$F_{MSY\ lower}$	0.141	Median lower estimates of (F_{MSY}) EqSim with combined SR	ICES, 2023b
	$F_{MSY\ upper}$	0.22	Median upper point estimates of (F_{MSY}) EqSim with combined SR	ICES, 2023b
	F_{ECO}	0.141	Ecosystem Indicator (I_S); $F_{ECO} = F_{MSY\ lower} + ((F_{MSY\ upper} - F_{MSY\ lower}) * I_S)$	ICES, 2023b
Precautionary approach	B_{lim}	9364	Lowest SSB with above-average recruitment	ICES, 2023b
	B_{pa}	13012	B_{lim} combined with the assessment error	ICES, 2023b
	F_{lim}	0.32	F with 50% probability of SSB less than B_{lim}	ICES, 2023b
	F_{pa}	0.23	F_{P05}; the F that leads to SSB > B_{lim} with 95% probability	ICES, 2023b

4.5 Management plans

The Irish Sea cod management plan, as described in Council Regulation (EC) 1342/2008 was evaluated independently by ICES in 2009 using the approach adopted in AGCREMP 2008 and found to be not consistent with the ICES Precautionary Approach (ICES 2009).

4.6 Uncertainties and bias in assessment

4.6.1 Surveys

The Irish Sea has relatively good survey coverage. The quarter 1 groundfish survey and the FSP survey have got good consistent cover of the age contributions. The Q4 groundfish survey only attributes to the recruitment at age 0.

4.6.2 Stock structure and migrations

Stock structure and migrations have been in full discussed in the WKIrish2 report (ICES, 2016), however, there are still uncertainties and discussions.

A tagging study of Irish Sea cod and Celtic Sea cod was conducted from 2016-2019 in part to address these issues. Up to January 2019 4238 cod were caught and tagged aboard chartered commercial fishing vessel using semi-pelagic fishing gear, FSP survey, shore angling

competitions and others. Up to January 2019 138 tagged cod were returned. The project relies on collaboration with the fishing industry to provide the data to develop a better understanding of the current behaviour, biology and stock status of Irish Sea cod. Most recent results suggest a stronger migratory behaviour of Irish Sea cod into the Celtic Sea, indicating that up to 18% of mature fish might leave the Irish Sea (Report citation). This will have considerable impacts on the future management and assessment of the stock, but additional research is necessary. Currently a further project using data storage tags and trace element analysis is being conducted to understand stock structure and migratory behaviour as well as mixing.

4.7 Management considerations

A number of emergency and cod recovery plan measures have been introduced since 2000 to conserve Irish Sea cod. These include a spawning closure since 2000 and effort control since 2003. There have also been several vessel decommissioning schemes. As it has not been possible to provide analytical catch forecasts in recent years, the TAC has been reduced by 15–20% annually since 2006 and by 25% since 2009.

An MSY approach was used to set TAC in 2018 and 2019, which was followed by a precautionary advice in 2020 and 2021. Since 2022 the stock has assessed using an MSY approach; however, low SSB and recruitment in recent years result in a zero catch advice.

4.8 Future issues and considerations

Cod in the Irish Sea and the Celtic Sea are in a highly exploited state and show historically a very steep age-profile. Recruitment since 2002 has been impeded.

It is essential to further the understanding of the stock structure to improve future management, which includes the further investigation of migration and natural mortality in the Irish Sea. It might be necessary for a combined approach to manage the stocks in 7A and 7E-G.

Under the current highly exploited status it seems that recruitment rather than fishing pressure is driving stock trends. It is also questionable in how far an MSY approach with reference points as applied in the traditional ICES format is a valid approach for this stock which is recruitment rather than fishery controlled. The working group is awaiting the outcomes of WKREF to further investigate the most appropriate way to manage the stock in the future. This might mean a shift to an MSE approach for management.

4.9 References

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4.10 Tables and figures

Table 6: Official landings of cod in Division 7.a as officially reported to ICES and figures used by ICES from 1996. All weights are in tonnes, minor differences in total value are due to rounding. Countries reported landings are official values.

Year	Belgium	France	Ireland	Netherlands	Spain	UK (England Wales, & NI)	UK (Isle of Man)	UK (Scotland)	Total	Landings in rectangles 33E2 & 33E3 ***	ICES Landings	ICES Discards
1996	142	148	2476	25	-	2359	27	126	5303		4964**	
1997	183	268	1492	29	-	2370	19	80	4441		5859**	
1998	316	269	1739	20	-	2517	34	67	4962		5318**	
1999	150	n/a	966	5	-	1665	9	80	2875		4784**	
2000	60	53	455	1	-	799	11	38	1417		1274	
2001	283	74	751	-	-	885	1	32	2026		2252	
2002	318	116	1111	-	-	1134	7	29	2715		2695	
2003	183	151	594	-	14	505	7	23	1477		1285	
2004	104	29	380	-	-	646	5	15	1179	108	1072	
2005	115	35	220	-	-	594	n/a	3	967	54	910	
2006	60	18**	275	-	-	589	n/a	6	948	103	840	
2007	67	17**	608	-	-	423	n/a	2	1117	527	702	148
2008	26	3	618**	-	-	543	22	12	1224	558	661	62
2009	19	12	323**	-	-	387	12	12	765	193	468	60
2010	21	1	289	-	-	282	1	-	594	143	464	377
2011	36	3	275	-	-	169	1	-	485	147	368	43

Year	Belgium	France	Ireland	Netherlands	Spain	UK (England Wales, & NI)	UK (Isle of Man)	UK (Scotland)	Total	Landings in rectangles 33E2 & 33E3 ***	ICES Landings	ICES Discards
2012	23	1	193	-	-	109	< 1	-	326	85	198	658
2013	13	< 1	160			107	< 1	-	281	76	206	118
2014	9	< 1	148	-	-	79	< 1	-	236	24	213	149
2015	12	< 1	137	-	-	50	< 1	-	199	39	161	224
2016	3	< 1	84	-	-	35	< 1	-	122	40	82	60
2017	5	< 1	57	-	-	41	< 1	< 1	103	19	84	59
2018	2	< 1	105	-	-	128	< 1	< 1	235	20	215	42
2019	10	< 1	- c	-	-	195	< 1	< 1	205 c	37	295	7
2020	10	0	77	-	-	97	< 1	< 1	255	71	181	25
2021	3	0	93	-	-	89	<1	<1	185	52	133	4
2022*	3	0	55	-	-	70	<1	<1	128	30	98	27
2023*	1.4	0	19	-	-	36	<1	<1	56		56	9.0

* Preliminary official landings.

** Includes sample-based estimates of landings into ports.

*** Landings in the southern part of Division 7.a (rectangles 33E2 and 33E3) are not included in the assessment and are considered to be part of the cod stock in divisions 7.e–k.

c Incomplete/missing due to part of the data being unavailable under national GDPR clauses.

Table 7 Working Group figures for annual landings and TAC uptake since 2000. a) total, b) by country

a)

Year	Total	TAC	% uptake
2000	1273	2100	61
2001	2251	2100	107
2002	2695	3200	84
2003	1285	1950	66
2004	1072	2150	50
2005	910	2150	42
2006	840	1828	46
2007	702	1462	48
2008	662	1199	55
2009	468	899	52
2010	465	674	69
2011	368	506	73
2012	198	380	52
2013	206	285	72
2014	213	182	117
2015	161	146	110
2016	82	146	56
2017	84	146	57
2018	215	695	31
2019	298	807	37
2020	181	257	70
2021	133	206	65
2022	98	74	132
2023	65	165	34

Table 7b)

2009	UK	Ireland	France	Belgium	Netherlands	Total
Landings	391	55	3	19	0	498
TAC	259	592	33	12	3	899
% uptake	151%	9%	9%	160%	0%	

2010	UK	Ireland	France	Belgium	Netherlands	Total
Landings	292	151	1	21	0	465
TAC	194	444	25	9	2	674
% uptake	150%	34%	4%	233%	0%	

2011	UK	Ireland	France	Belgium	Netherlands	Total
Landings	170	160	3	36	0	369
TAC	146	333	19	7	2	506
% uptake	117%	48%	16%	533%	0%	

2012	UK	Ireland	France	Belgium	Netherlands	Total
Landings	112	63	0	23	0	198
TAC	109	251	14	5	1	380
% uptake	103%	25%	0%	460%	0%	

2013	UK	Ireland	France	Belgium	Netherlands	Total
Landings	107	85	1	13	0	206
TAC	82	188	10	4	1	285
% uptake	130%	45%	10%	325%	0%	

2014	UK	Ireland	France	Belgium	Netherlands	Total
Landings	79	124	0	9	0	213
TAC	52	120	7	2	2	182
% uptake	153%	103%	0%	455%	0%	

2015	UK	Ireland	France	Belgium	Netherlands	Total
Landings	50	99	0	12	0	161
TAC	42	97	5	2	0	146
% uptake	119%	102%	0%	600%	NA	

2016	**UK**	**Ireland**	**France**	**Belgium**	**Netherlands**	**Total**
Landings	35	44	0.4	3	0	82
TAC	42	97	5	2	0	146
% uptake	83%	45%	8%	150%	0%	
2017						
Landings	41	38	0.2	5	0	84
TAC	42	97	5	2	0	146
% uptake	98%	39%	4%	250%	0%	
2018						
Landings	128.5	84.6	0.05	1.9	0	214.9
TAC	200	459	25	9	2	695
% uptake	64%	18%	<1%	<1%	0%	31%

Table 7b) continued

2019	**UK**	**Ireland**	**France**	**Belgium**	**Netherlands**	**Total**
Landings	193.9	90	0.2	10.2	0	294.6
TAC	233	530	30	11	3	807
% uptake	83%	17%	<1%	93%	0%	36.5%
2020						
Landings	95.6	75.9	0	9.5	0	181.1
TAC	74	170	9	3	1	257
% uptake	129%	45%	0%	317%	0%	70%
2021						
Landings	88.7	41.8	0	2.8	0	133.3
TAC	91	104	7	3	1	206
%uptake	97%	40%	0%	93%	0	65%
2022						
Landings	70	25.3	0	2.7	0	98.1
TAC	91	104	7	3	1	206
%uptake	77%	24%	0%	90%	0	48%
2023	**UK**	**Ireland**	**France**	**Belgium**	**Netherlands**	**Total**
Landings	36	19	0	1.4	0	56
TAC	74	82	6	2	1	165

2019	UK	Ireland	France	Belgium	Netherlands	Total
%uptake	49%	23%	0%	70%	0	34%

Table 8: Landings and discard proportions by métier.

Catch (2023)	Landings				
65 tonnes	otter trawls		mid-water trawl	beam trawls	other gear types
	Nephrops directed 55%	demersal fish directed 33%	<1%	9%	1.3%
	56 tonnes				
	Discards				
	otter trawls		mid-water trawl	beam trawls	other gear types
	27% *Nephrops* directed	<1% demersal fish directed	0%	72%	<1%
	9 tonnes				

Table 9 Total catch numbers-at-age (thousands).

Year	0	1	2	3	4	5	6+
1968	17	439	1563	1003	456	177	30
1969	20	969	1481	1050	269	186	113
1970	22	1810	1385	352	204	163	71
1971	22	2835	2022	904	144	67	51
1972	26	900	3267	824	250	58	59

Year	0	1	2	3	4	5	6+
1973	27	2377	1091	1783	430	173	81
1974	16	601	3559	557	494	131	74
1975	26	1810	642	1407	294	249	117
1976	27	1247	3007	363	500	61	104
1977	31	946	511	1233	163	218	71
1978	40	855	1092	310	311	39	65
1979	44	1948	1288	608	127	164	71
1980	25	2636	2797	729	243	49	55
1981	38	1457	3635	1448	244	99	47
1982	46	538	2284	1455	557	102	79
1983	47	1011	932	751	499	154	46
1984	37	1733	1195	439	240	161	75
1985	34	1360	2105	703	158	84	77
1986	49	1180	2248	699	203	64	65
1987	47	4522	1793	841	252	75	43
1988	43	2971	4734	702	263	71	38
1989	41	754	2163	1886	231	86	37
1990	38	869	1075	545	372	70	30

Year	0	1	2	3	4	5	6+
1991	47	2169	1408	442	127	98	22
1992	37	1529	1243	664	132	42	49
1993	39	388	2907	403	119	16	13
1994	40	916	569	848	68	20	10
1995	43	678	1283	180	163	7	6
1996	88	447	1113	700	38	39	6
1997	5	651	1149.5	501	213	17	16
1998	0	231	1928	335	80	28	8
1999	141	236	843	871	66	21	7
2000	62	1107	176	107	50	4	1
2001	7	403	841	53	13	9	2
2002	0	238	564	405	7	2	3
2003*	50	121	472	109	36	1	0
2004*	50	161	134	174	22	6	3
2005*	50	118	256	78	34	5	1
2006	50	89	174	128	17	8	3
2007	16	216	210	56	11	1	0
2008	6	77	169	87	9	3	0

Year	0	1	2	3	4	5	6+
2009	329	60	57	66	17	3	0
2010	49	220	188	16	7.5	2	1
2011	10	54	106	36	2	1	1
2012	8	84	135	145	10	0	0
2013	36	37	59	30	9	2	0
2014	1	41	86	26	5	1	0
2015	0	37	80	26	4	1	0
2016	0	11	25	30	2	1	0
2017	0	12	28	16	3	0	0
2018	256	95	27	36	2	2	1
2019	0	60	68	12	9	1	2
2020*	0	108	50	20	4	2	1
2021	0	11.8	22.1	13.1	4.7	0.3	0.7
2022	21.8	118.0	11.8	10.9	3.8	0.8	0.1
2023	0	2.2	35.3	3.7	0.7	0.1	0.01

***Excluded from assessment due to very low sampling**

Table 10. Mean weights-at-age in the landings (used for whole stock and catch). *mean weight at age in landings only available for Q1, hence considerably lower than previous years and not included.

	0	1	2	3	4	5	6+
1996	0.1	0.98	1.63	3.26	5.3	7.72	9.79
1997	0.1	0.85	1.94	3.62	5.29	6.12	9.4
1998	0.1	0.93	1.65	3.73	5.37	7.03	9.35
1999	0.1	0.85	1.62	3.18	5.51	7.52	10.25
2000	0.1	0.85	1.99	3.57	5.14	7.15	8.39
2001	0.1	0.99	1.82	4.15	5.61	7.33	9.51
2002	0.1	0.94	1.84	3.44	5.73	7.71	10.01
2003	0.1	1.21	1.66	3.29	5.43	10.2	11.09
2004	0.1	1.11	2.2	3.63	6.51	7.64	8.61
2005	0.1	0.91	1.94	3.51	5.32	7.74	8.89
2006	0.1	0.83	1.84	3.67	4.71	6.39	7.84
2007	0.1	0.83	1.85	3.78	5.35	7.99	10.04
2008	0.1	0.89	1.59	3.54	6.00	7.57	9.46
2009	0.1	1.1	2.01	3.46	5.31	7.1	6.82
2010	0.1	1.26	2.29	3.93	6.34	7.33	9.64
2011	0.1	0.95	1.88	3.75	5.54	6.75	9.04
2012	0.1	0.93	1.88	3.37	5.34	7.60	8.56
2013	0.1	0.97	2.32	4.06	5.54	7.43	10.79
2014	0.1	0.88	2.26	4.49	7.00	8.75	9.41
2015	0.1	0.83	1.79	3.69	6.49	8.55	9.95
2016	0.1	0.95	1.58	3.1	5.01	10.66	8.136
2017	0.1	0.70	1.82	3.82	5.85	7.62	9.74
2018	0.1	0.43	1.69	3.64	5.56	8.58	8.70
2019	NA	0.44	2.13	4.25	6.14	6.79	9.00
2020 *	0.1	0.523	1.880	3.903	5.85	7.66	9.14
2021	0.1	0.187	1.831	4.164	6.485	8.64	7.25
2022	0.16	0.28	1.71	3.56	5.77	7.66	8.68
2023	NA	1.77	1.29	4.96	8.05	12.5	12.5

Table 10: Estimates of numbers discarded (a) and the discarded proportions (b) from 1968–2023. Data are total numbers ('000 fish) discarded at-age, estimated from numbers per sampled trip raised to total fishing effort by each country supplying data (UK, Ireland and Belgium) Please refer to WKIrish3 (ICES, 2017) documents.

a)

Year	0	1	2	3	4	5	6+
1968	17.81	74.71	0	0	0	0	0
1969	20.85	87.45	0	0	0	0	0
1970	22.13	92.83	0	0	0	0	0
1971	22.94	96.2	0	0	0	0	0
1972	26.51	111.18	0	0	0	0	0
1973	27.17	113.96	0	0	0	0	0
1974	16.94	71.04	0	0	0	0	0
1975	26.38	110.62	0	0	0	0	0
1976	26.77	112.28	0	0	0	0	0
1977	31.05	130.23	0	0	0	0	0
1978	39.96	167.57	0	0	0	0	0
1979	44.35	185.98	0	0	0	0	0
1980	24.6	103.16	0	0	0	0	0
1981	37.67	157.97	0	0	0	0	0
1982	46.04	193.1	0	0	0	0	0
1983	46.98	197.05	0	0	0	0	0

Year	0	1	2	3	4	5	6+
1984	37.3	156.45	0	0	0	0	0
1985	33.89	142.12	0	0	0	0	0
1986	49.15	206.15	0	0	0	0	0
1987	47.38	198.69	0	0	0	0	0
1988	42.59	178.64	0	0	0	0	0
1989	41.03	172.09	0	0	0	0	0
1990	37.85	158.74	0	0	0	0	0
1991	46.64	195.61	0	0	0	0	0
1992	36.74	154.1	0	0	0	0	0
1993	39.4	165.24	0	0	0	0	0
1994	39.92	167.44	0	0	0	0	0
1995	42.97	180.2	0	0	0	0	0
1996	87.95	128.79	0	0	0	0	0
1997	5.28	127.79	0.5	0	0	0	0
1998	0	27.47	2	0	0	0	0
1999	141.42	165.79	0	0	0	0	0
2000	62.36	817.69	0	0	0	0	0
2001	7.22	65.15	0	0	0	0	0

Year	0	1	2	3	4	5	6+
2002	0	42.49	0	0	0	0	0
2003 *	50.43	75.68	32.62	15.83	1.25	0.13	0
2004*	50.43	92.78	32.81	15.83	1.25	0.13	0
2005*	50.43	76.34	32.36	15.83	1.25	0.13	0
2006	50.43	75.08	32	15.83	1.25	0.13	0
2007	16	167	4.60	0	0	0	0
2008	5.50	63.40	3.40	0	0	0	0
2009	329.30	39.80	4.40	0.1	0	0	0
2010	48.70	180	60.30	1.4	0.5	0.1	0
2011	9.70	42.70	0.90	0	0	0	0
2012	7.50	79.90	100.20	112.9	5.9	0.2	0
2013	36.10	31	26.50	11	2	0.5	0
2014	1.09	34.66	41.93	10.3	1.53	0.1	0
2015	0	37.30	45.80	6.8	1.3	0.3	0
2016	0	9.84	14.15	13.45	0.91	0.74	0
2017	0.43	9.85	7.88	8.10	0.57	0.10	0.10
2018	255.50	72.19	8.89	4.88	0.12	0.22	0
2019	0	39.2	0.4	0	0	0	0

Year	0	1	2	3	4	5	6+
2020*	NA						
2021	0	10.6	6.1	0	0	0	0
2022	21.8	107.8	1.0	0	0	0	0
2023	NA	0.28	9.6	0.19	0.01	0	0

*** very low sampling levels**

b)

Year	0	1	2	3	4	5	6+
1968	1	0.17	0	0	0	0	0
1969	1	0.09	0	0	0	0	0
1970	1	0.05	0	0	0	0	0
1971	1	0.03	0	0	0	0	0
1972	1	0.12	0	0	0	0	0
1973	1	0.05	0	0	0	0	0
1974	1	0.12	0	0	0	0	0
1975	1	0.06	0	0	0	0	0
1976	1	0.09	0	0	0	0	0
1977	1	0.14	0	0	0	0	0
1978	1	0.20	0	0	0	0	0

Year	0	1	2	3	4	5	6+
1979	1	0.10	0	0	0	0	0
1980	1	0.04	0	0	0	0	0
1981	1	0.11	0	0	0	0	0
1982	1	0.36	0	0	0	0	0
1983	1	0.19	0	0	0	0	0
1984	1	0.09	0	0	0	0	0
1985	1	0.10	0	0	0	0	0
1986	1	0.17	0	0	0	0	0
1987	1	0.04	0	0	0	0	0
1988	1	0.06	0	0	0	0	0
1989	1	0.23	0	0	0	0	0
1990	1	0.18	0	0	0	0	0
1991	1	0.09	0	0	0	0	0
1992	1	0.10	0	0	0	0	0
1993	1	0.43	0	0	0	0	0
1994	1	0.18	0	0	0	0	0
1995	1	0.27	0	0	0	0	0
1996	1	0.29	0	0	0	0	0

Year	0	1	2	3	4	5	6+
1997	1	0.20	0	0	0	0	0
1998	NA	0.12	0	0	0	0	0
1999	1	0.70	0	0	0	0	0
2000	1	0.74	0	0	0	0	0
2001	1	0.16	0	0	0	0	0
2002	NA	0.18	0	0	0	0	0
2003*	1	0.63	0.07	0.15	0.03	0.12	NA
2004*	1	0.58	0.25	0.09	0.06	0.022	0
2005*	1	0.65	0.13	0.20	0.04	0.03	0
2006	1	0.84	0.18	0.12	0.07	0.02	0
2007	1	0.77	0.02	0	0	0	NA
2008	1	0.82	0.02	0	0	0	NA
2009	1	0.67	0.08	0	0	0	NA
2010	1	0.82	0.32	0.06	0.07	0.05	0
2011	1	0.80	0.01	0	0	0	0
2012	1	0.95	0.74	0.78	0.60	1	NA
2013	1	0.84	0.45	0.37	0.22	0.34	NA
2014	1	0.85	0.49	0.39	0.28	0.09	NA

Year	0	1	2	3	4	5	6+
2015	NA	1	0.57	0.26	0.30	0.23	NA
2016	NA	0.91	0.58	0.45	0.40	0.62	0
2017	1	0.80	0.28	0.51	0.20	0.21	0.49
2018	1	0.76	0.33	0.13	0.05	0.10	0
2019	NA	0.65	<0.01	0	0	0	0
2020*							
2021	1	0.89	0.28	0	0	0	0
2022	1	0.91	0.098	0	0	0	0
2023	NA	0.13	0.27	0.05	0	0	0

NA= not available.

***Data for 2020 is unavailable due to restricted discard sampling**

Table 12. Maturity ogive updated for 2023. Prior to 1995 maturity was considered constant.

Year	1	2	3+
1996	0	0.292	1
1997	0	0.346	1
1998	0	0.399	1
1999	0	0.451	1
2000	0	0.502	1
2001	0	0.553	1
2002	0	0.602	1
2003	0	0.645	1
2004	0	0.666	1
2005	0	0.679	1
2006	0	0.688	1
2007	0	0.696	1
2008	0	0.703	1
2009	0	0.707	1
2010	0	0.706	1
2011	0	0.704	1
2012	0	0.707	1
2013	0	0.711	1
2014	0	0.724	1
2015	0	0.738	1
2016	0	0.754	1
2017	0	0.769	1
2018	0	0.786	1
2019	0	0.802	1
2020	0	0.820	1
2021	0	0.837	1
2022	0	0.855	1
2023	0	0.934	1

Table 13. Survey catch numbers-at-age and c.v. for all three surveys and CPUE for Q1 survey.
Survey catch numbers-at-age and c.v.

Year	c.v.	1	2	3	4
1995	0.68	700.73	386.15	20.03	10.78
1996	0.42	1106.13	329.28	111.67	1.39
1997	0.64	537.30	415.84	66.72	21.39
1998	0.84	169.36	769.23	56.87	11.98
1999	0.86	49.50	253.08	241.87	15.29
2000	0.65	629.60	101.053	34.58	33.01
2001	0.89	406.68	561.44	18.44	5.78
2002	0.64	662.16	253.31	333.54	0
2003	0.54	73.87	1079.20	104.05	32.70
2004	0.75	216.96	171.96	88.62	5.38
2005	0.76	63.53	225.07	29.41	27.96
2006	0.63	169.99	130.75	58.30	2.52
2007	0.95	164.35	124.39	30.60	5.15
2008	0.90	40.66	217.15	13.02	5.17
2009	0.76	144.00	59.00	33.00	9.00
2010	0.82	1022.12	208.96	14.66	2.26
2011	0.49	353.98	414.69	46.01	2.26
2012	0.81	161.90	222.82	99.27	14.25
2013	0.81	276.59	213.68	60.08	1.49
2014	0.63	314.41	222.80	53.29	13.66
2015	0.84	78.96	719.35	69.19	8.56
2016	1.06	349.20	175.00	148.30	10.70
2017	0.77	69.8	445.20	57.80	12.60
2018	1.26	138.1	50.50	62.60	0
2019	0.88	214.9	171.6	27.8	14.7
2020	0.977	78.5	145.4	39.4	0
2021	1.19	86.1	158.9	38.2	0
2022	0.65	625.5	65.6	9.7	2
2023	0.66	0.385	3.63	0.03	0.048

Northern Irish groundfish Quarter 4

year	c.v.	0
1995	0.54	6.66
1996	0.43	12.519
1997	0.72	2.345
1998	0.91	0.047
1999	0.64	6.734
2000	0.79	6.212
2001	0.83	4.863
2002	0.90	0.123
2003	0.71	6.746
2004	0.94	3.663
2005	0.81	8.144
2006	0.87	1.16
2007	1.28	0.067
2008	1.42	0.185
2009	0.94	5.356
2010	1.33	2.779
2011	0.92	0.084
2012	1.26	1.924
2013	0.93	11.208
2014	0.79	0.121
2015	0.87	2.244
2016	1.06	0.149
2017	0.82	4.291
2018	1.42	0.685
2019	1.27	0.072
2020	1.39	0.072
2021	1.61	0.335
2022	1.43	0
2023	1.31	0

UK FSP survey

year	2	3	4	5	6+
2005	0.43	1.41	0.99	0.08	0.03
2006	0.54	2.81	0.43	0.10	0.01
2007	0.61	1.32	0.59	0.06	0.06
2008	0.22	0.82	0.15	0.08	0.02
2009	0.17	1.15	0.38	0.10	0.02
2010	0.74	0.45	0.47	0.13	0.02
2011	0.41	1.68	0.14	0.10	0.04
2012	0.36	2.30	0.80	0.07	0.02
2013	0.84	1.88	1.35	0.37	0.06
2014					
2015	0.60	2.04	1.17	0.26	0.05
2016	1.00	6.39	1.43	0.41	0.03
2017	3.06	2.85	3.84	1.01	0.23
2018	0.43	3.73	0.61	0.63	0.15
2019	1.30	0.75	0.83	0.12	0.19
2020	0.77	2.64	0.13	0.18	0.08
2021	0.24	0.71	0.19	0.01	0.027
2022	0.24	0.54	0.29	0.08	0.047
2023	0.36	0.38	0.14	0.04	0

Q1 groundfish survey CPUE and SD

Year	CPUE	SD
1995	0.955	0.214
1996	1.729	0.313
1997	1.392	0.218
1998	1.436	0.199
1999	1.597	0.256
2000	1.023	0.146
2001	1.491	0.225

Year	CPUE	SD
2002	2.619	0.965
2003	1.697	0.235
2004	0.765	0.139
2005	0.890	0.267
2006	0.508	0.079
2007	0.465	0.105
2008	0.502	0.099
2009	0.494	0.141
2010	0.719	0.130
2011	1.205	0.365
2012	1.018	0.179
2013	1.075	0.206
2014	1.089	0.274
2015	1.785	0.267
2016	1.374	0.247
2017	1.030	0.304
2018	0.632	0.120
2019	0.817	0.222
2020	0.493	0.177
2021	0.476	0.122
2022	0.450	0.116
2023	0.585	0.149

Table 11: Assessment summary

Year	Recruitment age 0			SSB			Land-ings	Dis-cards	Fishing mortality ages 2–4		
	Low	Value	High	Low	Value	High			low	value	High
1968	116685	177502	238319	32158	42277	52397	8541	1285	0.188	0.25	0.32
1969	178222	254838	331454	27564	37478	47392	7991	1898	0.20	0.28	0.36

Year	Recruitment age 0			SSB			Land-ings	Dis-cards	Fishing mortality ages 2–4		
	Low	Value	High	Low	Value	High			low	value	High
1970	295875	395401	494927	23690	33283	42876	6426	708	0.151	0.21	0.27
1971	87071	138580	190089	24612	34635	44658	9246	363	0.179	0.25	0.32
1972	263700	349534	435368	30904	42432	53960	9234	1546	0.173	0.24	0.30
1973	50677	86649	122620	35847	49223	62599	11819	1222	0.22	0.30	0.39
1974	206468	278834	351200	29960	41620	53280	10251	1749	0.21	0.29	0.37
1975	57571	93844	130117	29650	41447	53243	9863	857	0.22	0.30	0.39
1976	100921	149085	197249	22855	32634	42412	10247	381	0.23	0.32	0.42
1977	104280	153144	202008	22042	32172	42302	8054	201	0.20	0.30	0.40
1978	217063	287104	357145	16407	25105	33802	5662	0	0.152	0.23	0.30
1979	247963	320315	392667	17177	25431	33685	7548	0	0.198	0.28	0.36
1980	130294	181298	232302	20364	28248	36133	10599	0	0.24	0.32	0.40
1981	55087	86198	117309	28304	36898	45492	13958	0	0.29	0.38	0.46
1982	84178	121325	158472	31056	40655	50253	13381	313	0.31	0.41	0.51
1983	131445	177592	223739	24823	34319	43815	10015	372	0.26	0.36	0.46
1984	119168	164514	209860	16634	24145	31656	8383	2	0.25	0.36	0.47
1985	85845	125161	164477	17140	24036	30932	10483	61	0.30	0.41	0.52
1986	255606	321610	387614	17516	24212	30909	9852	154	0.31	0.42	0.54
1987	113142	157876	202610	17850	24914	31977	12894	128	0.39	0.51	0.64
1988	45695	75019	104344	17195	22869	28543	14168	109	0.44	0.58	0.71
1989	55083	89636	124188	18896	24872	30847	12751	202	0.45	0.61	0.76
1990	69059	104713	140367	12971	18799	24627	7379	159	0.32	0.47	0.61
1991	118775	160709	202643	8744	13435	18126	7095	163	0.39	0.57	0.74
1992	20155	37464	54772	8300	12728	17156	7735	98	0.40	0.55	0.70
1993	55156	77396	99637	9618	13347	17076	7555	155	0.42	0.57	0.71
1994	57280	76844	96408	9450	13512	17574	5402	142	0.36	0.50	0.65
1995	73179	94732	116285	5879	9127	12374	4587	166	0.32	0.45	0.57
1996	106976	136094	165212	6538	9369	12200	4964	140	0.36	0.50	0.64
1997	23046	34513	45980	7713	10788	13863	5859	120	0.36	0.49	0.62

Year	Recruitment age 0			SSB			Land-ings	Dis-cards	Fishing mortality ages 2–4		
	Low	Value	High	Low	Value	High			low	value	High
1998	6409	11993	17577	9672	13344	17016	5318	29	0.30	0.42	0.55
1999	73643	104841	136039	8605	12869	17132	4784	159	0.33	0.57	0.80
2000	32672	49012	65353	3540	7310	11079	1274	699	0.143	0.27	0.39
2001	44258	62939	81620	5943	10167	14390	2252	64	0.102	0.169	0.24
2002	9348	15274	21199	7872	13028	18184	2695	46	0.141	0.23	0.31
2003	22153	31786	41419	7863	13131	18398	1285	215	0.083	0.134	0.185
2004	9882	14777	19672	7682	12741	17800	1072	254	0.085	0.136	0.187
2005	13506	19555	25603	6309	10293	14278	910	204	0.084	0.134	0.183
2006	18386	26181	33976	4749	7686	10622	840	185	0.110	0.175	0.24
2007	5096	8364	11631	4151	6885	9619	702	145	0.089	0.144	0.198
2008	14410	22044	29677	3817	6188	8558	662	61	0.089	0.143	0.197
2009	35942	54465	72988	3017	4917	6817	466	88	0.081	0.129	0.178
2010	23516	37124	50732	3567	5777	7988	464	386	0.070	0.113	0.156
2011	18727	30820	42912	4908	7730	10552	365	48	0.028	0.045	0.063
2012	25842	42271	58700	6289	9770	13251	198	678	0.063	0.099	0.136
2013	46926	74874	102823	7206	11513	15819	206	152	0.021	0.034	0.046
2014	12949	22632	32315	8956	14171	19385	213	184	0.0177	0.028	0.039
2015	25276	40163	55049	10313	16141	21970	161	147	0.0133	0.021	0.029
2016	5138	9254	13371	9253	14510	19767	82	60	0.0081	0.0125	0.0168
2017	14707	23377	32047	10182	15811	21441	84	59	0.0077	0.0118	0.0159
2018	11962	19130	26298	8556	13255	17954	215	42	0.0187	0.028	11962
2019	7907	12782	17658	7361	11351	15341	295	7	0.023	0.035	7907
2020	4275	7514	10754	6129	9472	12816	181	25	0.0190	0.029	4275
2021	31983	51557	71131	5549	8581	11613	133	4	0.0151	0.023	31983
2022	993	4808	8623	3934	6060	8186	98	27	0.0177	0.027	993
2023	0	896	2337	5248	8010	10772	56	9	0.0058	0.0093	0
2024		23431*			8266						

*Geometric Mean 2002 to 2021

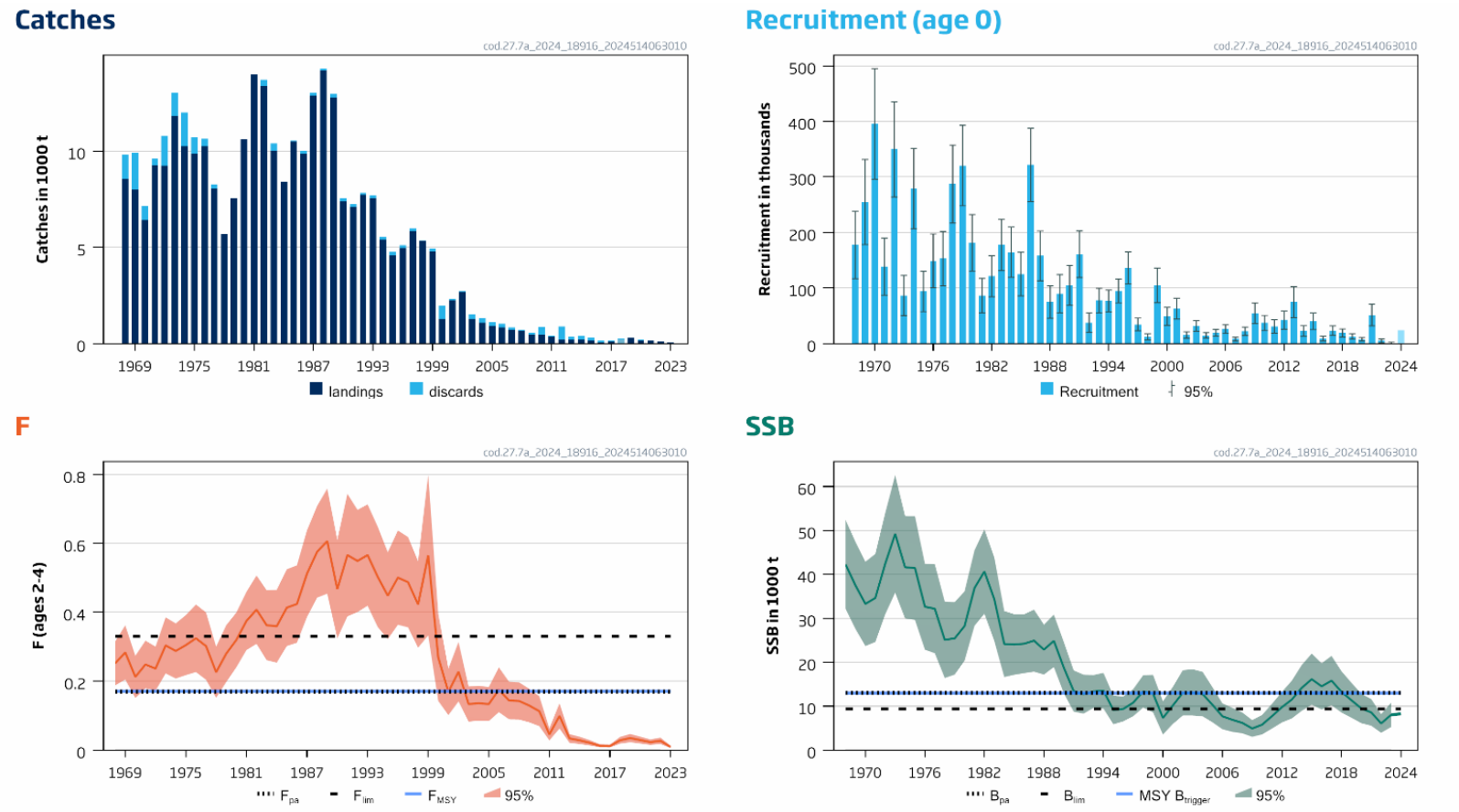

Figure 1: Assessment summary.

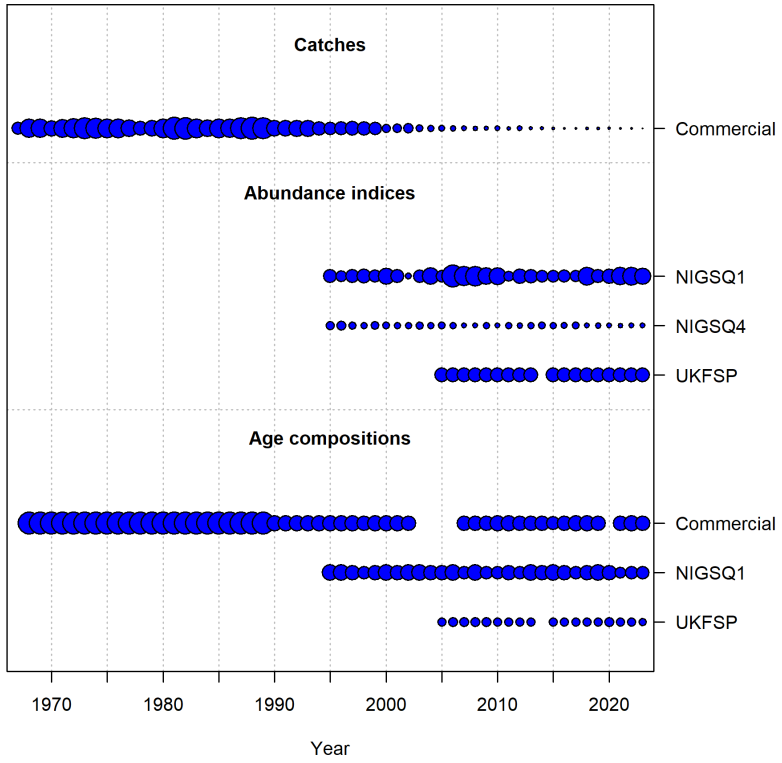

Figure 2 Available data.

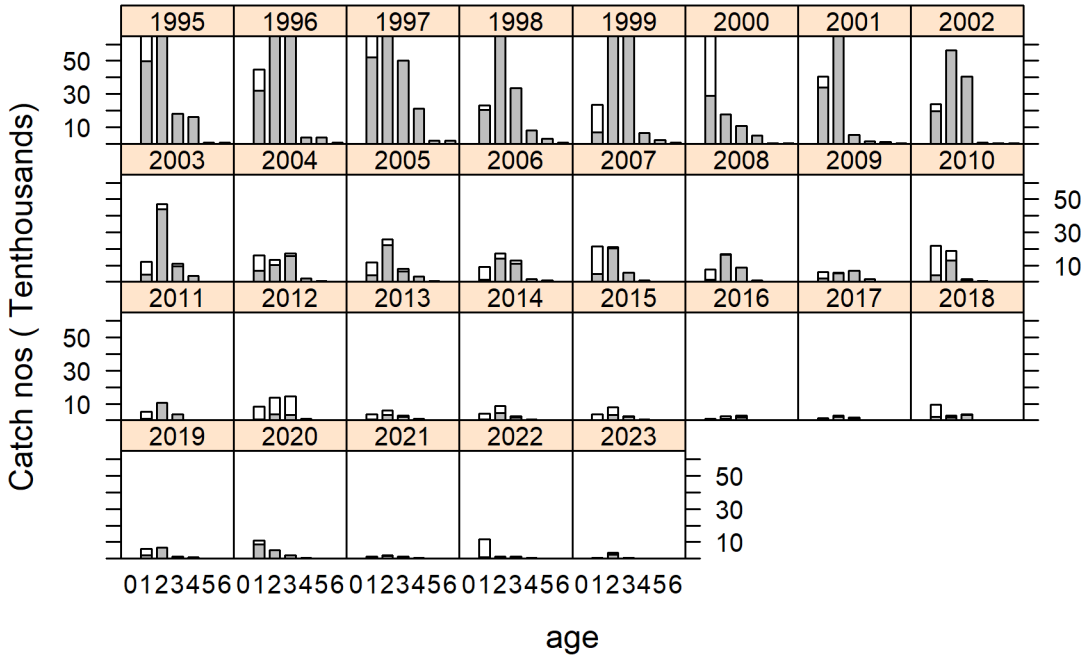

Figure 3: Landings and dicards at age. Landings are shaded in grey, discards in white.

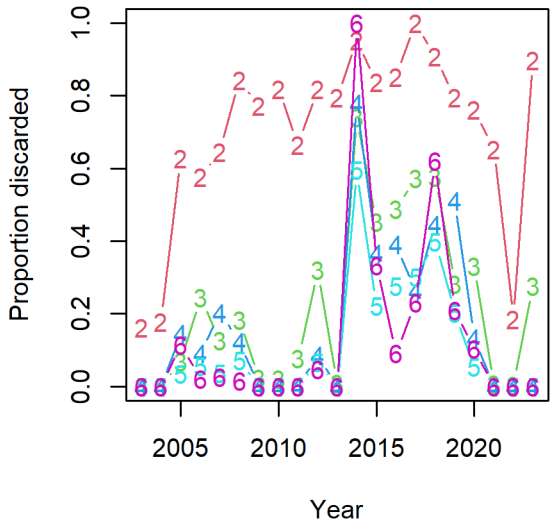

Figure 4:Proportion discarded at age. Ages 1 and 0 not displayed.

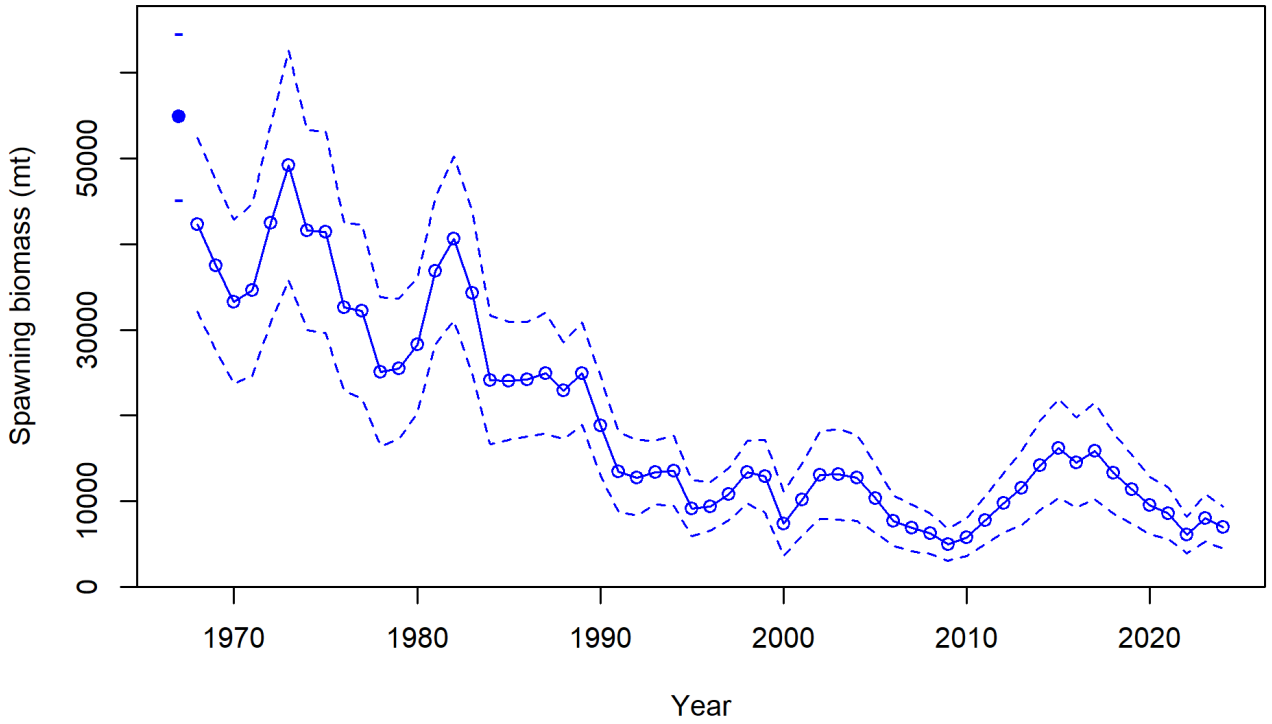

Figure 5: SSB with 95% confidence interval.

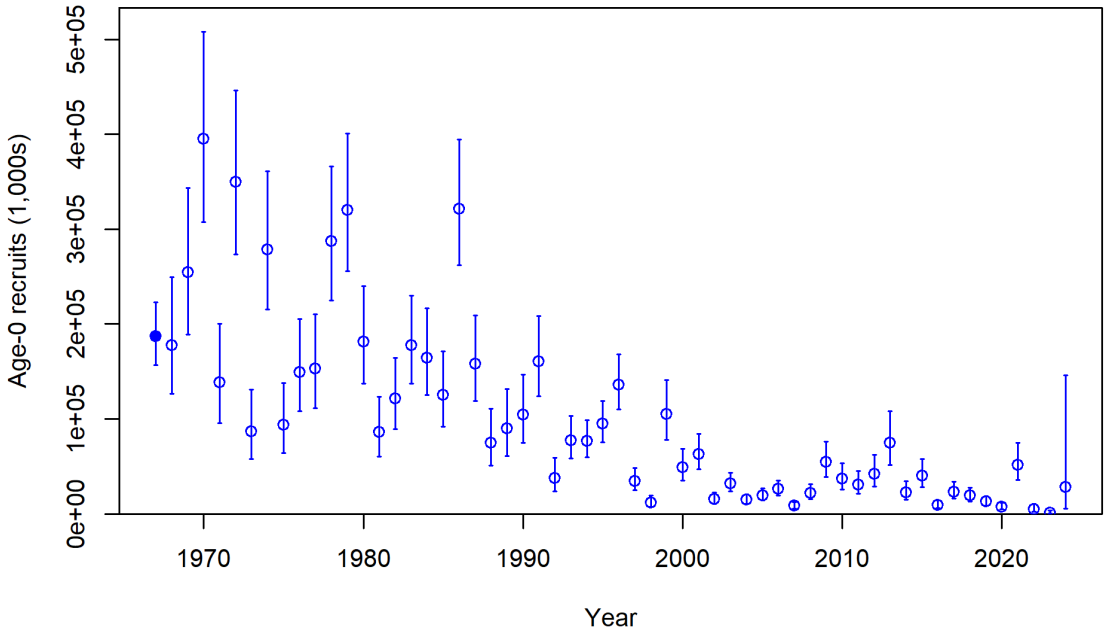

Figure 6: Recruitment with 95% confidence level. Recruitment in the figure for 2023 is model-estimated and not the same as in the forecast.

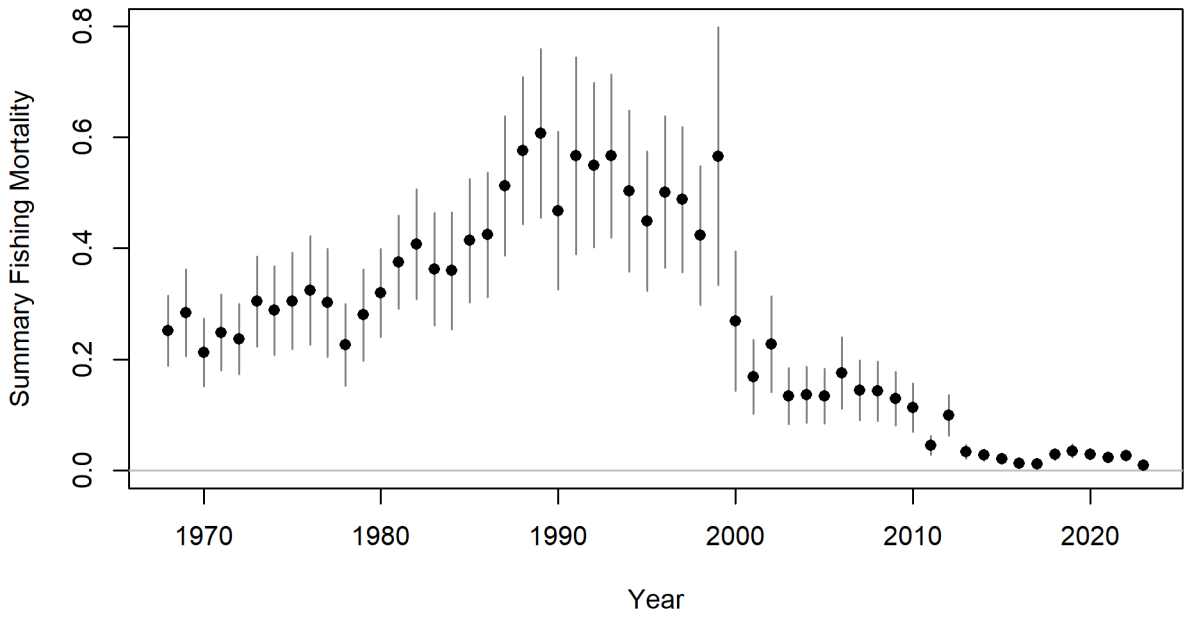

Figure 7 Fbar ages 2-4

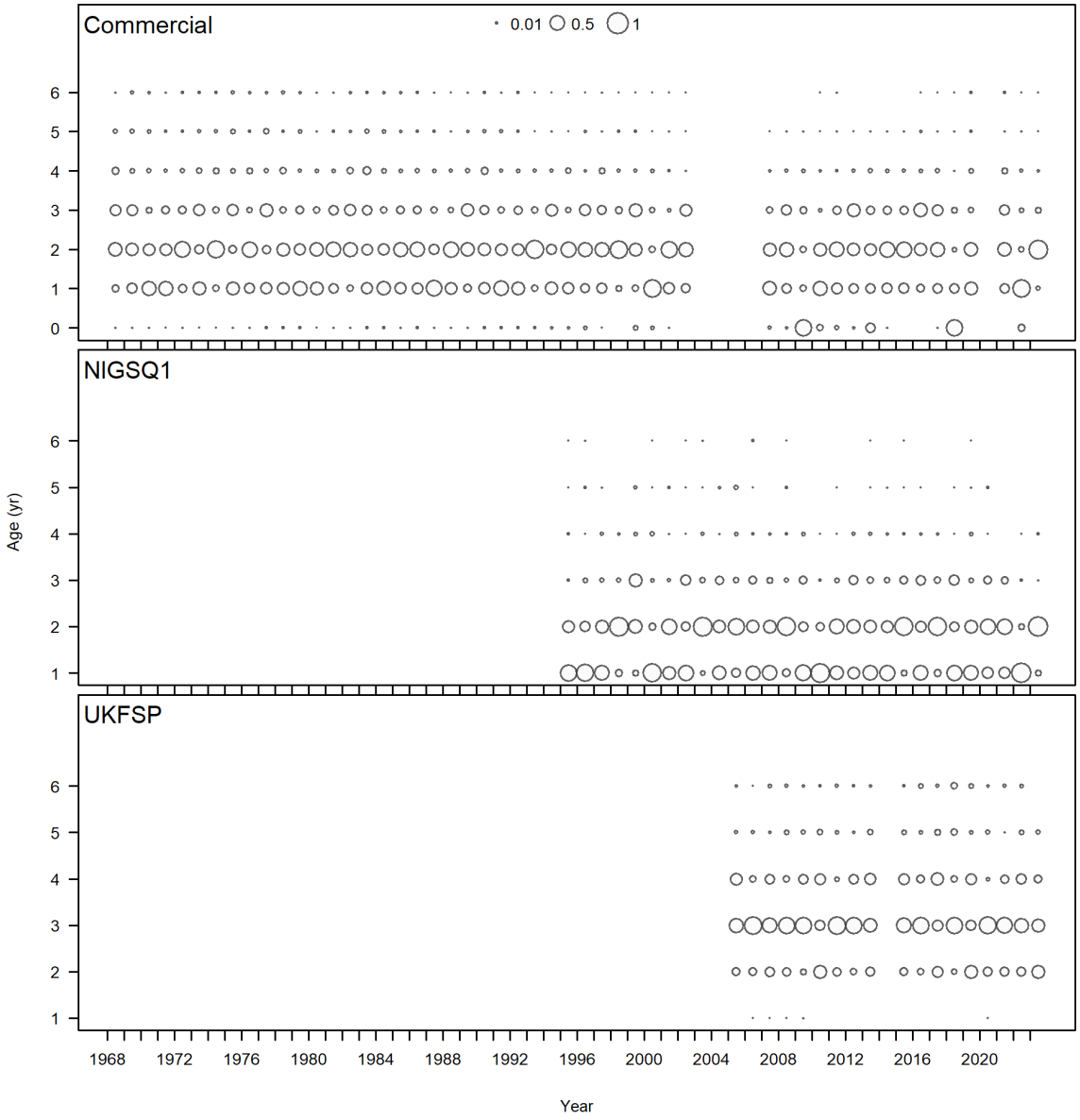

Figure 8: Age compositions for commercial data and surveys.

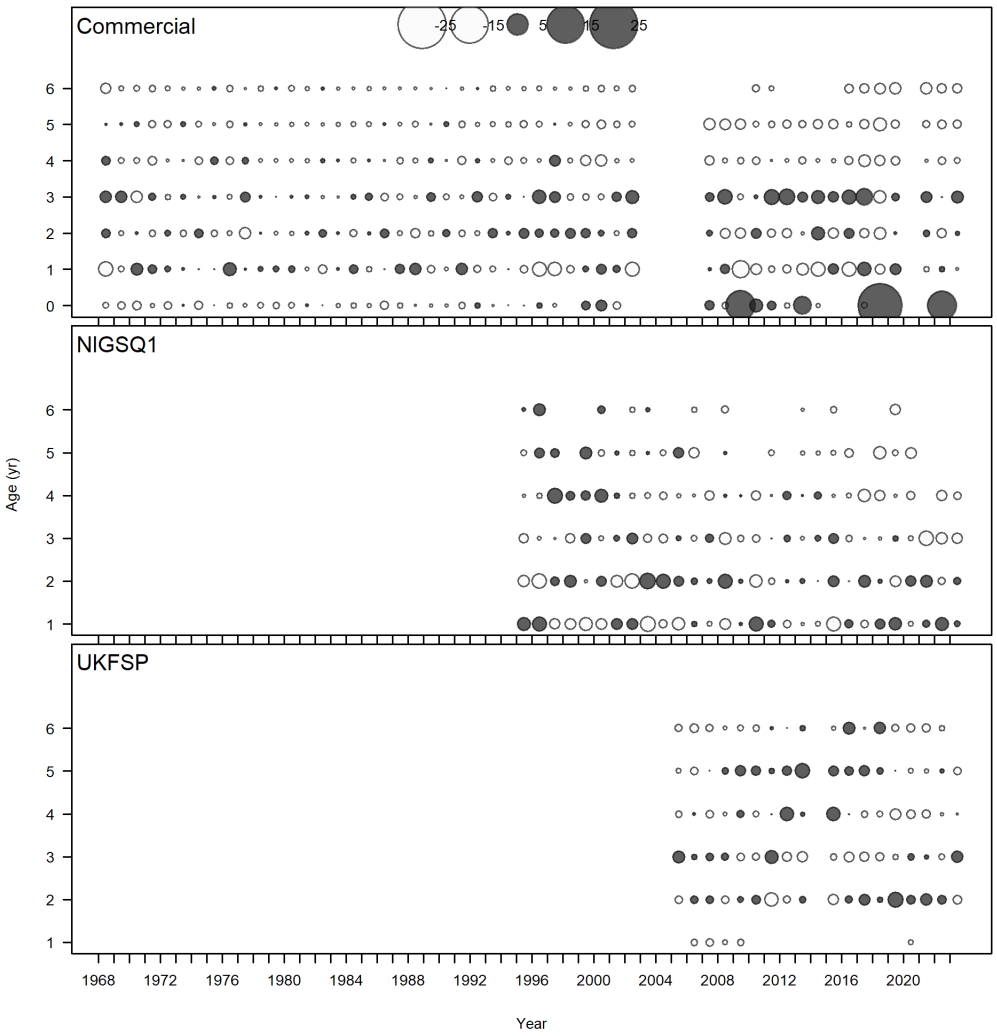

Figure 9. Residuals at age.

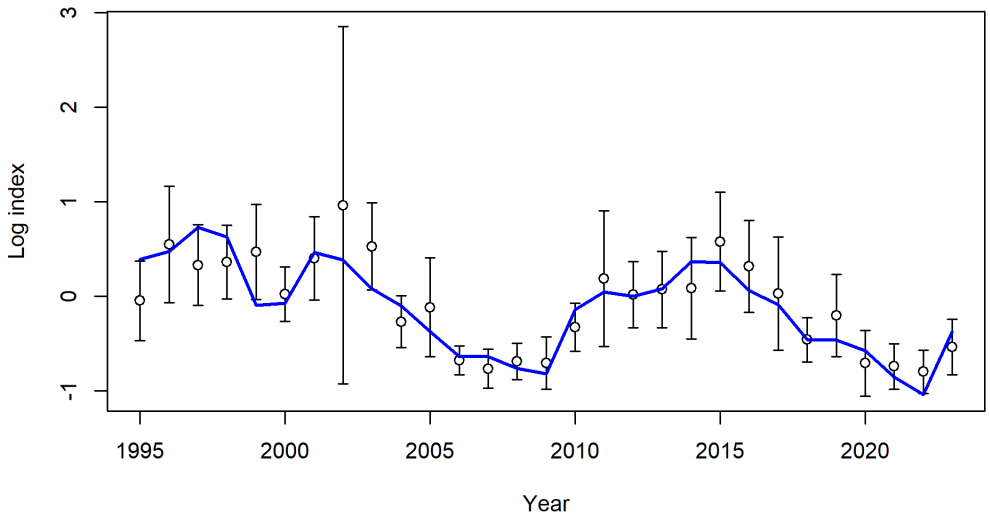

Figure 10. Log CPUE fit NIGFS Q1.

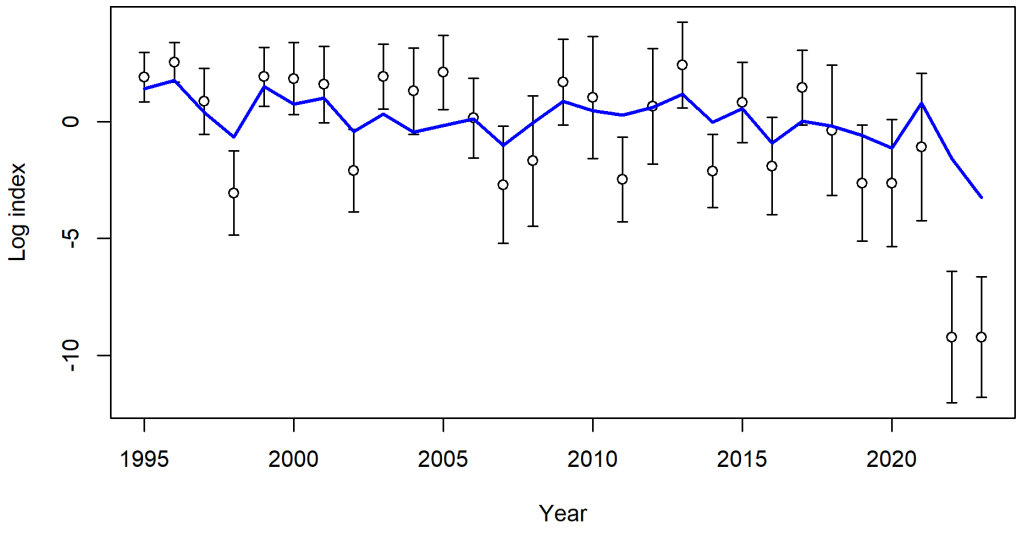

Figure 11. Log index fit NIGFS Q4.

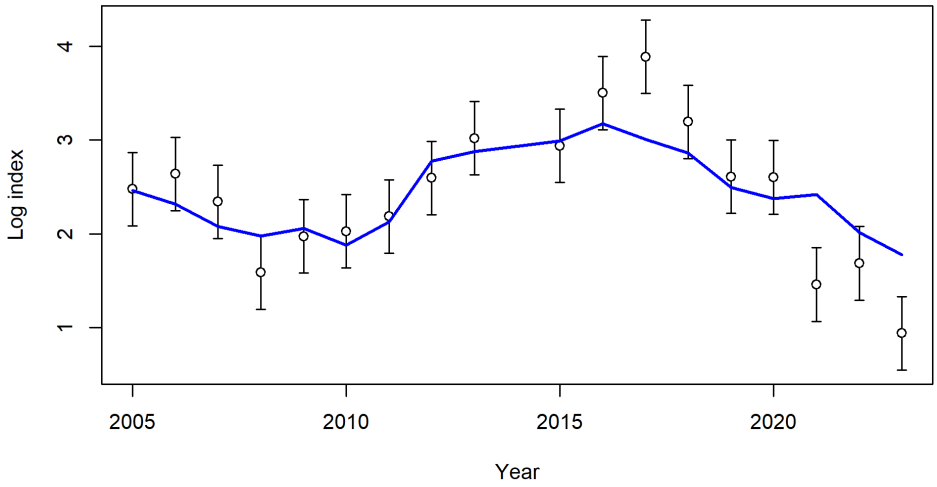

Figure 12. Log index fit UKFSP survey.

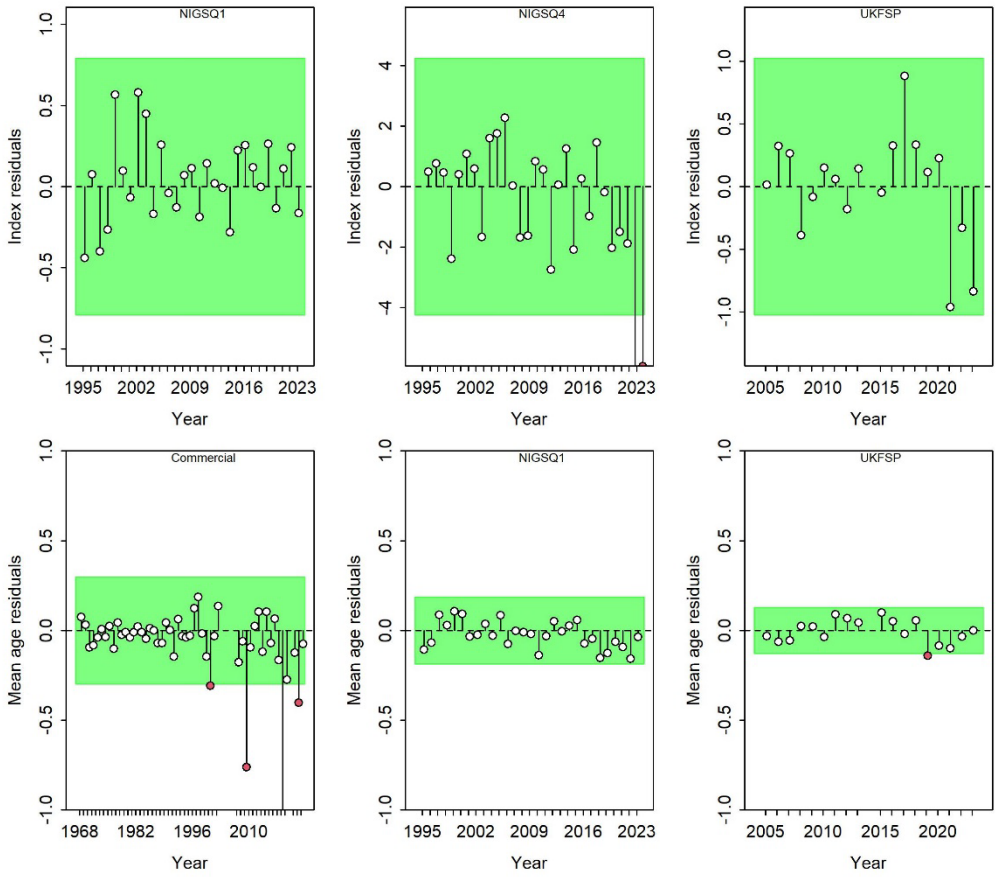

Figure 13. Results for runs tests for the three indices included and and bottom row Mean age residual fits for total catches, NIGFSQ1 and UKFSP surveys.

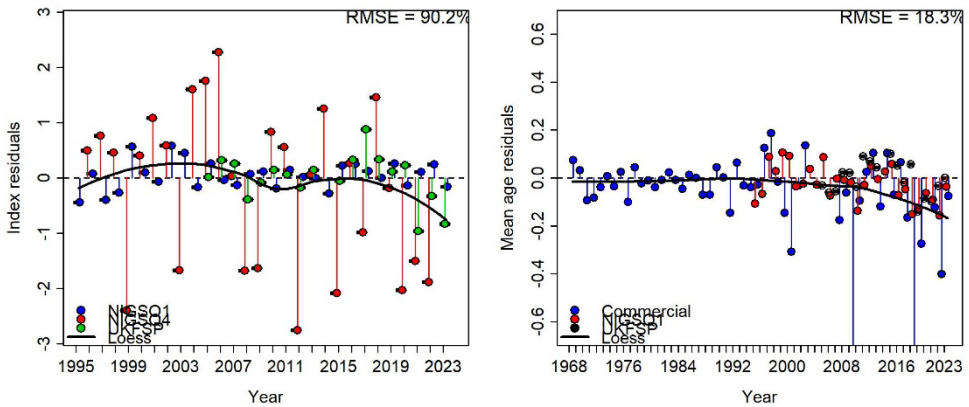

Figure 14. RMSE with fitted LOESS smoother.

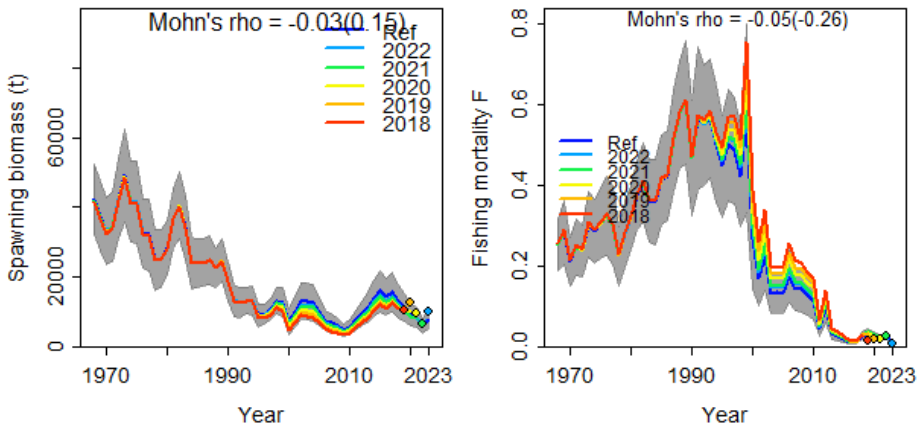

Figure 15. Mohns Rho for SSB and Fbar.

4.10.1.1.1.1

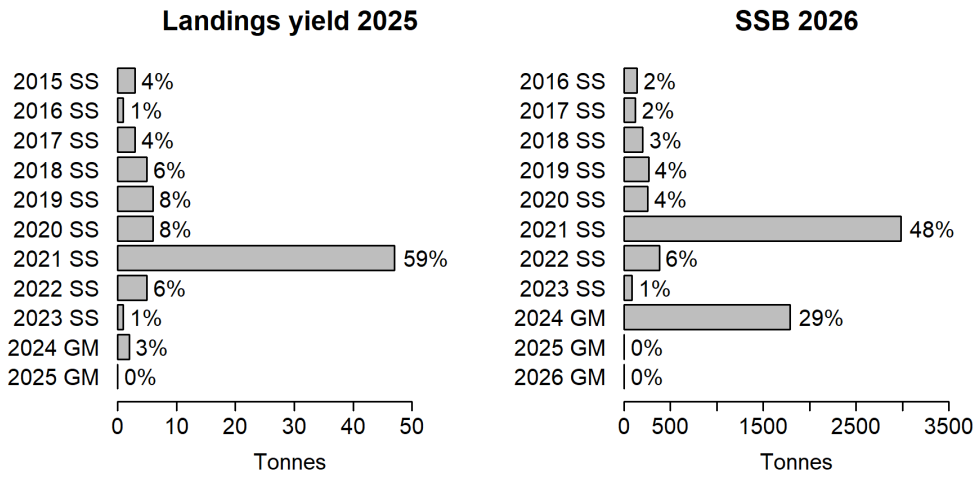

Figure 16. Contribution plot of yearclasses to the Landings in 2025 and the SSB in 2026.