

WORKING GROUP ON BEAM TRAWL SURVEYS (WGBEAM; outputs from 2019 meeting)

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Contents

i	Executive summary	iii
ii	Expert group information	iv
1	Terms of Reference	1
2	Summary of work plan	3
3	List of outcomes and achievements of the WG in this delivery period	4
4	Progress report on ToRs and work plan	5
4.1	Tabulate, report and evaluate population abundance indices by age-group for sole, plaice and dab and other species if required in the North Sea, Division 7a, Divisions 7d-g, Divisions 8ab and the Adriatic taking into account the key issues involved in the index calculation (Tor a)	5
4.1.1	Abundance indices by age-group for plaice and sole for the offshore surveys.	5
4.1.1.1	Sole	5
4.1.1.2	Plaice	7
4.1.2	Abundance indices by age-group for plaice for the inshore surveys	9
4.1.2.1	Sole	9
4.1.2.2	Plaice	9
4.1.3	Combined offshore beam trawl survey indices for plaice and dab	10
4.1.3.1	Plaice	10
4.1.3.2	Dab	10
4.2	Trawl survey in the North Sea Division 7a, 7d-g, 8a-b and the Adriatic (ToRa)	10
4.2.1	Offshore beam trawl survey in 2018	10
4.2.1.1	Participation and coverage of the area	10
4.2.1.2	Survey results	11
4.2.1.3	Staff exchanges (ToR b)	11
4.2.2	Inshore beam trawl surveys	11
4.2.2.1	Participation and coverage of the area	11
4.2.2.2	Staff exchanges (ToR b)	12
4.3	Analyse the changes in mean length-at-age for sole and plaice in the North Sea, English Channel, Bristol Channel, and Irish Sea (ToR c)	12
4.4	Other activities	13
4.4.1	DATRAS governance group	13
4.4.1.1	Use of different species validity codes in DATRAS products	13
4.4.1.2	Estimated/seeded ages	14
4.4.1.3	Commercial vessels	15
4.4.1.4	Additional fields	15
4.4.1.5	Other topics	15
4.4.2	Offshore manual	16
4.4.3	Litter data collection and upload to DATRAS	16
4.4.4	Workshop on index calculation based on DATRAS (WKICDAT)	17
5	Revisions to the work plan and justification	18
6	Next meeting	19
Annex 1:	List of participants	20
Annex 2:	Recommendations	22
Annex 3:	Terms of reference	23
Annex 4:	Details on offshore and inshore beam trawl survey	26
Annex 5:	Population abundance for sole and plaice, offshore surveys	31
Annex 5.1:	Tables of catch rate of sole, offshore surveys	31
Annex 5.2:	Tables of catch rate of plaice, offshore surveys	38
Annex 5.3:	Figures of catch rate of sole. Offshore surveys	50
Annex 5.4:	Figures of catch rate of plaice, offshore surveys	58

Annex 6:	Population abundance indices for sole and plaice, inshore surveys	66
Annex 6.1:	Indices from the D(Y)FS inshore beam trawl surveys.....	66
Annex 6.2:	Indices from SNS inshore beam trawl survey.....	69
Annex 7:	Surveys summary sheet	72
Annex 8:	Workshop on index calculation based on DATRAS (WKICDAT)	85
8.1	Tasks and results of the workshop	86
8.1.1	Complete a list of sampling designs of the different Beam Trawl Surveys	86
8.1.2	Investigate the impact of sex-stratified otolith sampling on the deltaGAM index	87
8.1.3	Comparison of time variant and time invariant model residuals to evaluate possible spatial shifts in the distribution of different cohorts.	89
8.1.4	Combined sole index	95

i Executive summary

The Working Group on Beam Trawl Surveys (WGBEAM) plans, coordinates, and implements European inshore and offshore beam trawl surveys. WGBEAM 2019 reviewed data from eleven offshore and four inshore surveys. The group collated an overview of the 2018 results and the 2019 planning of all surveys under its coordination, and provided standard output under the form of updated abundance index time-series for sole and plaice in the offshore and inshore beam trawl surveys. The annual output on spatial sampling coverage of the offshore and inshore beam trawl surveys was updated. In general, all surveys relevant for the index calculation for plaice and sole completed their sampling plans and obtained good coverage of the survey area. Only the Quarter 1 South-West Ecosystem Survey (Q1SWECOS) reported technical issues in 2018, which lead to a reduction of covered stations in the Celtic Sea.

WGBEAM members finalised a manual on the offshore beam trawl surveys for publication in 2019. This manual is meant to be a living document that will be reviewed annually by the working group and an updated version will be submitted for review at the end of each multi-annual period.

In relation to the ICES Database on Trawl Surveys (DATRAS), actions that would lead to better data quality were formulated and reported, and ongoing and future development issues were reported and/or discussed. Related to tors b and c, the chair of the Working Group on DATRAS governance (WGDG) presented the current developments and questions for WGBEAM. With respect to these questions, WGBEAM specified how the different DATRAS species validity codings ("SpecVal") should be taken into account in the various standard data product(s) based on beam trawl survey data. Further, some specific variables in the DATRAS reporting format were discussed, and proposed suggestions from WGDG and the ICES data centre for clarification and enhancement of data quality were supported, e.g. a flag for estimated/seeded ages, use of ship code for commercial vessels, new required fields for WGBEAM inshore and offshore surveys for sample processing information.

The WGBEAM report also includes a report from the WGBEAM organised Workshop on Index Calculation based on DATRAS data (WKICDAT). This describes the evaluation of GAM modelled indices, with respect to WGBEAM-related survey data issues.

ii Expert group information

Expert group name	Working Group on Beam Trawl Surveys (WGBEAM)
Expert group cycle	Multiannual
Year cycle started	2017
Reporting year in cycle	3/3
Chair(s)	Holger Haslob, Germany
Meeting venue(s) and dates	4-7 April, Galway, Ireland, (11 participants)
	10-13 April, IJmuiden, The Netherlands, (11 participants)
	18-20 March, Copenhagen, Denmark, (14 participants)

1 Terms of Reference

WGBEAM – Working Group on Beam Trawl Surveys

2016/MA2/SSGIEOM11 The **Working Group on Beam Trawl Surveys** (WGBEAM), chaired by Holger Has-lob, Germany, will work on ToRs and generate deliverables as listed in the Table below.

	MEETING DATES	VENUE	REPORTING DETAILS	COMMENTS (CHANGE IN CHAIR, ETC.)
Year 2017	4-7 April	Galway, Ireland	Interim report by 1 June 2017 to ACOM-SCICOM	New chair
Year 2018	10-13 April	IJmuiden, The Netherlands	Interim report by 25 May 2018 to ACOM-SCICOM	
Year 2019	18-22 March	ICES HQ, Copenhagen	Final report by 17 May 2019 to ACOM-SCICOM	

ToR descriptors

ToR	Description	Background	Science Plan codes	Duration	Expected Deliverables
a	Tabulate, report and evaluate population abundance indices by age-group for sole, plaice and dab and other species if required in the North Sea, Division 7a, Divisions 7d-g, Divisions 8ab and the Adriatic taking into account the key issues involved in the index calculation.	a) Science Requirements Length-at-age analysis b) Advisory Requirements Required to support indices for assessments c) Requirements from other EGs Specific questions from other EGs possible	3.2	Annually	WG report chapter
b	Further coordinate and standardize offshore and coastal beam trawl surveys in the North Sea and Divisions 7a, 7d-g, 8a-b and the Adriatic, and update and publish the standard as a SISP protocol.	a) Science Requirements b) Advisory Requirements Required to ensure consistent approach within and between areas to meet EU directives.	3.1, 3.2	Annually	WG report chapter inshore manual offshore manual database (DATRAS)

c	Analyse the changes in mean length-at-age for sole in the North Sea, English Channel, Bristol Channel and Irish Sea. (continuation of WGBEAM work in 2014-2016)	<p>a) Science Requirements</p> <p>The large WGBEAM dataset has the potential to elucidate temporal and spatial changes in population parameters.</p> <p>b) Advisory Requirements</p> <p>Indices are being used by assessments working groups and any changes to age structure of species of interest need to be investigated.</p>	5.2	Expected output in 2019	WGBEAM 2018 update and ultimately ASC presentation
d	Provide index calculations based on DATRAS for dab in the North Sea, and plaice and sole in Divisions 7a, 7d-g, 8a-b and the Adriatic.	Required to support indices for assessments	3.2	3 years	Provision of new index series to relevant WGs
e	Evaluate the results and outcomes of a workshop on index calculation methods based on DATRAS beam trawl data.	Currently, a modelled approach (delta GAM method) combining several surveys into a single index based on DATRAS data are used for several North Sea stocks (i.e. North Sea plaice, lemon sole, and dab). WGBEAM will organize a workshop on this issue. The aim of this workshop will be to evaluate and to contrast the deltaGAM method with the previously used index calculation methods with regard to the output of the stock assessment models used.	3.2, 3.3	1 year expected output in 2019	WG report chapter

2 Summary of work plan

YEAR 1	ANNUAL STANDARD OUTPUTS FOR A,B. ToR C IN PROGRESS. CONTINUE ANALYSIS ON ToR D. ToR E: STARTED TO ANALYSE THE MACRO EPIBENTHOS CATCHES IN SPECIES COMPOSITION AND QUANTITY OF AT LEAST IBTS Q3 AND BEAM TRAWL SURVEY CATCHES.
Year 2	Annual standard outputs for a,b. Continue analysis on ToR c,d.
Year 3	Annual standard outputs for a,b. Continue analysis on ToR c,d. Complete ToR e.

3 List of outcomes and achievements of the WG in this delivery period

In this delivery period, WGBEAM has worked on and achieved the following:

1. Update and interpretation of abundance index time-series for sole and plaice in offshore and inshore beam trawl surveys.
2. Increase standardization of the surveys:
 - The offshore beam trawl survey manual was finalized and adopted by the working group.
3. Data quality and availability:
 - BTS offshore data uploaded for the delivery period (2016 – 2018)
 - NED DYFS data uploaded for the delivery period (2016 – 2018)
 - SNS data uploaded into DATRAS (2002 – 2018)
 - BEL DYFS data uploaded into DATRAS (2017 – 2018)
 - SoleMon survey data uploaded into DATRAS (2016 – 2018)
 - Improvement regarding data quality in DATRAS
4. Other activities:
 - Analysis of the changes in mean length-at-age for sole and plaice in the North Sea, the English Channel, the Bristol Channel, and the Irish Sea (to be continued).
 - Organizing a two day work shop on the calculation of indices based on DATRAS (WKICDAT).
 - WGBEAM contributed with data expertise to Moriarty et al. (2017) and to Moriarty et al. (2019)
 - Moriarty, M., Greenstreet, S. P. R., and Rasmussen, J. (2017). Derivation of groundfish survey monitoring and assessment data products for the North-east Atlantic. *Scott. Mar. Freshw. Sci.* 8:240. doi: 10.7489/1984-1
 - Meadhbh Moriarty, Simon P. R. Greenstreet, Jens Rasmussen and Ingeborg de Boois, 2019. Assessing the State of Demersal Fish to Address Formal Ecosystem Based Management Needs: Making Fisheries Independent Trawl Survey Data 'Fit for Purpose'. *Front. Mar. Sci.*, 02 April 2019 | <https://doi.org/10.3389/fmars.2019.00162>

4 Progress report on ToRs and work plan

4.1 Tabulate, report and evaluate population abundance indices by age-group for sole, plaice and dab and other species if required in the North Sea, Division 7a, Divisions 7d-g, Divisions 8ab and the Adriatic taking into account the key issues involved in the index calculation (Tor a).

4.1.1 Abundance indices by age-group for plaice and sole for the offshore surveys.

4.1.1.1 Sole

North Sea – Subarea 4

Time-series trends for sole in the North Sea, based on the Netherlands BTS-I (previously Isis) offshore survey, are shown in Figure 5.1.1.1a in Annex 5.3 (Table a in Annex 5.1). This survey indicates that recent year classes have been mainly poor with the 1-group below the long-term arithmetic mean for the last five years (2013 – 2018). The 1-group in 2018 was similar to 2017, and similar to the 1-groups in 2014 and 2015. The 2-group index was around the long-term mean in 2018, after two years of low values. The 3-group index has been declining from a high in 2015, and that trend continued in 2018, when the index was slightly below the long-term arithmetic mean. In general, there has been an increase in older fish (5+ group), with values above the long-term arithmetic mean for the last 5 years (2014-2018).

Time-series trends for sole in the Southern North Sea, based on the UK offshore survey, are depicted in Figure 5.1.1.1b in Annex 5.3 (Table b in Annex 5.1). The number of age group 1 is highly variable, and numbers of one-year olds were below the long-term mean from 2012 – 2014. Since then, observed age group 1 values increased and in 2017 the highest age group 1 survey index was observed for the whole time series. However, in 2016 and 2018 the values for this age group were well below the average again. Strong cohorts of 2-year-old fish in 2016 and 2018 were observed, a result of the high numbers observed of 1-year old fish in 2015 and 2017. The number of older fish (4+ group) has been steady around the long-term arithmetic mean for the last 5 years (except for 2017).

Time-series trends for sole in the Southern North Sea, based on the BEL offshore survey, are displayed in Annex 5.3 Figure 5.1.1.1. (h). The number of age group 1 is highly variable, with a high age group 1 value observed in 2017 but below observed average value for age group 1 in 2018. The observed age group 2 value in 2018 is the highest recorded in this time series and reflects the strong age group 1 observed in 2017. Age group 3 fluctuates without trend around the average value, and was below average in 2018. The strong 2013 age group 3 cohort is visible until 2015 where a strong age group

5 was observed. However, age group 5 for the re-cent three years was observed below the average. For age group 6 a decreasing trend was observed from 2016 onwards.

Western Waters - Subarea 7

The indices for sole from area 7 stocks are summarized in Figure 5.1.1.1c-e in Annex 5.3 (Tables c – f in Annex 5.1).

Division 7d

After three years (2009–2011) during which the relative abundance of sole in the Eastern English Channel was either at or above the time-series average across all age groups, this trend did not continue in 2012 and 2013. In these two years the numbers of one and two year olds were far below the long-term average, with the number of one year olds in 2013 (the incoming year class 2012) being the second lowest of the whole time-series. In 2014 and 2015 the number of one-year old sole was again far above the average and among the five highest values recorded. This trend did not continue in 2016, as the number of one year old sole was below the long term mean, while the numbers in 2017 were similar to the values in 2014 and 2015 while the value in 2018 was slightly above the long term mean. The abundance of age group 2 in 2018 was high due to high values of age group 1 in 2017, while age group 3 was slightly below the average.

The relative abundances for the 1–3 age groups have been quite variable over time, what can often be attributed to strong 1 group recruitments that can be followed through from one year to the next.

Division 7f

The relative abundances of the age group 1 sole in the Bristol Channel was below the time-series average for the years 2009–2014. In 2015–2017 age group 1 showed again above average values, and the value in 2017 was the highest since 2008. However, the value in 2018 was the lowest ever recorded. The high values of age group 1 in 2015–2017 has resulted in high values of age groups 2, 3 and 4+ in 2018.

Division 7a

Of all sole stocks in area 7, sole in the Irish Sea is clearly in the worst shape according to the beam trawl surveys carried out in this Division. Since 2005 the abundances have been below the time-series means for all age groups. In 2015 the numbers of age group 1 was observed for the first time since 2005 above the time-series average, but in 2016, 2017 and 2018 numbers below the average were observed again. The numbers of age group 2 were high in 2018, a result of the strong 2016 year class. The numbers of age group 3 were higher than the average in 2017, but dropped down below the long term average in 2018. The numbers for the 4+ group remained stable at the low 2005–2017 level until 2018 when an increase well above the long-term mean was recorded. As for most other sole stocks, peaks in the abundance of age group 1 can generally be tracked through to following years.

Division 8 a,b

The ORHAGO survey time-series of age group abundances of sole in the Bay of Biscay (Figure 5.1.1.1g; Table g in Annex 5.1) are marked by the arrival of two below average year classes in 2011 and 2012 at age 1. The yearly advance in age of these two year classes can be followed from age 1 to 3. Their abundance indices in successive years are consistent between them. The five following year classes are close to the mean at age 1 from 2013 onwards. Their abundance indices at age 2 are consistent with age 1

estimates. The 4+ age group abundance indices have de-creased from 2013 to 2016. This trend is due to the cumulative effects of the in-crease in age of three year classes (2010, 2011 and 2012) which are below average at age 3. However, the 4+ age group abundance indices are above or close to the long-term mean from 2012 onwards.

Northern Adriatic Sea

Figure 5.1.1.1g shows the time-series trends in sole for the northern Adriatic Sea, based on the SoleMon offshore beam trawl surveys. Although sole otoliths were collected since 2007, the ageing is still in progress and for some years, a survey age-length key is not yet available. So age slicing, based on von Bertalanffy parameters (L_{inf} : 39.6; k : 0.44, t_0 : -0.46), was carried out using LFDA 5.0.

This survey indicates that the 2018 0-group of sole in the northern Adriatic has been little higher than the level of the long-term arithmetic mean. Ages 1, 2 and 4+ in 2018 cruise were higher than the long-term arithmetic mean. Differently from 2017, age 3 in 2018 survey has been lower than the level of the long-term arithmetic mean. Overall, it is possible to notice a good internal consistency of the cohorts, in particular the high recruitment observed in 2013 can be followed in the succeeding years.

4.1.1.2 Plaice

North Sea – Subarea 4

Figures 5.1.1.2a and 5.1.1.2b in Annex 5.4 show trends in the indices for North Sea plaice from the Netherlands offshore survey (Tables a and b in Annex 5.2) carried out by Tridens. The survey is split up in two parts: one that covers mainly the southern North Sea (BTS-I; previously: Isis), and the other part extends substantial-ly further north and west (BTS-II; previously: Tridens).

The BTS-I survey indicates that recruitment has been below average in most years since the strong 2001 year class became apparent as one year olds in 2002. In 2014, as detected in 2009, 2011 and 2013, the observed number of one year olds was higher than the long-term mean. In 2015, 2016 and 2018 it was again below the average, while it was above the long-term mean in 2017. The BTS-II survey con-firmed the strong 2001 year class, but also documented a series of seven consecu-tive incoming year classes that were above average from 2007 onwards, including 2014. This pattern is visible at all ages in this survey, and the cohorts can be tracked well over time. The 2016-year class is the highest on record, evident by the high values of 1-group in 2017, while the 2017 year class seems to be lower than the av-erage. The clear increasing trend in the age 5+ group is continuing in 2018 with the highest record of the time-series ever. The combined index (Figure 5.1.1.2c in Annex 5.4) shows low numbers for age group 1 in 2018, the lowest values on record since 2006. It also shows above average numbers-at-ages 2-4 in 2018, with an in-creasing trend since the beginning of the 21st century for ages 5+.

The population abundance series for plaice from the UK offshore survey (depicted in Figure 5.1.1.2d; Table d in Annex 5.2), tells a different story for the Southern North Sea. Here, the high incoming year classes 2010 and 2013 are apparent as the biggest since 2002. Differently from Dutch surveys the number of incoming recruits at age 1 (year class 2014) is clearly below the long-term average in 2015, and a simi-lar story can be said about year class 2015, which is well below the average in 2016. While below aver-age, the 2016 and 2017 year classes are slightly higher than the 2014 and 2015 year clas-ses. The increasing trend in numbers which can be seen from the combined Dutch sur-vey index for age groups 3 and 4+ is not that clearly visible in the UK offshore survey

in this area, although for age group 3 a strong increase was recorded in 2016 and 2018 and age group 4+ has been well above the average in 2017 and 2018.

The plaice abundance time-series for plaice by the BEL offshore survey are displayed in Annex 5.3 figure (i). Age group 1 shows variable values fluctuating around the long term average without trend and close below the average in 2018. Age group 2 values were observed above the average for the recent years. Age group 3 is also fluctuating without trend around the average, but the value is below for the two recent years with the lowest observed since 2010 in 2018. Age group 4 values are since 2012 observed above the average with only the 2017 value below the average.

Western Waters - Subarea 7

The indices for plaice from area 7 stocks are summarized in Figure 5.1.1.2e-h in Annex 5.4 (Tables e – h in Annex 5.2).

Division 7d

The abundance at age 1 after the drop observed in 2012, was again close to the long-term arithmetic mean (year class 2012) in 2013. In 2014, the abundance at age 1 was observed to be exceptional high and is by far the highest record of the time-series. However, in 2015 the number of age group 1 dropped again to the long-term average and dropped even further in 2016 when the lowest number since 2005 was observed. It rebounded again in 2017 and was slightly above the long-term mean before dropping again below the mean in 2018. In 2015, the observed number of age group 2 was the highest ever observed in the time series. The numbers of age group 2 in 2016-2018 were lower than in 2015, but still well above the long term average. As a result of the good year classes in 2009-2011 the numbers of age 4+ were the highest ever observed in the time-series for the years 2013-2018. Cohorts can be generally well tracked between years in this survey.

Division 7f

The relative abundance at age 1 increased considerably for plaice in the Bristol Channel in 2013, reaching a value similar to what was observed in 2010 and 2011. This trend continued in 2014 and resulted in the highest record for age group one in the time series observed so far. However, in 2015-2018 the lowest values ever were recorded. The strong year class from 2010 can be tracked over the years and produced time-series peaks of 3 in 2013 and 4+ year olds in 2014. The numbers in the 4+ group were again high in 2015 and 2016, and a record high values were observed in 2017 and 2018. Since 2009 the numbers of this age group consistently increased. In earlier years of this time series, abundance peaks of age 1 fish could not always be tracked over the following years as well as in recent years.

Division 7a

The age 1 abundance of plaice in the Irish Sea in 2014 was above the level of the long-term average with the highest record of the time-series. Since 2002–2003 the abundance figures have remained relatively constant for all age groups (with a lower value for age 1 in 2005–2006 as the main exception), and noticeably above those recorded for the years prior to this date. In 2015 the observed number of age group 1 was well below the time series mean and in 2016, 2017 and 2018, the lowest numbers of the series were observed. However, as opposed to sole in this area, plaice in 7a seems to be characterized by a healthy stock status, with numbers for the 4+ group in 2013–2018 being the highest of the time-series and an increasing trend since the beginning of the time series in 1995. Cohorts can be tracked relatively well over consecutive years in this survey.

4.1.2 Abundance indices by age-group for plaice for the in-shore surveys

The Belgian Demersal Young Fish Survey (DYFS), the German DYFS and the Dutch Demersal Fish Survey (DFS) together cover most of the coastal and estuarine waters along the continental coast from the French-Belgian border to Esbjerg in Denmark. All these surveys were initiated in the 1970s.

Previously, the three continental surveys and the UK Young Fish Survey (YFS) were combined into international inshore indices for 0 and 1 group plaice and sole. Due to termination of the UK YFS and the spring survey of the German DYFS, the combined 0 group indices are now calculated using Belgian, Dutch and German data, and the combined 1 group indices using Belgian and Dutch data only. The Dutch, and hence the combined indices, are calculated from 1990 onwards, mainly due to a change in the survey design of the Dutch DFS in 1990.

The Dutch Sole Net Survey (SNS) was initiated in 1970 and samples transects further offshore than the other inshore surveys. The SNS survey area overlaps with those of the Dutch DFS and BTS-Isis.

The Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak (WGNSSK) uses the SNS indices and the combined inshore indices for recruitment estimates of the North Sea plaice and sole stocks. The SNS indices are also used as tuning fleet in the assessment models for plaice and sole. The combined inshore indices are considered to be suitable for 0 group plaice and sole, but less suitable for 1 group sole and even more so for 1 group plaice, because of the spatial coverage of the survey in relation to the spatial distribution of these age groups. The SNS is considered to be suitable for plaice and sole age groups 1 to 4.

The abundance indices are presented in Annex 6.1 for the D(Y)FS and Annex 6.2 for the SNS. The corresponding combined inshore indices and the SNS indices are plotted for 1990 to 2018 in Figures 5.1.2.1 and 5.1.2.2 respectively (Annexes 6.1 and 6.2).

4.1.2.1 Sole

The combined inshore index for 0-group sole was above average and the third highest on record since 1990. The 1-group sole index remained below average since 2012 and this was also observed in 2018 (Figure 5.1.2.1 in Annex 6.1). In the SNS, age groups 1 and 2 have been below the average now since 2016, but increased a little bit compared to 2017. The indices of age groups 3 and 4 in 2018 were also observed below the long term average (Figure 5.1.2.2 in Annex 6.2).

A year effect can be observed for sole in 2012, where the total for all age groups was the lowest in the entire time-series since 1990 (Figure 5.1.2.2 in Annex 6.2). This was the year where the SNS was carried out on the RV Tridens instead of the RV Isis (ICES WGBEAM 2013) and the observed year effect may indicate that the change in vessel has caused a bias in the SNS indices. The internal consistency is relatively good until age 3 but becomes weaker for age group 4, especially in the most recent years.

4.1.2.2 Plaice

The combined inshore indices for 0- and 1-group plaice were below average in 2017 (Figure 5.1.2.1 in Annex 6.1). The 0-group plaice index in 2018 was well above the long term average, but the 1-group index further decreased and was one of the lowest observed for the whole time series in 2018. In the SNS, the group 1, 2 and 3 indices are

below average while the 4-group indices are above the average since 2013 (Figure 5.1.2.2 in Annex 6.2).

Although a year effect in 2012 in the SNS is far less evident for plaice than for sole (Figure 5.1.2.2 in Annex 6.2), this year should also be treated with caution for plaice. The use of a different vessel in this year may also have affected the catchability of plaice in 2012 (see above). The internal consistency is rather poor for plaice in the most recent survey years.

4.1.3 Combined offshore beam trawl survey indices for plaice and dab

During the recent benchmark workshops for dab (ICES, 2016) and plaice (ICES, 2017) it was agreed to use combined survey indices for each of the stocks using data from different beam trawl surveys. In both cases a GAM model approach (Berg et al., 2014) was applied to construct age based survey indices making use of the DATRAS database.

4.1.3.1 Plaice

The combined beam trawl survey index for the North Sea plaice stock (ple.27.420) includes data from different beam trawl surveys (1996-2018, ages 1-9) which are available in DATRAS. For details see the report of the Benchmark Workshop on North Sea Stocks WKNSEA 2017 (ICES, 2017) and the report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak WGNSSK (ICES, 2019).

4.1.3.2 Dab

The combined beam trawl survey index for the North Sea dab stock (dab.27.3a4) includes data from different beam trawl surveys (2003-2018, ages 1-6) which are available in DATRAS. For details see the report of the Benchmark Workshop on North Sea Stocks WKNSEA 2016 (ICES, 2016) and the report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak WGNSSK (ICES, 2019).

4.2 Trawl survey in the North Sea Division 7a, 7d-g, 8a-b and the Adriatic (ToRa)

4.2.1 Offshore beam trawl survey in 2018

4.2.1.1 Participation and coverage of the area

Eleven surveys were carried out, covering the North Sea, 5a, 7d, 7e, 7fg, 7a, 8a, 8b and the Northern Adriatic Sea. The participating vessels and time of the surveys are listed in Table 4.2.1.1. Further details (areas covered, technical specifications) by country are given in Annex 4.1.

Table 4.2.1.1. Overview of offshore beam trawl surveys during 2018.

Country	Vessel	Area	Dates	Gear
Belgium	Belgica	southern North Sea	27 Aug – 07 Sep 2018	4m beam
England	Endeavour	7d, 4c	14 Jul – 27 Jul 2018	4m beam
England	Endeavour	7a, 7f	12 – 03 Oct 2018	4m beam
England	Endeavour	7e. Celtic Sea	15 Mar – 03 Apr 2018	4m beam
France	Côtes de la Manche	8a, 8b	06 – 29 Nov 2018	4m beam
Germany	Solea	German Bight	20 Aug – 05 Sep 2018	7m beam
Iceland	Bjarni Sæmundsson RE-30	Entire coast of Iceland	22. Aug – 04 Sep 2018	4m beam
Italy/Slovenia	G. Dallaporta	northern Adriatic Sea	22 Nov – 07 Dec 2018	3.5m beam
Netherlands	Tridens	central North Sea	20 Aug – 14 Sep 2018	8m beam + flip-up rope
Netherlands	Tridens	southern North Sea	30 Jul – 17 Aug 2018	8m beam

4.2.1.2 Survey results

A summary of each of the offshore surveys is to be found in Annex 8.

4.2.1.3 Staff exchanges (ToR b)

No staff exchange has taken place in 2018.

4.2.2 Inshore beam trawl surveys

4.2.2.1 Participation and coverage of the area

The inshore surveys in the North Sea are carried out by Belgium (Demersal Young Fish Survey-DYFS), Germany (DYFS) and the Netherlands (Demersal Fish Survey-DFS). UK (Young Fish Survey-YFS) ceased the survey due financial constraints in 2012.

The Sole Net Survey (SNS), which is carried out by the Netherlands in the North Sea, is classified as an inshore survey, but ‘nearshore’ may be more appropriate because the area covered is further offshore than the other inshore surveys.

The participating vessels and time of the cruises are listed in Table 4.2.1.2. Further details (areas covered, technical specifications) by country are given in Annex 4.2.

Table 4.2.1.2. Overview of inshore beam trawl surveys during 2018.

Country	Vessel	Area	Dates	Gear
Belgium	Simon Stevin	Belgian coastal zone	10 Sep – 19 Sep	6 m shrimp trawl
Germany	Chartered vessel & Clupea	German Bight and German Wadden Sea	31 Aug – 05 Oct	3 m shrimp trawl
Netherlands (SNS)	Isis	Dutch coastal zone	10 Sept – 27 Sept	6 m beam trawl
Netherlands	Luctor	Scheldt estuary	3 Sep – 20 Sep	3 m shrimp trawl
Netherlands	Stern	Dutch Wadden Sea	27 Aug – 27 Sep	3 m shrimp trawl
Netherlands	Isis	Dutch coastal zone and German Bight	03 Oct – 08 Nov (5 weeks in the period)	6 m shrimp trawl

A summary of each of the surveys is to be found in in Annex 8.

4.2.2.2 Staff exchanges (ToR b)

No staff exchanges have taken place in 2018.

4.3 Analyse the changes in mean length-at-age for sole and plaice in the North Sea, English Channel, Bristol Channel, and Irish Sea (ToR c)

Trends in mean length-at-age were examined for two flatfish species: plaice and sole. Comparison of trends across areas and species can help us evaluate hypotheses on causal factors underlying growth changes. Multi-decadal datasets from beam trawl surveys in the North Sea, English Channel, Bristol Channel, Irish Sea and Bay of Biscay are presently available through DATRAS or otherwise available to WGBEAM. These data enable a large-scale comparison using the same methodology for different areas and species. Weighted mean length-at-age was calculated, for males and females separately, by combining catch data and biological sampling data. The preliminary results generally indicate declining growth rates across the stocks examined, but they also indicate different timings and rates of decline between species, areas and age groups. These changes appear to be more complex than a response to changes in temperature as frequently proposed. It appears there may be other factors relevant in explaining these changes.

Progress in 2018 and planning of the completion of this ToR c

The datasets included in the analyses have been elaborated:

- Updated for the years 2016 and 2017
- German BTS data in DATRAS elaborated for the years 1995-2001
- Belgian BTS data now available in DATRAS for the years 2010-2017
- Full time series of UK data for the western English Channel (1989-2013) available through WGBEAM

The work-up of the data was scrutinised. Most important change was the distinction of ALK (age-length-key) areas within the individual UK surveys. Up until now, different ALK areas within one survey had only been applied for the Dutch surveys.

Two approaches for analysing changes in mean length-at-age were examined. The results of the two approaches were in line with each other; they both clearly show trends in length-at-age that differ between species, stocks and age-groups. Crude comparison of these trends with stock assessment information suggests a correlation with population size.

This work will be completed, in the form of a draft manuscript submitted to a peer-reviewed journal.

4.4 Other activities

4.4.1 DATRAS governance group

The Working Group on DATRAS governance (WGDG) has been installed in 2018 and consists of representatives of the ICES Data Centre and the demersal survey working groups: WGBEAM, IBTSWG and WGBIFS. The group has four terms of reference:

- a) Further evolve the framework on the governance of DATRAS;
- b) Oversee and advise on the interpretation and prioritisation of recommendations from expert groups addressed to DATRAS;
- c) Facilitate common functionality in terms of data providers and data user across different surveys to improve upload efficiency and allow broader perspectives (covered by more than one survey) can be effectively addressed;
- d) Provide a platform for end user feedback to the DATRAS system, as well as feedback on the outcomes of those suggestions.

Related to tors b and c, the WGDG chair presented the current developments and questions for WGBEAM.

4.4.1.1 Use of different species validity codes in DATRAS products

Currently there are 11 codes for [species validity](#) in DATRAS. Only specval 1 is used for data products. WGBEAM was asked which species validity codes have to be taken into account in the data product(s), and how the different codings should be taken into account in the various standard data product(s).

Specval	Meaning	Take into account in WGBEAM product(s)	Comment
1	Valid information for use in DATRAS data products		
2	Partly valid information	no	Not used by WGBEAM
3	Length composition incomplete	no	Not used by WGBEAM
4	No length measurements only total number	yes	Present Length=NULL
5	Observed only, not measured, not counted, but only presence/absence is registered	Not in current CPUE product, but is relevant in species diversity	WGBEAM to define a new product where this specval can be used.
6	No length measurements, only category catch weight	Not in current CPUE product, but is relevant in species diversity	WGBEAM to define a new product where this specval can be used and also other weights can be incorporated
7	No length measurements, only total number and category catch weight	yes	Also add to a new product where weight is incorporated
8	Only volume (litre) registered	yes	Only use the numbers in the current product; incorporation of volumes in other product is still unclear
9	Valid information available but not recorded in the file	no	Not used by WGBEAM
10	No category catch weight, only total numbers and length composition	yes	Currently not used by WGBEAM, but should be taken into account in the current product and a potential new product where weights are incorporated if used.

4.4.1.2 Estimated/seeded ages

Some countries provide estimated ages for smaller fish instead of read ages. There is a wish to be able to flag those records. ICES Data Centre proposes to add it to the field 'AgeSource', and mark it as 'assumed age based on length'.

WGBEAM supports the idea to clearly mark the seeded/estimated ages. Uploading seeded ages for whole years are by default not recommended. Exception is when there is only one survey in an area.

Belgium, France, and the Netherlands only submit real age information (otolith reading). Germany does not deliver calculated ages to DATRAS, but calculates index based on length. UK (Cefas) would like to make seeded otoliths available ('made up age') via DATRAS in future, including a remark that the information is not based on actual age

readings. Italy (Adriatic) would like to use an age-length key for year where age data is missing, including a remark that the information is not based on actual age readings.

4.4.1.3 Commercial vessels

Commercial vessel names are not always reported. In case of DYFS UK (Cefas), the list of ships exists, but is not mapped to data. The data are stored by area rather than the platform. As area is not a part of the submission key, this affects upload and download of separate surveys under the DYFS umbrella. Although there are already codes for national 'unspecified commercial vessel', this is not stimulated for future use. If possible, a unique shipcode should be supplied, whether pseu-dominised or not.

WGBEAM: Germany uses commercial vessels for DYFS, historically not always specified, but in future specification should be possible. UK (Cefas) has historical unspecified commercial vessels in the DYFS.

4.4.1.4 Additional fields

New fields are required for WGBEAM offshore and inshore surveys:

- Sample processing method: not all shrimp catch is processed fresh (sometimes cooked or frozen) before measuring and/or weighing. Especially shrimp can be dealt with in various manners. Currently DATRAS provides no option to describe how the shrimp (or other species) were processed before measuring (raw, cooked, preserved in formaldehyde, etc.). This field only has to be implemented for the inshore surveys.
- Length Measurement type: should be able to clarify what part of the shrimp was measured (full body length, only carapax, etc.). This field is also useful for e.g. rays/skates, crabs, cephalopods. This field should be implemented for all surveys under WGBEAM.

4.4.1.5 Other topics

- ICES Data Centre proposes an alternative simplification of data submission with use of headers, so submitters can submit the information they have available. WGDG agreed that this sounds like a useful proposal, facilitating the flexibility for the surveys. The DATRAS team will prepare a proposal (1-page) with focus on why and how. Then, depending on the timeframe, the proposal should be reviewed by WGDG, survey WGs –including WGBEAM-, and DIG. WGBEAM shortly discussed the proposal and in general agrees with the idea, but would like to see the full proposal for implementation.
- WGBEAM agrees that multiple species validity codes for one species in a haul should be allowed in DATRAS so Belgium, Netherlands and Italy can submit their data in line with their data collection. Once implemented, a note should be added in the manual with respect to data handling to prevent confusion.
- Stdspecreccode and Bycspecreccode: the following codes are used in the North Sea:

StdSpecRecCode	BycSpecRecCode	Country	BTS	Comment
1	0	BEL	108	2015, 2016
	1	BEL	415	
		ENG	6598	
		GFR	1206	
		NED	4312	

The BycSpecRecCode 0 for Belgium has correctly been reported; in 2015 and 2016 the survey was carried out by a commercial vessel and only the absolute minimum sampling could be carried out, resulting in sampling only the commercial fish species.

4.4.2 Offshore manual

The manual on the offshore beam trawl surveys has been handed in for review in autumn 2018 and was returned in January 2019. Reviewers' comments have been discussed and/or taken into account during WGBEAM 2019. The final version of the manual has been sent to the EOSG chair on 22 March 2019, for further processing.

The manual is meant to be a living document that will be reviewed annually and in case no major changes in procedures occur, a new version will be submitted for review at the end of each multi-annual period. The annual review will be kept at the WGBEAM sharepoint.

4.4.3 Litter data collection and upload to DATRAS

All countries collect litter from the trawls. Currently information in DATRAS is only available for the BTS, and not for the surveys in the Bay of Biscay, Mediterranean, Icelandic Sea. The litter reference code reflects the data collection. For hauls without litter items no C-TS code is available, so RECO-LT is used.

For all countries except UK (Cefas) the submission is complete till 2017. Belgium, Netherlands and Germany still have to submit the 2018 data, submission for UK (Cefas) for 2009-2014 is missing in DATRAS. No data submissions to DOME could be found either for UK (Cefas) litter from fish trawls.

For Belgium in 2015 and 2016 no litter information has been collected.

Country	Ship	LTREF	2011	2012	2013	2014	2015	2016	2017	2018
BEL	11BE	C-TS	107	160	192	65			163	
		RECO-LT	12	4	6	3			5	
ENG	END	C-TS-REV					178	521	526	519
		RECO-LT					15	50	39	46
GFR	SOL2	C-TS	27	96	130	49	168	213	135	
NED	TRI2	C-TS		296	319	477	419	421	437	
		RECO-LT		4	6	5	4	1	9	

4.4.4 Workshop on index calculation based on DATRAS (WKICDAT)

In recent years a lot of progress of automated index calculation procedures and the adoption of model-based indices, including combining several surveys into a single index (e.g. deltaGAM method), directly based on DATRAS exchange data, was made. While the automation benefits consistency and transparency it also makes implicit assumptions regarding data collection which are easy to forget when applying an automated procedure. Specifically the indices which are based on data from the different beam trawl surveys, which use different gears and apply different biological sampling designs, have to be thoroughly evaluated and contrasted to historical methods to understand the differences and their possible implication for the estimation of population dynamic trends.

It has to be investigated to what extent the new method affects the outcomes of the used stock assessment models in comparison with the previously used methods. Therefore, WGBEAM organized a two days work shop (WKICDAT) in conjunction with the working group meeting in Copenhagen (21-22 March, 2019) in order to discuss and investigate the use of the so-called deltaGAM index method (Berg et al., 2014) with regard to different survey designs of beam trawl surveys (BTS) conducted in the North Sea. More information and details are presented in Annex 8 of this report.

5 Revisions to the work plan and justification

There were no revisions made to the work plan and justification in 2018.

6 Next meeting

24th – 27th March, Reykjavik, Iceland

Annex 1: List of participants

Name	Institute	Country	E-mail
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Chun Chen (chair invited expert; WebEx)	Wageningen Marine Research PO Box 68 1970 AB IJmuiden Netherlands	Netherlands	chun.chen@wur.nl
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Annex 2: Recommendations

*Recommendations for WGBEAM 2019 have been uploaded to ICES recommendation database.

Annex 3: Terms of reference

WGBEAM – Working Group on Beam Trawl Surveys

2016/MA2/SSGIEOM11

The Working Group on Beam Trawl Surveys (WGBEAM), chaired by Holger Haslob, Germany, will work on ToRs and generate deliverables as listed in the Table below.

	Meeting dates	Venue	Reporting details	Comments (change in Chair, etc.)
Year 2017	4-7 April	Galway, Ireland	Interim report by 1 June 2017 to ACOM-SCICOM	New chair
Year 2018	10-13 April	IJmuiden, The Netherlands	Interim report by 25 May 2018 to ACOM-SCICOM	
Year 2019	18-22 March	ICES HQ, Copenhagen, Denmark	Final report by 17 May 2019 to ACOM-SCICOM	

ToR	Description	Background	Science Plan codes	Duration	Expected Deliverables
a	Tabulate, report and evaluate population abundance indices by age-group for sole, plaice and dab and other species if required in the North Sea, Division 7a, Divisions 7d-g, Divisions 8ab and the Adriatic taking into account the key issues involved in the index calculation.	a) Science Requirements Length-at-age analysis b) Advisory Requirements Required to support indices for assessments c) Requirements from other EGs Specific questions from other EGs possible	3.2	Annually	WG report chapter
b	Further coordinate and standardize offshore and coastal beam trawl surveys in the North Sea and Divisions 7a, 7d-g, 8a-b and the Adriatic, and update and publish the standard as a SISP protocol.	a) Science Requirements b) Advisory Requirements Required to ensure consistent approach within and between areas to meet EU directives.	3.1, 3.2	Annually	WG report chapter inshore manual offshore manual database (DATRAS)

c	Analyse the changes in mean length-at-age for sole in the North Sea, English Channel, Bristol Channel and Irish Sea. (continuation of WGBEAM work in 2014-2016)	a) Science Requirements The large WGBEAM dataset has the potential to elucidate temporal and spatial changes in population parameters. b) Advisory Requirements Indices are being used by assessments working groups and any changes to age structure of species of interest need to be investigated.	5.2	Expected output in 2019	WGBEAM 2018 update and ultimately ASC presentation
d	Provide index calculations based on DATRAS for dab in the North Sea, and plaice and sole in Divisions 7a, 7d-g, 8a-b and the Adriatic.	Required to support indices for assessments	3.2	3 years	Provision of new index series to relevant WGs
e	Evaluate the results and outcomes of a workshop on index calculation methods based on DATRAS beam trawl data.	Currently, a modelled approach (delta GAM method) combining several surveys into a single index based on DATRAS data are used for several North Sea stocks (i.e. North Sea plaice, lemon sole, and dab). WGBEAM will organize a workshop on this issue. The aim of this workshop will be to evaluate and to contrast the deltaGAM method with the previously used index calculation methods with regard to the output of the stock assessment models used.	3.2, 3.3	1 year expected output in 2019	WG report chapter

Summary of the Work Plan

ANNUAL STANDARD OUTPUTS FOR A,B. CONTINUE ANALYSIS ON ToR D, C. STARTED TO ANALYSE THE MACRO EPIBENTHOS CATCHES IN SPECIES COMPOSITION AND QUANTITY OF AT LEAST IBTS Q3 AND BEAM TRAWL SURVEY CATCHES.	
YEAR 1	
Year 2	Annual standard outputs for a,b. Continue analysis on ToR c,d.
Year 3	Annual standard outputs for a,b. Continue analysis on ToR c,d. Complete ToR e.

Supporting information

Priority	The current activities of this Group will lead ICES into issues related to the ecosystem effects of fisheries, especially with regard to the application of the Precautionary Approach. Several indices produced by WGBEAM are already included in Category 1 stock assessments (NS sole, NS plaice, Biscay sole, NS dab since 2016) and data collected on beam trawl surveys are increasingly used to produce indices for Category 3 stock assessments. Consequently, these activities are considered to have a very high priority.
Resource requirements	The research programmes which provide the main input to this group are already underway, and resources are already committed. The additional resource required to undertake additional activities in the framework of this group is negligible.
Participants	The Group is normally attended by some 10–15 members and guests.
Secretariat facilities	None.
Financial	No financial implications.
Linkages to ACOM and groups under ACOM	As WGBEAM directly calculates and discusses survey indices for stock assessments, and coordinates surveys from which data are used in other stock assessments, there is a clear linkage to ACOM and some of the stock assessment WGs under its coordination (WGNSSK, WGCSE, WGBBI, WGEF, WGINOSE, WGISUR).
Linkages to other committees or groups	There is a very close working relationship with all the groups of the SSGIEOM/SSGESST. Joint sessions are sometimes organized (e.g. with WGCAN in 2014). It is also relevant to the Working Group on Ecosystem Effects of Fisheries.
Linkages to other organizations	The work of this group is closely aligned with similar work in FAO.

Annex 4: Details on offshore and inshore beam trawl survey

Annex 4.1: Details of the offshore beam trawl surveys currently undertaken by each country coordinated by WGBEAM.

[illegible]

Tow speed (knots):	4	5	4	5.5	4	4	4	4	4
Codend stretched mesh (mm):	40	90 Liner: 40 mm	80 Liner: 40 mm	40	40	40	75 Liner: 40 mm	75 Liner: 40 mm	75 Liner: 40 mm
Number of ticklers:	0	10	5	0	8	8	0	0	0
Gear code:	BT4A	BT4A	BT7	Rapido	BT8	BT8F	BT4FM	BT4FM	BT4FM
Attachment:	chain mat	(none)	(none)	(none)	(none)	**	*	*	*
Station positions:	fixed	fixed	pseudo-random	fixed	pseudo-random	pseudo-random	fixed	fixed	fixed
Av No stns/yr	53	49	63	67	88	63-73	100	94	131
Benthos sampling since:	2009	2013	1992	2005	1985	1996	1991	1992	2006

Gwen Drez (24,5 m) replaced in 2014 by Antea (34,95 m) and in 2015 by Côtes de la Manche; ## new vessel since 2004, previously 35m; ### Corystes (53 m) in 2009 replaced by CEFAS Endeavour; * chain mat and flip-up rope, ** flip-up rope only.

Annex 4.1 continued: Details of the offshore beam trawl surveys currently undertaken by each country coordinated by WGBEAM.

	Iceland	Ireland
Survey area:	5a	7jgh
Year survey started:	2016	2016
Dates:	July/August	March
Usual start date	Week 30-34	Week 10
Number of survey days	10	10
Ship:	RS Bjarni Saemundsson	RV Celtic Explorer
Ship length:	56 m	65 m
Beam trawl length:	4 m	4 m
Number of beams fished:	1	2
Number of beams sorted:	1	2
Trawl duration (min):	30	30
Tow speed (knots):	4	4
Codend stretched mesh (mm):	75 Liner: 40 mm	75 Liner: 40 mm
Number of ticklers:	0	0
Gear code:		BT4FM
Attachment:	*	*
Station positions:	fixed	random
Av No stns/yr	80	50
Benthos sampling since:	2018	2016

Annex 4.2: Inventory of the inshore beam trawl surveys.

Country	Netherlands (SNS)	Netherlands (DYFS)			UK (YFS)	Belgium (DYFS)
Geographical Area	Scheveningen (NL) to Esbjerg (DK)	Wadden Sea	Scheldt Estuary	Dutch coast to Danish coast	Eastern/South-Eastern English Coast	Belgian Coast
Ship	Tridens / Isis	Stern / Waddenzee	Luctor ##	Isis / Beukels / WR17 / GO29	Chartered vessels	Simon Stevin #
ship size (m)	73m / 28m	21m / 21m	34m	± 28m	8–10m	36m
Date started	1969	1970	1970	1970	1973-2007 Ceased 2011	1970
Sampling Period	Apr/May ('69–'89) Sept/Oct	Apr/May ('70–'86) Sept/Oct	Apr/May ('70–'86) Sept/Oct	Apr/May ('70–'86) Sept/Oct	Sept/Oct	Sept/Oct
Usual Start date	12 Sept	29 Aug	5 Sept	26 Sept	1 Sept	1–14 Sept
Number of days per period	8–9 within 2 weeks	20 within 5 weeks	12 within 3 weeks	16 within 5 weeks	3 surveys x 8 days	7 within 2 weeks
Beam trawl type	6m beam trawl	3m shrimp trawl	3m shrimp trawl	6m shrimp trawl	2m shrimp trawl	6m shrimp trawl
Tickler Chains	4	1	1	1	3	0
Mesh size net	80mm	35mm	35mm	35mm	10mm	40mm
Mesh size codend	40mm	20mm	20mm	20mm	4mm	22mm
Speed fished	3.5–4 knots	3 knots	3 knots	3 knots	1 knot	3.5 knots
Time Fished	15 min	15 min	15 min	15 min	10 min	30 min
Approx. number of stations per year	55	120	80	100	82	33
Target species	0–4 group sole and plaice	0–1 group sole and plaice	0–1 group sole and plaice	0–1 group sole and plaice	0–1 group sole and plaice	0–2 group sole and plaice
Catch rate and LF distribution	All fish species	All fish species <i>Crangon</i>	All fish species <i>Crangon</i>	All fish species <i>Crangon</i>	All fish species	Commercial fish species <i>Crangon crangon</i> (1973–92, 2004–05)

Catch rate	Epibenthos (quantity)	Epibenthos (quantity)	Epibenthos (quantity)	Epibenthos (quantity)	<i>Crangon</i> (volume)	<i>Crangon crangon</i> (weight)
Age data for plaice and sole	All years	All years	All years	All years	Since 2003	None

Broodwinner (27 m) in 2013 replaced by Simon Stevin; ## Schoolevaar (21 m) in 2016 replaced by Luctor

Annex 4.2 continued: Inventory of the inshore beam trawl surveys.

Country	Germany (DYFS)		
Geographical Area	NiedersachsenWadden Sea +Elbe Estuary	Schleswig-Holstein Waddensea	Coastal Area outside the island chain
Ship	Chartered vessels	Chartered vessels	RV Clupea
ship size (m)	12–16m	12–18m	28m
Date started	1972	1974	2012
Sampling Period	Apr/May ('74–'04) Sept/Oct	Apr/May ('74–'04) Sept/Oct	Sept/Oct
Usual Start date	15 Sept	5 Sept	15 Sept
Number of days per period	5	5 – 7	14
Beam trawl type	3m shrimp trawl	3m shrimp trawl	3m shrimp trawl
Tickler Chains	0	0	0
Mesh size net	32mm	32mm	32mm
Mesh size codend	18mm	18mm	18mm
Speed fished	3 knots	3 knots	3 knots
Time Fished	15 min	15 min	15 min
Approx. number of stations per year	75	75	85
Target species	0–1 group sole and plaice	0–1 group sole and plaice	0–1 group sole and plaice
Catch rate and LF distribution	All fish species <i>Crangon</i>	All fish species <i>Crangon</i>	All fish species <i>Crangon</i>
Catch rate	Epibenthos (quantity)	Epibenthos (quantity)	Epibenthos (quantity)
Age data for plaice	Since 2013	Since 2013	Since 2013

Annex 5: Population abundance for sole and plaice, offshore surveys

Annex 5.1: Tables of catch rate of sole, offshore surveys

a) Netherlands: sole (N.hr⁻¹/8m trawl) North Sea (4) RV "Isis"

Year/Age	0	1	2	3	4	5+
1985	0.00	7.03	7.12	3.69	1.65	0.96
1986	0.00	7.17	5.18	1.60	0.99	1.02
1987	0.04	6.97	12.55	1.83	0.56	1.11
1988	0.00	83.11	12.51	2.68	1.03	0.65
1989	0.49	9.01	68.08	4.19	4.10	1.13
1990	0.02	37.84	24.49	21.79	0.78	2.16
1991	0.82	4.03	28.84	6.87	6.45	0.45
1992	0.02	81.63	22.28	10.45	2.53	3.45
1993	0.02	6.35	42.35	1.34	5.52	9.79
1994	2.17	7.66	7.12	19.74	0.12	2.72
1995	0.43	28.13	8.46	6.27	5.13	2.29
1996	0.16	3.98	7.63	1.95	1.79	3.68
1997	0.54	169.34	4.92	2.99	0.74	1.32
1998	0.37	17.11	27.42	1.86	1.24	0.48
1999	6.34	11.96	18.36	15.78	0.58	3.36
2000	0.19	14.59	6.14	4.04	1.48	0.69
2001	9.20	8.00	9.96	2.16	1.56	0.99
2002	5.91	20.99	4.18	3.43	0.89	0.88
2003	0.32	10.51	9.95	2.46	1.67	0.89
2004	0.68	4.19	4.35	3.55	0.64	0.90
2005	0.08	5.53	3.40	2.38	1.30	0.48
2006	0.06	17.09	2.33	0.28	0.71	0.76
2007	0.71	7.50	19.50	1.46	0.56	0.92
2008	3.09	15.25	9.06	12.30	1.31	0.78

2009	4.91	15.95	5.00	2.86	4.79	0.73
2010	2.46	54.81	10.71	2.03	0.77	1.64
2011	2.23	26.17	17.39	4.01	1.09	1.79
2012	1.09	5.15	18.21	8.86	1.69	1.34
2013	0.38	6.84	3.56	12.57	5.39	1.35
2014	0.14	18.93	15.58	3.37	6.76	3.73
2015	0.20	21.10	25.60	9.66	1.29	6.86
2016	0.74	6.45	11.83	8.42	2.91	2.49
2017	0.00	16.28	7.10	5.99	6.30	2.25
2018	0.09	16.04	14.35	4.29	3.06	2.58

b) United kingdom: sole (total numbers per km towed) Southern North Sea (4c)

Year/Age	0	1	2	3	4+
1996	1.75	41.02	41.66	22.79	32.29
1997	3.00	66.76	57.27	20.20	28.53
1998	5.50	9.42	53.46	16.50	14.63
1999	8.00	184.11	39.72	45.74	54.03
2000	3.00	162.50	160.74	12.85	44.41
2001	4.00	40.76	174.02	77.16	28.05
2002	1.87	117.85	44.64	30.73	32.65
2003	0.00	49.42	116.88	15.11	50.32
2004					
2005	52.50	143.36	69.17	24.01	83.96
2006	7.25	145.30	55.42	15.82	58.46
2007	9.43	48.27	87.81	21.33	29.01
2008	1.00	103.36	54.60	47.19	35.26
2009	1.01	35.62	97.53	45.06	93.99
2010	1.60	72.07	58.93	17.70	45.98
2011	5.86	155.22	51.80	15.03	21.01
2012	0.00	38.71	128.17	40.64	30.86

2013	0.00	61.13	50.15	82.43	47.72
2014	10.71	69.12	112.74	17.80	44.27
2015	0.00	232.38	29.19	28.70	40.93
2016	2.60	22.94	113.55	12.01	35.60
2017	0.80	353.64	20.98	55.46	25.02
2018	1.33	69.35	190.64	17.01	43.67

c) United Kingdom: sole (N.hr⁻¹/8m trawl) Eastern Channel (7d)

Year/Age	0	1	2	3	4+
1989	0.16	3.01	22.09	4.62	4.40
1990	0.00	17.96	5.55	5.55	2.94
1991	0.00	12.14	31.17	3.19	4.65
1992	0.00	1.33	15.29	13.47	5.05
1993	0.00	0.82	22.96	11.42	13.77
1994	0.00	8.33	4.26	11.07	11.14
1995	0.06	5.89	16.09	2.22	8.64
1996	5.55	5.30	10.79	5.97	7.08
1997	0.06	24.75	10.85	4.42	5.19
1998	0.13	3.27	24.11	3.67	3.43
1999	2.56	35.99	8.22	11.33	5.05
2000	0.00	14.98	27.45	5.52	8.75
2001	1.27	10.19	27.88	11.55	6.84
2002	0.00	53.56	16.11	8.60	8.09
2003	0.00	11.03	45.65	5.87	7.44
2004	0.00	12.67	11.81	10.97	7.63
2005	0.00	43.27	6.91	3.50	9.72
2006	0.00	10.84	42.62	4.51	7.35
2007	0.00	2.57	28.97	15.45	5.80
2008	0.00	3.77	7.35	9.14	8.15
2009	0.00	51.25	19.16	7.10	13.06
2010	0.00	16.59	30.76	5.14	8.29

2011	0.00	13.66	28.60	14.70	6.14
2012	0.00	1.75	9.72	7.51	6.99
2013	0.00	0.72	8.91	15.09	16.41
2014	0.45	25.39	16.35	12.38	22.04
2015	0.00	25.24	21.36	6.04	11.96
2016	0.00	10.17	33.14	11.17	12.84
2017	0.13	27.85	15.18	16.26	11.25
2018	0.39	14.86	36.49	6.66	19.20

d) United Kingdom: sole (total numbers for 2*4m beam trawl) Western Channel (7e)

Year/Age	0	1	2	3	4	5	6	7	8	9	10+
1989	0	5	56	120	107	34	40	17	5	7	12
1990	0	23	52	76	31	24	7	15	3	6	11
1991	0	11	231	79	51	23	21	5	17	4	15
1992	0	5	140	316	44	36	12	7	5	11	11
1993	0	5	54	115	105	14	10	9	3	3	10
1994	0	6	47	106	62	44	5	5	2	3	7
1995	0	14	37	44	42	26	31	4	5	5	13
1996	0	28	112	67	25	32	20	17	3	2	9
1997	0	11	130	126	43	14	16	13	14	5	15
1998	0	11	141	114	76	22	10	14	6	8	11
1999	0	11	97	128	47	23	8	4	4	4	17
2000	0	12	136	70	52	23	16	5	3	5	9
2001	0	9	197	162	52	31	12	12	4	1	7
2002	0	6	37	113	48	27	6	3	2	0	12
2003	0	23	124	78	56	28	6	1	1	2	4
2004	0	16	110	120	24	15	10	16	9	4	4
2005	0	8	110	39	53	12	12	6	2	4	4
2006	0	5	120	95	26	37	10	7	9	0	5
2007	0	7	188	135	50	11	23	3	3	1	4
2008	0	10	85	158	77	40	2	14	3	6	7

2009	0	11	104	126	96	49	13	13	12	1	8
2010	0	20	175	154	84	59	31	20	7	12	14
2011	0	9	156	231	62	39	25	24	8	2	4
2012	0	3	47	162	125	40	27	13	3	6	9
2013	0	4	36	100	106	80	21	9	6	3	4
2014	Survey discontinued										

e) United Kingdom: sole (total numbers for 4m beam trawl) Bristol Channel (7f)

Year/Age	0	1	2	3	4+
1995	26.57	123.88	222.1	51.99	36.4
1996	2.55	150.29	211.4	53.56	40.6
1997	32.04	433.35	180.47	17.93	39.23
1998	90.29	770.05	411.18	50.9	33.71
1999	24.38	2464.28	250.2	32.05	35.47
2000	13.17	915.67	1355.65	30.83	34.36
2001	22.3	378.72	599.32	258.58	41.99
2002	7.75	662.7	238.33	127.23	127.68
2003	11.83	392.36	529.52	46.78	86.43
2004	55.7	748.87	377.4	86.6	79.58
2005	37.17	342.92	224.96	31.87	40.65
2006	10.73	273.36	200.5	39.29	32.73
2007	91.26	357.35	108.04	42.75	46.23
2008	5.1	1038.53	104.26	12.68	45.41
2009	0.84	509.45	317.75	24.17	32.88
2010	17.84	85.08	470.57	121.81	41.29
2011	17.32	501.31	52.26	138.64	92.04
2012	13.19	542.01	230.89	7.2	90.03
2013	9.39	278.96	517.91	43.35	64.62
2014	33.83	243.96	257.6	76.27	52.34
2015	27.61	746.63	48.35	44.19	64.29
2016	25.95	573.51	359.34	11.61	65.04
2017	5.99	1045.99	173,91	67.96	67.35
2018	0.00	27.19	531.55	1070.32	128.02

f) United Kingdom: sole (total numbers for 4m beam trawl) Irish Sea (7a)

Year/Age	0	1	2	3	4+
1995	18.8	195.2	122.32	200.46	199.97
1996	3.34	703.15	100.07	25.2	155.99
1997	4.02	919.09	458.01	56.9	132.89
1998	1.59	427.83	568.26	231.5	82.73
1999	2.65	305.21	232.92	202.38	235.23
2000	0	281.1	368.16	116.44	292.47
2001	0.79	72.31	225.42	152.36	203.9
2002	0	162.88	48.56	95.92	253.8
2003	0	192.12	166.5	40.81	238.33
2004	0	322.44	190.81	94.45	187.92
2005	0	43.42	135	56.07	102.31
2006	0	84.53	86.95	71.14	119.81
2007	0	99.1	73.48	39.17	120.38
2008	0	102.96	103.08	49.22	98.96
2009	0	47.49	118.89	54.17	99.48
2010	0	20.28	47.43	58.45	66.74
2011	0	72.28	28.48	50.75	122.48
2012	0	17.75	39.16	12.93	92.4
2013	6.49	59.47	45.06	28.64	89.4
2014	15.01	136.53	33.73	17.17	102.8
2015	0	334.1	119.32	32.88	94.32
2016	0	105.88	296.63	74.39	96.28
2017	1.59	188.17	80.39	140.24	108.63
2018	4.27	212.71	218.30	59.79	192.33

g) France: sole (total numbers per 10 km towed for 4m beam trawl) Bay of Biscay (8a, 8b)

Year/Age	0	1	2	3	4+
2007	2.05	6.39	15.90	6.76	5.40
2008	0.43	33.84	12.43	6.80	3.19
2009	22.21	8.45	47.71	9.50	2.73
2010	5.66	17.80	19.27	15.71	2.39
2011	3.43	9.99	20.59	7.54	3.93
2012	4.67	6.12	8.90	10.18	9.16
2013	6.02	16.61	8.42	5.05	11.02
2014	9.69	17.06	22.78	5.08	8.40
2015	4.82	13.88	19.19	5.55	7.05
2016	2.94	12.60	18.83	11.21	6.36
2017	2.59	12.69	16.47	9.68	8.14
2018	2.69	9.41	17.84	6.42	8.79

Annex 5.2: Tables of catch rate of plaice, offshore surveys

a) Netherlands: plaice (N.hr⁻¹/8m trawl) North Sea (4) RV "Isis"

Year/Age	0	1	2	3	4	5	6	7	8	9	10+
1985	595.27	136.76	173.89	36.06	11.00	1.27	0.97	0.34	0.15	0.09	0.23
1986	9.30	667.44	131.70	50.17	9.21	3.78	0.40	0.42	0.15	0.07	0.19
1987	44.13	225.82	764.19	33.84	4.88	1.84	0.61	0.25	0.13	0.08	0.19
1988	29.62	680.17	146.99	182.31	9.99	2.81	0.81	0.46	0.04	0.11	0.25
1989	31.86	467.88	319.27	38.66	47.30	5.85	0.83	0.31	0.66	0.13	0.07
1990	27.00	185.34	146.07	79.34	26.35	5.47	0.76	0.19	0.38	0.24	0.20
1991	152.18	291.38	159.42	33.96	13.57	4.31	5.66	0.24	0.20	0.09	0.11
1992	26.81	360.89	174.53	29.25	5.96	3.75	2.87	1.19	0.35	0.05	0.09
1993	74.27	188.99	283.40	62.78	8.27	1.13	1.13	0.58	0.46	0.15	0.07
1994	284.48	193.26	77.14	34.46	10.59	2.67	0.60	0.80	0.90	0.37	0.03
1995	108.10	265.63	40.62	13.22	7.53	1.11	0.81	0.33	1.05	0.20	0.12

1996	222.51	310.29	206.88	21.47	4.47	3.13	0.84	0.04	0.16	0.12	0.11
1997	65.52	1046.84	59.24	17.18	2.67	0.26	0.36	0.16	0.11	0.00	0.03
1998	255.65	347.58	402.66	44.96	8.29	1.22	0.34	0.15	0.21	0.07	0.08
1999	257.56	293.25	121.55	171.25	3.39	1.96	0.13	0.13	0.03	0.03	0.08
2000	209.29	267.47	69.25	29.35	22.36	0.57	0.16	0.50	0.03	0.01	0.05
2001	807.93	206.53	72.24	17.84	9.17	8.72	0.27	0.13	0.04	0.04	0.17
2002	248.36	519.22	44.48	14.90	4.99	2.54	1.32	0.08	0.13	0.00	0.09
2003	225.62	132.75	159.12	10.06	5.55	1.43	1.13	0.64	0.11	0.10	0.02
2004	197.94	233.71	39.62	61.91	6.15	2.46	1.49	0.95	2.84	0.00	0.01
2005	270.77	163.05	66.18	6.76	12.79	1.08	1.16	0.29	0.15	0.49	0.04
2006	250.80	128.61	36.38	18.11	2.98	5.89	0.87	0.76	0.04	0.27	0.39
2007	298.09	312.00	67.17	19.71	14.42	2.94	6.09	0.68	0.83	0.16	0.65
2008	387.59	221.57	120.73	30.11	9.08	7.20	0.62	1.72	0.29	0.23	1.05
2009	555.47	408.99	105.22	45.98	13.01	4.03	3.47	0.57	2.13	0.28	0.93
2010	814.36	261.10	84.25	34.24	20.18	4.66	2.16	3.46	0.21	2.55	1.23
2011	323.43	486.16	148.22	55.31	20.06	12.90	3.95	2.24	2.26	0.23	0.91
2012	454.62	241.84	191.50	58.07	20.90	12.64	5.59	1.79	0.49	1.69	0.79
2013	336.30	449.77	113.18	90.49	27.00	10.64	5.82	1.50	1.52	1.08	1.94
2014	138.25	360.29	145.34	82.28	39.50	22.38	8.48	2.54	2.55	1.66	1.62
2015	139.93	267.28	239.65	84.42	30.28	30.42	11.09	4.05	2.39	1.71	1.91
2016	549.77	227.77	79.42	67.81	30.97	24.77	12.31	8.46	2.67	1.12	3.63
2017	148.71	368.70	128.52	43.82	39.70	21.36	11.72	6.28	5.40	1.40	3.32
2018	2247.20	175.84	202.15	75.96	21.26	23.86	12.13	7.71	3.58	3.91	2.35

b) Netherlands: plaice (N.hr⁻¹/8m trawl) North Sea (4) RV "Tridens"

Year/Age	0	1	2	3	4	5	6	7	8	9	10+
1996	0.00	1.64	6.02	4.45	2.90	2.04	1.57	0.72	0.42	0.19	0.47
1997	0.00	0.22	7.12	9.13	3.25	2.11	1.52	0.40	0.82	0.35	0.43
1998	0.00	0.23	32.25	9.57	4.87	2.20	1.27	0.93	0.76	0.30	0.54
1999	0.05	2.69	7.71	35.23	5.56	2.50	1.93	0.63	0.76	0.31	0.33
2000	0.04	4.79	13.44	12.91	16.96	2.88	1.72	0.93	0.81	0.22	0.53
2001	0.18	2.15	8.61	9.90	6.68	7.36	1.06	0.59	0.42	0.51	0.54
2002	0.00	18.55	12.91	9.54	6.41	4.18	4.42	0.74	0.74	0.39	0.93
2003	0.34	3.98	41.69	13.38	9.06	5.08	2.81	3.92	0.70	0.74	1.56
2004	0.01	5.98	15.78	31.49	9.43	4.32	2.44	1.24	2.50	0.41	1.41
2005	0.04	6.88	23.37	12.23	17.67	2.82	6.87	1.56	0.57	3.57	2.48
2006	0.24	6.73	32.19	25.73	11.37	10.92	1.99	3.90	0.86	0.72	3.26
2007	0.00	26.57	23.74	19.55	23.17	4.90	10.15	1.97	3.79	0.32	5.47
2008	0.00	17.47	50.46	25.59	18.39	18.97	6.24	12.75	2.66	6.75	8.41
2009	0.12	12.11	41.68	43.33	19.13	12.05	11.77	3.08	10.12	1.57	8.03
2010	0.64	26.18	35.72	34.56	30.09	13.41	5.70	12.23	2.74	6.36	7.71
2011	0.17	41.88	71.48	41.59	28.46	31.67	14.28	5.50	11.88	1.17	12.89
2012	0.00	12.99	87.81	65.99	32.01	19.32	16.04	7.15	3.63	8.63	8.99
2013	0.00	15.06	48.68	63.14	39.97	25.03	14.23	10.97	4.24	2.96	12.47
2014	0.19	23.72	74.41	60.68	48.55	30.20	13.07	9.83	6.03	7.13	13.24
2015	0.00	11.01	67.41	73.77	48.30	41.66	23.01	8.76	6.46	7.07	15.77
2016	0.28	17.12	40.53	72.33	45.16	26.00	19.98	14.18	6.32	5.98	13.61
2017	1.58	54.68	84.36	37.42	47.94	35.58	24.98	11.83	15.45	4.81	17.19
2018	0.49	12.26	86.33	61.39	33.62	34.54	26.32	23.11	11.44	15.54	16.10

c) Netherlands: plaice (N.hr⁻¹/8m trawl) North Sea (4) Combined with gear correction (RV "Isis" and RV "Tridens")

Year/Age	0	1	2	3	4	5	6	7	8	9	10+
1996	102.14	143.90	99.62	13.28	3.49	2.47	1.22	0.47	0.32	0.16	0.32
1997	24.19	386.84	28.68	14.89	3.01	1.39	1.07	0.30	0.54	0.22	0.28
1998	96.33	131.19	177.63	25.46	5.74	1.79	0.94	0.65	0.56	0.22	0.37
1999	100.26	116.99	53.60	96.35	4.74	2.24	1.30	0.45	0.51	0.21	0.25
2000	81.46	108.39	38.89	22.88	18.47	2.08	1.17	0.81	0.53	0.15	0.36
2001	297.38	80.30	39.79	15.69	6.85	7.12	0.75	0.43	0.28	0.34	0.42
2002	87.79	217.28	26.71	14.03	5.64	3.48	3.25	0.51	0.52	0.26	0.64
2003	87.99	53.58	94.43	15.86	7.52	3.74	2.19	2.75	0.50	0.52	1.02
2004	80.36	101.41	30.31	51.22	8.17	3.62	2.12	1.15	2.63	0.26	0.90
2005	106.92	70.84	45.65	13.81	15.24	2.18	4.79	1.09	0.40	2.46	1.64
2006	97.99	54.86	42.92	29.19	8.18	8.70	1.50	2.71	0.57	0.54	2.22
2007	115.92	139.39	44.43	24.59	19.29	4.11	8.45	1.47	2.72	0.26	3.78
2008	143.96	98.91	89.74	33.84	14.87	14.55	4.29	8.90	1.85	4.50	5.87
2009	219.27	170.84	76.53	54.06	15.65	9.01	8.51	2.16	7.06	1.08	5.39
2010	326.44	144.79	69.54	47.94	31.17	13.79	5.07	12.01	2.31	6.20	6.31
2011	120.52	226.46	125.99	58.14	24.20	23.62	10.62	4.13	8.24	0.77	8.66
2012	178.35	118.44	149.63	79.76	26.66	16.43	11.64	5.01	2.43	6.01	6.21
2013	132.57	192.77	90.45	90.34	34.15	19.59	10.89	7.68	3.18	2.27	8.71
2014	50.41	155.22	123.19	83.28	43.05	25.39	10.79	7.30	4.67	5.22	9.32
2015	54.65	116.49	156.63	102.48	42.19	36.39	18.30	6.94	5.00	5.11	10.95
2016	214.64	111.87	68.79	89.45	38.77	23.94	16.28	11.10	4.90	4.26	9.97
2017	60.52	176.85	98.46	39.30	43.87	30.01	19.69	9.42	11.64	3.57	12.11
2018	874.12	74.48	126.99	65.00	28.97	29.95	20.64	17.09	8.40	11.11	11.22

d) United Kingdom: plaice (total numbers per km towed) Southern North Sea (4c)

Year/Age	0	1	2	3	4	5	6	7	8	9	10+
1996	6.50	14.00	4.00	0.50	0.25	0.25	0.25	0.00	0.00	0.00	0.00
1997	0.25	12.13	2.13	1.00	0.25	0.00	0.00	0.00	0.00	0.00	0.00
1998	0.75	0.25	13.25	2.25	0.50	0.00	0.00	0.00	0.00	0.00	0.00
1999	1.63	24.73	2.27	3.88	0.50	0.00	0.00	0.00	0.00	0.25	0.00
2000	13.75	25.63	4.46	0.25	2.58	0.33	0.00	0.00	0.00	0.00	0.00
2001	24.50	47.59	22.91	0.50	0.50	0.25	0.00	0.00	0.25	0.00	0.00
2002	1.07	42.67	1.87	1.07	0.00	0.00	0.27	0.00	0.00	0.00	0.00
2003	2.93	12.13	12.13	0.53	0.27	0.27	0.00	0.53	0.00	0.27	0.00
2004											
2005	0.00	14.72	9.28	0.50	0.00	0.00	0.00	0.00	0.00	0.50	0.00
2006	1.50	16.83	1.42	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2007	0.43	16.39	3.46	0.43	0.29	0.00	0.29	0.00	0.00	0.00	0.00
2008	0.25	20.60	3.56	0.50	0.00	0.25	0.25	0.00	0.00	0.00	0.00
2009	2.46	13.98	3.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2010	4.53	17.72	3.96	0.58	0.27	0.00	0.00	0.00	0.00	0.00	0.00
2011	9.14	35.41	7.67	1.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2012	0.53	9.70	8.83	1.91	0.80	0.00	0.53	0.00	0.00	0.00	0.00
2013	10.40	16.78	2.87	1.40	1.07	0.27	0.00	0.00	0.00	0.00	0.00
2014	1.14	26.77	3.69	0.36	0.79	0.29	0.00	0.00	0.00	0.00	0.00
2015	3.56	7.24	6.23	2.30	0.27	1.07	0.27	0.00	0.00	0.00	0.00
2016	1.33	10.02	6.13	5.73	0.27	0.27	0.80	0.00	0.00	0.00	0.00
2017	1.47	11.85	8.31	4.58	4.12	1.49	0.27	0.00	0.27	0.00	0.00
2018	24.60	16.96	9.99	5.94	2.77	1.60	0.53	0.00	0.00	0.00	0.00

e) United Kingdom: plaice (N.hr⁻¹/8m trawl) Eastern Channel (7d)

Year/Age	0	1	2	3	4	5	6	7	8	9	10+
1989	4.39	3.79	15.84	28.93	31.66	4.00	1.72	1.65	0.63	0.31	1.75
1990	1.30	9.24	9.39	11.13	11.73	12.59	1.53	0.96	1.23	1.02	0.63
1991	0.00	16.80	14.53	11.47	8.68	8.64	4.60	1.83	1.08	0.11	1.14
1992	0.00	22.37	21.31	6.60	6.64	7.17	5.41	3.20	0.54	0.28	0.79
1993	0.00	4.59	20.18	7.99	2.79	2.87	2.38	3.05	3.42	0.62	0.65
1994	0.20	9.35	8.54	10.07	5.95	1.98	0.61	0.97	1.73	1.78	0.80
1995	0.00	14.48	6.24	3.80	5.68	2.22	0.75	0.75	1.48	1.17	1.36
1996	24.14	22.09	17.26	1.73	1.03	2.00	1.29	0.57	0.38	0.66	4.13
1997	0.98	48.17	28.55	10.97	1.25	1.57	0.51	0.56	0.36	0.20	1.84
1998	43.19	30.59	37.93	12.06	4.98	0.63	0.60	0.65	0.32	0.30	2.03
1999	1.38	12.82	10.67	28.77	4.62	1.61	0.31	0.19	0.26	0.13	1.01
2000	1.59	19.53	30.19	18.75	20.47	4.99	1.27	0.73	0.38	0.44	2.04
2001	2.73	27.90	20.27	14.12	9.82	14.84	2.74	0.78	0.45	0.32	1.79
2002	1.31	37.86	25.86	12.51	5.46	2.62	5.28	0.98	0.20	0.17	0.90
2003	3.20	10.62	39.70	9.81	4.42	2.28	1.14	2.67	0.81	0.20	0.47
2004	15.97	52.93	22.48	20.72	4.75	1.15	0.26	0.84	1.27	0.23	0.55
2005	0.34	15.62	36.18	12.80	10.04	3.19	1.07	0.64	0.43	0.99	0.98
2006	5.58	30.06	28.85	16.80	5.94	4.27	1.31	1.08	0.59	0.33	0.94
2007	0.23	53.11	28.90	12.17	6.21	3.17	2.90	0.82	0.59	0.19	1.59
2008	0.13	39.58	40.58	10.51	4.29	3.84	1.80	0.90	0.67	0.16	0.39
2009	8.76	77.73	39.53	20.92	5.87	3.23	2.27	0.77	1.30	0.33	1.19
2010	1.36	64.24	64.70	17.74	9.15	3.12	1.72	1.27	0.18	0.35	0.99
2011	12.30	115.07	112.22	39.55	10.28	7.00	2.85	1.09	0.34	0.70	1.05
2012	0.00	24.69	81.10	55.98	18.65	4.24	3.30	1.06	0.90	0.66	0.95
2013	0.22	32.26	61.02	88.19	45.04	10.24	3.41	1.13	1.08	0.13	0.92
2014	0.52	145.33	156.47	50.67	62.13	26.75	8.95	1.96	1.82	0.92	1.20
2015	0.00	37.99	178.70	63.19	30.15	33.42	15.69	3.30	1.21	0.27	0.44
2016	3.98	12.53	101.41	102.92	37.87	21.26	23.17	11.29	2.86	0.64	0.59

2017	4.45	50.09	102.12	83.17	55.97	16.59	8.42	9.11	6.00	1.47	0.87
2018	29.91	25.58	97.02	112.24	52.41	30.30	9.33	4.97	5.47	2.72	0.67

f) United Kingdom: plaice (total numbers for 2*4m beam trawl) Western Channel (7e)

Year/Ag e	0	1	2	3	4	5	6	7	8	9	10+
1989	0	31	70	281	188	23	11	14	8	6	18
1990	0	25	38	220	87	75	2	6	1	6	7
1991	2	22	27	63	79	62	41	9	0	1	3
1992	0	152	44	72	24	40	20	17	3	5	4
1993	0	21	70	60	24	13	25	13	11	2	2
1994	0	34	32	98	30	10	2	9	13	8	2
1995	0	50	46	45	48	12	4	5	6	1	4
1996	1	33	106	30	17	25	5	1	3	7	8
1997	0	53	122	197	24	6	12	7	1	1	7
1998	0	81	125	125	85	9	6	7	4	0	3
1999	1	38	44	182	53	30	3	2	6	4	2
2000	0	47.93	62.76	125.38	178.56	38.11	22.18	1.08	2.00	0	5.00
2001	20.50	31.88	63.69	50.99	111.35	97.44	24.54	12.61	0	3.00	5.00
2002	0	138.00	101.55	86.58	23.20	23.47	39.87	5.33	2.00	0	2.00
2003	0	28.83	137.32	59.84	50.14	4.50	18.06	27.08	7.22	0	2.00
2004	0	11.00	32.50	59.84	23.00	10.00	3.00	1.00	10.00	0	4.00
2005	1.50	30.43	75.41	90.88	69.82	12.88	3.20	2.67	5.25	2.20	2.75
2006	0.00	55.00	102.40	103.05	30.39	31.19	2.67	3.80	0.00	4.50	2.00
2007	0.00	37.00	91.15	120.53	33.79	27.03	6.00	5.50	0.50	2.50	4.00
2008	0.00	14.92	145.77	67.61	30.87	12.00	7.83	9.50	3.50	1.00	4.00
2009	3.00	16.17	156.37	213.65	29.13	14.63	10.94	8.00	4.61	1.00	2.50
2010	14.00	184.25	350.81	224.27	112.75	31.05	15.05	16.50	1.00	3.33	4.00

[illegible]

g) United Kingdom: plaice (total numbers for 4m beam trawl) Bristol Channel (7f)

Year/Age	0	1	2	3	4	5	6	7	8	9	10+
1995	1.02	239.59	90.48	17.23	2.96	6.84	1.54	0.00	0.00	1.70	0.00
1996	8.10	223.69	288.11	30.78	0.99	2.62	0.80	0.00	0.00	0.00	0.00
1997	6.96	225.37	102.14	34.54	4.25	1.77	1.67	0.86	0.00	0.00	0.00
1998	4.98	237.20	126.22	46.99	8.92	2.00	0.97	0.00	0.00	0.00	0.92
1999	162.19	152.59	79.62	29.03	19.67	7.00	0.00	0.00	1.69	0.00	0.00
2000	84.73	339.63	63.17	31.25	6.56	5.50	0.00	0.89	0.00	0.00	0.00
2001	35.56	211.44	156.14	15.81	8.74	4.23	3.39	1.65	0.00	0.00	0.00
2002	0.94	136.74	175.12	80.45	5.93	6.13	2.03	3.52	0.84	0.00	0.00
2003	60.73	98.37	80.48	60.95	21.83	2.72	1.73	0.84	0.89	1.83	0.00
2004	163.87	258.51	33.41	27.08	13.42	2.19	0.96	0.96	2.48	0.00	1.94
2005	2.59	192.50	75.22	20.87	8.06	10.93	2.51	0.80	0.00	0.00	0.84
2006	80.54	85.78	101.97	34.16	9.57	1.79	9.03	0.00	2.48	0.79	0.00
2007	34.83	150.40	92.25	47.26	15.11	1.67	2.51	0.84	1.67	0.83	0.00
2008	6.27	140.69	217.04	46.79	15.70	4.82	0.82	2.49	0.00	0.00	0.84
2009	186.33	161.81	55.96	78.58	21.45	10.89	4.09	1.59	0.00	0.83	0.00
2010	143.24	331.76	88.54	26.41	39.94	6.68	4.29	0.88	0.00	0.83	1.77
2011	8.28	362.26	300.14	55.04	21.86	21.37	13.99	2.56	2.58	0.85	0.00
2012	17.28	142.13	430.79	100.57	22.36	9.02	12.53	4.94	0.83	0.00	0.00
2013	63.52	329.79	139.06	185.39	46.85	5.77	3.88	7.91	2.80	1.30	0.00
2014	0.00	371.76	202.30	64.65	105.70	23.80	1.79	2.91	1.69	1.68	1.68
2015	19.39	28.36	454.08	162.34	52.37	76.66	48.06	15.23	8.34	3.73	4.33
2016	0.00	12.52	163.10	268.26	102.30	27.50	33.05	16.22	5.97	1.02	1.30
2017	1.69	11.49	104.10	137.39	121.11	91.87	19.28	26.97	11.42	0.00	0.00
2018	87.29	4.15	45.26	90.20	58.10	75.08	58.33	18.44	10.25	3.61	4.81

h) United Kingdom: plaice (total numbers for 4m beam trawl) Irish Sea (7a)

Year/Age	0	1	2	3	4	5	6	7	8	9	10+
1995	210.8 2	1018.3 9	307.43	142.05	66.34	12.63	13.95	0	0.84	2.4	6.67
1996	82.96	1349.9 2	476.84	98.11	58.74	38.86	7.47	8.6	0.88	1.72	6.66
1997	24.72	1081.3 3	529.88	255.42	51.5	39.5	17.98	6.54	5.87	0	5.34
1998	134.3 9	926.42	608.71	168.31	75.55	27.03	17.95	10.95	2.3	0.76	5.42
1999	142.9 2	943.45	765.83	273.12	89.33	30.34	13.34	5.76	5.7	3.4	0
2000	104.9	1676.4 1	523.23	236.12	111.8 6	57.83	17.43	5.33	2.74	2.55	4.19
2001	197.9 9	1165.3 8	526.08	172.91	103.5	70.93	22.21	8.32	5.53	4.55	3.19
2002	12.68	1376.5	1281.6 8	513.25	192.9 7	62.48	40.13	12.61	13.42	4.1	5.23
2003	204.9 2	1174.7 7	1461.8 5	656.39	234.7 6	96.68	49.19	31.07	7.79	3.3	3.45
2004	172.8 4	1440.8 9	942.24	939.96	320.4 8	207.1 7	45.47	45.5	10.93	2.95	2.63
2005	235.7 7	710.26	1058.7 2	544.84	407.7 8	242.6 1	90.74	14.09	13.79	7.18	8.7
2006	384.7 5	888.82	666.27	572.61	326.3 6	140.6 1	65.48	46.43	12.83	11.52	4.75
2007	147.4 6	2116.2 5	996.39	416.47	331.1 7	155.3 4	75.26	35.76	29.36	5.04	7.56
2008	359.3 5	1057.5 2	1553.7 2	506.4	277.5 9	199.1 7	62	44.94	26.82	3.71	0
2009	119.2 2	1158.7 9	859.37	971.88	246.1 1	149.9	198.3 9	51.77	24.63	16.09	10.41
2010	400.6 1	1446.7 8	1121.3 5	531.83	400.5 7	145.9 9	123.2 1	77.64	47.71	20.04	17.49
2011	186.4 3	1772.7 9	1177.0 6	528.14	265.0 8	310.0 5	111.8 9	98.74	71.49	50.12	52.38
2012	278.2 2	1540.8	1463.8 4	524.32	247.2 3	125.0 7	115.3 2	98.29	57.25	70.32	56.09
2013	542.3 8	1185.1 5	1318.8	771.94	460.0 5	298.4 1	119.9	128.1 4	65.36	71.58	51.99

2014	100.7 7	2192.8 2	1737.5 5	731.08	601.9 7	262.6 5	203.5 6	151.5 9	62.76	23.12	60.88
2015	67.48	893.81	2058.3 2	574.21	440.0 6	273.1	209.2 9	94.12	56.2	48.02	95.38
2016	49.89	446.83	1412.7 1	1047.3 8	646.1 7	400.9 3	219.7 2	239.9 1	127.2 8	61.49	103.4 6
2017	9.99	316.11	1279.3 5	664.51	654.8 7	480.5 2	226.9 1	205.2 2	108.8 1	86.63	133.6 5
2018	124.4 5	496.06	736.24	591.53	350.9 2	442.6 7	384.3 4	246.4 9	172.9 4	115.1 1	209.8 2

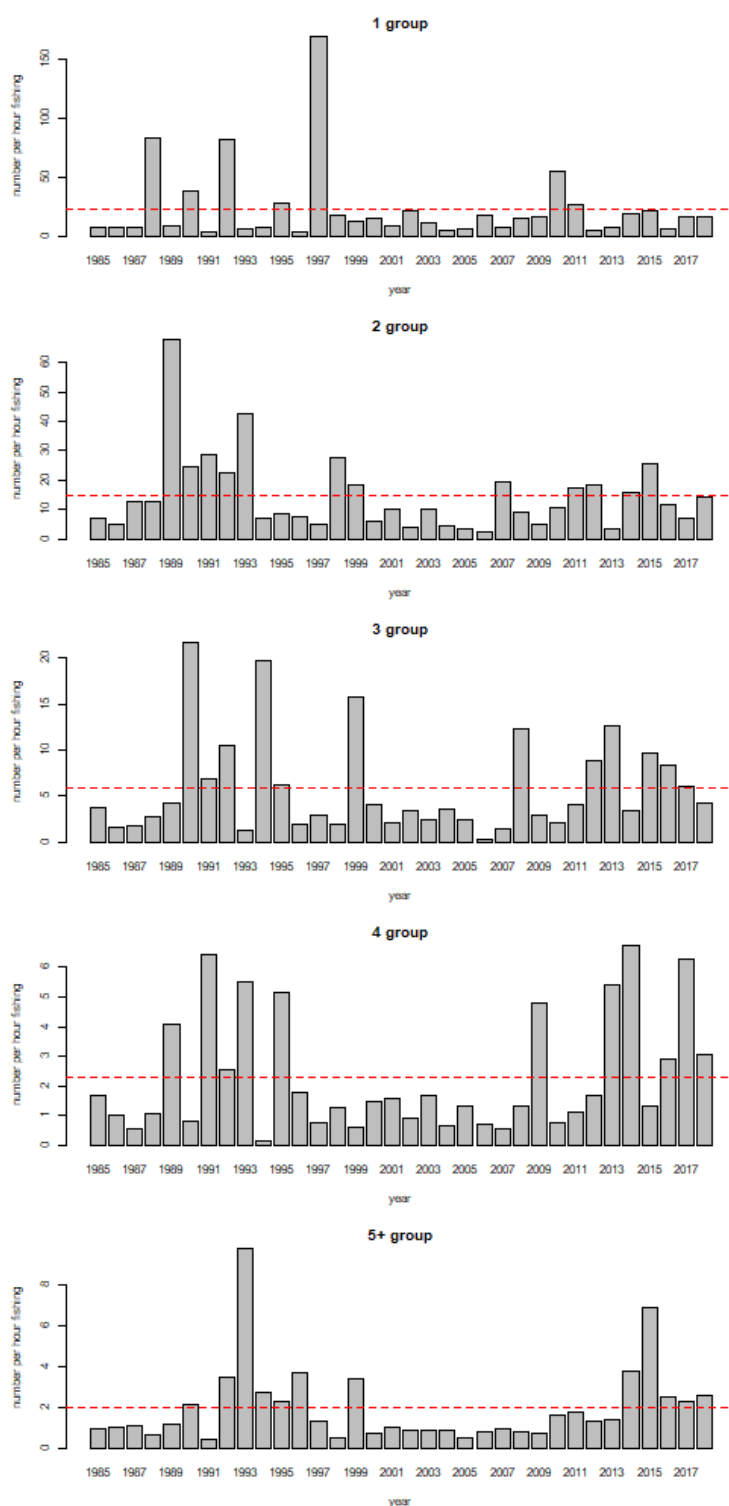
i) Iceland: plaice (N.hr⁻¹/4m trawl)

Year/Age	0	1	2	3	4	5	6	7	8	9	10+
2016	1.55	28.36	30.94	29.91	30.94	11.86	7.73	3.09	3.09	3.09	7.74
2017	0.00	2.77	8.04	9.43	14.83	13.58	10.26	7.20	2.77	2.21	3.87
2018	0.10	2.27	5.68	12.49	10.53	7.33	8.87	6.09	5.06	2.06	4.23

j) Italy-Slovenia-Croatia: sole (Num./Km²)

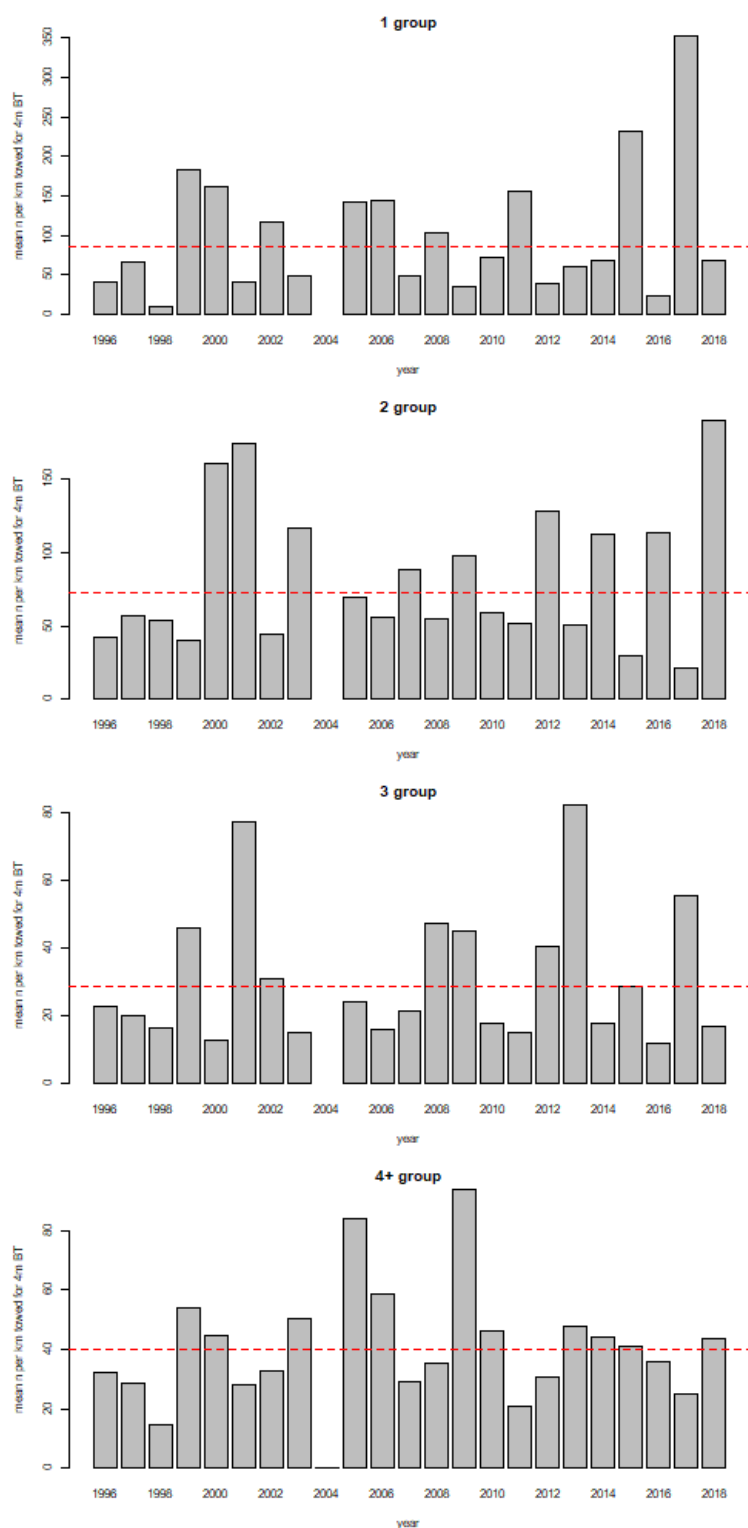
Year/Age	0	1	2	3	4+
2005	133.178	95.727	40.556	8.894	3.386
2006	74.357	195.404	44.465	5.134	0.41
2007	143.921	137.693	74.958	18.054	1.995
2008	51.169	103.147	57.484	10.622	5.419
2009	116.588	79.42	47.98	5.451	1.541
2010	44.636	194.164	22.628	4.902	2.821
2011	157.307	166.875	35.514	4.67	1.324
2012	120.604	236.069	74.73	6.257	0.33
2013	360.036	290.53	68.726	7.429	0.1
2014	213.865	581.102	111.551	6.825	3.858
2015	227	242.672	122.987	12.773	2.764
2016	72.687	394.534	95.479	33.548	4.472
2017	73.682	239.979	168.524	55.135	7.95
2018	151.92	473.818	123.932	7.74	3.6

Annex 5.3: Figures of catch rate of sole. Offshore surveys



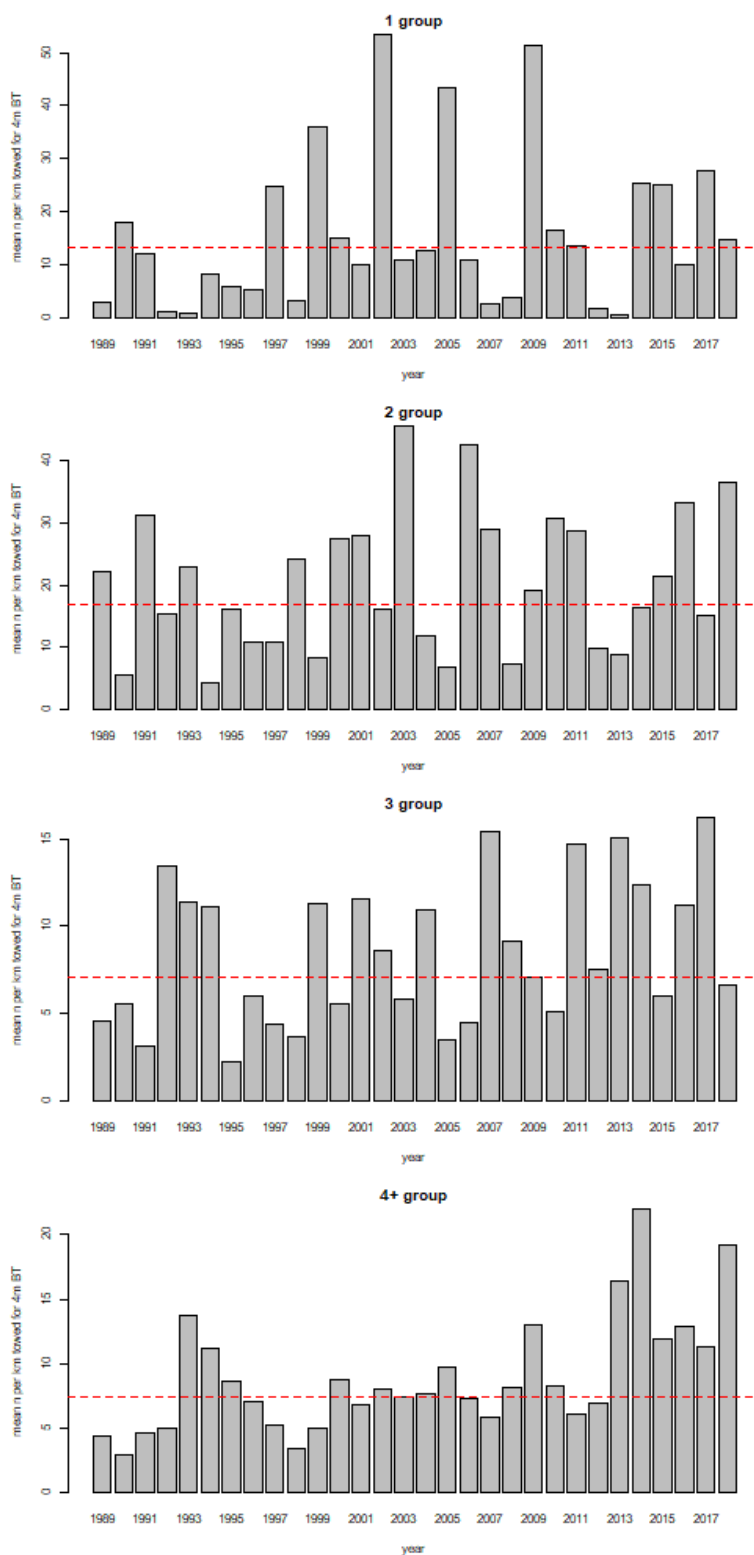
a) Netherlands: sole (N.hr⁻¹/8m trawl) North Sea (4) BTS-I. (Horizontal line=long-term mean for the period presented)

Figure 5.1.1.1. Catch rate of sole, offshore surveys. Horizontal line displays the long-term mean for the period presented.



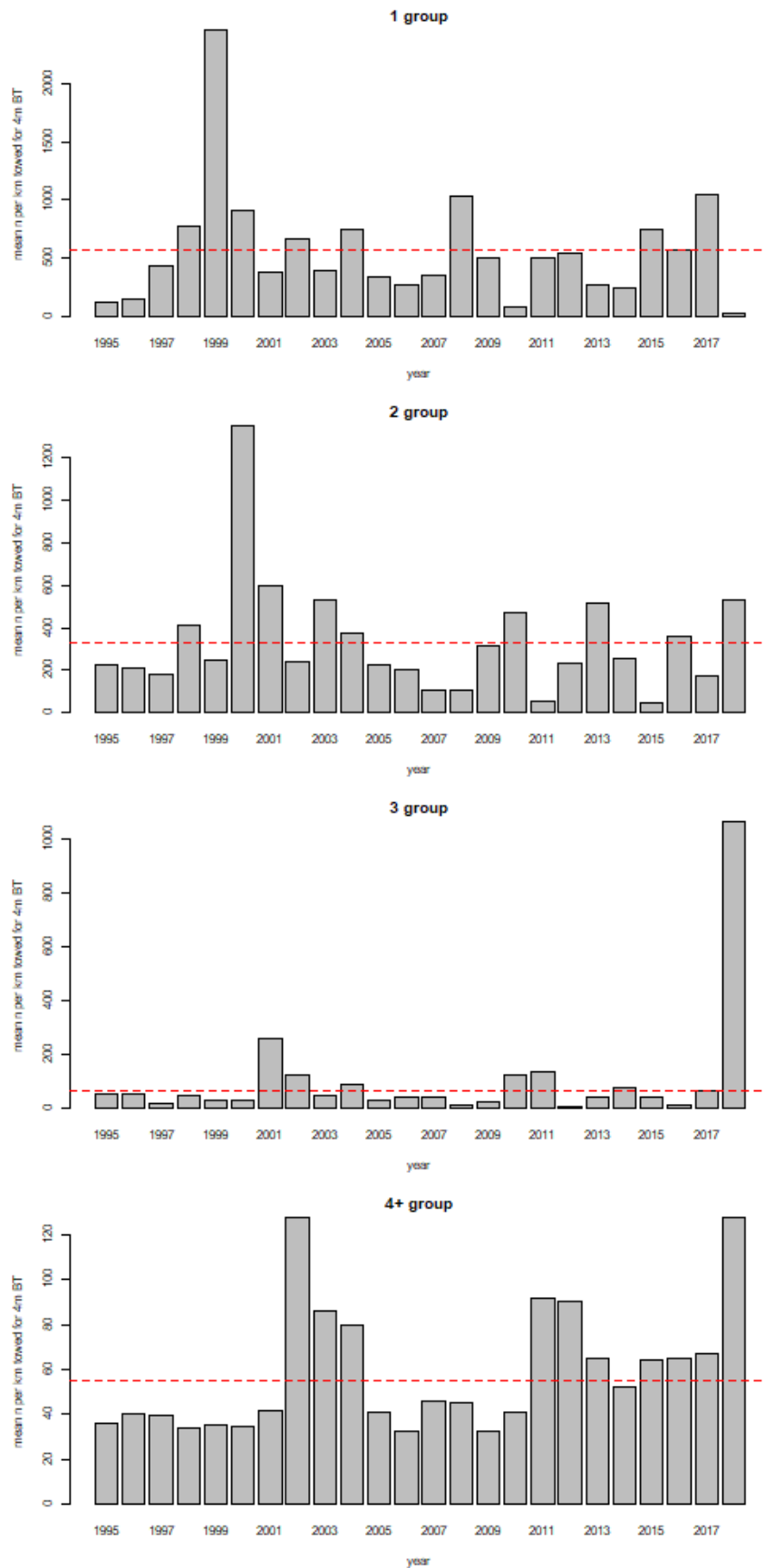
b) UK: sole (mean numbers per km towed for 4m beam trawl) Southern North Sea (4c)

Figure 5.1.1.1. Continued.



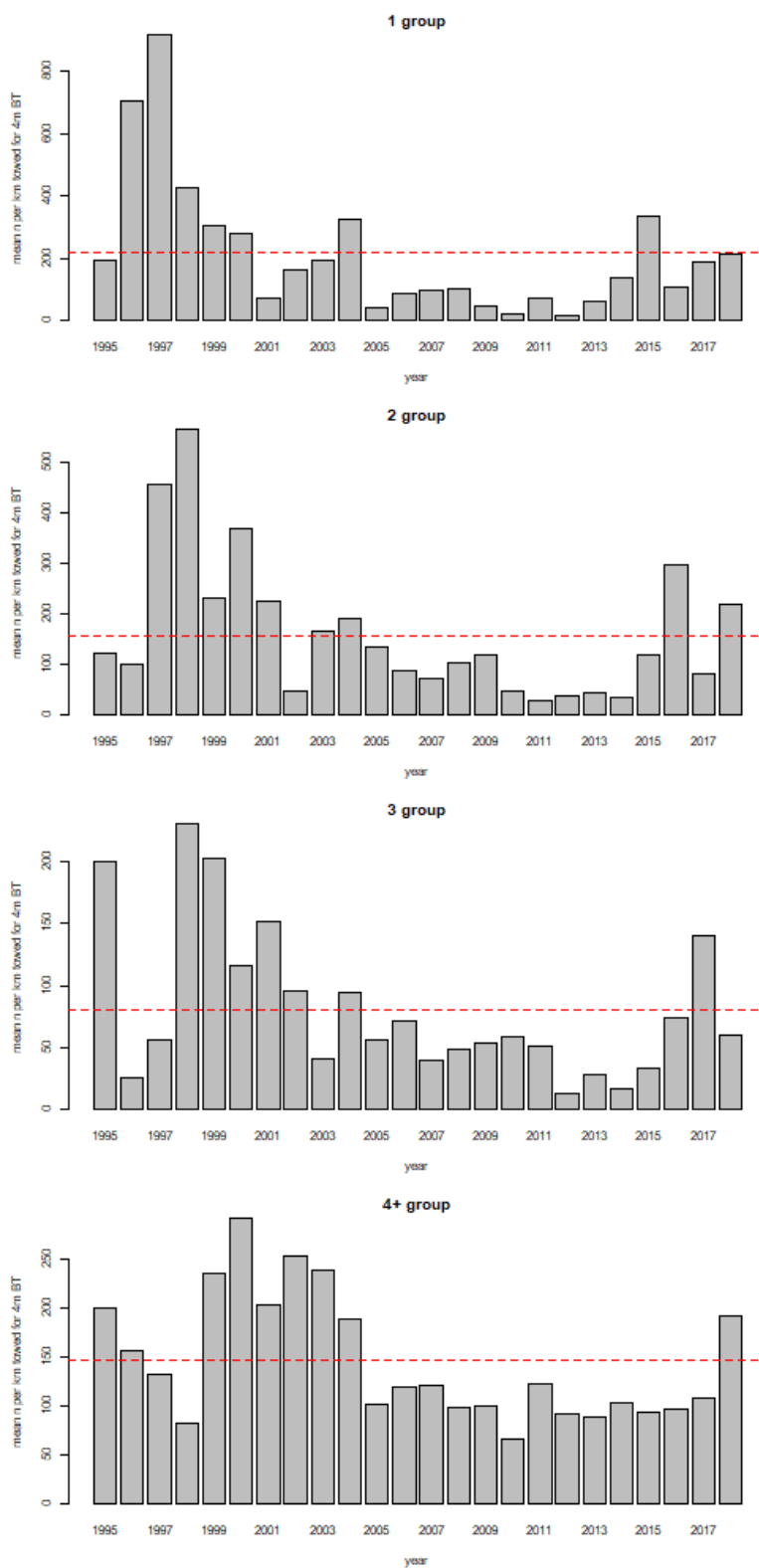
c) UK: sole (mean numbers per km for 4m beam trawl) Eastern English Channel (7d)

Figure 5.1.1.1. Continued.



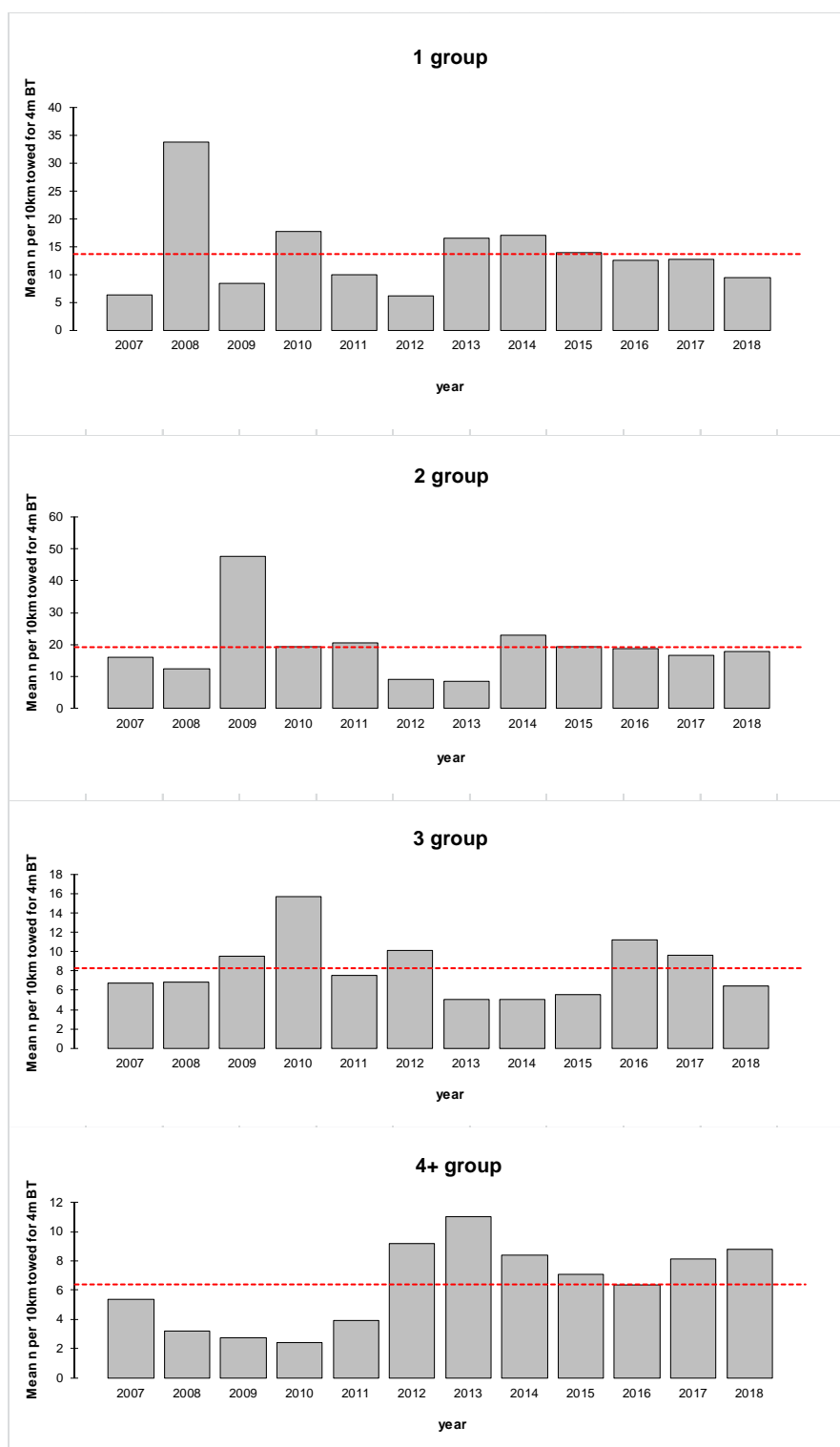
d) UK: sole (mean numbers per km towed for 4m beam trawl) Bristol Channel (7f)

Figure 5.1.1.1. Continued.



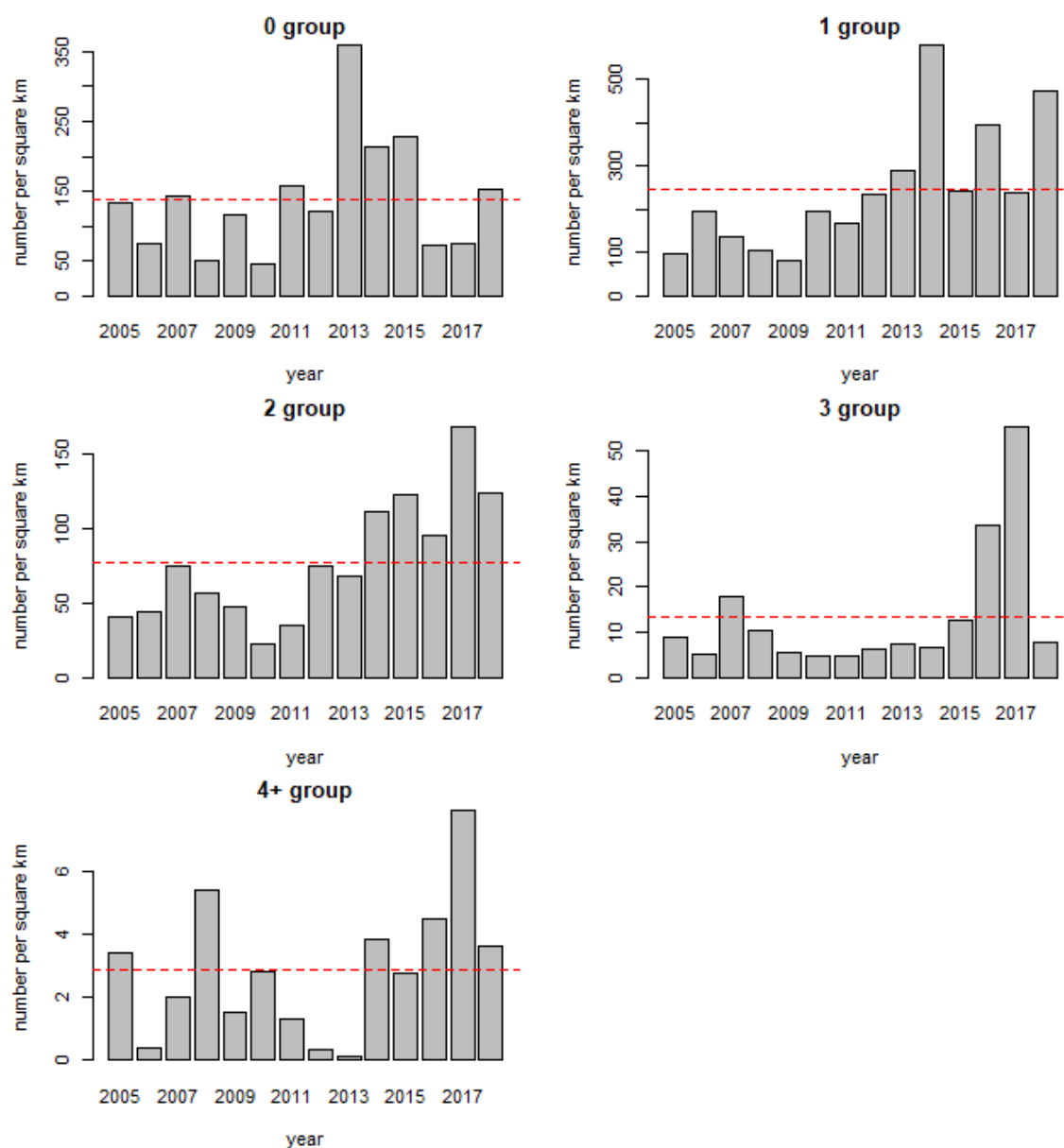
e) UK: sole (mean numbers per km towed for 4m beam trawl) Eastern Irish Sea (7a)

Figure 5.1.1.1. Continued.



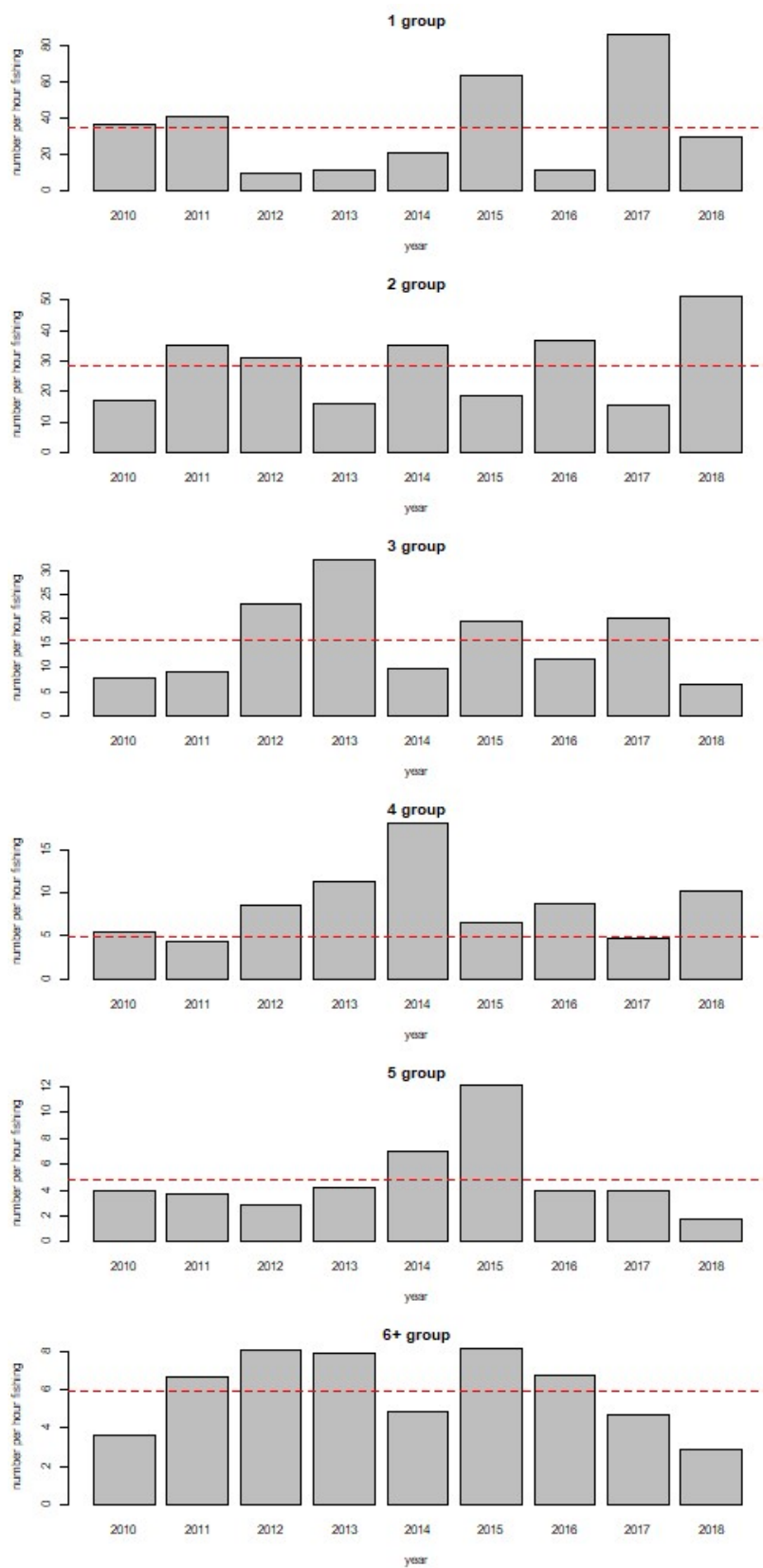
- f) France: Catch rate of sole from French survey in the Bay of Biscay. (mean numbers per 10km towed for 4m beam trawl; Horizontal line=long-term mean for the period presented).

Figure 5.1.1.1. Continued.



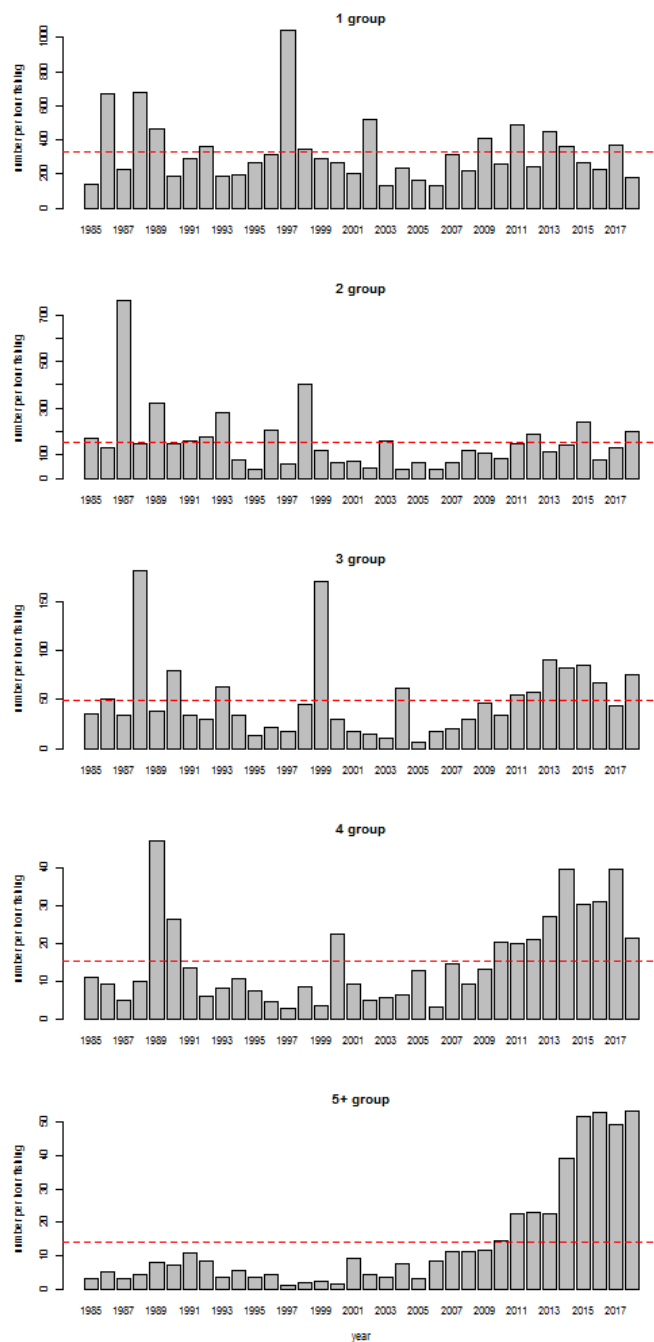
- g) Italy-Slovenia-Croatia: Catch rate of sole from the Adriatic beam trawl survey. (horizontal line = long-term mean for the period presented; Croatian hauls are available only from 2016).

Figure 5.1.1.1. Continued.



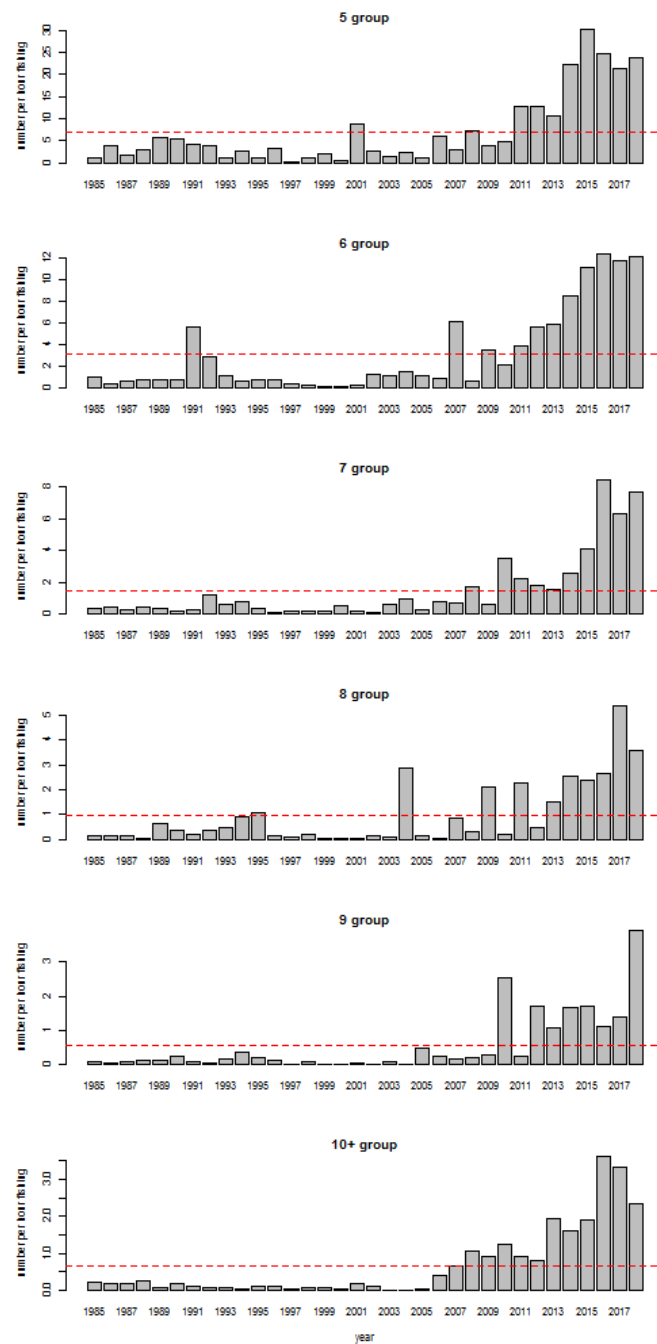
h) BEL: sole (number per hour fishing) BEL BTS.

Annex 5.4: Figures of catch rate of plaice, offshore surveys



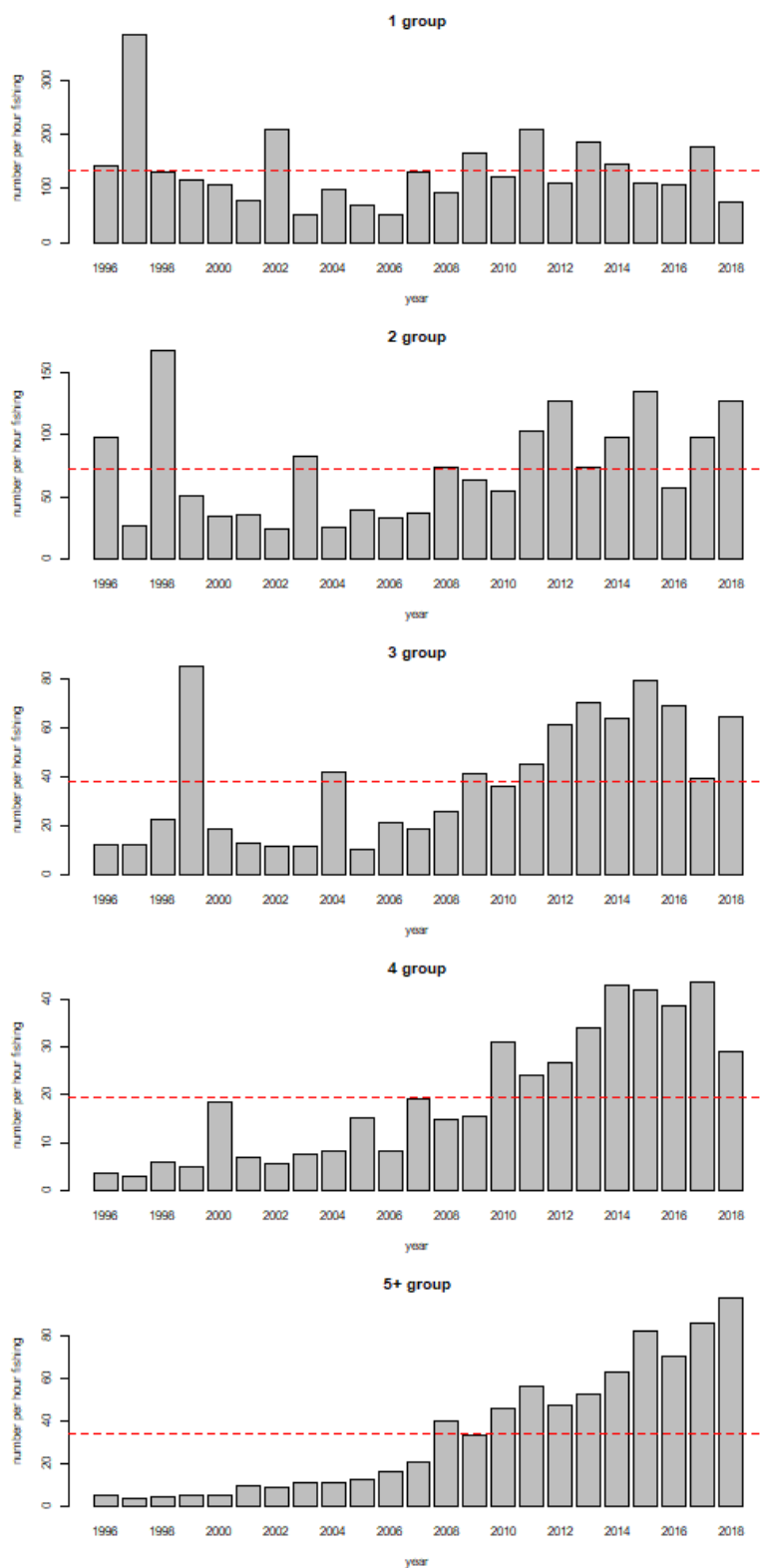
- a) Netherlands: plaice ($N \cdot hr^{-1/8m}$ trawl) North Sea (4) BTS-I. (Horizontal line=long-term mean for the period presented).

Figure 5.1.1.2. Catch rate of plaice, offshore surveys. Horizontal line displays the long-term mean for the period presented.



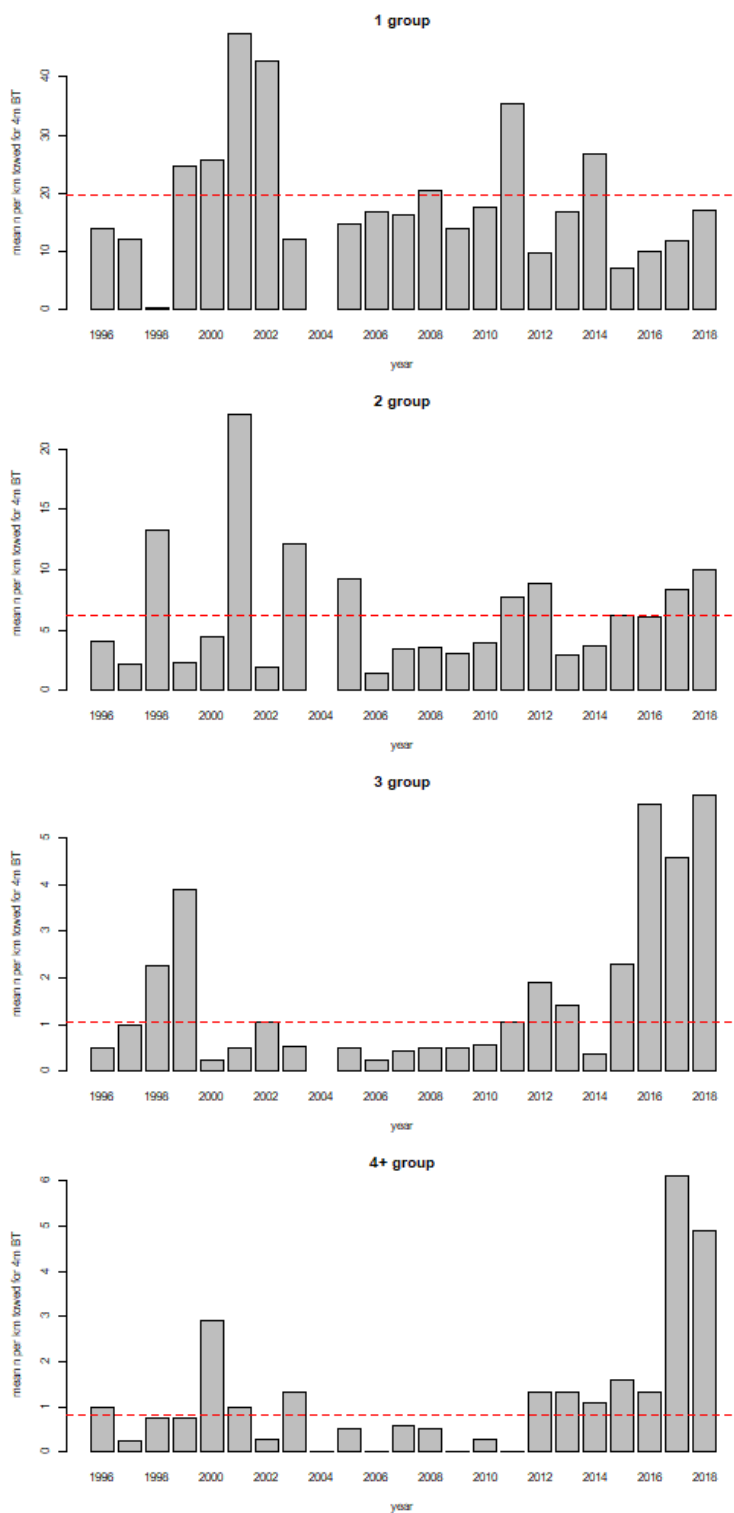
b) Netherlands: plaice (N.hr⁻¹/8m trawl) North Sea (4) BTS-II

Figure 5.1.1.2. Continued.



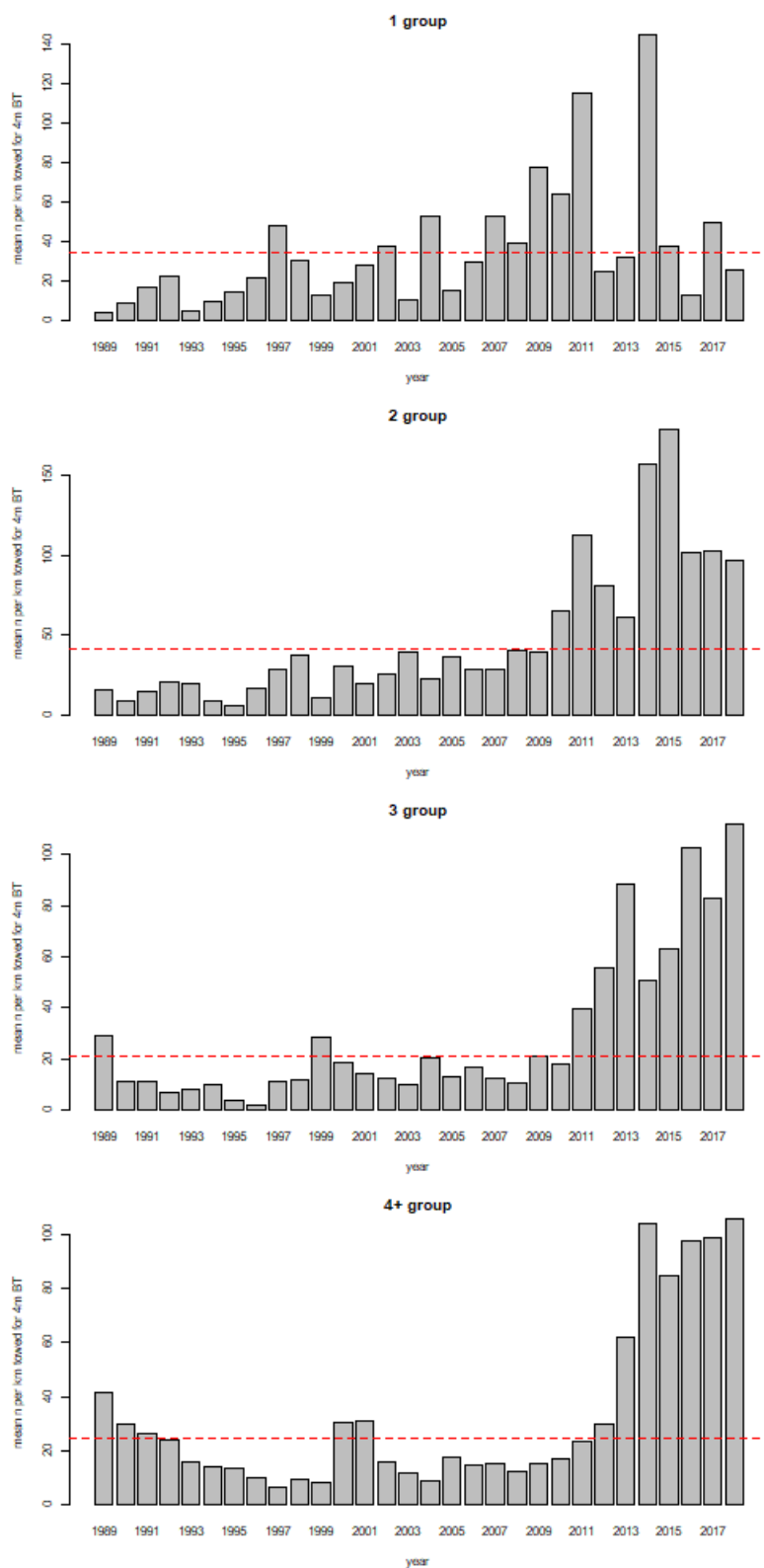
c) Netherlands: plaice ($N \cdot hr^{-1/8m}$ trawl) North Sea (4) combined index BTS-I and BTS-II

Figure 5.1.1.2. Continued.



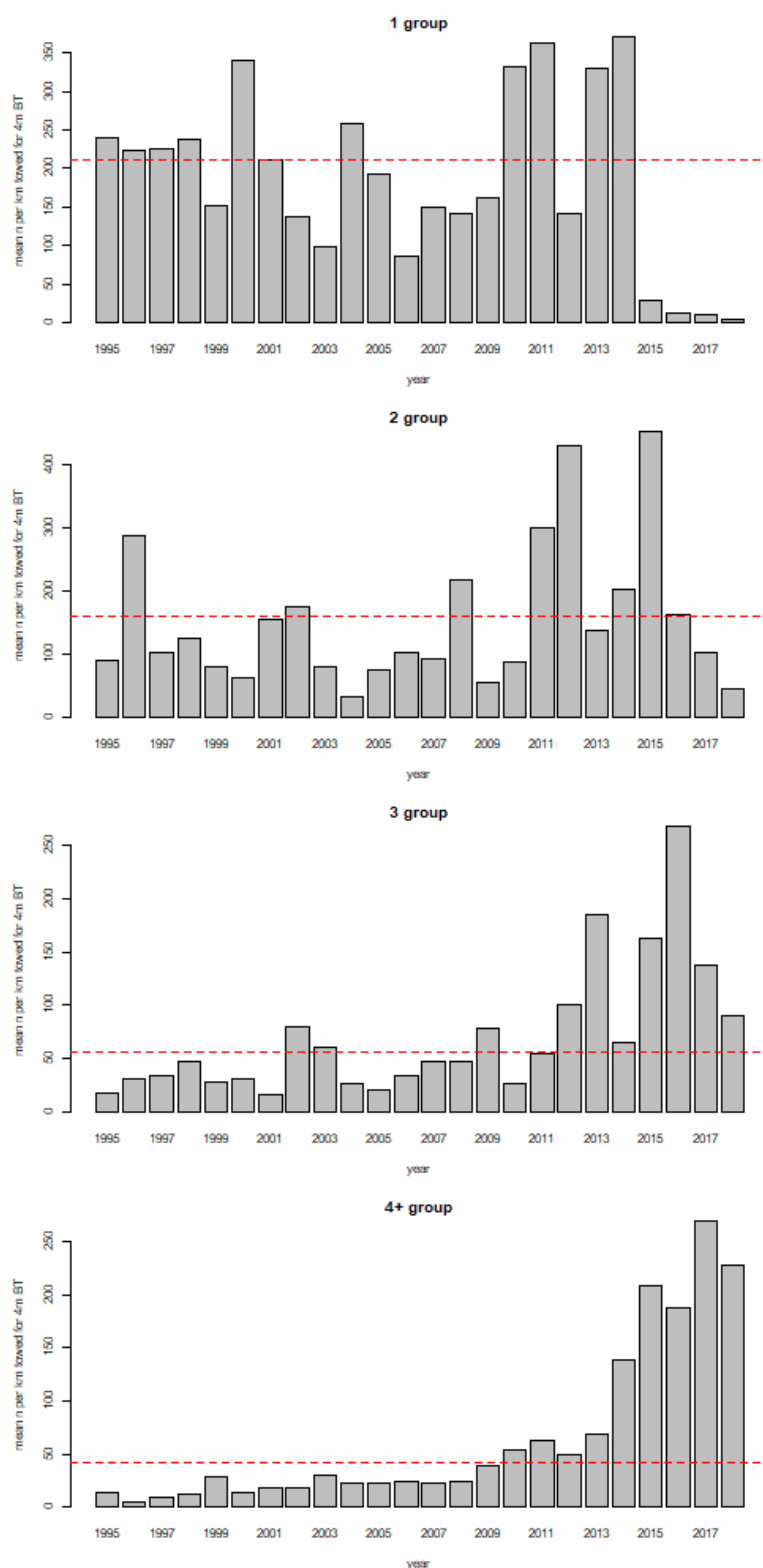
d) UK: plaice (mean numbers per km towed for 4m beam trawl) Southern North Sea (4c)

Figure 5.1.1.2. Continued.



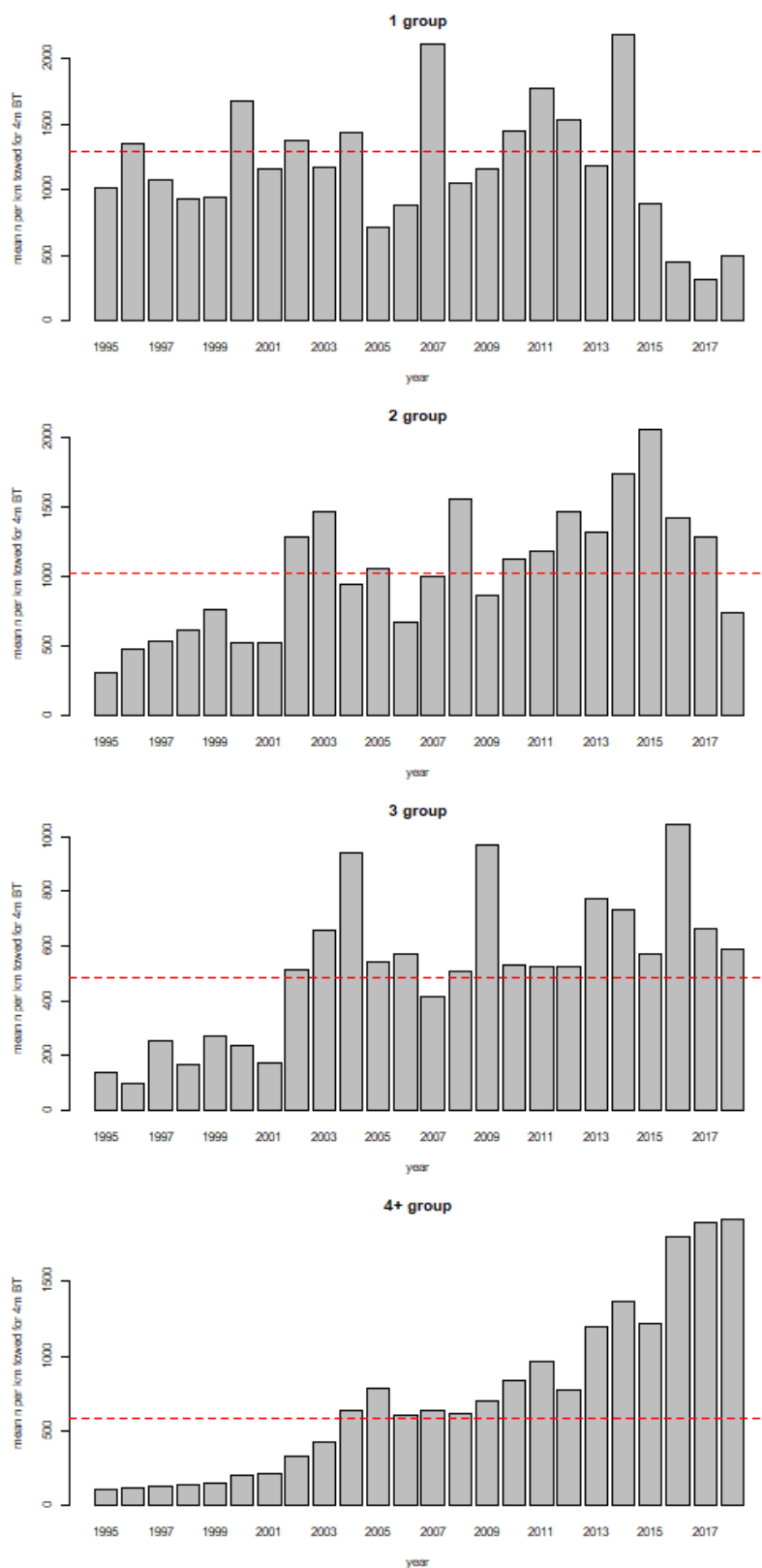
e) UK: plaice ($N \cdot hr^{-1/8m}$ beam trawl) Eastern English Channel (7d)

Figure 5.1.1.2. Continued.



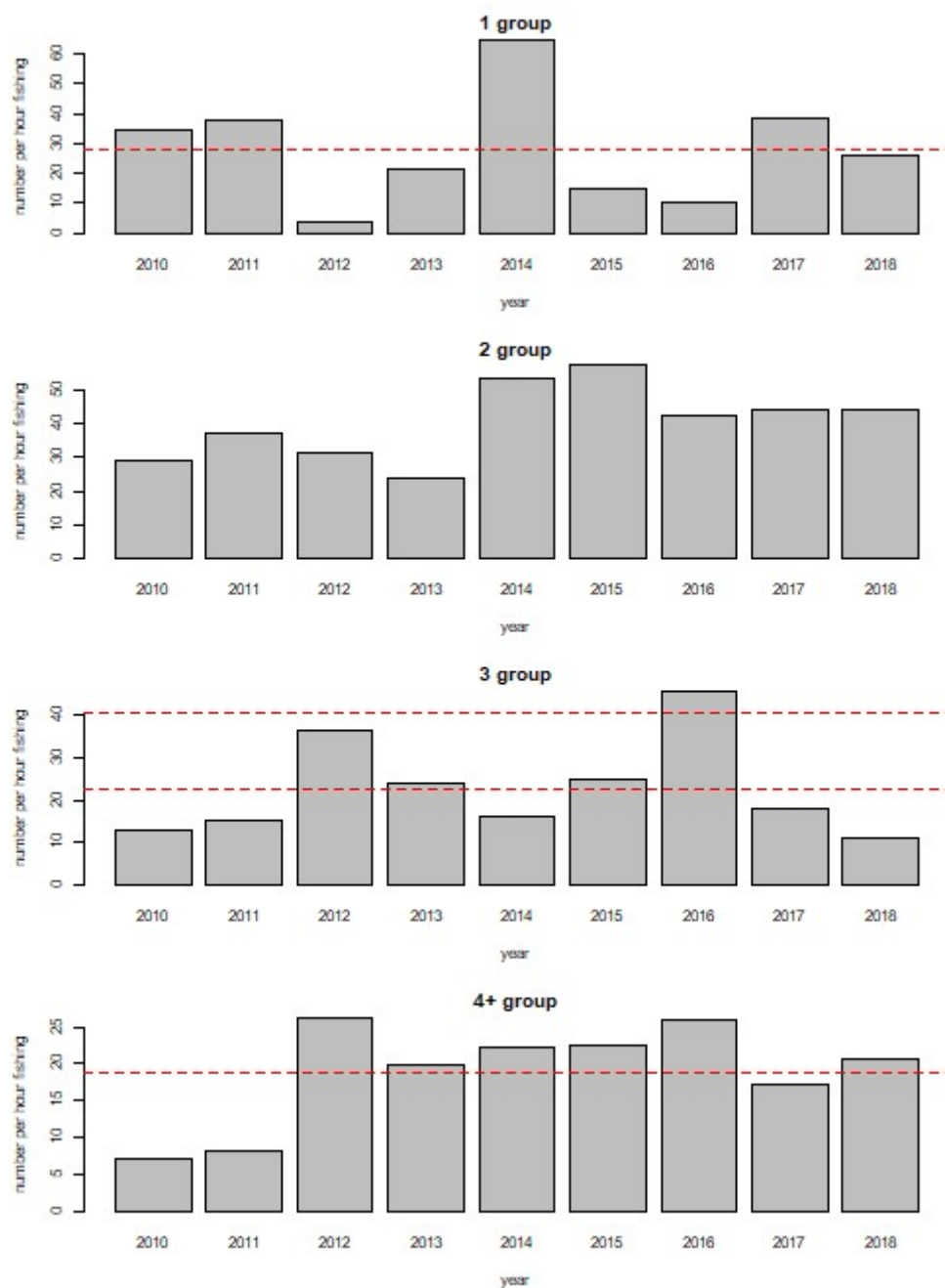
f) UK: plaice (mean numbers per km towed for 4m beam trawl) Bristol Channel (7f)

Figure 5.1.1.2. Continued.



g) UK: plaice (mean numbers per km towed for 4m beam trawl) Eastern Irish Sea (7a)

Figure 5.1.1.2. Continued.



h) BEL: plaice (number per hour fishing) BEL BTS.

Annex 6: Population abundance indices for sole and plaice, inshore surveys

Annex 6.1: Indices from the D(Y)FS inshore beam trawl surveys

a) Plaice abundance indices in numbers per 1000 m² (national) or numbers*10⁶ (combined)

	Plaice, age 0				Plaice, age 1		
	nl	be	de	combined	nl	be	combined
Raising	11.007	1.472	1.919		11.007	1.472	
Gear correction	1	1.22	1.22		1	1	
1990	34.515	2.482	23.590	439.593	5.518	1.256	62.588
1991	25.489	1.155	21.240	332.358	4.633	0.170	51.251
1992	15.326	0.315	4.720	180.310	4.066	0.182	45.020
1993	18.860	0.198	3.860	216.990	2.362	0.121	26.178
1994	23.898	1.306	7.710	283.438	0.636	0.292	7.432
1995	10.623	2.623	10.440	146.076	0.789	0.724	9.749
1996	45.345	12.648	41.770	619.615	0.426	0.198	4.985
1997	16.584	4.273	16.670	229.243	3.729	3.448	46.119
1998	*	2.763	8.110	*	*	1.543	*
1999	*	1.136	2.940	*	*	1.624	*
2000	8.953	1.290	10.280	124.926	0.162	0.949	3.185
2001	22.353	1.572	27.470	313.175	0.136	0.630	2.422
2002	10.013	5.609	1.120	122.907	0.088	4.685	7.861
2003	19.197	3.224	9.200	238.626	0.257	1.210	4.607
2004	9.787	4.463	4.700	126.738	0.592	1.999	9.455
2005	6.589	3.942	2.680	85.880	0.155	0.264	2.100
2006	14.230	1.117	3.997	167.988	0.143	0.690	2.585
2007	7.074	4.298	5.410	98.253	0.129	0.236	1.770
2008	10.691	3.796	2.230	129.710	0.067	0.657	1.708
2009	9.757	7.402	9.050	141.870	0.138	0.311	1.981
2010	12.807	1.182	15.600	179.615	0.073	0.501	1.537
2011	6.897	2.182	5.610	92.963	0.329	2.778	7.713
2012	15.191	3.057	3.600	181.122	0.111	1.691	3.713
2013	12.37	5.716	9.423	168.48	0.267	0.745	4.03
2014	8.454	3.822	3.450	107.99	0.207	1.372	4.29
2015	8.124	1.504	3.435	100.162	0.206	1.560	4.559
2016	6.444	2.147	1.395	78.052	0.194	0.890	3.447
2017	10.877	1.696	1.893	127.198	0.156	0.780	2.867
2018	18.214	6.137	3.344	219.34	0.082	0.162	1.137

* No valid survey

b) Sole abundance indices in numbers per 1000 m² (national) or numbers*10⁶ (combined)

	Sole, age 0				Sole, age 1		
	nl	be	de	combined	nl	be	combined
Raising	11.007	1.472	1.919		11.007	1.472	
Gear correction	1	1.59	1.59		1	1.9	
1990	0.440	0.356	0.230	6.381	0.119	0.045	1.435
1991	14.521	2.168	0.870	167.563	0.015	0.005	0.184
1992	0.755	0.160	0.190	9.266	0.344	0.350	4.771
1993	1.263	0.450	0.120	15.324	0.024	0.024	0.335
1994	1.817	0.687	0.150	22.063	0.015	0.106	0.457
1995	0.284	1.568	0.090	7.065	0.075	0.084	1.065
1996	2.454	4.949	0.550	40.272	0.013	0.418	1.306
1997	2.141	1.400	0.030	26.940	0.248	0.804	4.981
1998	*	3.476	0.180	*	*	2.336	*
1999	*	2.310	0.100	*	*	0.506	*
2000	0.716	0.535	0.120	9.504	0.036	0.086	0.636
2001	2.648	9.452	0.050	51.424	0.032	0.687	2.269
2002	2.426	13.386	0.180	58.583	0.087	4.060	12.307
2003	0.618	1.498	0.100	10.609	0.087	0.479	2.298
2004	0.589	10.516	0.050	31.252	0.030	2.235	6.585
2005	2.245	5.665	0.990	40.987	0.032	1.240	3.819
2006	1.037	0.341	0.115	12.567	0.126	2.297	7.813
2007	0.863	1.739	0.050	13.727	0.013	0.226	0.776
2008	0.970	0.434	0.024	11.768	0.011	0.059	0.292
2009	1.224	5.519	0.310	27.332	0.035	1.873	5.620
2010	2.245	7.724	0.024	42.862	0.059	1.439	4.673
2011	0.981	0.477	0.070	12.130	0.143	0.900	4.088
2012	0.915	0.428	0.050	11.226	0.012	0.269	0.880
2013	3.458	1.944	0.724	44.819	0.036	0.528	1.868
2014	1.980	0.686	0.070	23.616	0.094	0.532	2.522
2015	0.564	0.461	0.054	7.448	0.025	0.222	0.893
2016	0.878	1.110	0.005	12.276	0.081	0.356	1.888
2017	1.359	2.410	0.121	20.965	0.037	0.097	0.681
2018	4.819	1.477	0.083	56.748	0.075	0.310	1.693

* No valid survey

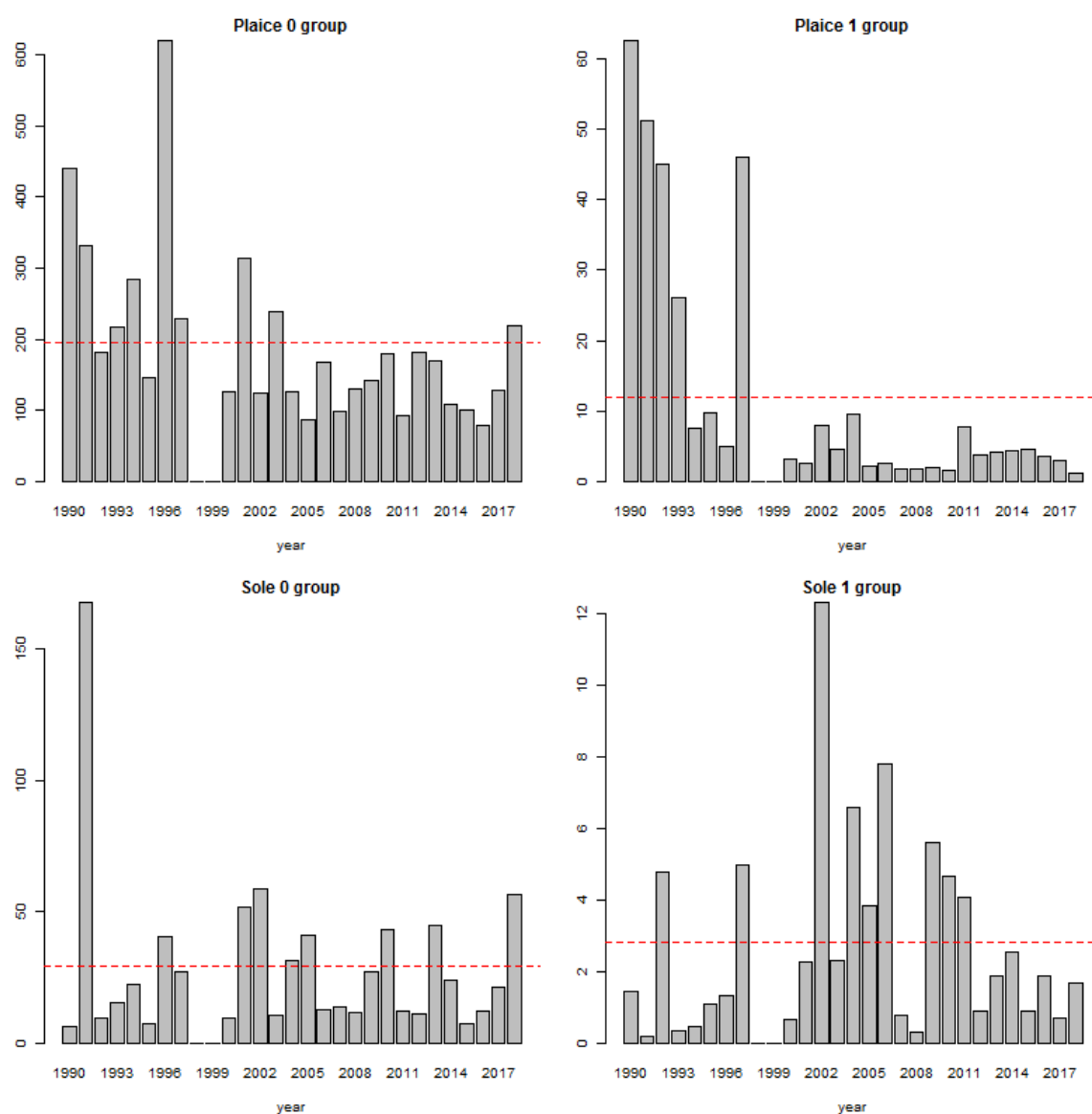


Figure 5.1.2.1. Combined inshore indices for 0- and 1-group plaice and sole. The horizontal line is the long-term mean for the period presented. The indices were declared to be invalid in 1998 and 1999, due to insufficient coverage of the Dutch survey area and are not displayed.

Annex 6.2: Indices from SNS inshore beam trawl survey

a) Plaice abundance indices in numbers per 100 hours fished

Plaice	age group			
	1	2	3	4
1970	9311.368	9731.527	3272.977	769.727
1971	13538.483	28163.543	1414.688	100.825
1972	13206.903	10779.712	4477.829	89.111
1973	65642.504	5133.332	1578.221	461.359
1974	15366.398	16508.939	1128.838	160.004
1975	11628.230	8168.365	9556.302	65.238
1976	8536.534	2402.627	868.236	236.317
1977	18536.699	3423.843	1737.311	589.947
1978	14011.969	12678.032	345.465	134.778
1979	21495.430	9828.822	1574.911	161.222
1980	59174.156	12882.339	490.655	180.434
1981	24756.155	18785.306	834.420	38.321
1982	69993.328	8642.029	1261.036	87.857
1983	33974.181	13908.624	249.374	70.965
1984	44964.544	10412.798	2466.902	41.667
1985	28100.547	13847.837	1597.696	328.037
1986	93551.910	7580.403	1152.144	144.873
1987	33402.438	32991.107	1226.651	199.582
1988	36608.576	14421.140	13153.247	1350.132
1989	34276.253	17810.152	4372.837	7126.431
1990	25036.611	7496.000	3160.028	816.139
1991	57221.278	11247.222	1517.833	1076.833
1992	46798.224	13841.786	2267.598	612.976
1993	22098.315	9685.589	1006.278	97.778
1994	19188.431	4976.550	855.907	75.944
1995	24766.964	2796.381	381.327	96.994
1996	23015.391	10268.227	1185.155	44.714
1997	95900.889	4472.700	496.633	31.667
1998	33665.689	30242.247	5013.857	49.667
1999	32951.262	10272.083	13783.060	1058.214
2000	22855.018	2493.389	891.444	982.556
2001	11510.524	2898.476	370.167	175.833
2002	30809.227	1102.715	264.641	65.242
2003	*	*	*	*
2004	18201.602	1349.703	1080.686	50.778
2005	10118.405	1818.912	141.881	365.524
2006	12164.222	1570.978	384.722	52.444
2007	14174.543	2133.911	139.537	51.852
2008	14705.767	2700.438	464.129	178.500
2009	14860.033	2018.683	492.452	38.333
2010	11946.907	1811.517	529.338	55.476
2011	18348.596	1142.515	308.193	74.696
2012	5893.440	2928.552	681.524	82.000
2013	15394.878	3021.319	1638.492	427.603
2014	17312.696	2258.336	513.847	457.944
2015	16726.486	5040.444	1881.944	477.611
2016	10384.821	2434.271	1086.255	521.600

2017	15935.908	1715.479	1211.712	534.073
2018	9464.911	5250.011	993.133	533.000

* No survey

b) Sole abundance indices in numbers per 100 hour fishing

Sole	age group			
	1	2	3	4
1970	5410.280	734.377	237.695	35.444
1971	902.697	1831.076	113.370	2.857
1972	1454.685	272.270	148.553	0.000
1973	5587.152	935.259	83.810	37.303
1974	2347.930	361.429	65.159	0.000
1975	525.425	864.480	176.960	17.500
1976	1399.429	73.556	229.111	26.667
1977	3742.944	776.101	103.838	43.091
1978	1547.714	1354.661	294.069	28.000
1979	93.778	408.273	300.838	76.889
1980	4312.889	88.889	109.333	61.333
1981	3737.200	1413.052	49.970	20.000
1982	5856.463	1146.204	227.778	6.667
1983	2621.143	1123.325	120.579	39.857
1984	2493.111	1099.911	318.322	74.433
1985	3619.435	715.602	167.074	49.333
1986	3705.063	457.607	69.235	31.429
1987	1947.852	943.704	64.815	21.333
1988	11226.667	593.833	281.611	81.533
1989	2830.744	5004.997	207.558	53.131
1990	2856.167	1119.500	914.250	100.444
1991	1253.620	2529.104	513.839	623.854
1992	11114.014	144.405	360.410	194.857
1993	1290.778	3419.571	153.778	212.778
1994	651.778	498.251	934.097	10.222
1995	1362.100	223.672	142.848	411.134
1996	218.359	349.085	29.600	35.533
1997	10279.333	153.630	189.819	26.470
1998	4094.611	3126.374	141.713	98.730
1999	1648.854	971.782	455.612	10.000
2000	1639.173	125.883	166.278	118.000
2001	970.310	655.357	106.667	35.476
2002	7547.460	379.044	195.300	0.000
2003	*	*	*	*
2004	1369.505	624.376	393.032	68.889
2005	568.083	162.917	124.000	0.000
2006	2726.417	117.083	25.000	30.000
2007	848.642	910.988	33.333	39.506
2008	1259.119	258.548	325.333	0.000
2009	1931.598	344.354	61.667	102.667
2010	2636.933	237.131	67.114	42.202
2011	1247.967	883.867	211.333	111.833
2012	226.576	159.476	54.000	18.000
2013	967.400	426.616	490.472	179.267
2014	2849.000	448.190	44.786	60.000
2015	3192.000	2333.889	137.833	159.944

2016	733.750	623.320	494.632	109.770
2017	956.704	204.269	209.604	209.688
2018	1002.330	482.406	163.095	94.062

* No survey

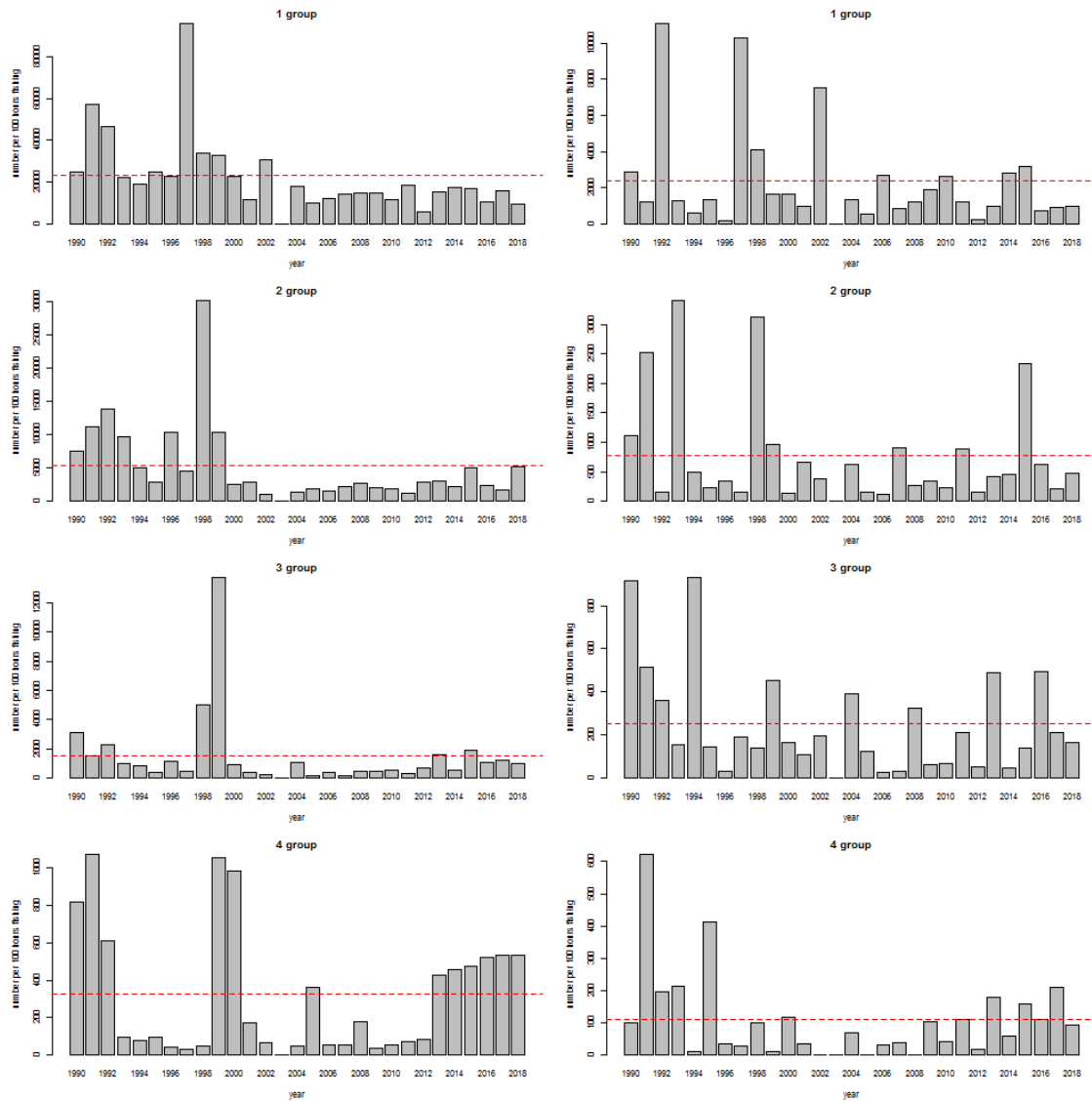


Figure 5.1.2.2. SNS indices for 1 – 4-group plaice (left) and sole (right), in numbers per 100 hours fishing. The horizontal line is the long-term mean for the period presented.

Annex 7: Surveys summary sheet

Survey, country	Area coverage	Running since	Methodology described in	Information to assessment WG	Data availability	Comments on 2018 survey	Data collected
Beam Trawl Survey (BTS), Belgium	South-western North Sea	1992	WGBEAM beam trawl survey manual (update in progress)	WGNSSK: Pleuronectes platessa (ple.27.420), indices by age group, age 1-10+ WGEF: elasmobranch species, CPUE per species per haul	Unaggregated data: datras.ices.dk Density plots per species: http://ecosystemdata.ices.dk/map/	The Belgian BTS was carried out from 27 Aug to 7 Sept 2018 with RV Belgica. The weather conditions were favourable to carry out all fishing activities during the planned two weeks of the campaign. There were some minor technical problems, but these did not cause substantial delays or a loss of stations. 57 out of 62 stations were completed successfully. Stations 81 and 36 had to be skipped due to lack of time, because the maximum speed during transits was substantially lower than in the previous years. Due to the presence of passive fishing gear (crab pots or nets) on the fishing track, stations 20 and 87 had to be cancelled and due to net damage station 60 was lost. There was no time to redo these stations within the time period of the campaign. This year the number of otoliths collected for sole and plaice reduced from 3 to 2 per cm size class per ICES Statistical Rectangle. For cod, brill and turbot it remained 3 like the year before.	Fish species: all species Fish length: all species, elasmobranch by sex Fish weight: sample weight per species, elasmobranch by sex Fish biological data: individual weight, length, sex, yearclass for plaice, sole, cod, turbot, brill, dab and lemon sole. Maturity data for summer spawner lemon sole. Benthos: all species, numbers and total weight per species per haul. <i>Sepia sp.</i> , <i>Loligo vulgaris</i> , <i>Cancer pagurus</i> , <i>Nephrops norvegicus</i> and <i>Homarus gammarus</i> length measurements. Anthozoa, Bryozoa, Hydrozoa and Porifera only presence absence. Marine litter: all hauls CTD: continuous profile Other: /

Survey, country	Area coverage	Running since	Methodology described in	Information to assessment WG	Data availability	Comments on 2018 survey	Data collected
						Since this year also two new species were sampled for age: dab and lemon sole of which 3 otoliths per cm size class per ICES Statistical Rectangle were collected.	
Beam Trawl Survey (BTS), Germany	German Bight (North Sea)	1991	WGBEAM beam trawl survey manual (update in progress)	WGSSK: Limanda limanda (dab.27.3a4), Pleuronectes platessa (ple.27.420), Solea solea (sol.27.4), indices by age group, age 1-10+ WGEF: elasmobranch species, CPUE per species per haul	Unaggregated data: datras.ices.dk Density plots per species: http://ecosys-temdata.ices.dk/map/	The BTS was carried out from 20 Aug to 05 Sept. with good weather conditions. 63 hauls were successfully fished out without incidents (approx. 31.5 hours fishing time).	Fish species: all species Fish length: all species; dab, plaice, elasmobranch by sex. Fish weight: sample weight per species, elasmobranch by sex Fish biological data: individual weight, length, sex, yearclass for dab, plaice, sole Benthos: all species, numbers and total weight per species per haul. Cephalopods, edible crab, <i>Nephrops norvegicus</i> length measurements. Marine litter: all trawls CTD: vertical profile planned for all hauls Other: -
Beam Trawl Survey (BTS), Netherlands	Southern and Eastern North Sea	1985	WGBEAM beam trawl survey manual (update in progress)	WGSSK: Limanda limanda (dab.27.3a4), Pleuronectes platessa (ple.27.420), Scophthalmus maximus (tur.27.4), Scophthalmus rhombus (bli.27.3a47de), Solea solea (sol.27.4), indices by age group, age 1-10+ WGEF: CPUE per species per haul	Unaggregated data: datras.ices.dk Density plots per species: http://ecosys-temdata.ices.dk/map/	Survey completed as planned.	Fish species: all species Fish length: all species, elasmobranch by sex. Fish weight: no sample weight per species, elasmobranchs by sex. Fish biological data: individual weight, length, sex, yearclass for plaice, sole, dab, lemon sole, turbot, brill, long rough dab, flounder, cod. Maturity data for summer spawners such as lemon sole. Benthos: all species, numbers. Cephalopods, edible crab, <i>Nephrops norvegicus</i> length measurements. Marine litter: all trawls

Survey, country	Area coverage	Running since	Methodology described in	Information to assessment WG	Data availability	Comments on 2018 survey	Data collected
							CTD: vertical profile planned for all hauls, but not always managed due to technical issues and weather conditions. Other: -
Beam Trawl Survey (BTS), Netherlands	Central and Western North Sea	1998	WGBEAM beam trawl survey manual (update in progress)	WGNSSK: Limanda limanda (dab.27.3a4), Pleuronectes platessa (ple.27.420), Scophthalmus maximus (tur.27.4), Scophthalmus rhombus (bll.27.3a47de), Solea solea (sol.27.4), indices by age group, age 1-10+ WGEF: elasmobranch species, CPUE per species per haul	Unaggregated data: datras.ices.dk Density plots per species: http://ecosystemdata.ices.dk/map/	Survey completed as planned.	Fish species: all species Fish length: all species, elasmobranch by sex. Fish weight: sample weight per species, elasmobranchs by sex. Fish biological data: individual weight, length, sex, yearclass for plaice, sole, dab, lemon sole, turbot, brill, long rough dab, flounder, scaldfish, solenette, thickback sole, cod, hake. Maturity data for summer spawners such as lemon sole and thickback sole. Benthos: all species, numbers and total weight per species per haul. Commercial cephalopods, edible crab, <i>Nephrops norvegicus</i> length measurements. Marine litter: all trawls CTD: vertical profile planned for all hauls, but not always managed due to technical issues and weather conditions. Other: selection of box corer samples for pulse trawling research for NIOZ PhD.
Western Channel Beam Trawl Survey, 7e, 1st quarter	Western English and Celtic Sea	2006	WGBEAM beam trawl survey manual (update in progress)	WGCSE Sole 7e Plaice 7e WGEF Cuckoo ray 6 7 8abd Spotted ray 7ae-h Undulate ray 7de	Unaggregated data: Cefas Density plots per species: Cefas	The survey took place from 15 Mar to 13 Apr 2018. Mechanical issues with the vessel meant that a number of the survey strata in the Celtic Sea were poorly or not at all sampled. Weather conditions were generally favourable, and the survey was completed without	Fish species: all species Fish length: all species. Elasmobranch species, four-spot megrim, megrim, plaice by sex. Fish weight: sample weight by species and sex for all elasmobranch species, four-spot megrim, megrim, plaice.

Survey, country	Area coverage	Running since	Methodology described in	Information to assessment WG	Data availability	Comments on 2018 survey	Data collected
(SWE-COS), England				Smooth hound Nea Lesser-spotted dogfish 7a-ce-j Greater-spotted dogfish 6 7 Blonde ray 7e Small-eyed ray 7de Thornback ray 7e Category 6 stocks Common skate 6 7a-ce-k		major incident. A total of 116 successful tows were completed out of a total of 131 planned for the survey. This comprising 81 of the 81 planned tows in the western English Channel and 35 of the 50 planned tows in the Celtic Sea.	<p>Fish biological data: Individual weight, length, sex and maturity for all elasmobranch species, and conger eel, (cod), (haddock), (whiting), ling, hake, (monkfish), John dory, all species of gurnard, seabass, red mullet, four-spot megrim, (megrim), (turbot), (brill), witch, (lemon sole), (plaice), (sole). Ages determined for those species highlighted by brackets.</p> <p>Benthos: all species, numbers and total weight per species quantified for beam trawl with blinder. Additional observations made for beam trawl without blinder captured against catch for beam trawl with blinder. Length measurements collected for cephalopods and commercial shellfish. Sentinel and non-native species weighed and counted for both beam trawls.</p> <p>Marine litter: all trawls</p> <p>CTD: average surface and bottom temperatures and salinities collected for each tow.</p> <p>Other: zoo-plankton (ring net), phyto-plankton (plankton image analyser), epi-benthos (2m beam trawl), infauna, PSA (grab), seabed images (drop camera), environmental data (ESM2), acoustic data, water samples for caesium & tritium analysis, opportunistic tagging of species of elasmobranch.</p>

Survey, country	Area coverage	Running since	Methodology described in	Information to assessment WG	Data availability	Comments on 2018 survey	Data collected
Beam Trawl Survey (BTS), England	Eastern English Channel and Southern North Sea	1988	WGBEAM beam trawl survey manual (update in progress)	WGNSSK Plaice 4 SD20 Plaice 7d Sole 7d WGEFlonde ray 4c 7d Cuckoo ray 3 4 Spotted ray 3 4 7d Thornback ray 3 4 7d Undulate ray 7de Smooth-hound Nea Lesser-spotted dogfish 3a 4 7d	Unaggregated data: datras.ices.dk Density plots per species: http://ecosys-temdata.ices.dk/map/	The survey took place from 14 to 27 Jul 2018. The survey was completed but two index stations could not be fished due to static gear issues. A total of 77 stations were completed successfully, (63 in English Channel (35 English side, 28 French side); 14 in North Sea), 12 of which were at a reduced duration (ca. 20-min). During the survey, time was available to complete 5 tows off the Belgium coast, and a further 16 10-min tows for the tag and release of 217 sole for Ifremer.	Fish species: all species Fish length: all species. Elasmobranch species, plaice by sex. Fish weight: sample weight by species and sex for all elasmobranch species, plaice. Fish biological data: Individual weight, length, sex and maturity for all elasmobranch species, and conger eel, (cod), (whiting), ling, (monkfish), John dory, all species of gurnard, (seabass), red mullet, (turbot), (brill), dab (lemon sole), flounder, (plaice), (sole). Ages determined for those species highlighted by brackets. Benthos: all species. Numbers and total weight per species at a selected number of pre-selected stations. If not, species observed only. Sentinel and non-native species weighed and counted. Length measurements collected for cephalopods and commercial shellfish. Marine litter: all trawls CTD: average surface and bottom temperatures and salinities collected for each tow. Other: environmental data (ESM2), collection of water samples for nutrient analysis, opportunistic tagging of species of elasmobranch.
ISBCBTS (September) (ISBCTS), England	Irish Sea and Bristol Channel	1988	WGBEAM beam trawl survey manual (update in progress)	WGCSE Plaice 7a Sole 7a Sole 7fg Plaice 7fg	Unaggregated data: datras.ices.dk Density plots per species: http://ecosys-temdata.ices.dk/map/	The survey took place from 12 Sept 03 Oct 2018. At the start of the survey poor weather conditions meant that it was necessary to select where to	Fish species: all species Fish length: all species. Elasmobranch species, plaice by sex. Fish weight: sample weight by species and sex for all elasmobranch species, plaice.

Survey, country	Area coverage	Running since	Methodology described in	Information to assessment WG	Data availability	Comments on 2018 survey	Data collected
				WGEF Thornback ray 7afg Small-eyed ray 7fg Spotted ray 7ae-h Cuckoo ray 6 7 8abd Smooth-hound Nea Lesser-spotted dogfish 7a-ce-j Greater-spotted dogfish 6 7 Category 5 stocks Blonde ray 7afg	sys-temdata.ices.dk/map/	fish but as the survey progressed conditions improved. The survey was completed without major complication, although many stations had to be reduced to <30mins because of static gear / anticipated large catches of benthos. Four of the 108 stations could not be fished but these were not essential for tuning index calculations. During the night, and outside of survey fishing activities, a further 20 beam trawl, and 16 GOV tows were undertaken to collect demersal fish samples for the CSEMP project.	Fish biological data: individual weight, length, sex and maturity for all elasmobranch species, and conger eel, (cod), (haddock), (whiting), ling, hake, (monkfish), John dory, all species of gurnard, seabass, red mullet, (turbot), (brill), dab (lemon sole), (plaice), (sole). Ages determined for those species highlighted by brackets. Benthos: all species. Numbers and total weight per species at a selected number of pre-selected stations. If not, species observed only. Sentinel and non-native species weighed and counted. Length measurements collected for cephalopods and commercial shellfish. Marine litter: all trawls CTD: average surface and bottom temperatures and salinities collected for each tow. Other: environmental data (ESM2), collection of surface water samples for analysis of tritium and water samples to determine alkalinity, opportunistic tagging of species of elasmobranch.
Beam Trawl Survey, France	Bay of Biscay	2007	WGBEAM beam trawl survey manual (update in progress)	WGBIE : Sole 8ab	Unaggregated data: datras.ices.dk Density plots per species: http://eco-sys-temdata.ices.dk/map/	The survey took place from 06. Nov. to 29. Nov. 2018. Despite bad weather that prevailed during the first week of the survey, a total of 49 tows were successfully completed out of 50 planned. As in recent years, tows were carried out for all the index stations except for one station where the tow was again cancelled	Fish species: all species Fish length: all species, hake, meagre, megrim, monkfish, red mullet, seabass, sole, whiting and elasmobranch species by sex. Fish weight: sample weight by species and sex for species measured by sex. Fish biological data: maturity, sex, otoliths for hake, meagre, megrim, red mullet, seabass, sole

Survey, country	Area coverage	Running since	Methodology described in	Information to assessment WG	Data availability	Comments on 2018 survey	Data collected
						for security reasons (on a position where it was difficult to haul back the trawl in 2015 because it was full of mud and mussels). The duration of 5 tows was reduced at 15 min due to expectation of large amounts of sediment or benthos.	and whiting. Illicium for monks-fish. Benthos: Numbers and total weight per species Marine litter: all trawls. CTD: bottom temperatures collected for each tow (end).
Beam Trawl Survey, Iceland	Waters around Iceland, figure 7.1	2016	WGBEAM beam trawl survey manual (update in progress). Same as CEFAS	NWWG: next year for Pleuronectes platessa. Used for local assessments for Limanda limanda and Microstomus kitt	Upon request	The Survey was carried out from 22.08. to 04.09.2018, 80 valid hauls were carried out and went very well.	Fish species: all species Fish length: all species Fish weight: Individual weight taken for 10 fish at each station for following species: plaice, dab, lemon sole, halibut, megrim, long rough dab, flounder, witch flounder Fish biological data: individual weight, maturity, sex, otoliths for 10 fish at each station for plaice, dab, lemon sole, halibut, megrim, long rough dab, flounder, witch flounder Benthos: Crabs, Nephrops, commercially important shrimp and sea cucumber are counted. Marine litter: all trawls, recorded and weighted CTD: continuous during haul; CTD attached to net. Other: -
Beam Trawl Survey, Ireland	Western Celtic Sea	2016	Same as CEFAS	Presented to WGA 2018 and WGBIE	To be included in DATRAS. Ongoing work with ICES and CEFAS	A total of 49 valid tows were completed (out of a target of 51), as well as 4 additional tows (these had not been randomly selected but were sampled opportunistically. There was one foul haul but no gear	Fish species: all species Fish length: all species Fish weight: weight taken for one fish per cm size class for cod, ling, megrim, plaice, Pollack, saithe, brill, hake, john dory, four-spot megrim, lemon sole, turbot, witch, blonde ray, cuckoo

Survey, country	Area coverage	Running since	Methodology described in	Information to assessment WG	Data availability	Comments on 2018 survey	Data collected
						damage. The weather was good for most of the survey.	ray, lesser spotted dogfish, spotted ray, common ray and thorn-back ray. Target set for length group for haddock, whiting and monkfish Fish biological data: as above Benthos: for starboard trawl benthos quantified, for port side only species that have not occurred in the starboard side are weighed Marine litter: recorded and quantified for all hauls CTD: intermittent Other: -
Beam Trawl Survey, Italy-Slovenia-Croatia	North Adriatic Sea (GSA 17) figure 7.2	2005	SoleMon handbook (available here: http://dcf-italia.cnr.it/re-served/linee-guida/1)	FAO-GFCM-SAC-WGSAD, STECF: <i>Melicerus kerathurus</i> , <i>Pecten jacobus</i> , <i>Scophthalmus maximus</i> , <i>Scophthalmus rhombus</i> , <i>Sepia officinalis</i> , <i>Solea solea</i> , <i>Squilla mantis</i> , Index of Abundance by size and age for sole, mantis shrimp and cuttlefish.	Unaggregated data: datras.ices.dk for sole	The 2018 survey was carried out from 22/11-7/12/2018 with RV G. Dallaporta. 66 hauls were carried out (approx. 30 hours fishing time). Due to time constrain, in 2018 the Croatian waters were not sampled. The survey was completed without incident. A total of 11 stations had to be fished for less than 30 minutes. This was mainly due to large by catches of benthos and/or as a precaution against gear damage.	Fish species: The primary target species is <i>Solea solea</i> , with additional species including cuttlefish, scallop, queen scallops, turbot, brill, skates, purple dye murex and caramote prawn. Fish length: all species Fish weight: individual weight for target species, total weight for the other. Fish biological data: individual weight, length, sex and maturity for target species. Length and total weight for other species. Benthos: all hauls, more than 250 macro and megabenthos species Marine litter: all hauls CTD: vertical profile planned for all hauls
Inshore beam trawl	Coastal zone Belgium, figure 7.3	1971	Inshore beam trawl survey manual in progress	WGNSSK: <i>Pleuronectes platessa</i> (ple.27.420), <i>Solea solea</i> (sol.27.4),	Unaggregated data (2017 – 2018): datras.ices.dk	The Belgian DYFS was carried out from 10 Sept to 19 Sept 2018 with RV Simon Stevin. The weather did not interfere	Fish species: all species Fish length: selected list of commercial species; elasmobranch by sex

Survey, country	Area coverage	Running since	Methodology described in	Information to assessment WG	Data availability	Comments on 2018 survey	Data collected
survey (DYFS)				combined BEL/GER/NED recruitment index		with the sea-going operations and no technical problems were encountered. This allowed for all 33 sampling stations to be fished successfully. None of the fished stations were declared invalid. From this year onwards otoliths from plaice and sole were collected for age determination (1 otolith per sampling stations for both species). And also for the first time, marine litter was collected in each haul.	Fish weight: sample weight per species for species that are measured Fish biological data: individual weight, length, sex, yearclass for plaice and sole Benthos: only <i>Crangon crangon</i> weight per size fraction and length of minimal 250 individuals. Marine litter: all hauls CTD: continuous profile Other: -
Inshore beam trawl survey (DYFS)	Coastal zone Germany and German Wadden Sea, figure 7.4	1972	Inshore beam trawl survey manual in progress	WGSSK: Pleuronectes platessa (ple.27.420), Solea solea (sol.27.4), combined BEL/GER/NED recruitment index	To be included in DATRAS. Ongoing work with ICES and TI-SF	The survey was conducted by 4 chartered commercial vessels and the RV "Clupea". The survey with commercial vessels was conducted in the period from 31/08-05/10/2019. 187 valid hauls were carried out (10 hauls invalid). The survey on RV "Clupea" took place from 12/09 to 28/09/2019. 65 hauls were carried out on this cruise.	Fish species: all species Fish length: all species Fish weight: sample of all species Fish biological data: individual weight, length, sex, year class for plaice. Benthos: all species, <i>Crangon crangon</i> total weight and length measurements of 250g subsample. Marine litter: only on RV Clupea CTD: TD continuous during haul Other: -
Inshore beam trawl survey (DYFS)	Coastal zone Netherlands, Dutch Wadden Sea, Eastern and Western Scheldt	1970	Inshore beam trawl survey manual in progress	WGSSK: Pleuronectes platessa (ple.27.420), Solea solea (sol.27.4), combined BEL/GER/NED recruitment index	Unaggregated data (2002 – 2018): datras.ices.dk Density plots per species: http://ecosystemdata.ices.dk/map/	Surveys in Eastern Scheldt, Western Scheldt and Wadden Sea completed as planned. Survey in coastal zone affected by weather conditions. Spatial coverage in line with planning, due to postponement SNS and bad weather during DYFS the survey lasted	Fish species: all species Fish length: all species Fish weight: no sample weight per species Fish biological data: individual weight, length, sex, yearclass for plaice, dab, sole, flounder, turbot, brill. Maturity data only to separate between immature and maturing.

Survey, country	Area coverage	Running since	Methodology described in	Information to assessment WG	Data availability	Comments on 2018 survey	Data collected
						an extra week. All stations sampled.	Benthos: all species numbers. <i>Crangon crangon</i> , Cephalopods, edible crab length measurements Marine litter: no CTD: continuous during haul, CTD attached to net. Other: additional hauls conducted for national programmes.
Sole net survey (SNS)	Dutch EEZ and southern German Bight	1969	Inshore beam trawl survey manual in progress	WGNSSK: Pleuronectes platessa (ple.27.420), Solea solea (sol.27.4), indices by age group age 1-4+	Unaggregated data (2002 – 2018): datras.ices.dk Density plots per species: http://ecosystemdata.ices.dk/map/	Survey completed. Survey started a few days later than planned due to technical problems, and took a few days more due to weather conditions.	Fish length: all species Fish weight: no sample weight per species Fish biological data: individual weight, length, sex, year class for plaice, dab, sole, flounder, turbot, brill. Maturity data only to separate between immature and maturing. Benthos: all species numbers. Cephalopods, edible crab length measurements. Marine litter: no CTD: continuous during haul, CTD attached to net. Other: -



Figure 7.1 Map IS BTS 2018

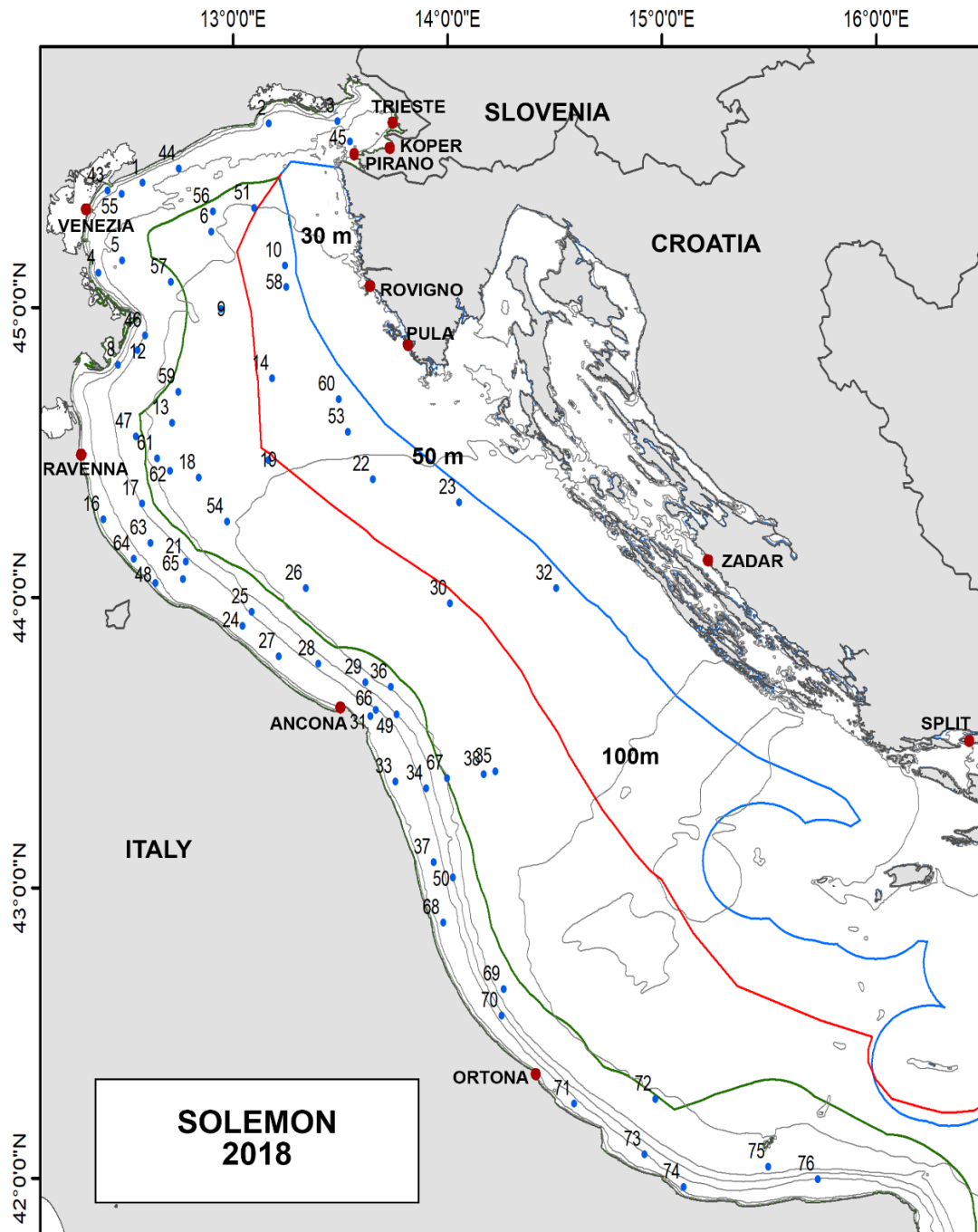


Figure 7.2 Map ITA SoleMon 2018

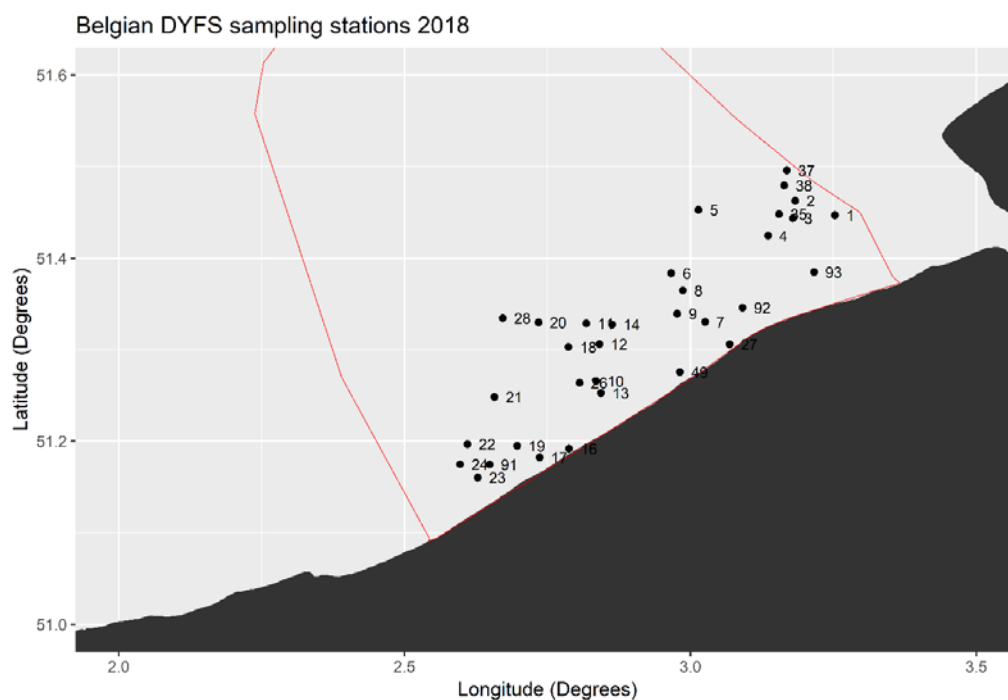


Figure 7.3 Map BEL Inshore Survey 2018

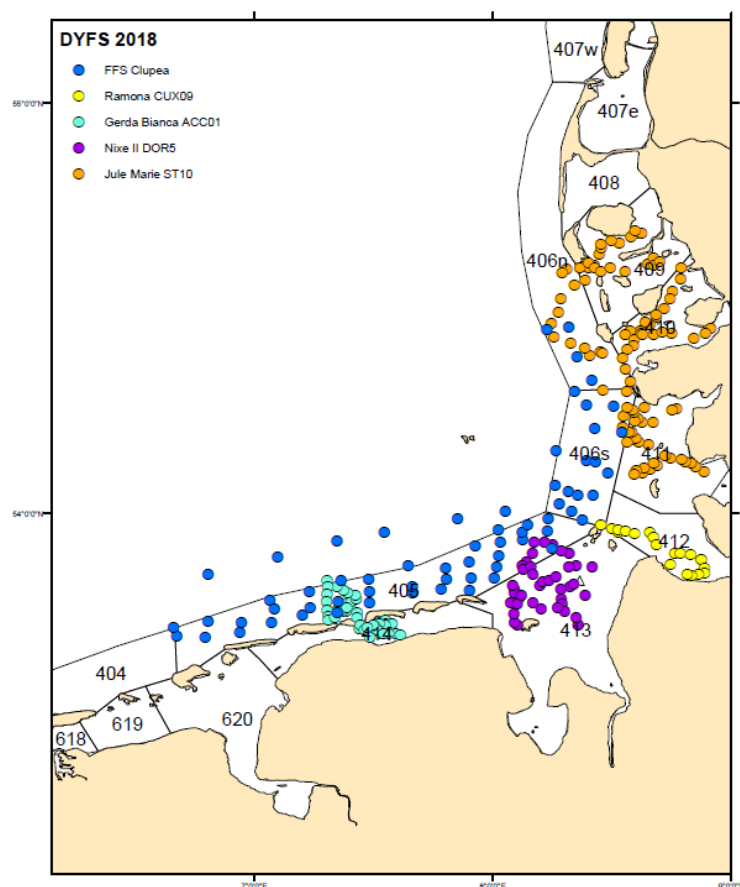


Figure 7.4 Map GFR Inshore Survey 2018

Annex 8: Workshop on index calculation based on DATRAS (WKICDAT)

Executive Summary WKICDAT

Introduction

In recent years a lot of progress of automated index calculation procedures and the adoption of model-based indices, including combining several surveys into a single index (e.g. deltaGAM method), directly based on DATRAS exchange data, was made. While the automation benefits consistency and transparency it also makes implicit assumptions regarding data collection which are easy to forget when applying an automated procedure. Specifically the indices which are based on data from the different beam trawl surveys, which use different gears and apply different biological sampling designs, have to be thoroughly evaluated and contrasted to historical methods to understand the differences and their possible implication for the estimation of population dynamic trends.

It has to be investigated to what extent the new method affects the outcomes of the used stock assessment models in comparison with the previously used methods. Therefore, the WGBEAM organized a two day work shop (WKICDAT) in conjunction with the working group meeting in Copenhagen (21-22 March, 2019) in order to discuss and investigate the use of these modelled survey indices for beam trawl data. The Work Shop on Index Calculation based on DATRAS (WKICDAT) met simultaneously with WGBEAM in Copenhagen 21 – 22 March 2019 to evaluate the use of the so-called deltaGAM index method (Berg et al., 2014) with regard to different survey designs of beam trawl surveys (BTS) conducted in the North Sea. The objective of calling a separate workshop were to encourage additional survey index and stock assessment expertise that might otherwise not have been aware of the initiative. Besides all WGBEAM participants, Casper Berg (DTU-AQUA) joined the workshop as chair invited external expert. Further, the stock coordinator for North Sea plaice (ple.27.420) and North Sea Sole (sol.27.4) joined the discussion via a web conference.

A new index calculation method for beam trawl surveys

The deltaGAM method makes use of a generalized additive model approach to estimate age as a smooth function of length and the geographical position on a haul basis. It is also able to account for ship or gear effects and to combine data from different surveys. Therefore, it is especially interesting for the use on BTS data since these surveys are not fully standardized in the North Sea and each BTS does only cover a certain part of the North Sea. However, by combining these different surveys it should be carefully investigated if the model approach adequately deals with different survey designs.

As a first step, a list of the different survey designs was compiled during the workshop. Further, it was investigated if sex stratified otolith sampling has an impact on the model based index calculation. For this task, the German BTS plaice data were used because only Germany collects otoliths for plaice and dab sex stratified. The results showed that the sex stratified otolith sampling does not affect the index calculation for this species. Another task was to investigate the impact of using a time variant or time invariant model for the index calculation with respect to distribution shifts of certain age classes. Finally, a sole index was constructed combining Dutch and Belgian BTS data. The Belgian data were not used in the current sole assessment before and the preliminary results of this task showed that the Belgian survey area covers important part of the sole distribution area. However, it has to be clarified by an inter-benchmark or full benchmark for the sole assessment what would be the best method to include these data into the sole assessment. This WKICDAT workshop

should be seen as a starting point to discuss and to further investigate the use of the deltaGAM method combining different beam trawl surveys. Two days were insufficient to do a full evaluation of the method and to cover all stocks and issues, but provided important insight to data users as to the assumptions underlying the model and how the data collection impacts the consistency.

8.1 Tasks and results of the workshop

8.1.1 Complete a list of sampling designs of the different Beam Trawl Surveys

Station stratification

BTS BEL: 62 fixed stations were historically chosen to adequately (a) spatially cover the ICES rectangles, (b) the target species population and (c) fishing characteristics.

BTS GER: generally fixed 63 stations by rectangle. Stations were chosen over time to minimize gear damage. Two to four hauls are carried out in each rectangle, depending on the distance to the coast (Near coast 4 hauls per rectangle, then 3 hauls, then 2 hauls). Covered rectangles changed somewhat over time. Since 2013 two rectangles in 3a were included.

BTS UK: fixed station design; the positions of stations are set historically, originally from areas deemed of high importance for plaice and sole catches by commercial fishermen and areas known to harbour juveniles.

BTS NDL TRI (BTS2): systematic station design (72 stations) if possible in the center of covered ICES rectangle.

BTS NDL ISI (BTS1): 82 stations distributed over the ICES rectangles based on flatfish catch expectations (historical information). Two to four hauls are carried out in a rectangle, depending on the distance to the coast.

Otolith sampling stratification

BTS BEL:

Plaice/sole

- from 2018 onwards 2 otoliths per cm length class per ICES rectangle
- in 2017 3 otoliths per cm length class per ICES rectangle
- 1992 – 2016 5 otoliths per cm length class per ICES rectangle (only fish ≥ 15 cm were sampled)

Dab

- 3 otoliths per cm length class per ICES rectangle from 2018 onwards

BTS NDL:

Plaice

- From 2001 onwards 1 otolith per cm length class per ICES rectangle for fish < 40 cm
- From 2001 onwards 2 otoliths per cm length class per ICES rectangle for fish ≥ 40 cm
- 1985 – 2000 5 otoliths per cm length class per flatfish area or roundfish area

Sole

- 2 otoliths per cm length class per ICES rectangle
- 1985 – 2000 5 otoliths per cm length class per flatfish area or roundfish area

Dab

- Since 2001 5 otoliths per cm length class per flatfish area or roundfish area

BTS GER:

Plaice/Dab

- From 2014 onwards 1 otolith per cm length per sex per ICES rectangle (reduced sampling due to limited resources)
- 3 otoliths per cm length per sex per ICES rectangle 1997 – 2013

Sole

- If possible every fish is sampled

BTS UK:

- Numbers not available yet

Length measurements

Plaice/Sole/Dab are measured to the cm below for length frequency distributions. GER measures male and females separately for all species (sole/plaice/dab). UK measures plaice separated by sex. NDL measures fish to the mm below when taking otoliths of this fish.

Gears

All countries use different gears. However, the gear used by country and spatial coverage is stable over time. It is important that there is some spatial and temporal overlap of different gears to be able to estimate possible gear effects. For details see the manual of offshore beam trawl surveys ([SISP 14 Manual for the Offshore Beam Trawl Surveys](#)).

8.1.2 Investigate the impact of sex-stratified otolith sampling on the deltaGAM index

Germany collects plaice otoliths stratified by sex, which differs from the methodology of other countries conducting beam trawl surveys in the North Sea. For North Sea plaice, a combined beam trawl survey index is currently used in the assessment model taking into account Dutch, Belgian and German beam trawl survey data. In the calculation procedure the German sex stratified otolith sampling is not taken further into account and only one sex combined age length key is applied which makes use of all available data from DATRAS. The following analysis was done to check if the sex stratified otolith sampling has an impact on the calculated deltaGAM index. For this purpose the index was calculated based only on the German sex specific data set in two ways: (a) only using one sex combined age length key and calculate the age based index, in the same way as it is done for the currently used plaice index (combined index); (b) index is calculated for females and males separately using sex specific age length keys and summing up the results (females+males). Both indices were then compared.

The results show minor differences between the combined and separated indices for age group 0 and age group 1. For older age groups there is hardly any difference visible from the plot (Figure 8.1.2.1). For the currently used plaice index it can therefore be concluded that the sex combined index calculation will not have a substantial impact on the assessment results. However, this was not tested during this workshop because of time constraints.

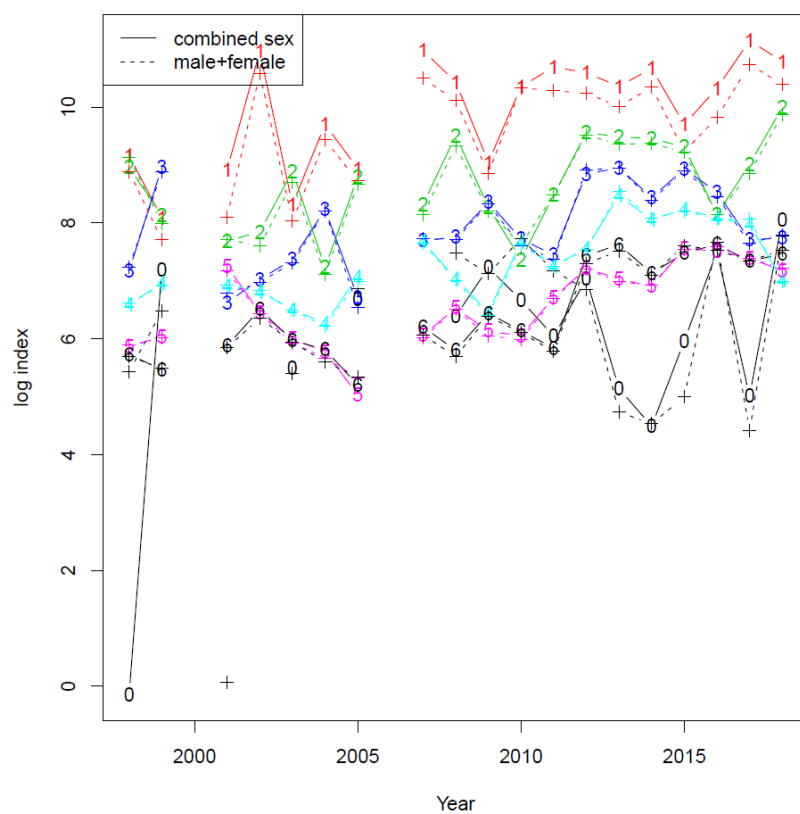


Figure 8.1.2.1: Age based plaice indices for sexes combined (solid lines) and summing up sex specific indices (dotted lines). Numbers denote different age groups.

8.1.3 Comparison of time variant and time invariant model residuals to evaluate possible spatial shifts in the distribution of different cohorts.

The model residuals of a time variant and a time invariant model were compared for different cohorts of plaice for the years 2006 – 2017 (Figure 8.1.3.1).

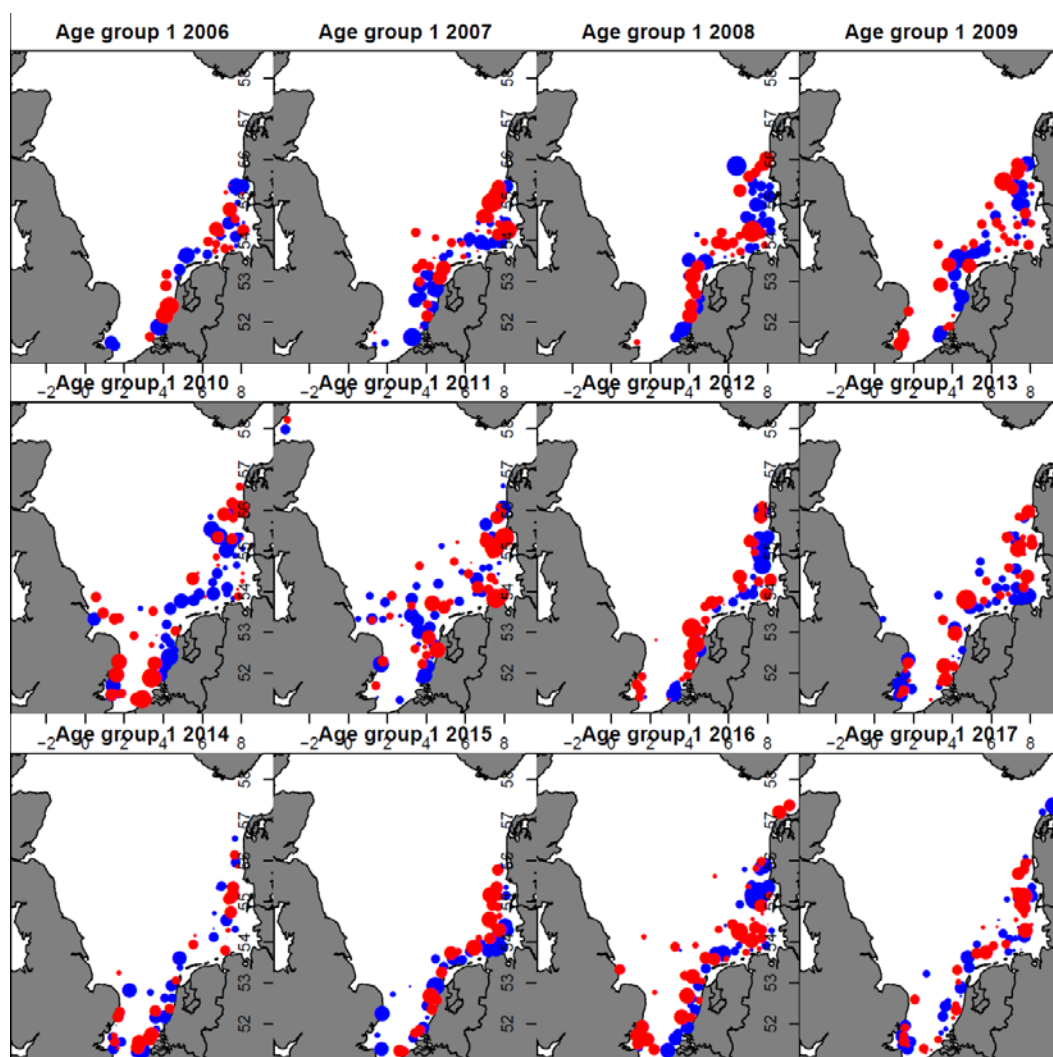


Figure 8.1.3.1: Residual plots showing the distribution of age group 1 – age group 6 plaice (2006 – 2017).

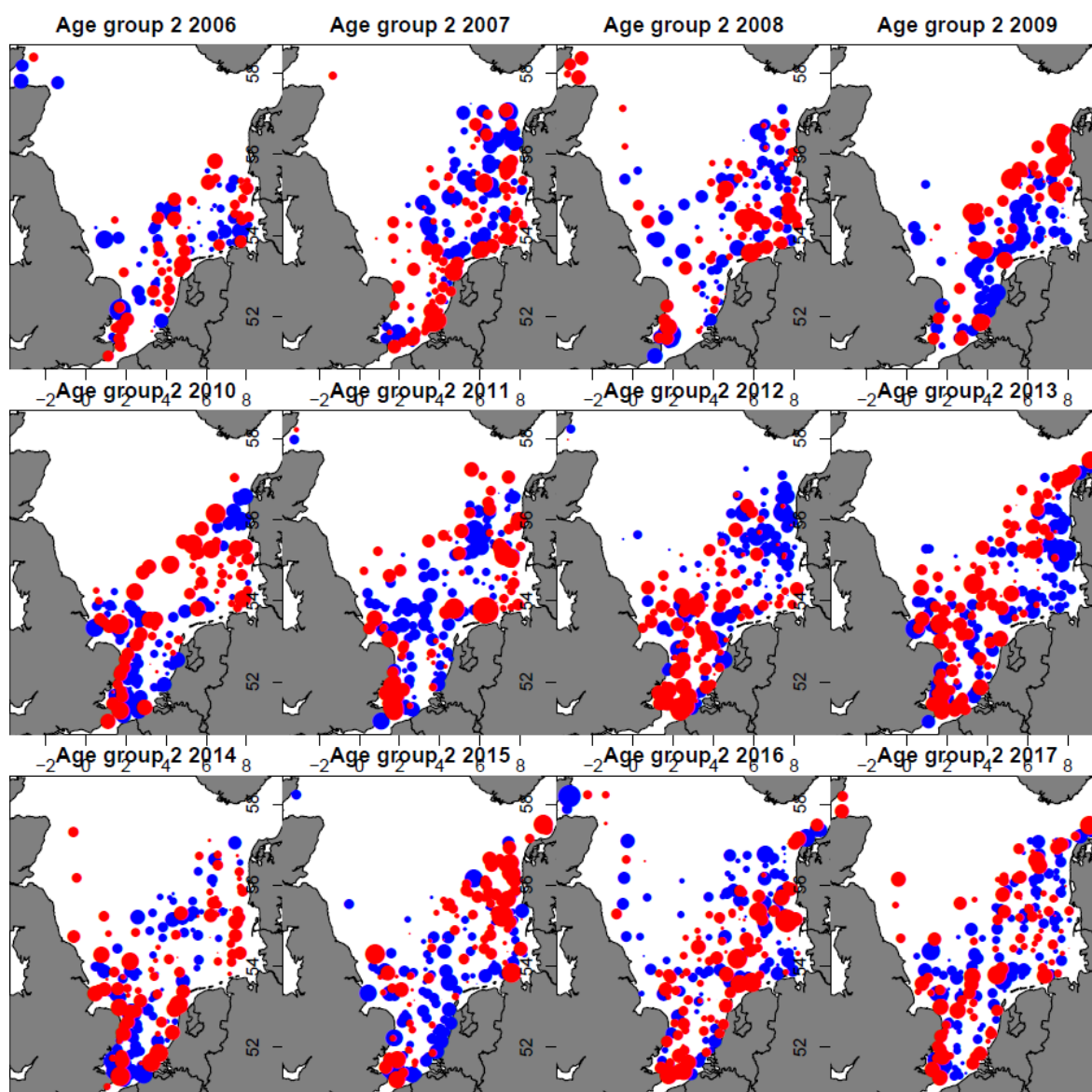


Figure 8.1.3.1 Continued

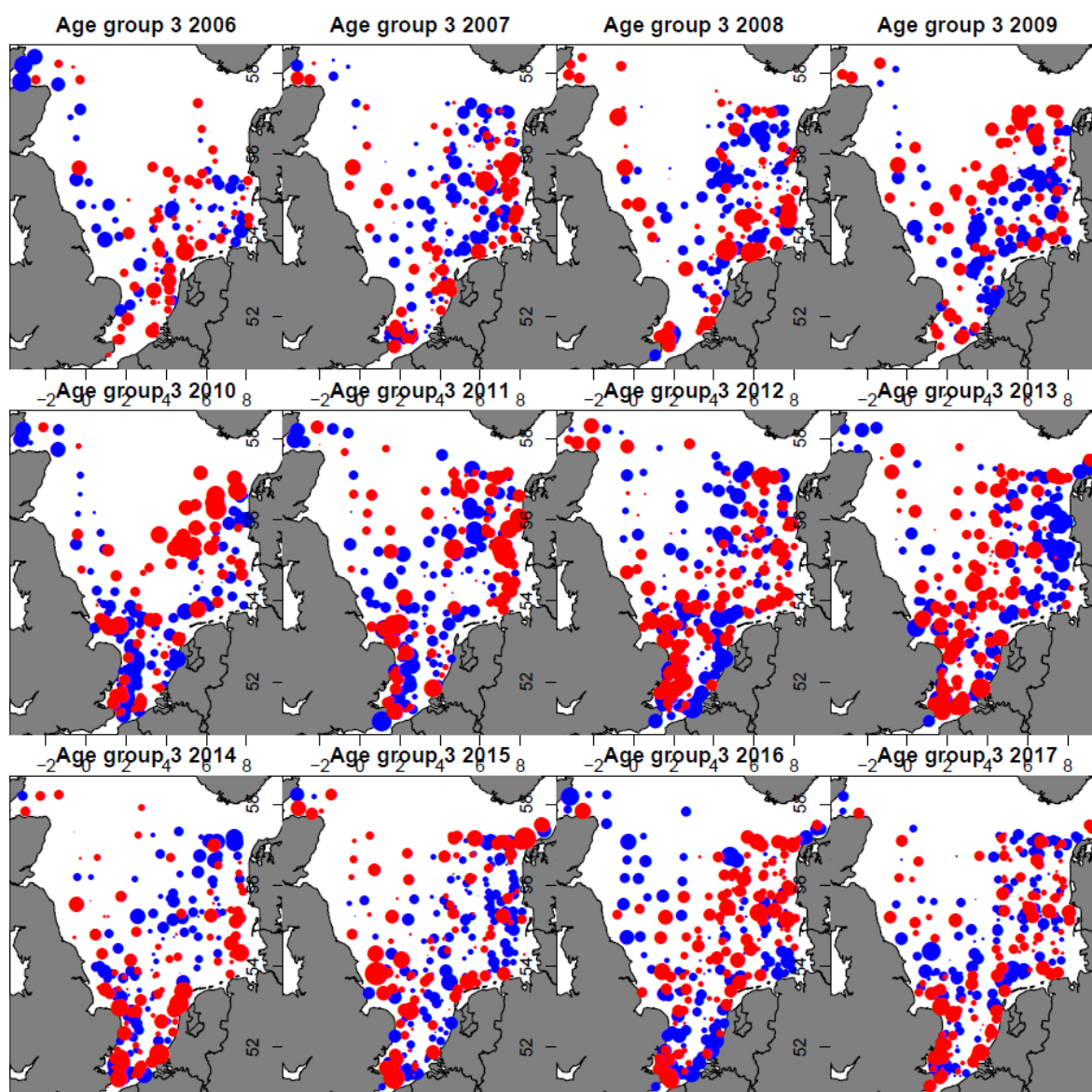


Figure 8.1.3.1 Continued

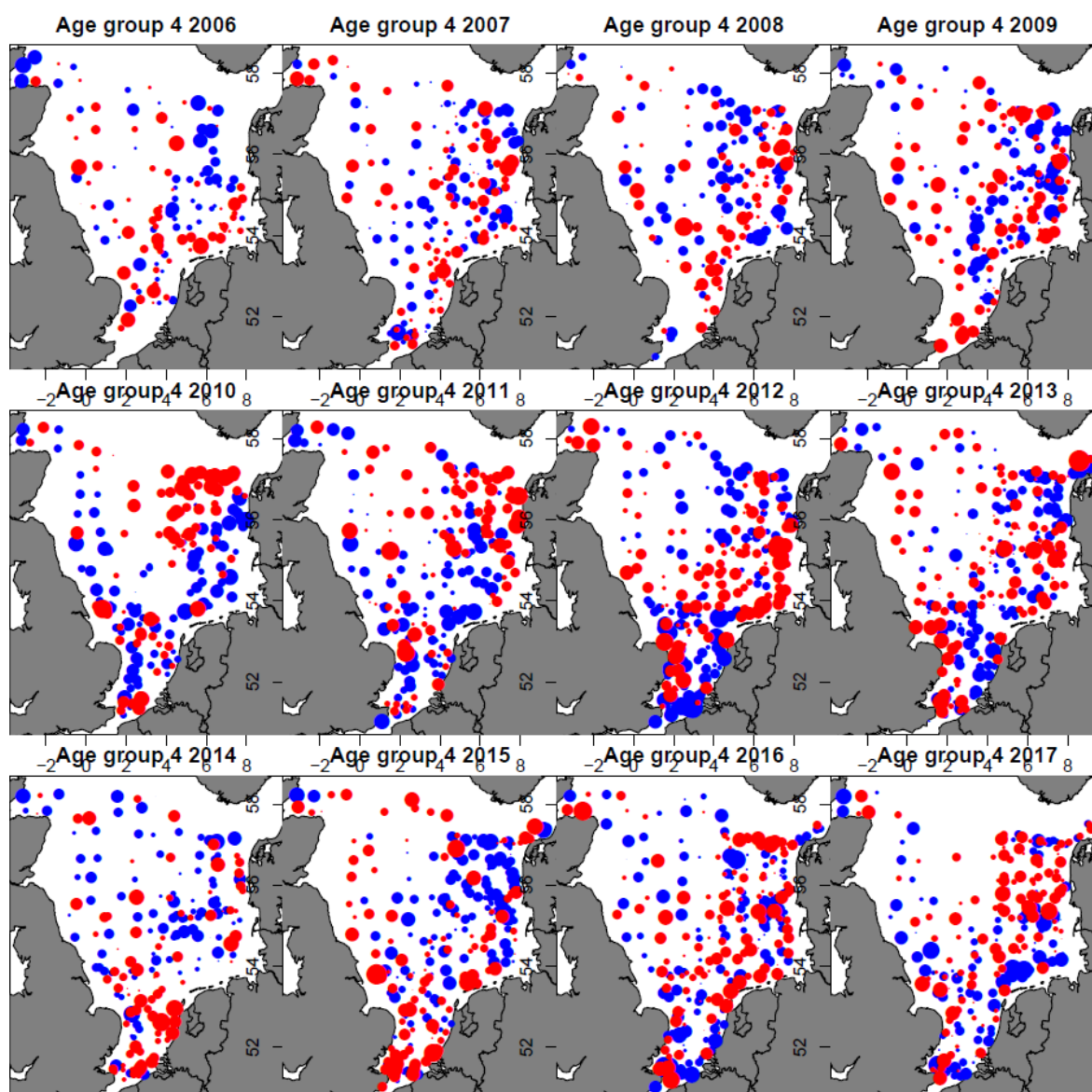


Figure 8.1.3.1 Continued

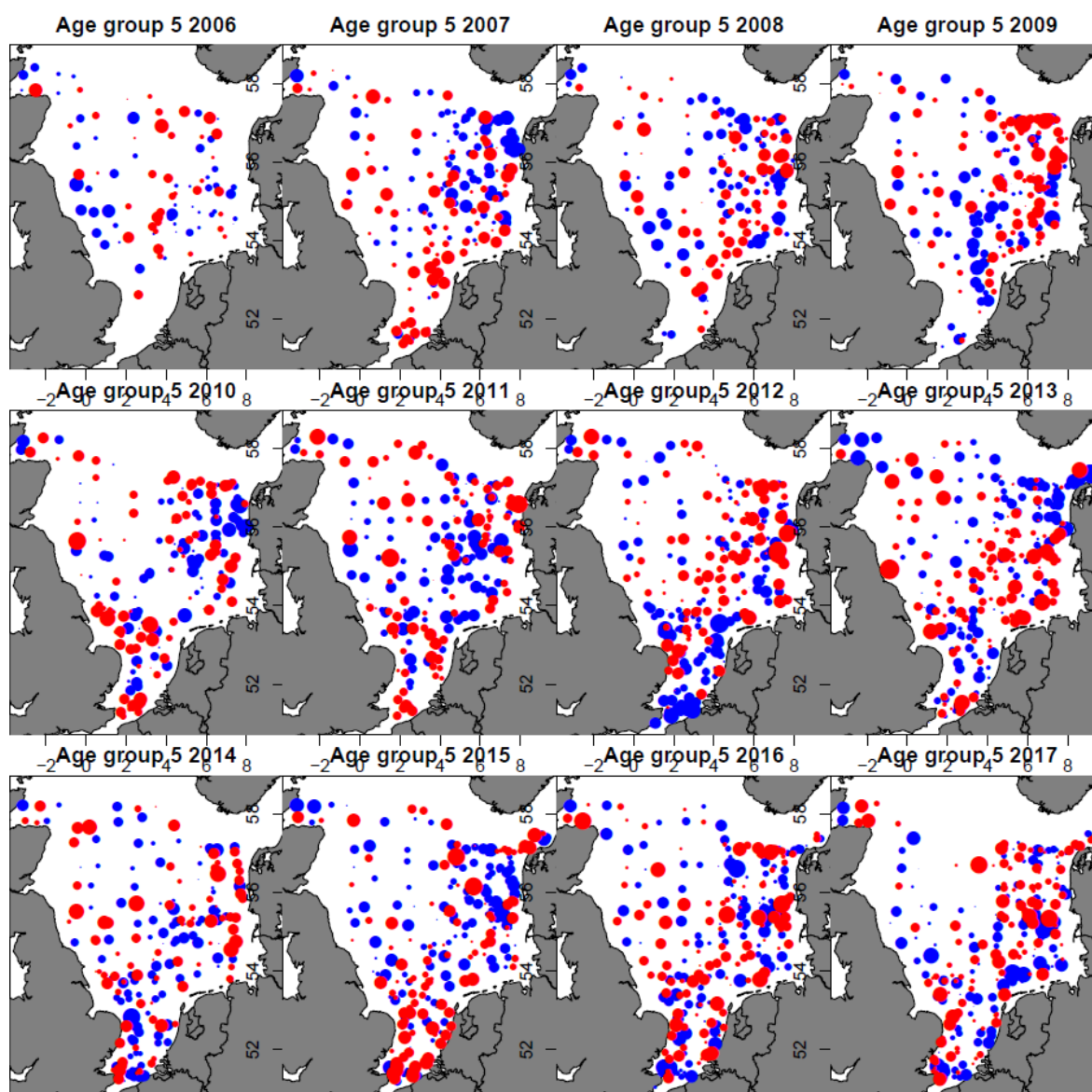


Figure 8.1.3.1 Continued

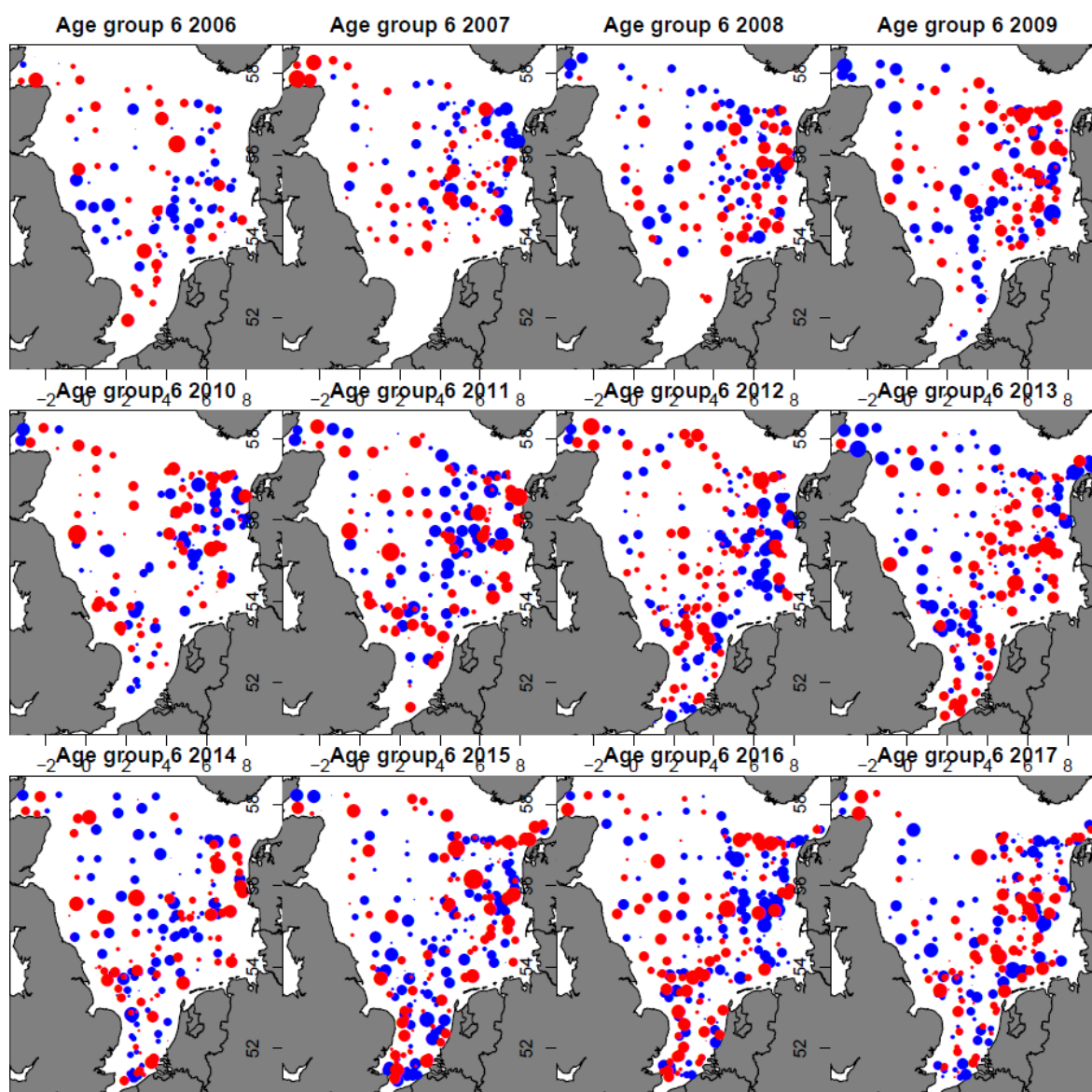


Figure 8.1.3.1 Continued

8.1.4 Combined sole index

A sole (sol.27.4) index was constructed, combining the Dutch BTS, Dutch SNS and Belgian BTS. The new index demonstrated reasonable internal consistency (Figure 8.1.4.1) and the distribution maps showed that the Belgium data added relevant information for an important area of the stock distribution (Figure 5.4.4.4). Further diagnostics and a more detailed evaluation of the suitability of the index in terms of what is understood about the ecology and distribution of the stock remains to be completed. A benchmark or inter-benchmark process are required in the case of a change to an assessment and these are more appropriate to do the statistical evaluation of the index provided here.

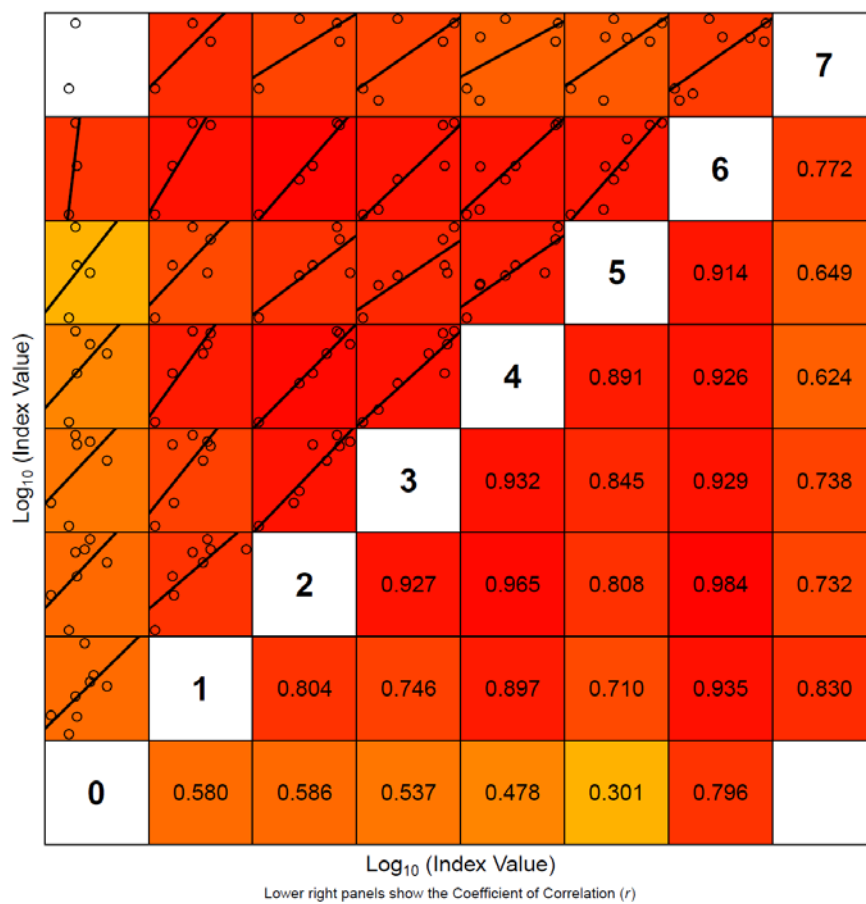


Figure 8.1.4.1 Internal consistency plot for the combined sole index (NDL BTS Isis, SNS, BEL BTS).

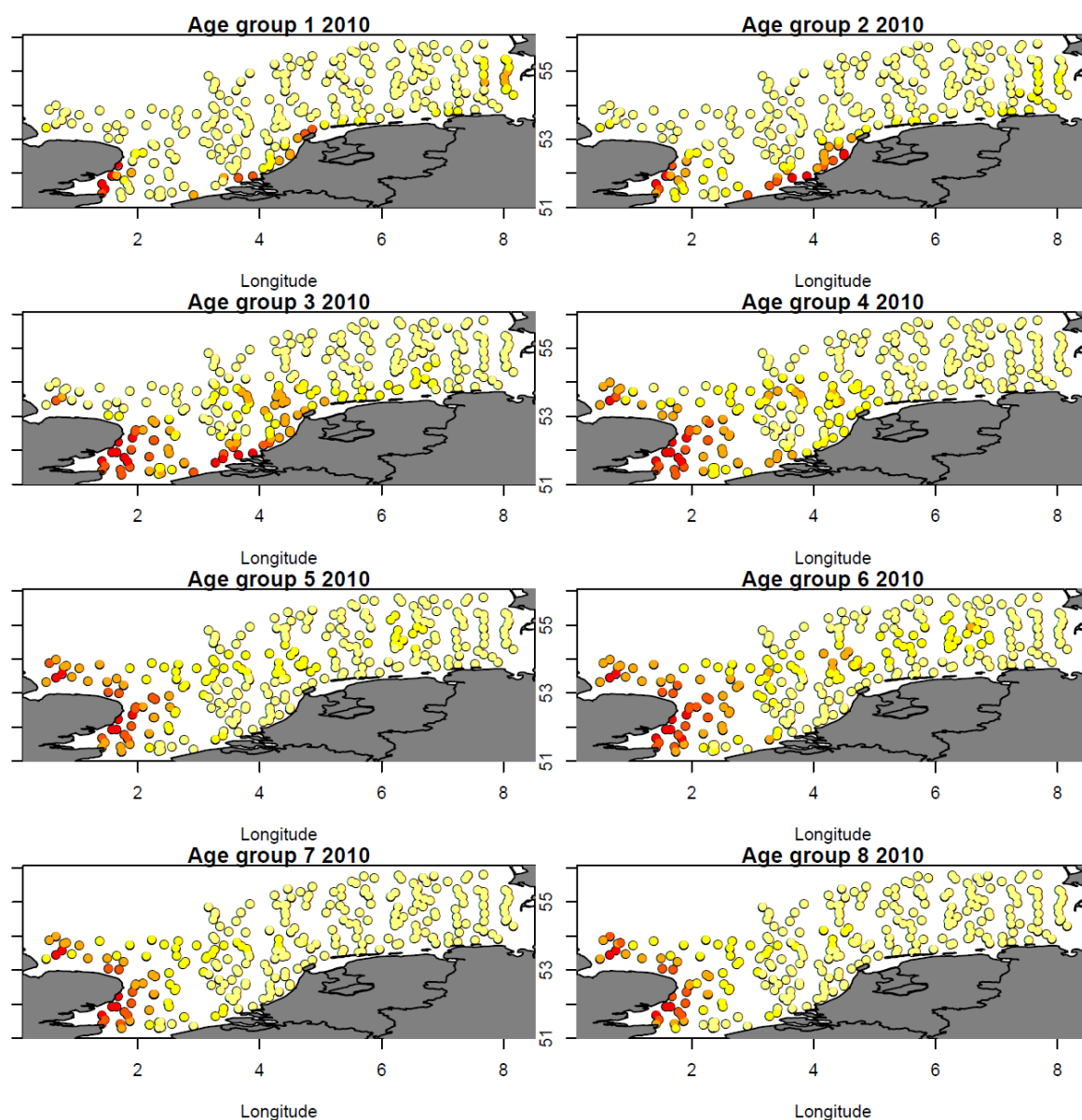


Figure 8.1.4.3 Distribution map of sole by age group for the years 2010-2018 based on combined survey data (NDL BTS Isis, SNS, BEL BTS).

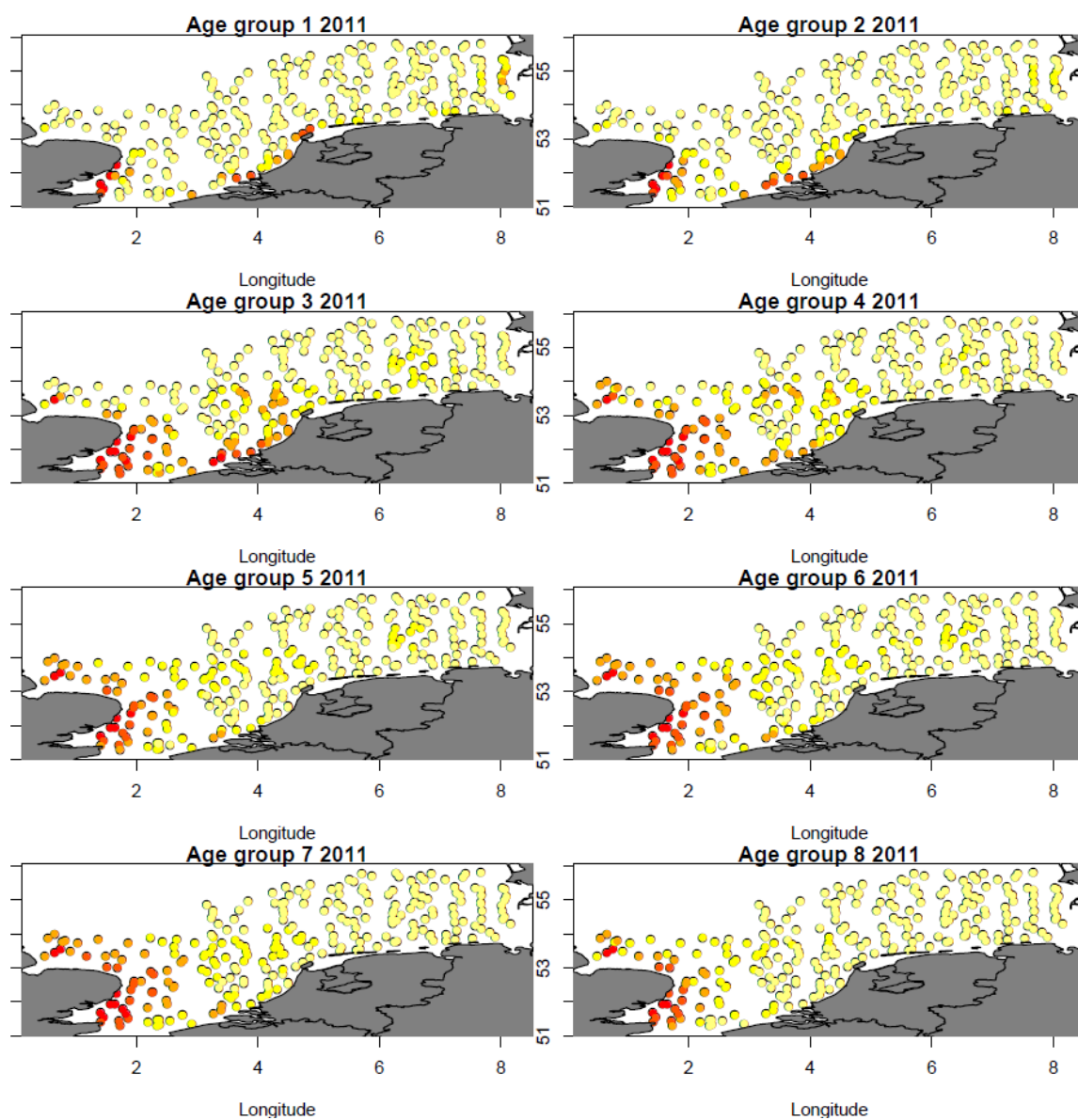


Figure 8.1.4.4 Continued

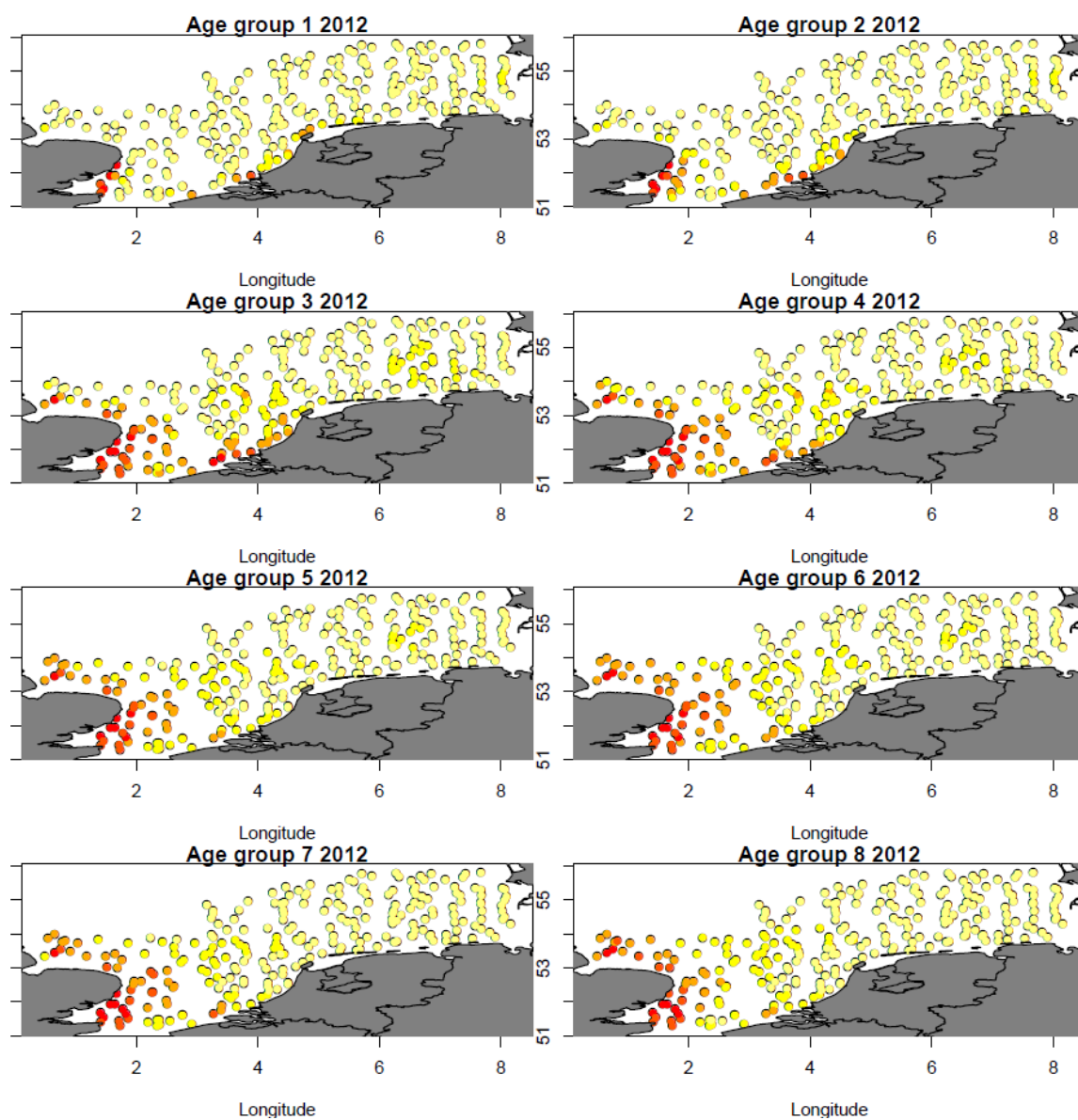


Figure 8.1.4.4 Continued

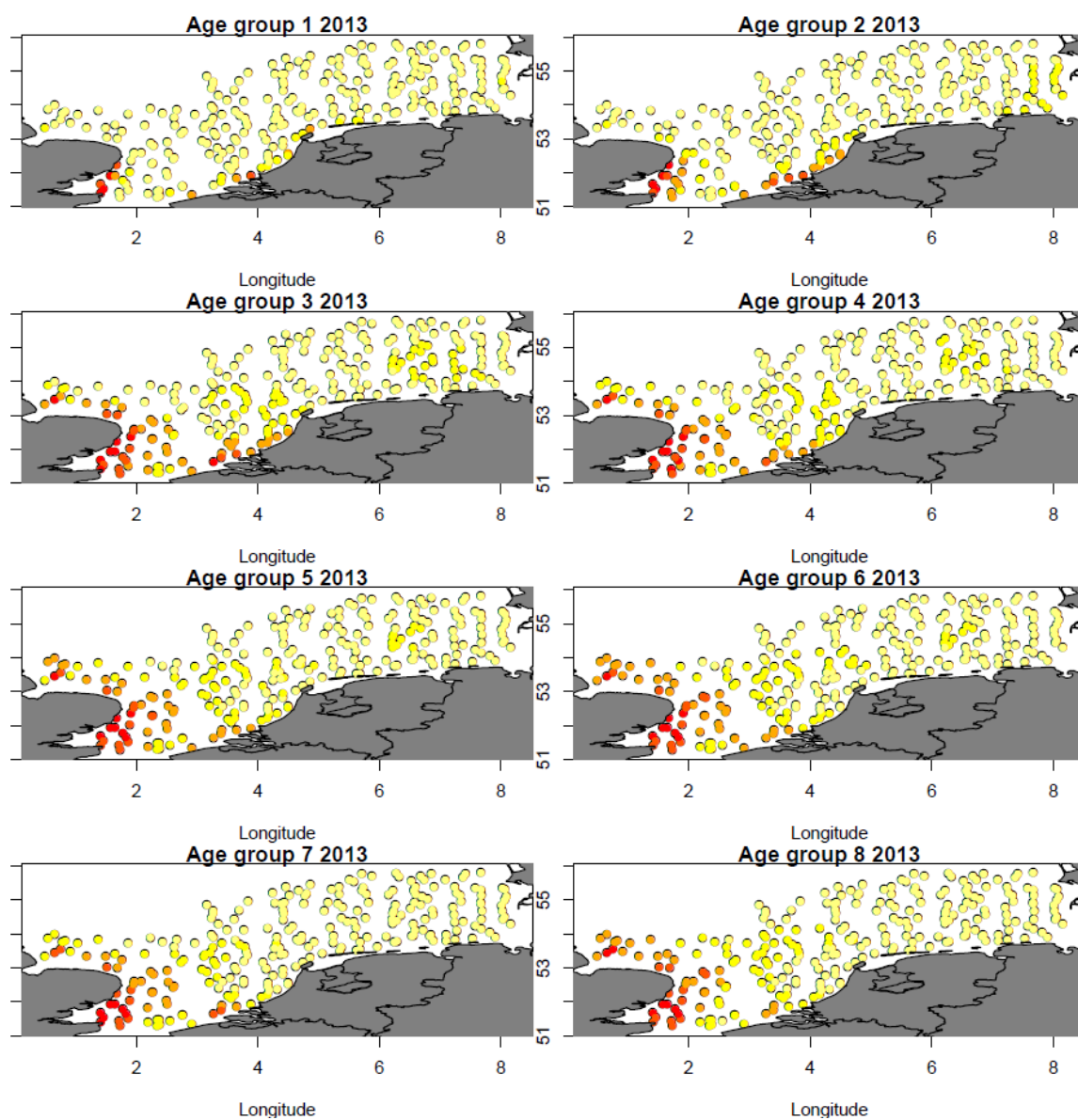


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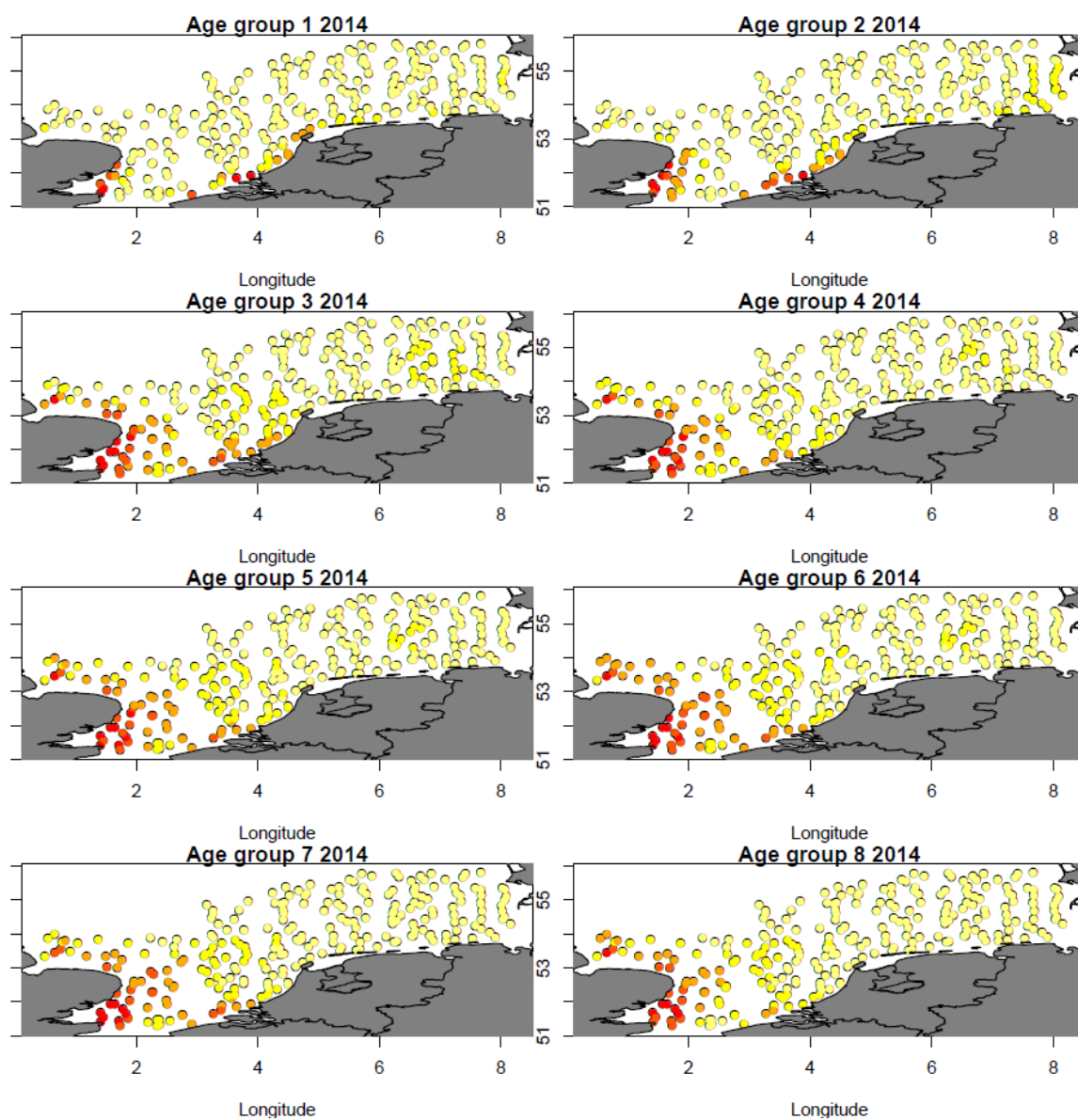


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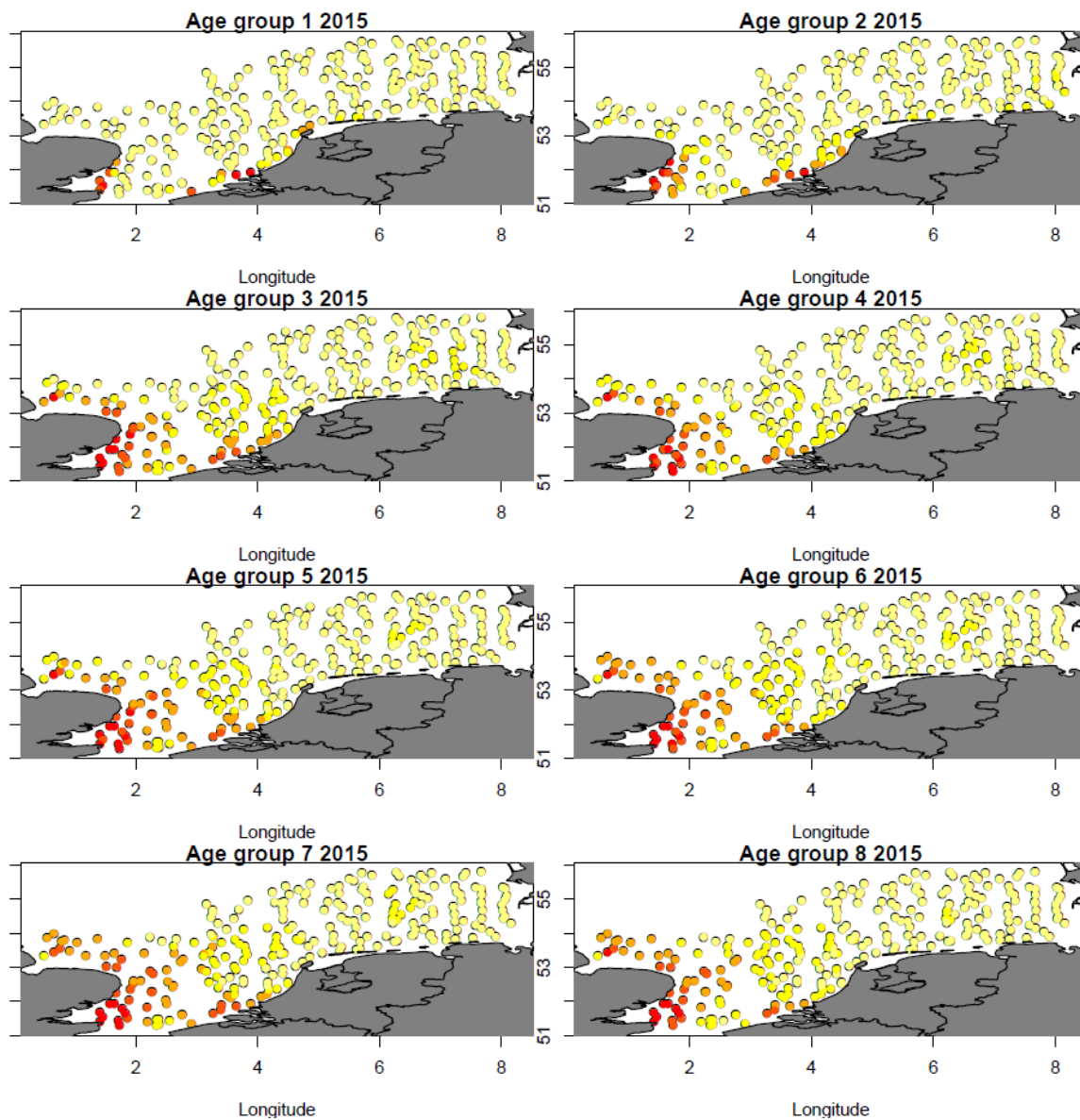


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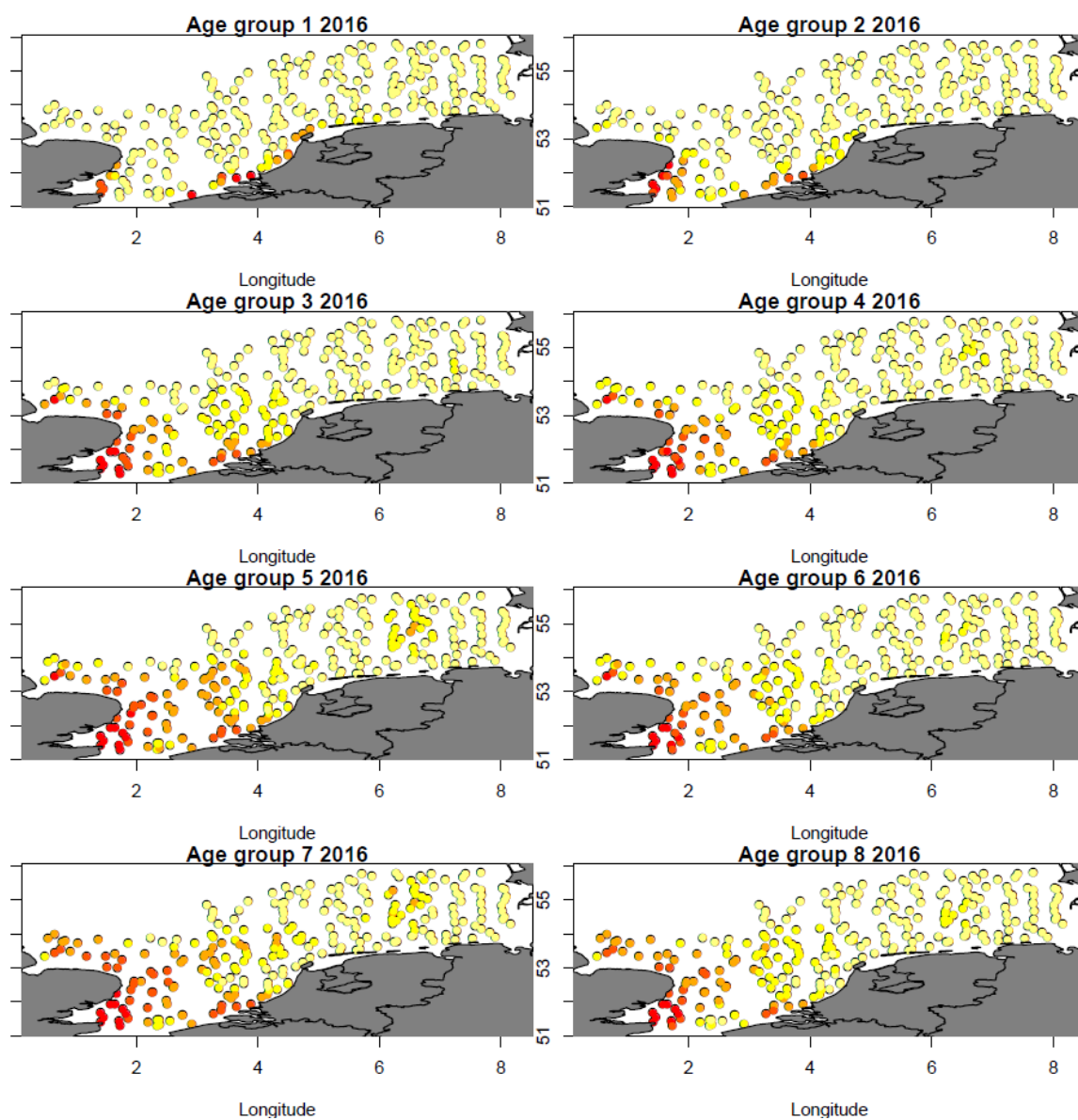


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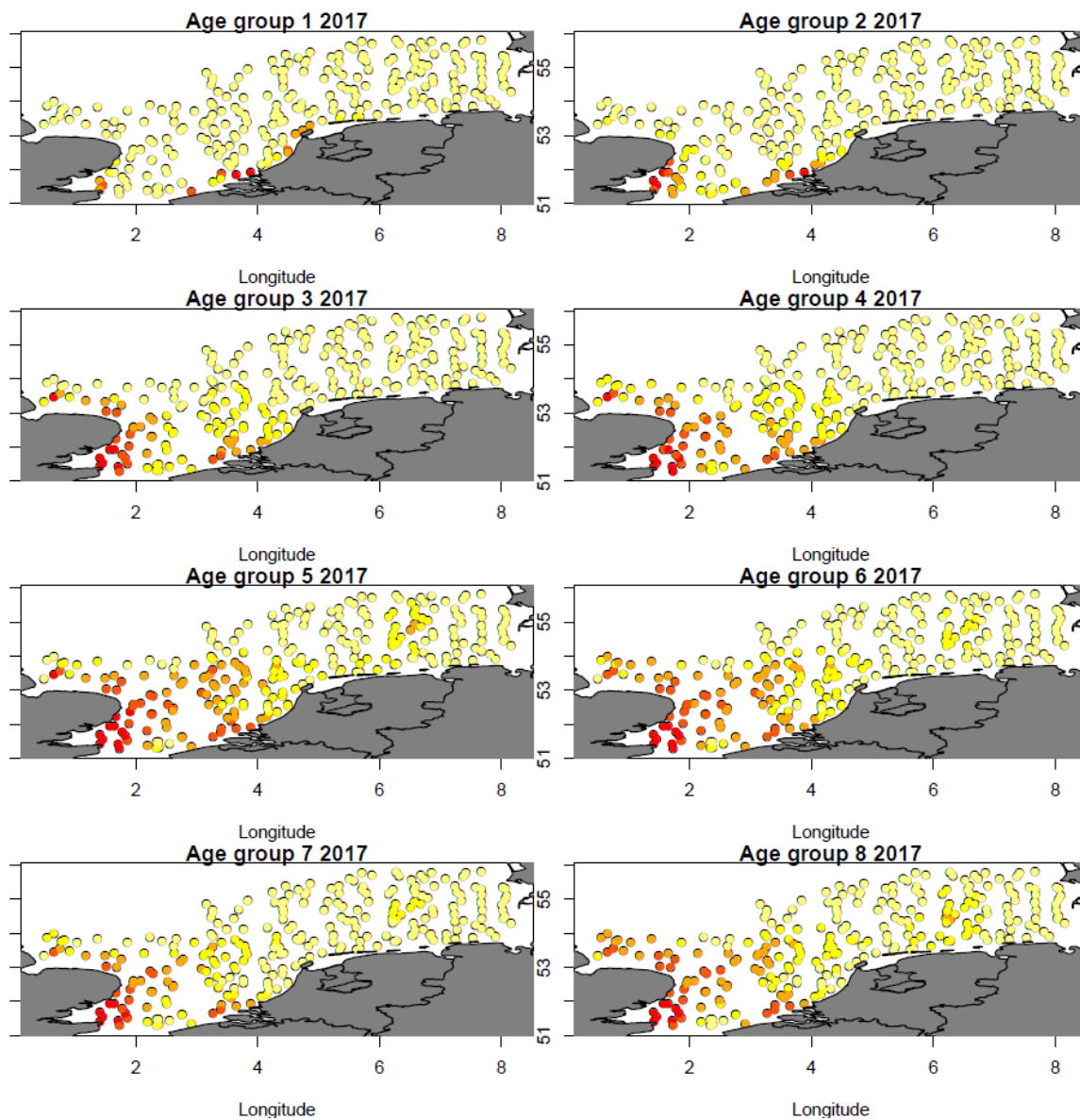


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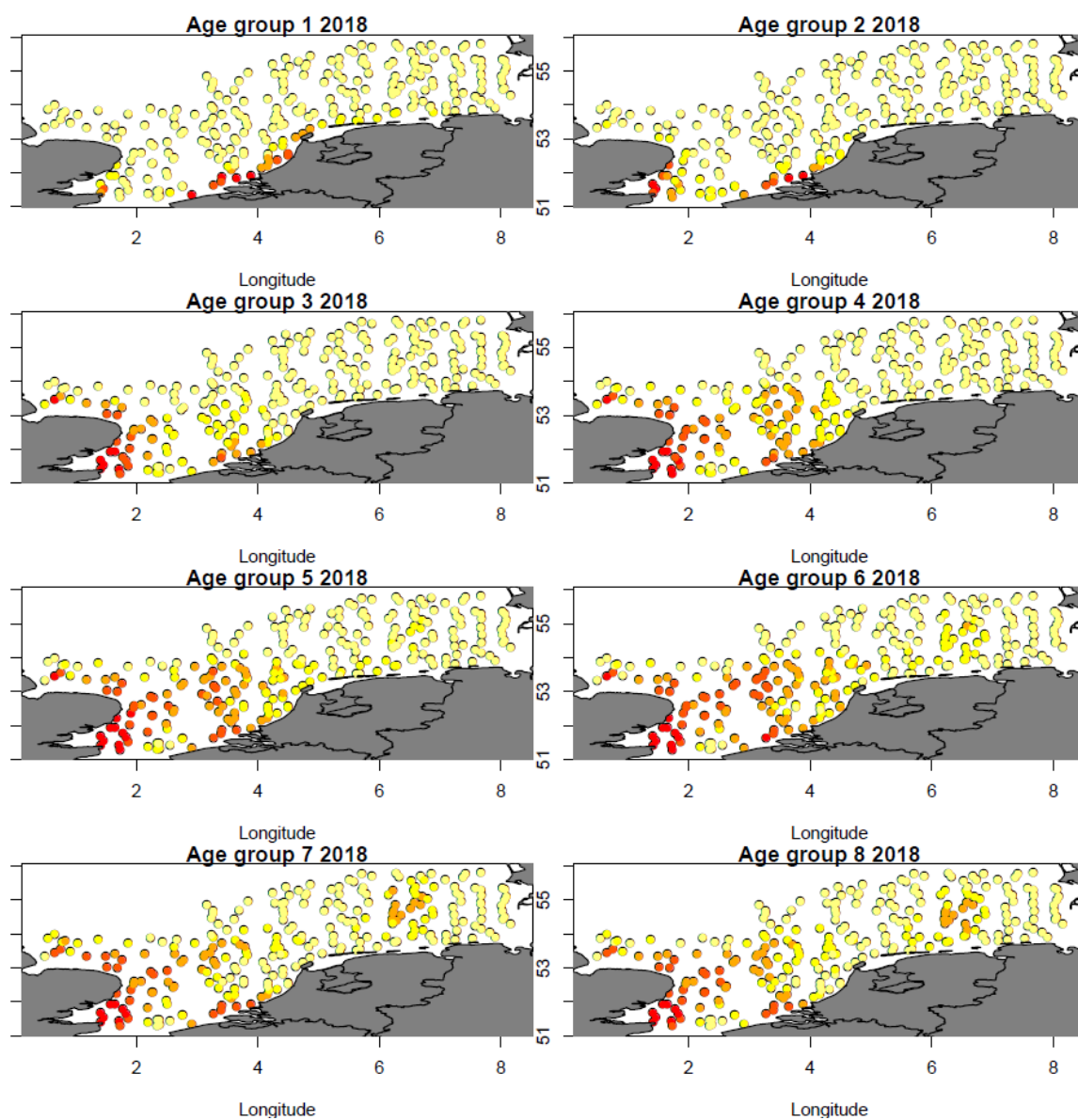


Figure 8.1.4.4 Continued