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Report of the Working Group on Beam Trawl Surveys (WGBEAM)

10-13 April 2018

IJmuiden, Netherlands

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CIEM Conseil International pour l'Exploration de la Mer

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Contents

Executive summary

The Working Group on Beam Trawl Surveys (WGBEAM) met on 10–13 April 2018 in IJmuiden, The Netherlands. The meeting was attended by 11 people representing seven countries and the ICES Data Centre, and was chaired by Holger Haslob, Germany. Data from eleven offshore and four inshore surveys were discussed (all surveys under WGBEAM coordination).

WGBEAM 2018 collated an overview of the 2017 results and the 2018 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 relation to the ICES Database on Trawl Surveys (DATRAS), actions leading to better data quality were formulated, and ongoing and future development issues were reported and/or discussed. WGBEAM reported back to the DATRAS governance group on which variables should be additionally included into the DATRAS format with regard to beam trawl surveys.

The finalization of the Offshore Beam Trawl Survey Manual was discussed and further actions taken. It was concluded that more information on the survey design should be implemented for each beam trawl survey and the draft manual should be restructured before submitting the final draft for external review.

During the meeting, WGBEAM collated information on marine spatial planning with specific attention to the construction of offshore wind farms and possible impacts on the existing surveys.

The working group discussed the progress of automating the index calculation procedure and the adoption of a modelling approach that combines several surveys into a single index based on DATRAS data (e.g. North Sea plaice and dab). However, WGBEAM indicated that the communication between survey and assessment groups is not fluent in many cases and the automation of procedures poses further risks to reducing the important communication between working groups. WGBEAM recommends that further consideration is needed by ACOM to ensure the quality of index information is maintained or improved, while it acknowledges the need for transparency, desire for consistency, and efficiency that the automation of survey indices provides. Based on this discussion WGBEAM aims to organize a two-day workshop bringing together expertise from survey and assessment groups in order to evaluate the use of the new combined indices.

1 Administrative details

Working Group name

Working Group on Beam Trawl Surveys (WGBEAM)

Year of Appointment within the current cycle

2018

Reporting year within the current cycle (1, 2 or 3)

2

Chair(s)

Holger Haslob, Germany

Meeting venue

IJmuiden, The Netherlands

Meeting dates

10–13 April 2018

2 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	1-5 April	ICES HQ, Copenhagen, Denmark	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 VIIa, Divisions VIId-g, Divisions VIIIab 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 assessements 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 VIIa, VIId-g, VIIIa-b and the Adriatic, and update and publish athe 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 assesements working groups and any changes to age structure of species of interest need to be investigated.	5.2	Expected output in 2017	WGBEAM 2017 update and ultimately ASC presentation
d	Provide index calculations based on DATRAS for dab in the North Sea, and plaice and sole in Divisions VIIa, VIId-g, VIIIa-b and the Adriatic.	Required to support indices for assessements	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

Year 1	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 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 affects 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 is 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 EOSG. Joint sessions are sometimes organized (e.g. with WGCRAN in 2014). It is also very 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.

3 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.

4 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:

- Update of offshore and inshore survey time-series for plaice and sole
- Update of deltaGAM indices for North Sea plaice and North Sea dab

2. Increase standardization of the surveys:

- Belgium staff participated in Dutch beam trawl survey.

3. Data quality and availability:

- Revision of offshore beam trawl manual. Finalization of manual in progress.
- Progress in incorporation of the Adriatic beam trawl survey into 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)
- Analysis of benthic communities of BTS offshore surveys in relation to fish data from BTS and IBTSQ3.
- Feedback to the DATRAS governance group on the need of variables to incorporate into DATRAS

5 Progress report on ToRs and workplan

5.1 Tabulate, report and evaluate population abundance in-dices by age-group for sole, plaice and dab and other species if required in the North Sea, Division VIIa, Divi-sions VIId-g, Divisions VIIIab and the Adriatic taking into account the key issues involved in the index calcu-lation (Tor a).

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

5.1.1.1 Sole

North Sea – Subarea 4

Time-series trends for sole in the North Sea, based on the Netherlands Isis offshore survey, are shown in Figure 5.1.1.1a in Annex 5.3. 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 (2012 – 2017). The 1-group in 2017 was higher than in 2016, and similar to the 1-groups in 2014 and 2015. The poor 2011 year class (age group 1 in 2012) resulted in below average age groups up to age group 3 (2014). However, in 2015 this cohort is well above the long term average and that trend continued in 2016. In general, there has been an increase in older fish (4+ group), with values well above the long-term arithmetic mean for the last 4 years (2013-2017). The spatial coverage of the Netherlands Tridens survey makes it unsuitable for monitoring sole abundance.

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. Here, the number of one-year olds was below the long-term mean from 2012 - 2014. In 2015 the highest value for age 1 for the whole time-series was observed until a new record was set in 2017, but in 2016 the value for this age group was well below the average. Strong cohorts of 2 year old fish in 2016 and 3 year old fish in 2017 were observed, a result of the large numbers observed of 1 year old fish in 2015.

Western Waters - Subarea 7

The indices for sole from area 7 stocks are summarized in Figure 5.1.1.1c-f in Annex 5.3.

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 averages across all age groups, this trend did not continue in 2012 and in 2013, when the numbers of one and two year olds were far below the long-term averages, with the number of one year olds in 2013 (the incoming year class 2012) being the second lowest of the 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. The very low observed value for the 2013 year class was not observed at that low level for the 2015 group 2 or the 2016 group 3 which were above 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 groups 1 sole in the Bristol Channel was below the time-series average for the years 2009-2014. In 2015-2017 age group 1 shows again above average value, and the value in 2017 is the highest since 2008. The low observed age group 1 in 2014 resulted in the lowest observed age group 2 value in 2015 and very low age group 3 value in 2016. The number of age group 4+ was fluctuating around the average for the last five years with values slightly above the average in 2015-2017.

Division 7a

Of all VII sole stocks, 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 and 2017 numbers below the average were observed again. The numbers of age group 3 were very high in 2017, and above the average for the first time since 2004, a result of the strong 2014 year class. However, the numbers for the 4+ group remain more or less stable at the low 2005–2017 level. As for most other sole stocks, peaks in the abundance of 1 groups 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) 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 decreased from 2013 to 2016. This trend is due to the cumulative effect of the increase 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 the long-term mean from 2012 onwards.

Northern Adriatic Sea

Figure 5.1.1.1h 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 (Linf: 39.6; k: 0.44, t0: -0.46), was carried out using LFDA 5.0.

This survey indicates that the 2017 0 age group of sole in the northern Adriatic has been lower than the level of the long-term arithmetic mean. Ages 1 in 2017 cruise were little higher than the long-term arithmetic mean. At age 2, 3 and 4+ the 2017 cruise yielded the highest index value of the time-series. Overall 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.

5.1.1.2 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 Isis and Tridens surveys. The Isis survey covers mainly the southern North Sea, whereas the Tridens extends substantially further north and west.

The Isis 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 and 2016 it was again below the average, while it was again above the long-term mean in 2017. The Tridens survey confirmed the strong 2001 year class, but also documented a series of seven consecutive 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 over time really well. The 2016 year class is the highest on record, evident by the high values of 1-group in 2017. The clear increasing trend in the age 4+ group is continuing in 2017 with the highest record of the time-series ever, and this increasing trend is clearly visible in all ages from 4-10. The combined Isis-Tridens index (Figure 5.1.1.2c in Annex 5.4) shows above average numbers for group 1 in 2017, for the first time since 2014. It also shows above average numbers-at-ages 2-4+ in 2017, with an increasing trend since the beginning of the 21st century for ages 4+. It is not clear where the larger numbers of four year olds in 2007–2009 come from in the Tridens and combined indices.

The population abundance series for plaice from the UK offshore survey (depicted in Figure 5.1.1.2d), 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 similar story can be said about year class 2015, which is well below the average in 2016. The increasing trend in numbers which can be seen from the combined Dutch survey index for age group 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 age group 4+ has been above the average for the last five years.

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.

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 smallest number since 2005 was observed. It rebounded again in 2017 and was slightly above the long term mean. In 2014 the observed number of age group 2 was the highest ever observed so far in the time-series, but the value for 2015 was even higher than that. The numbers of age group 2 in 2016 and 2017 were lower than in 2014 and 2015, but still well above the long term average. As a result of the good year classes 2009-2011 the numbers of age 4+ were the highest ever observed in the time-series for the years 2013-2017. Cohorts can be generally well tracked into all or some of the following 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 2015-2017 the lowest values ever were recorded. The strong year class 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 the high in 2015 and 2016, and a record high value was observed in 2017. Since 2009 the numbers of this age group consistently increased. Earlier in the survey history, 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 and 2017, the smallest numbers of the series were observed. However, as opposed to sole in this area, place in VIIa seems to be characterized by a healthy stock status, with numbers for the 4+ group in 2013–2017 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.

5.1.2 Abundance indices by age-group for plaice and sole for the inshore 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 2017 in Figures 5.1.2.1 and 5.1.2.2 respectively (Annexes 6.1 and 6.2).

5.1.2.1 Sole

The combined inshore indices for 0 and 1 group sole were below average in 2017. The 0 group index in 2017 was quite a bit higher than in 2016 (Figure 5.1.2.1 in Annex 6.1). In the SNS, age groups 1 and 2 have been below the average in 2016 and 2017. The

strong year class 2 of 2015 is now represented in this year's age group 4 which is now among the highest values estimated since 1990 (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.

5.1.2.2 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). In the SNS, the group 1, 2 and 3 indices are below average while the 4 group indices are above the average (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.

5.1.3 New 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.

5.1.3.1 Plaice

The combined beam trawl survey index for the North Sea plaice stock (ple.27.420) includes data from different beam trawl surveys (1996-2016, 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). The index was updated during the WGBEAM 2018 meeting and by the stock coordinator of plaice (Annex 7; Figure 1).

Table 5.1.3.1. Overview of data included in the North Sea plaice index calculation

Country	Vessel	Gear	Years	Ages
BEL	BE11	BT4A	2010-2014, 2017	1-9
GFR	SOL	BT7	2002-2003	
GFR	SOL2	BT7	2004-2005, 2007-2017	
NED	ISI	BT8	1996-2016	
NED	TRI2	BT8	1996-2017	
ENG	COR	BT4A	1996-2007	
ENG	END	BT4A	2008-2017	

5.1.3.2 Dab

The combined beam trawl survey index for the North Sea dab stock (dab.27.3a4) includes data from different beam trawl surveys (2003-2016, 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). The index was updated during the WGBEAM 2018 meeting (Annex 7; Figure 2).

Table 5.1.3.2. Overview of data included in the North Sea dab index calculation

Country	Vessel	Gear	Years	Ages
GFR	SOL	BT7	2003	1-6
GFR	SOL2	BT7	2004-2005, 2007-2017	
NED	ISI	BT8	2003-2016	
NED	TRI2	BT8	2003-2017	

5.2 Trawl surveys in the North Sea and Division 7a, 7d-g, 8a-b and the Adriatic (ToR a).

5.2.1 Results of 2017 surveys

5.2.1.1 Offshore beam trawl surveys

5.2.1.1.1 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 5.2.1.1. Further details (areas covered, technical specifications) by country are given in Annex 4.1.

Table 5.2.1.1. Overview of offshore bream trawl surveys during 2017.

Country	Vessel	Area	Dates	Gear
Belgium	Belgica	southern North Sea	28 Aug – 08 Sep 2017	4m beam
England	Endeavour	7d, 4c	19 Jul – 01 Aug 2017	4m beam
England	Endeavour	7a, 7f	06 – 26 Sep 2017	4m beam
England	Endeavour	7e. Celtic Sea	07 Mar – 05 Apr 2017	4m beam
France	Côtes de la Manche	8a, 8b	02 – 21 Nov 2017	4m beam
Germany	Solea	German Bight	18 Aug – 04 Sep 2017	7m beam
Iceland	Bjarni Sæmundsson RE-30	Entire coast of Iceland	24. Aug – 07 Sep 2017	4m beam
Ireland	Celtic Explorer	western Celtic sea	07 – 16 Mar 2017	4m beam
Italy/Slovenia	G. Dallaporta	northern Adriatic Sea	10 Nov – 09 Dec 2017	3.5m beam
Netherlands	Tridens	central North Sea	21 Aug – 15 Sep 2017	8m beam + flip-up rope
Netherlands	Tridens	southern North Sea	31 Jul – 18 Aug 2017	8m beam

5.2.1.1.2 Survey results

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

5.2.1.1.3 Staff exchanges (ToR b)

In the context of staff exchange and standardization of survey methods a member of ILVO (Institute for Agricultural, Fisheries and Food Research, Belgium) participated in the Dutch offshore Beam Trawl Survey 2017 organized by WMR (Wageningen Marine Research, Netherlands) in ICES division 4. The observations on differences and similarities by the staff involved in this exchange should help the involved parties and WGBEAM to better understand and coordinate the surveys from an international perspective. See Annex 9 for a detailed report.

No staff exchanges are planned for 2018

5.2.1.2. Inshore beam trawl surveys

5.2.1.2.1 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 5.2.1.2. Further details (areas covered, technical specifications) by country are given in Annex 4.2.

Table 5.2.1.2. Overview of surveys during 2017.

Country	Vessel	Area	Dates	Gear
Belgium	Simon Stevin	Belgian coastal zone	11 Sep – 20 Sep	6 m shrimp trawl
Germany	Chartered vessel & Clupea	German Bight and German Wadden Sea	25 Aug – 29 Sept	3 m shrimp trawl
Netherlands (SNS)	Isis	Dutch coastal zone	15 Sept – 28 Sept	6 m beam trawl
Netherlands	Luctor	Scheldt estuary	4 Sep – 21 Sep	3 m shrimp trawl
Netherlands	Stern	Dutch Wadden Sea	28 Aug – 29 Sep	3 m shrimp trawl
Netherlands	Isis	Dutch coastal zone and German Bight	04 Oct – 09 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.

5.2.1.2.2. Staff exchanges (ToR b)

No staff exchanges planned for 2018.

5.3 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. Multidecadal datasets from beam trawl surveys in the North Sea, English Channel, Bristol Channel, Irish Sea and Bay of Biscay are currently available through DATRAS or otherwise available to WGBEAM. These data allow 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 were scrutinised. Most important change was the distinction of ALK (age-lenth-key) areas within the individual UK surveys. Up till 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, prior to the next WGBEAM meeting in 2019.

5.4 Other activities

5.4.1 Feedback for DATRAS governance group

5.4.1.1 DATRAS governance group

In January 2018, the DATRAS governance group was installed. It is a group under the responsibility of the ICES Data and Information Group.

The main goals of the group are:

1. Elaborate the framework on the governance of DATRAS
2. Oversee and advise on the interpretation and prioritization of recommendations from expert groups addressed to DATRAS
3. Align DATRAS over the different surveys
4. Provide a platform for end-user feedback to the DATRAS system

A full overview of tasks of the DATRAS governance group can be found in the DIG 2017 report, Annex 9.

The governance group will consist of a DIG representative who will chair the group, (Ingeborg de Boois), representatives from ICES Data Centre (Anna Osypchuk, Vaishav Soni), and data-submitters from different surveys in DATRAS, representing all ICES survey planning groups delivering data to DATRAS: WGBIFS (Henrik Degel), IBTSWG (Finlay Burns), WGBEAM (Wim Allegaert).

The group had its first meeting in February 2018, and decided to collect feedback on variables that currently cannot be stored in DATRAS, or are not available in the current reporting format for the specific surveys.

5.4.1.2 WGBEAM feedback to governance group

DATRAS reporting format

WGBEAM took the inshore reporting format as a starting point, and first of all, would like to adopt that also for the offshore beam trawl surveys.

Add additional variables (to the current inshore format):

- HH: Check if tide direction can be put into DATRAS, in bottom current speed?
- HH: BycSpecreccode -add to vocab if litter has been collected during the survey
- CA: stratification by length class/weight/sex
- CA: How many otoliths were planned by length class in the design (AreaType, stratification by) –should be variable on a species level and even on length class.

New vocabulary:

- CA: Survey stratification; survey stratum: on what (spatial) stratification have the otoliths been collected? After discussion it was decided that all countries should check if the appropriate AreaType is available in the ICES vocabulary (vocab.ices.dk) and apply the correct vocabulary to the data. For the following surveys additional vocabulary for the offshore beam trawl surveys is needed (if possible, also provide shapefiles):
    - IBTS roundfish areas (NED); shapefile can be taken from IBTS AreaType roundfish areas
      BTS NED index areas (NED); shapefile to be delivered
    - ENG Q1 (ENG)

Descriptions:

For some variables in the reporting format the descriptions are not clear, e.g. CatCatchIdentifier. It would help when the variable descriptions are being reviewed and updated.

Other issues

- Export: also add scientific names to Exchange data. Currently in the download of Exchange data only valid ApiaID is presented. WGBEAM would like to also see scientific species names in the Exchange file (based on the valid AphiaID);
- The upload facility does not accept Specval=1 ánd specval=4 for the same haul, species and sex. This should be made possible, as it quite often occurs that e.g. edible crab is measured in a haul and a smashed crab is only counted, as it could be measured.
- If specval=4 then LengthClassCode, MinLengthClass and HLNoAtLength = -9; if validity code is 4 then LengthClassCode, MinLengthClass and HLNoAtLength = -9 (DATRAS screening facility). It is highly favourable to be able to add the number counted per species in DATRAS, and so, also submit the actual subbsampling factor.

- There is a wish to be able to link up the data in the stomach database with DATRAS data

Action WGBEAM:

Check if areatype has been filled in correctly for offshore and inshore data

5.4.2 Analysis of epibenthic community data from the Dutch offshore beam trawl surveys

Details on this analysis is given in Annex 10 (WD1)

Background:

WKPIMP 2016 requested that WGBEAM 'Compare the macro-epibenthos catches in species composi-tion and quantity of at least IBTS Q3 and Beam Trawl Survey catches'. WGBEAM was unable to fully complete the request as the IBTS Q3 data on epibenthos is not available on DATRAS. Instead WGBEAM evaluated the epibenthic community structure from the Dutch BTS surveys carried out on Tridens and ISIS with those of the fish communities of both the beam trawl and GOV (IBTS Q1 and Q3 combined). Haul locations and number of hauls differ between these surveys, so for the purposes of this analysis the data were aggregated by ICES-rectangle and year combinations to enable comparisons. The analysis was limited to the rectangle-year combinations where all three data types were available on DATRAS.

WGBEAM concluded:

General community structure is highly consistent between epibenthic communities and fish communities as sampled simultaneously by the beam trawl and independently in the GOV.

For the three communities examined patterns are spatio-temporally very consistent and at the very least do not suggest large changes over time. Spatial differences are much more important than changes over time suggesting that without considering spatial effects comparisons between years is unlikely to detect changes of the magnitude contained in the time-series.

Observed differences in the spatial extent of different clusters are largely artefacts of the clustering method chosen. Ordination analysis suggest that spatial changes are gradual and clustering responds differently to these changes. Correlation between the correspondence analysis eigenvectors is highly significant across the different communities with beam trawl and GOV fish communities having an r^2=0.934 on the first axes, and both fish communities correlating with epibenthic communities (r^2 0.88 and 0.87 for GOV and beam trawls respectively.

Spatial scales of community variability are significantly larger than the inter station distances, and correlation between communities sampled by different surveys (not the same location) suggest that habitats are either homogenous or a highly consistent mosaic of different communities at spatial scales much smaller than those of the trawls. In any case possible scales of marine spatial management are significantly larger than the scales of sampling.

The working group concludes that epibenthic sampling from gears designed for fishing can be indicative of epibenthic species at scales relevant to management and that combining epibenthic catches from the North Sea beam trawl surveys for integrated analysis with fish catches should be possible at least at the general level. Further analysis is necessary to investigate the utility for more specific purposes.

6 Revision to the work plan and justification

No revision was made during the meeting.

7 Next meeting

The next meeting for WGBEAM is scheduled to be 18 – 22 March 2019, at ICES Headquarters in Copenhagen.

Annex 1: List of participants

Name	Institute	Phone	Email
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Annex 2: Recommendations

Recommendation	Adressed to
1. During the WGBEAM 2018 survey summary sheets were revised and put in a new table format. This table now contains relevant information for the assessment working groups and all other potential data users. WGBEAM recommends that ACOM takes the responsibility to delegate update of the assessment used information to the relevant assessment working groups.	ACOM
2. WGBEAM recommends to ICES data centre to develop R-based and git hub-based swept-area CPUE calculation procedure.	ICES Data centre
3. WGBEAM recommends ACOM to consider whether it is necessary for French inshore beam trawl survey data, as used in the assessment of sole in subarea 7d, to be included in the survey coordination by WGBEAM.	ACOM
4. WGBEAM recommends to WGECO and WGINOSE to investigate whether the data used in the analyses on benthic communities can be used as indices or indicators.	WGECO, WGINOSE

Actions

- Restructure information of the Offshore manual in order to increase consistency and clarity particularly of the survey design elements, include Q1SWECOS and resubmit to EOSG chair (Ingeborg de Boois, Kay Panten, Loes Vandecasteele, Sven Kupschus).
- Continue work on inshore BTS manual and send to EOSG-chair for review in the process towards publication in the SISP-series. This is addressed to Loes Vandecasteele, Ingeborg de Boois, Gary Burt, Holger Haslob, Loes Bolle.
- IFREMER to give priority to the upload of beam trawl survey data to DATRAS. This is addressed to ACOM (France). In Progress.
- WGBEAM member countries to continue the upload of: - inshore beam trawl survey data to DATRAS; - offshore beam trawl survey including all taxa. This is addressed to Ingeborg de Boois, Loes Vandecasteele, Gary Burt, Kay Panten. BEL: inshore in progress; offshore done (2010-2016), in progress for earlier years. GER: inshore in progress; offshore (1998 – 2016) NED: inshore DYFS 2010-2016 submitted; offshore done UK: inshore in progress; Western Channel to be completed, all others done.
- Sort out submission of SNS data to DATRAS. This is addressed to ICES Data Centre (Vaishav Soni, Anna Osypchuk), Ingeborg de Boois. Dialogue between ICES Data Centre and NED, see WGBEAM 2017 report chapter 5.4.2.2. for progress.
- Continue the work on DATRAS checking procedures to be made available in an R-script so national data can be screened prior to the DATRAS screening, making the process more efficient. This is addressed to ICES Data Centre (Vaishav Soni, Anna Osypchuk). Long-term aim in progress.
- If time and weather allows: - overlapping hauls are carried out by countries operating in the same area; - the ICES Rectangles are visited that just miss out in the survey selection criteria for use in MSFD GES assessment (based on list of M. Moriarty); - NED and GFR continue to carry out side-by-side or overlapping hauls during their Q3 inshore beam trawl surveys in the context of gear comparisons, mainly to investigate differences in catchability for brown shrimp. This is addressed to all. No overlapping tows done in 2017.
- CPUE per length per Hour and Swept-area for Inshore surveys (currently DYFS). A request form has been sent in to accessions@ices.dk. This is addressed to Ingeborg de Boois, Vaishav Soni. In progress.
- Restrict access to previous versions of data uploaded into DATRAS to data submitters. Previous versions of uploaded data should be available upon request only for all other users. This is addressed to ICES data center.

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	1-5 April	ICES HQ, Copenhagen, Denmark	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 VIIa, Divisions VIId-g, Divisions VIIIab 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 assessements 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 VIIa, VIId-g, VIIIa-b and the Adriatic, and update and publish athe 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 assesements working groups and any changes to age structure of species of interest need to be investigated.	5.2	Expected output in 2017	WGBEAM 2017 update and ultimately ASC presentation
d	Provide index calculations based on DATRAS for dab in the North Sea, and plaice and sole in Divisions VIIa, VIId-g, VIIIa-b and the Adriatic.	Required to support indices for assessements	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

Year 1	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 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 affects 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 is 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 EOSG. Joint sessions are sometimes organized (e.g. with WGCRAN in 2014). It is also very 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 surveys

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

	Belgium	France	Germany	Italy	Netherlands	Netherlands	UK	UK	UK
Survey area:	4b and c west	8ab	4b east	North Adriatic Sea (GSA 17)	4b and c east	Central N Sea	7d, 4c	7a, f and g	Celtic Sea
Year survey started:	1992	2007	1991	2005	1985	1996	1988	1988	2006
Dates:	Late August-early September	November	mid August	November	August-early September	mid August-mid September	late July	September	mid February – mid March
Usual start date	week 33	Week 44	week 32	Week 45	week 32/33	week 34	week 30	Week 36/37	Week 36/37
Number of survey days	10	35	13	18	20	16–20	15	21–24	28
Ship:	RV Belgica	RV Gwen Drez	RV Solea #	RV G. Dallaporta	RV Isis	RV Tridens	RV Cefas Endeavour ##	RV Cefas Endeavour	RV Cefas Endeavour
Ship length:	50 m	24.5 m	42 m	35.7 m	28 m	73.5	73 m	73 m	73 m
Beam trawl length:	4 m	4 m	7 m	3.5 m	8 m	8 m	4 m	4 m	4 m
Number of beams fished:	1	1	2	2	2	2	1	1	1
Number of beams sorted:	1	1	1	2	1	1	1	1	1
Trawl duration (min):	30	30	30	30	30	30	30	30	30
Tow speed (knots):	4	5	4	5.5	4	4	4	4	4
Codend stretched mesh (mm):	40	20	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:	BT4M		BT7	Rapido	BT8	BT8F	BT4FM	BT4FM	BT4FM
Attachment:	(none)	(none)	(none)	(none)	(none)	**	*	*	*
Station positions:	fixed	fixed	pseudo-random	fixed	pseudo-random	pseudo-random	fixed	fixed	fixed
Av No stns/yr	53-62	120	63	67	88	63-73	100	94	131
Benthos sampling since:	1992	2007	1992	2005	1985	1996	1991	1992	2006

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

 # new vessel since 2004, previously 35m; ## Corystes (53 m) in 2009 replaiced by CEFAS Endeavour; * chain mat and flip-up rope, ** flip-up rope only.

	Iceland	Ireland
Survey area:	5a	7jgh
Year survey started:	2016	2016
Dates:	September	March
Usual start date	week 36	Week 10
Number of survey days	10	10
Ship:	Chartered vessel	RV Celtic Explorer
Ship length:	26 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	30	50
Benthos sampling since:	2016	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/Southeastern English Coast	Belgian Coast
Ship	Tridens / Isis	Stern / Wadden-zee	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	8 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 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 *Crangon*	All fish species *Crangon*	All fish species *Crangon*	All fish species	Commercial fish species *Crangon* (1973–92, 2004–05)
Catch rate	Epibenthos (quantity)	Epibenthos (quantity)	Epibenthos (quantity)	Epibenthos (quantity)	*Crangon* (volume)	*Crangon* (weight)
Age data for plaice and sole	All years	All years	All years	All years	Since 2003	None

 # Broodwinner (27 m) in 2013 replaiced by Simon Stevin; ## Schoolevaar (21 m) in 2016 replaiced 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 out-side 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 *Crangon*	All fish species *Crangon*	All fish species *Crangon*
Catch rate	Epibenthos (quantity)	Epibenthos (quantity)	Epibenthos (quantity)
Age data for plaice and sole	Since 2013	Since 2013	Since 2013

Annex 5: Population abundance indices 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 (IV) RV "Isis".

Year/Age	0	1	2	3	4+
1985	0.00	7.03	7.12	3.69	2.62
1986	0.00	7.17	5.18	1.60	2.01
1987	0.04	6.97	12.55	1.83	1.68
1988	0.00	83.11	12.51	2.68	1.68
1989	0.49	9.01	68.08	4.19	5.23
1990	0.02	37.84	24.49	21.79	2.94
1991	0.82	4.03	28.84	6.87	6.91
1992	0.02	81.63	22.28	10.45	5.97
1993	0.02	6.35	42.35	1.34	15.31
1994	2.17	7.66	7.12	19.74	2.85
1995	0.43	28.13	8.46	6.27	7.42
1996	0.16	3.98	7.63	1.95	5.46
1997	0.54	169.34	4.92	2.99	2.06
1998	0.37	17.11	27.42	1.86	1.72
1999	6.34	11.96	18.36	15.78	3.95
2000	0.19	14.59	6.14	4.04	2.17
2001	9.20	8.00	9.96	2.16	2.55
2002	5.91	20.99	4.18	3.43	1.76
2003	0.32	10.51	9.95	2.46	2.56
2004	0.68	4.19	4.35	3.55	1.54
2005	0.08	5.53	3.40	2.38	1.78
2006	0.06	17.09	2.33	0.28	1.46
2007	0.71	7.50	19.50	1.46	1.48
2008	3.09	15.25	9.06	12.30	2.09
2009	4.91	15.95	5.00	2.86	5.52
2010	2.46	54.81	10.71	2.03	2.41
2011	2.23	26.17	17.39	4.01	2.88
2012	1.09	5.15	18.21	8.86	3.03
2013	0.38	6.84	3.56	12.57	6.74
2014	0.14	18.93	15.58	3.37	10.50
2015	0.20	21.10	25.60	9.66	8.15
2016	0.74	6.45	11.83	8.42	5.40
2017	0.00	16.28	7.10	5.99	8.55

b) United Kingdom: sole (total numbers per km towed) Southern North Sea (IVc).

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

c) United Kingdom: sole (N.hr^-1/8m trawl) Eastern Channel (VIId)

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

Year/Age	0	1	2	3	4+
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

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

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 (VIIf).

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

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

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

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

a) Netherlands: plaice (N.hr^-1/8m trawl) North Sea (IV) 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

b) Netherlands: plaice (N.hr^-1/8m trawl) North Sea (IV) 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

c) Netherlands: plaice (N.hr^-1/8m trawl) North Sea (IV) 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

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

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

e) United Kingdom: plaice (N.hr^-1/8m trawl) Eastern Channel (VIId).

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

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

Year/Age	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
2011	0	207.99	578.76	351.47	94.41	54.86	8.75	8.27	3.00	1.00	6.50
2012	0	16.24	235.46	577.44	188.21	47.22	44.14	19.35	6.07	5.00	6.88
2013	10.00	8.23	102.88	379.14	397.31	176.37	77.90	20.88	4.79	6.50	1.00
2014	Survey discontinued										

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

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

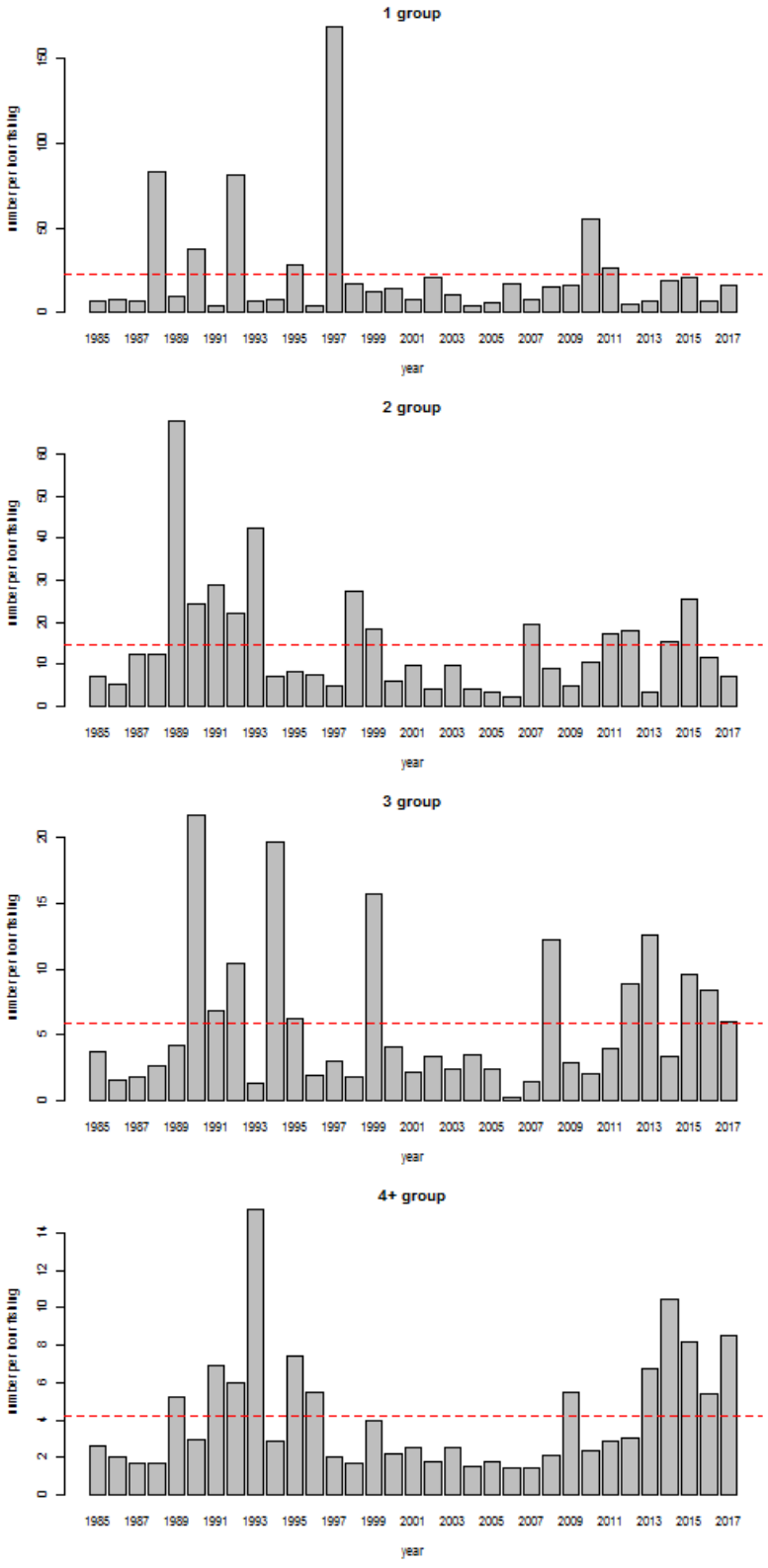
h) United Kingdom: plaice (total numbers for 4m beam trawl) Irish Sea (VIIa).

Year/Age	0	1	2	3	4	5	6	7	8	9	10+
1995	210.82	1018.39	307.43	142.05	66.34	12.63	13.95	0	0.84	2.4	6.67
1996	82.96	1349.92	476.84	98.11	58.74	38.86	7.47	8.6	0.88	1.72	6.66
1997	24.72	1081.33	529.88	255.42	51.5	39.5	17.98	6.54	5.87	0	5.34
1998	134.39	926.42	608.71	168.31	75.55	27.03	17.95	10.95	2.3	0.76	5.42
1999	142.92	943.45	765.83	273.12	89.33	30.34	13.34	5.76	5.7	3.4	0
2000	104.9	1676.41	523.23	236.12	111.86	57.83	17.43	5.33	2.74	2.55	4.19
2001	197.99	1165.38	526.08	172.91	103.5	70.93	22.21	8.32	5.53	4.55	3.19
2002	12.68	1376.5	1281.68	513.25	192.97	62.48	40.13	12.61	13.42	4.1	5.23
2003	204.92	1174.77	1461.85	656.39	234.76	96.68	49.19	31.07	7.79	3.3	3.45
2004	172.84	1440.89	942.24	939.96	320.48	207.17	45.47	45.5	10.93	2.95	2.63
2005	235.77	710.26	1058.72	544.84	407.78	242.61	90.74	14.09	13.79	7.18	8.7
2006	384.75	888.82	666.27	572.61	326.36	140.61	65.48	46.43	12.83	11.52	4.75
2007	147.46	2116.25	996.39	416.47	331.17	155.34	75.26	35.76	29.36	5.04	7.56
2008	359.35	1057.52	1553.72	506.4	277.59	199.17	62	44.94	26.82	3.71	0
2009	119.22	1158.79	859.37	971.88	246.11	149.9	198.39	51.77	24.63	16.09	10.41
2010	400.61	1446.78	1121.35	531.83	400.57	145.99	123.21	77.64	47.71	20.04	17.49
2011	186.43	1772.79	1177.06	528.14	265.08	310.05	111.89	98.74	71.49	50.12	52.38
2012	278.22	1540.8	1463.84	524.32	247.23	125.07	115.32	98.29	57.25	70.32	56.09
2013	542.38	1185.15	1318.8	771.94	460.05	298.41	119.9	128.14	65.36	71.58	51.99
2014	100.77	2192.82	1737.55	731.08	601.97	262.65	203.56	151.59	62.76	23.12	60.88
2015	67.48	893.81	2058.32	574.21	440.06	273.1	209.29	94.12	56.2	48.02	95.38
2016	49.89	446.83	1412.71	1047.38	646.17	400.93	219.72	239.91	127.28	61.49	103.46
2017	9.99	316.11	1279.35	664.51	654.87	480.52	226.91	205.22	108.81	86.63	133.65

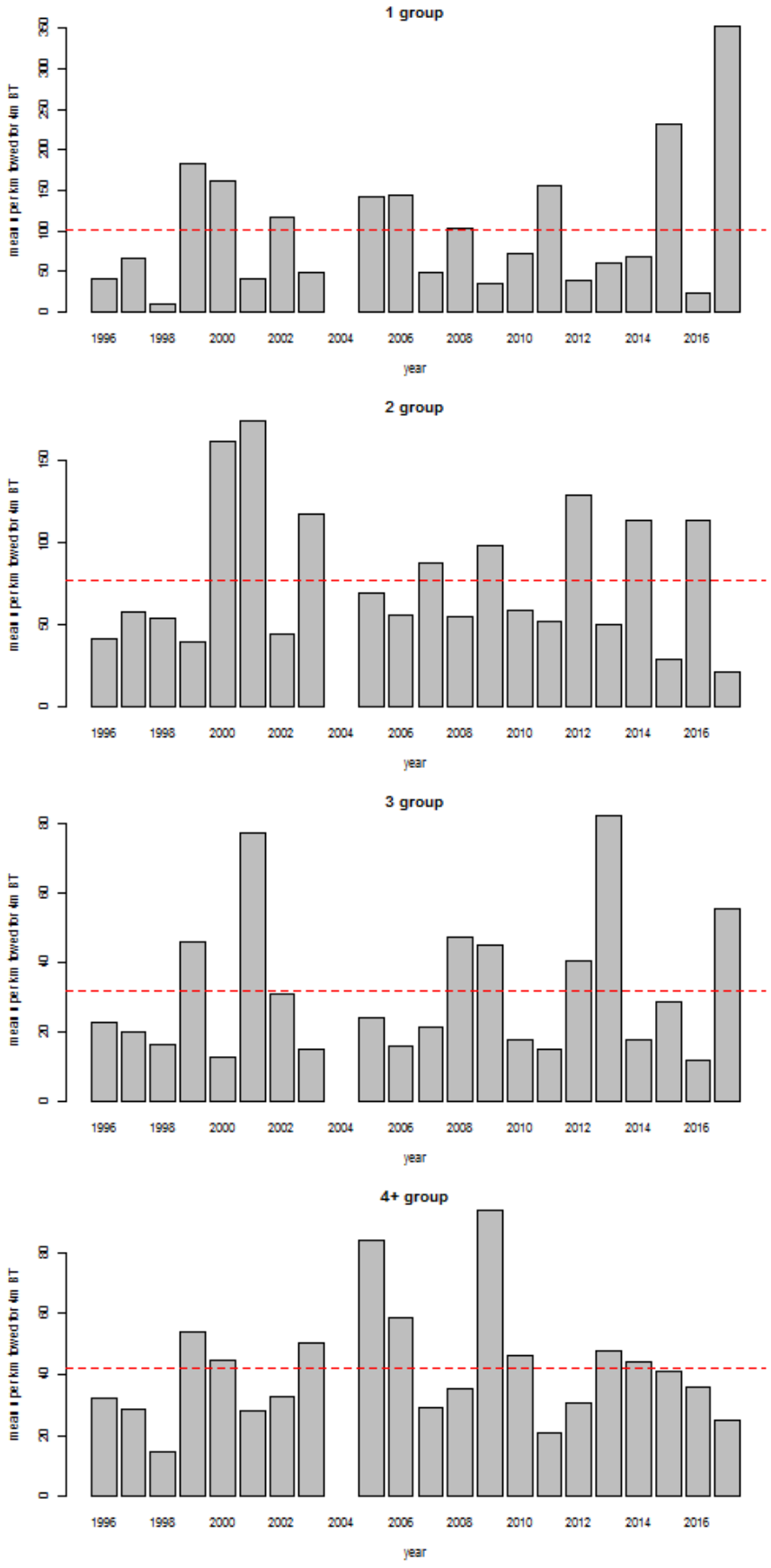
i) Iceland: plaice (N.hr^-1/4m trawl)

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

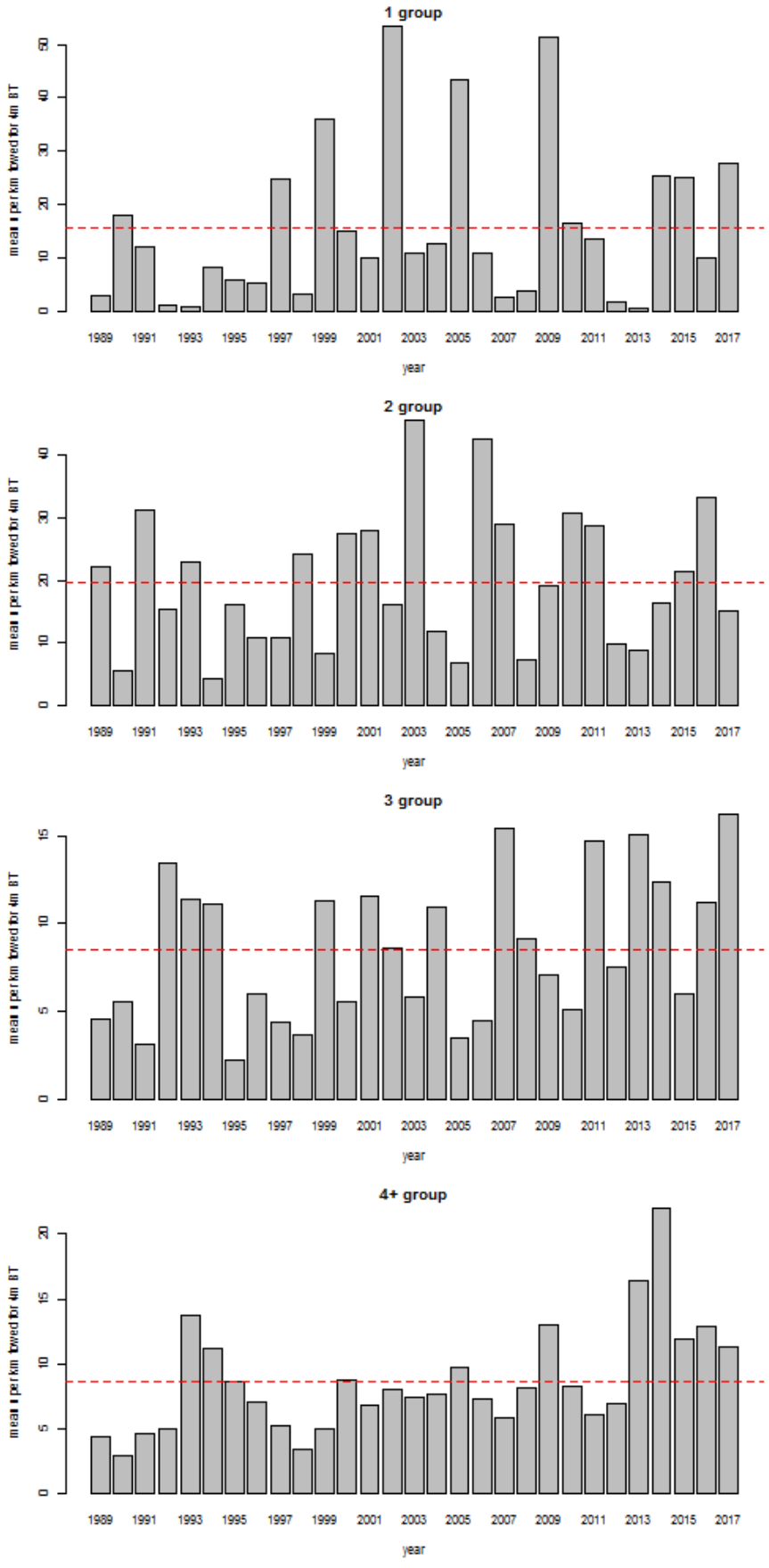
Annex 5.3: Figures of catch rate of sole. Offshore surveys



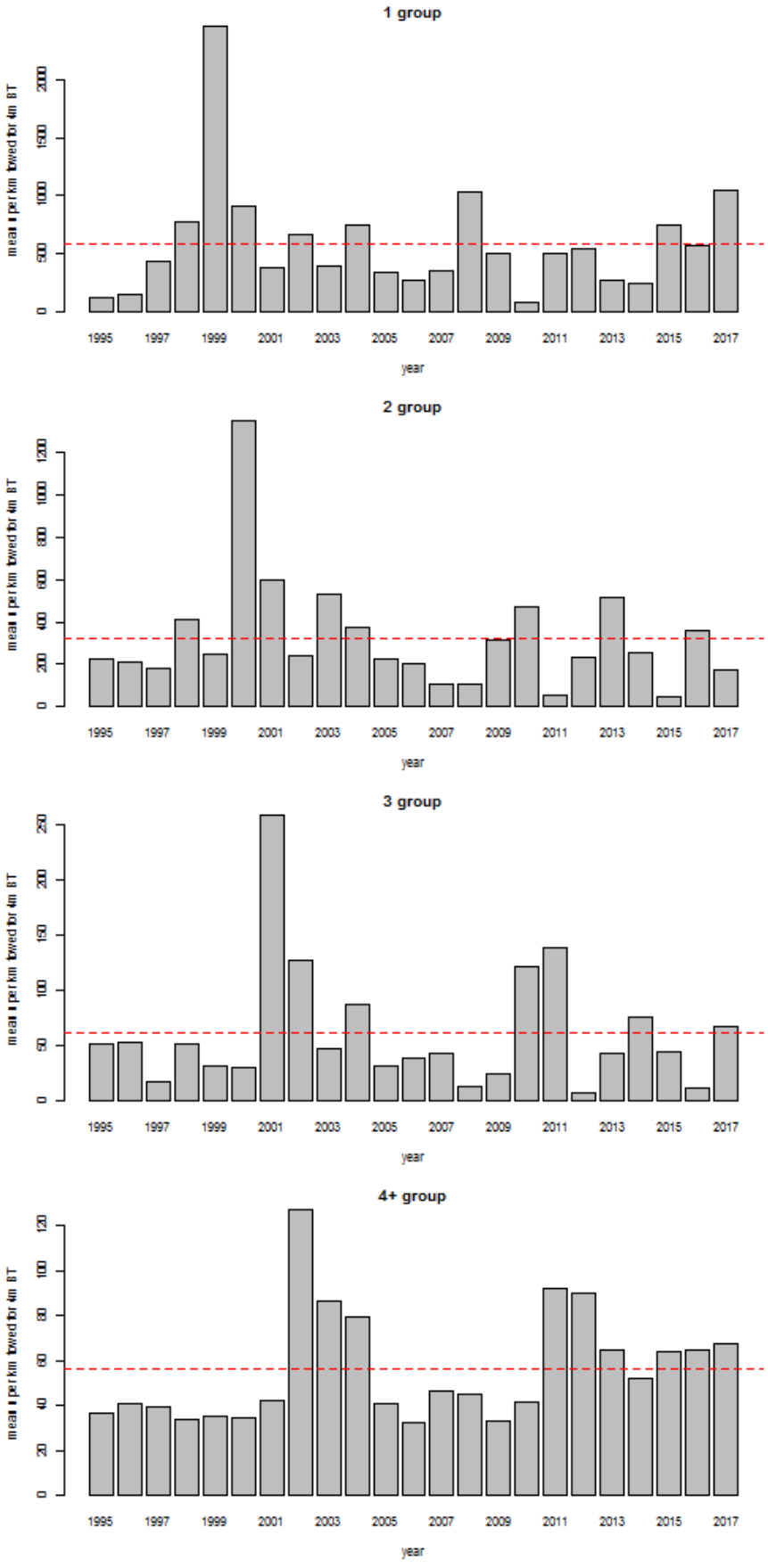
a) Netherlands: sole (N.hr^-1/8m trawl) North Sea (IV) RV "Isis". (Horizontal line=long-term mean for the period presented)



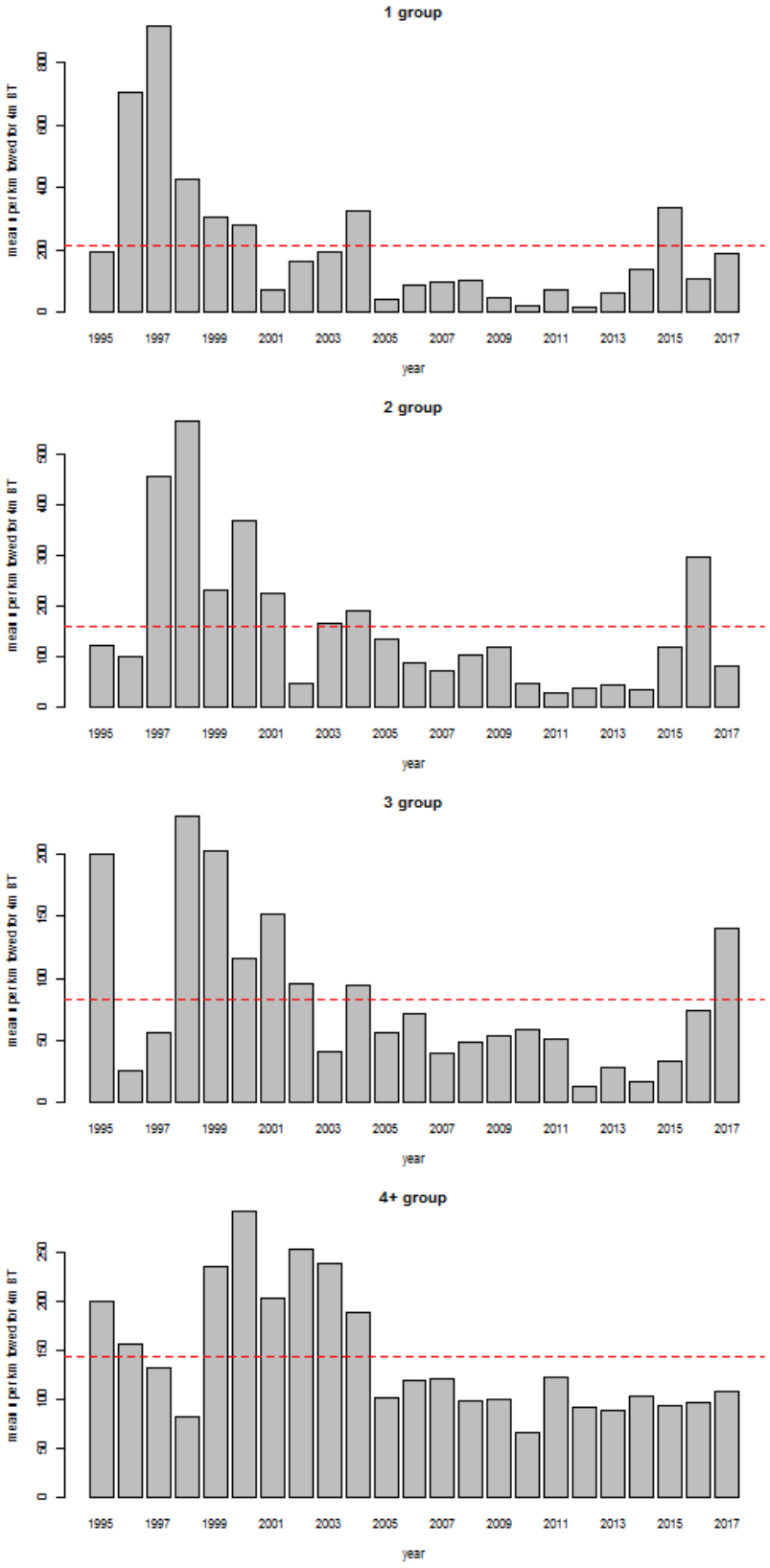
b) UK: sole (mean numbers per km towed for 4m beam trawl) Southern North Sea (IVc)



c) UK: sole (N.hr^-1/8m beam) Eastern English Channel (VIId)

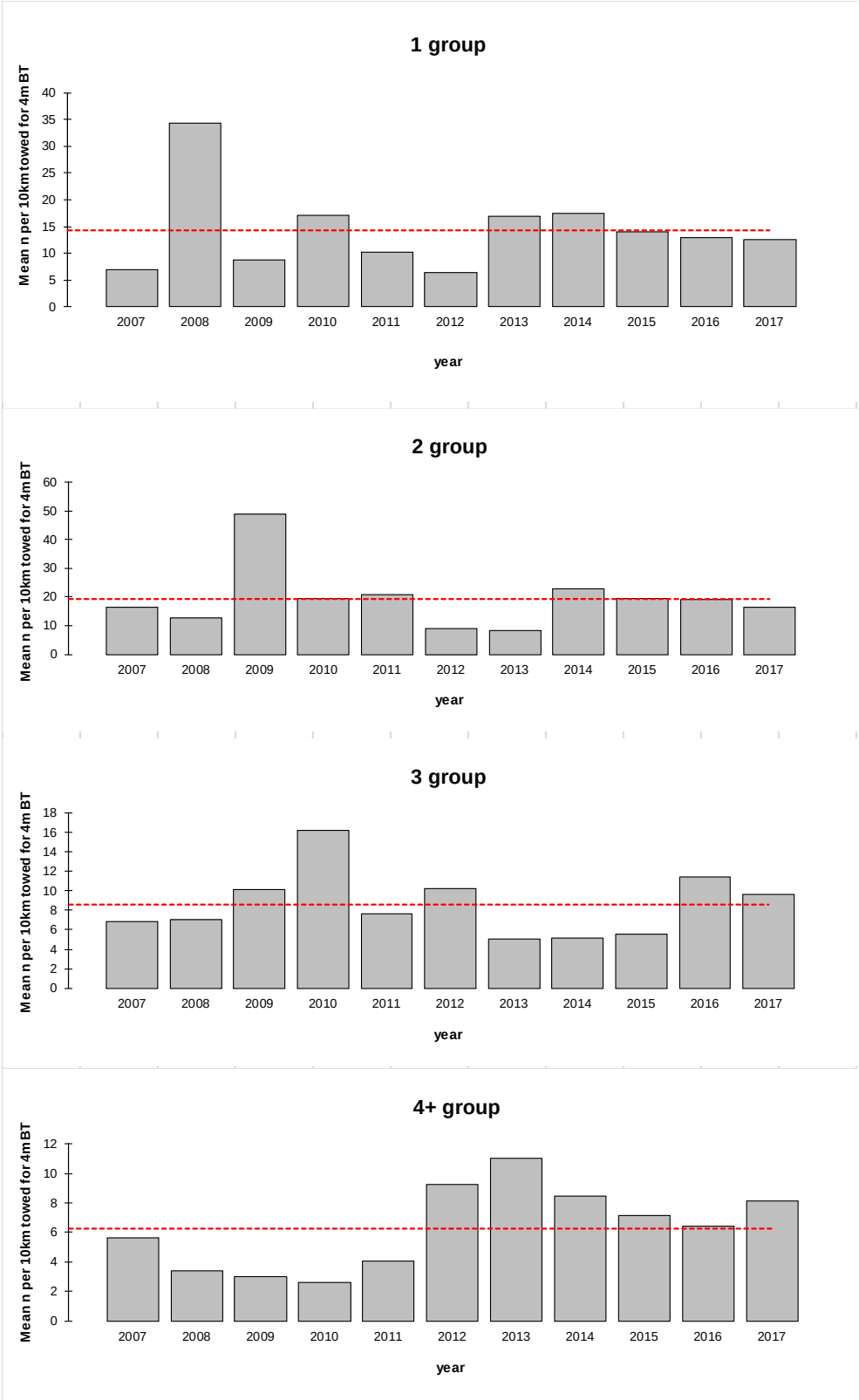


e) UK: sole (mean numbers per km towed for 4m beam trawl) Bristol Channel (VIIf)

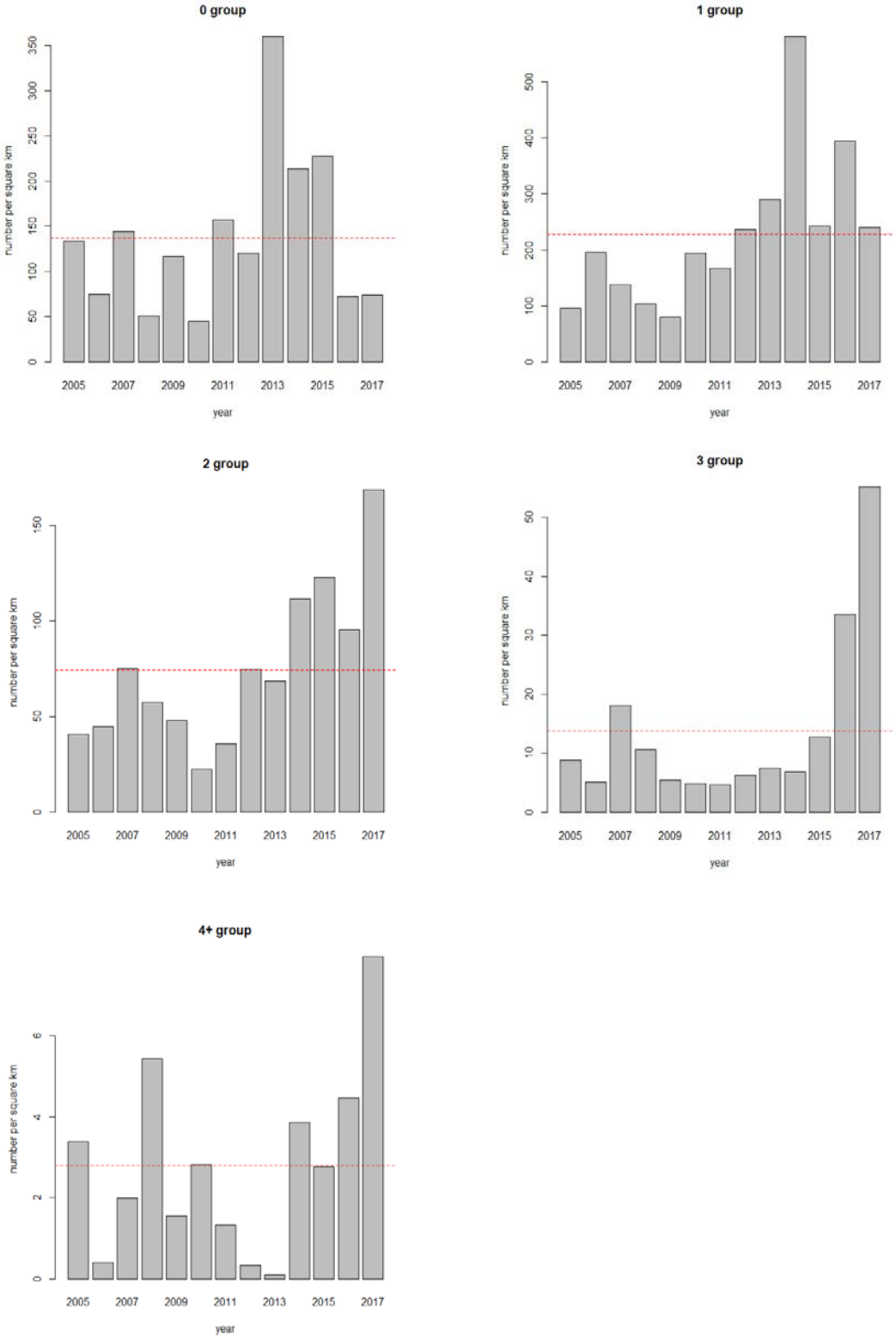


f) UK: sole (mean numbers per km towed for 4m beam trawl) Eastern Irish Sea (VIIa)

Figure 5.1.1.1. Continued

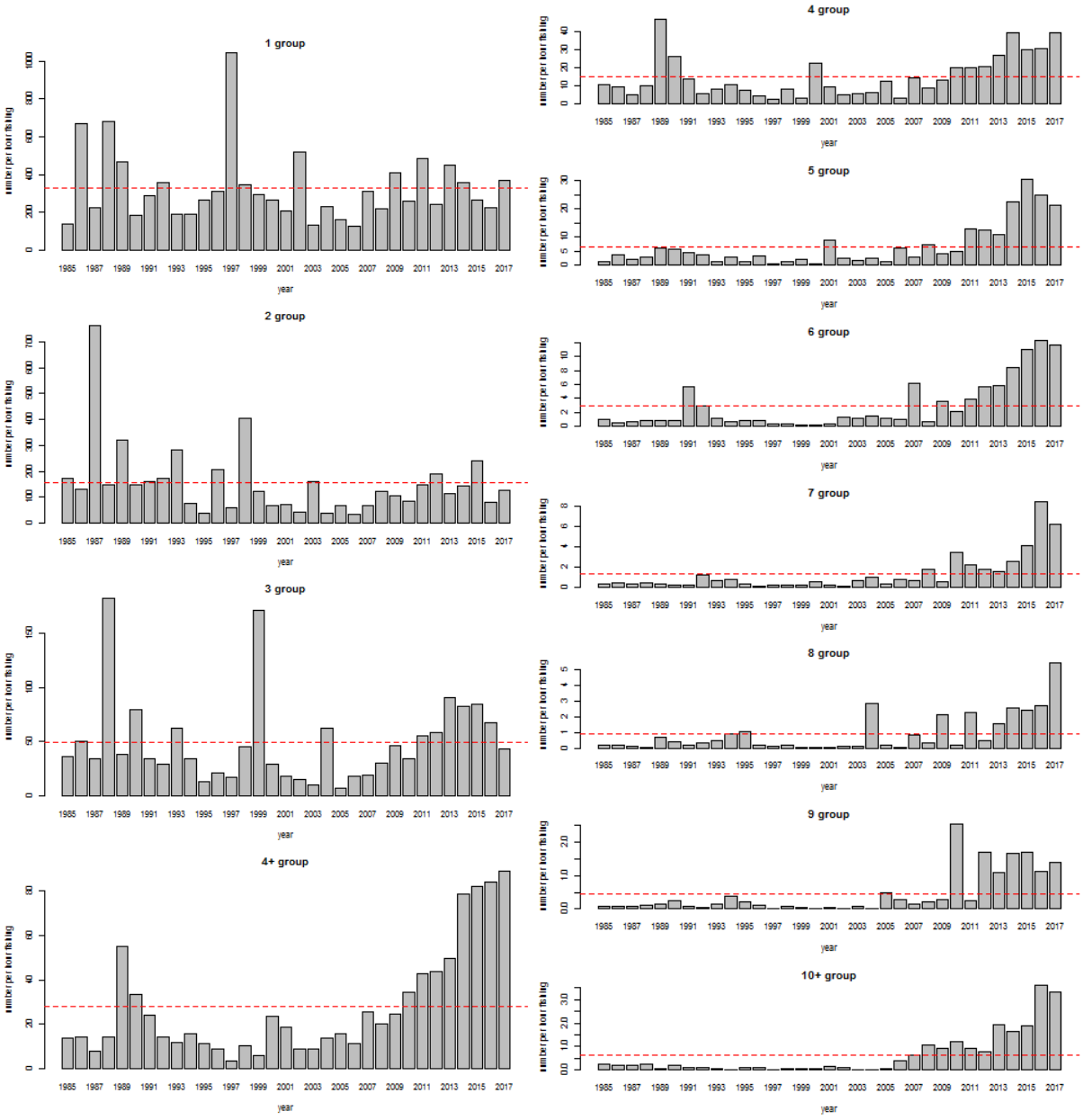


g) France: Catch rate of sole from French survey in the Bay of Biscay. (mean numbers per 10km towed for 4m beam trawl; Horizontal line=long-term mean for the period presented).

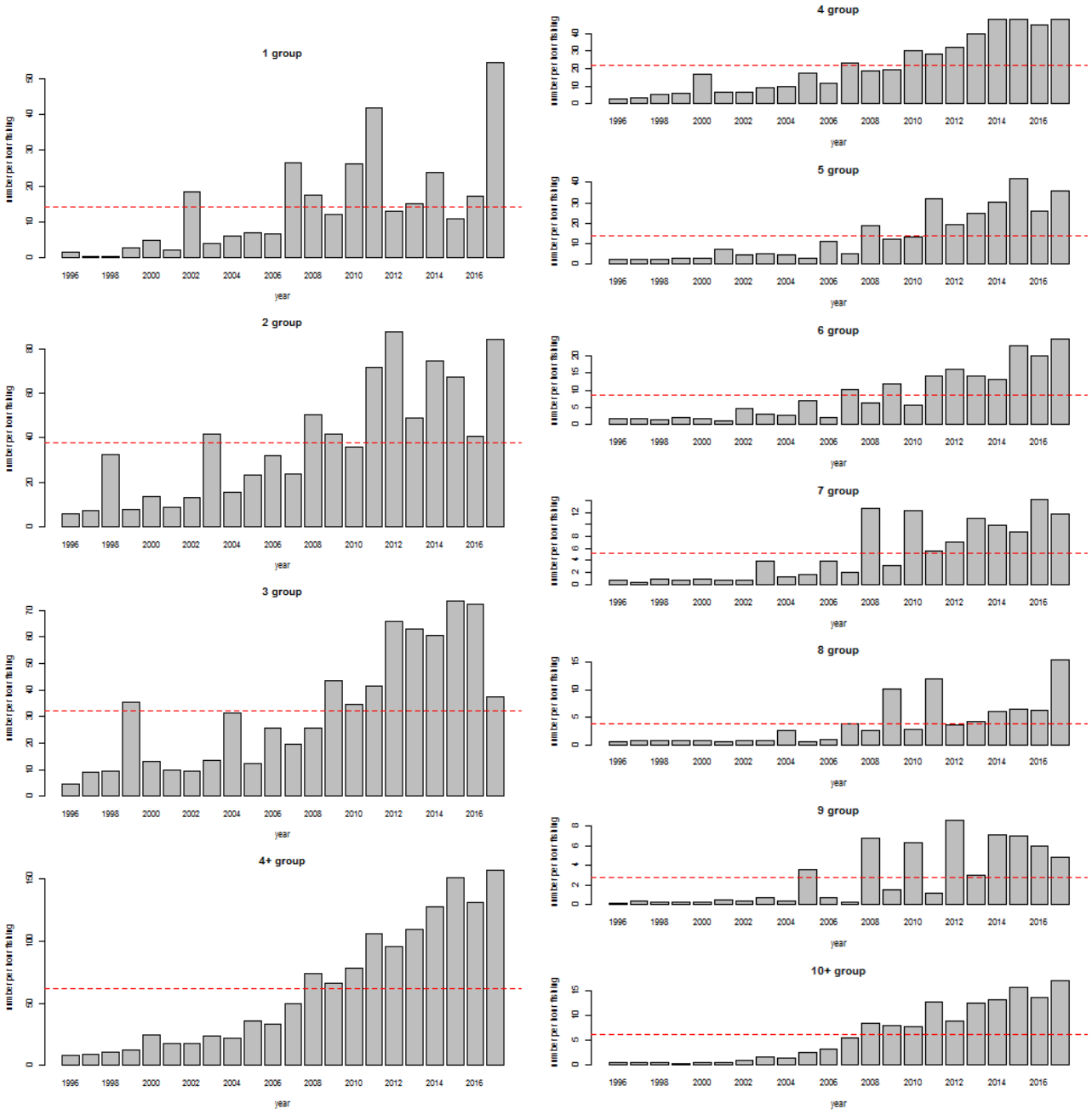


h) Italy-Slovenia-Croatia: Catch rate of sole from the Adriatic beam trawl survey. (horizontal line = long-term mean for the period presented; Croatian hauls are available only from 2016).

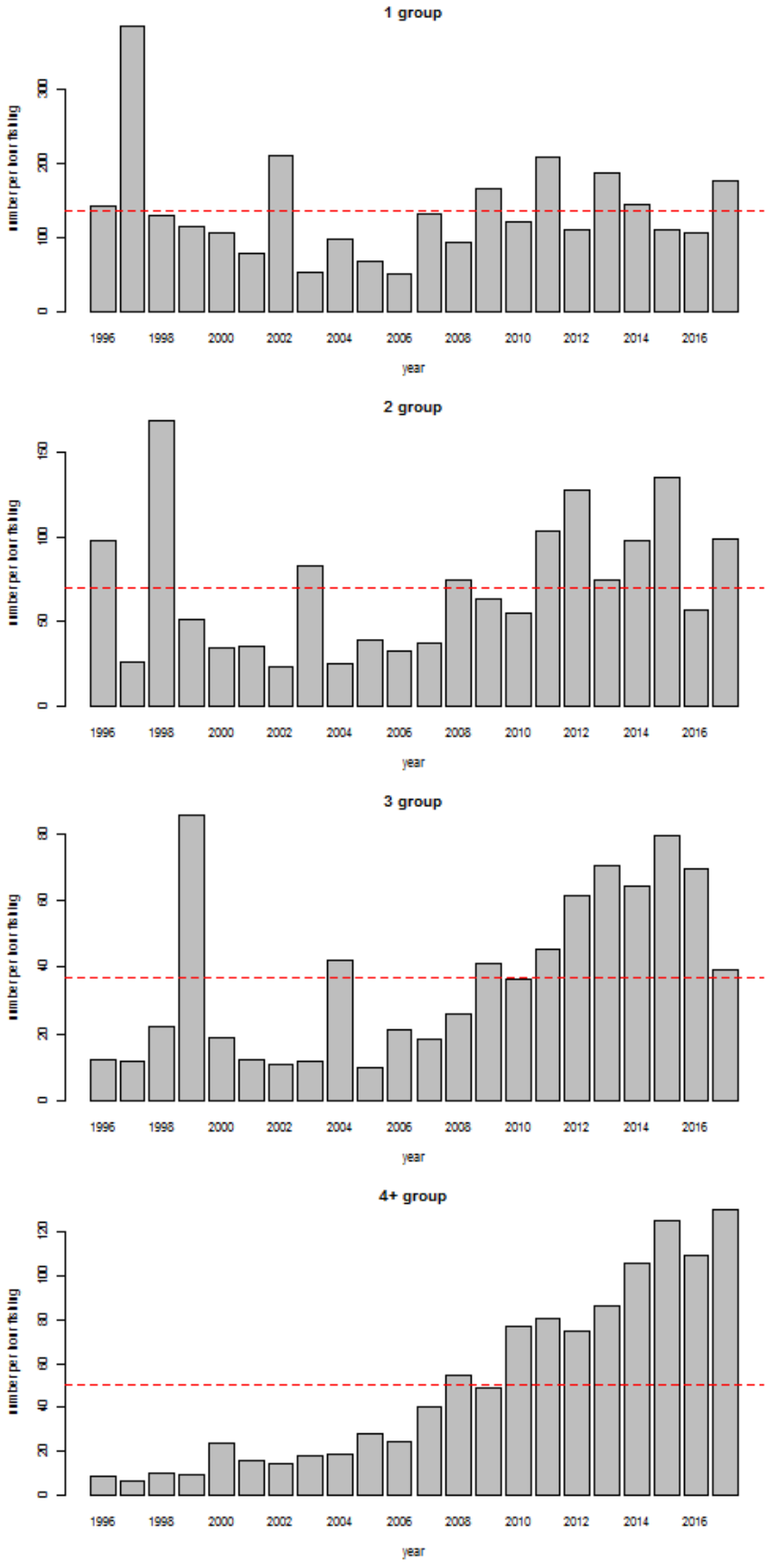
Annex 5.4: Figures of catch rate of plaice. offshore surveys



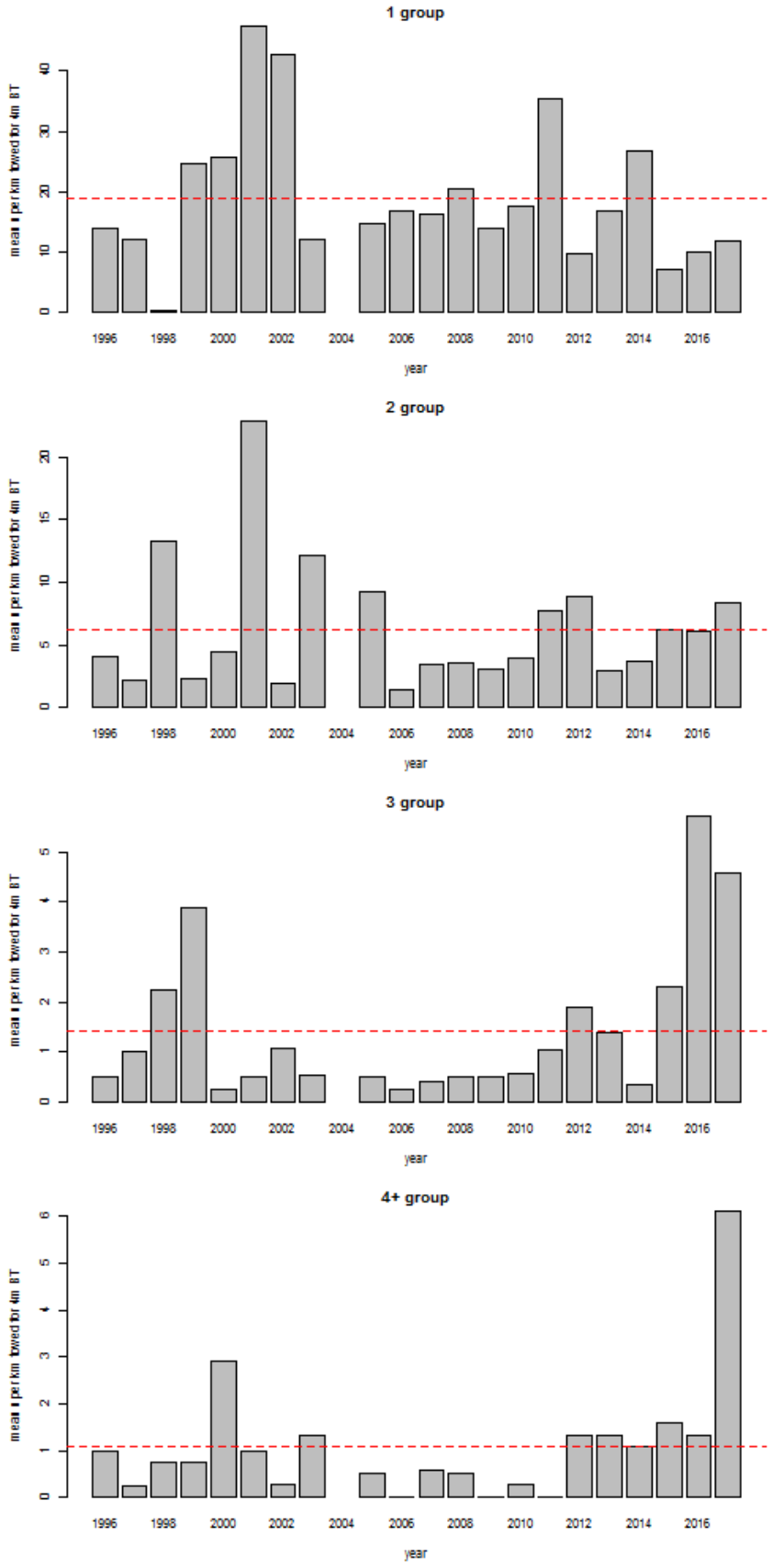
(a) Netherlands: plaice (N.hr^-1/8m trawl) North Sea (IV) RV "Isis". (Horizontal line=long-term mean for the period presented)



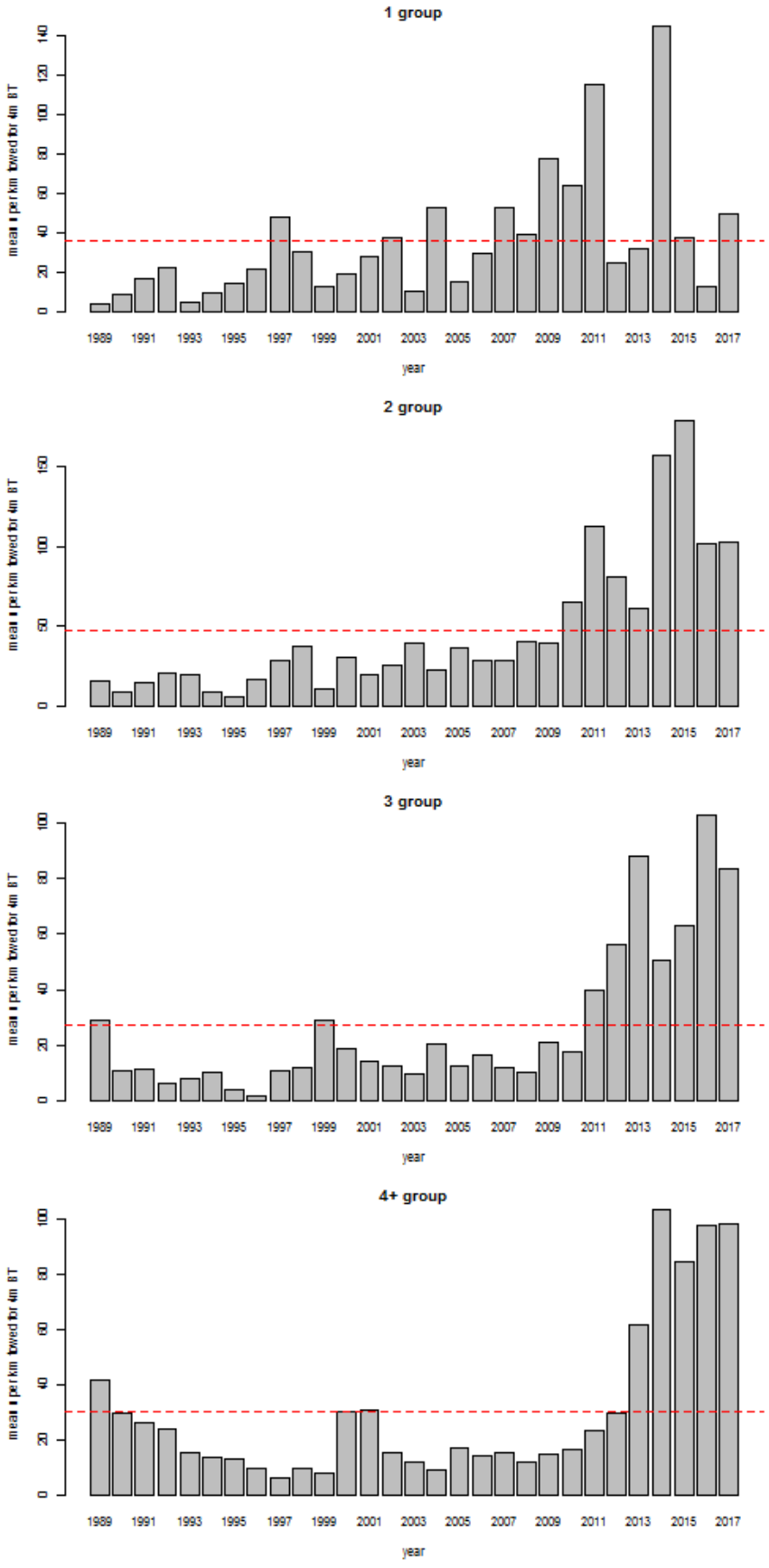
(b) Netherlands: plaice (N.hr^-1/8m trawl) North Sea (IV) RV "Tridens"



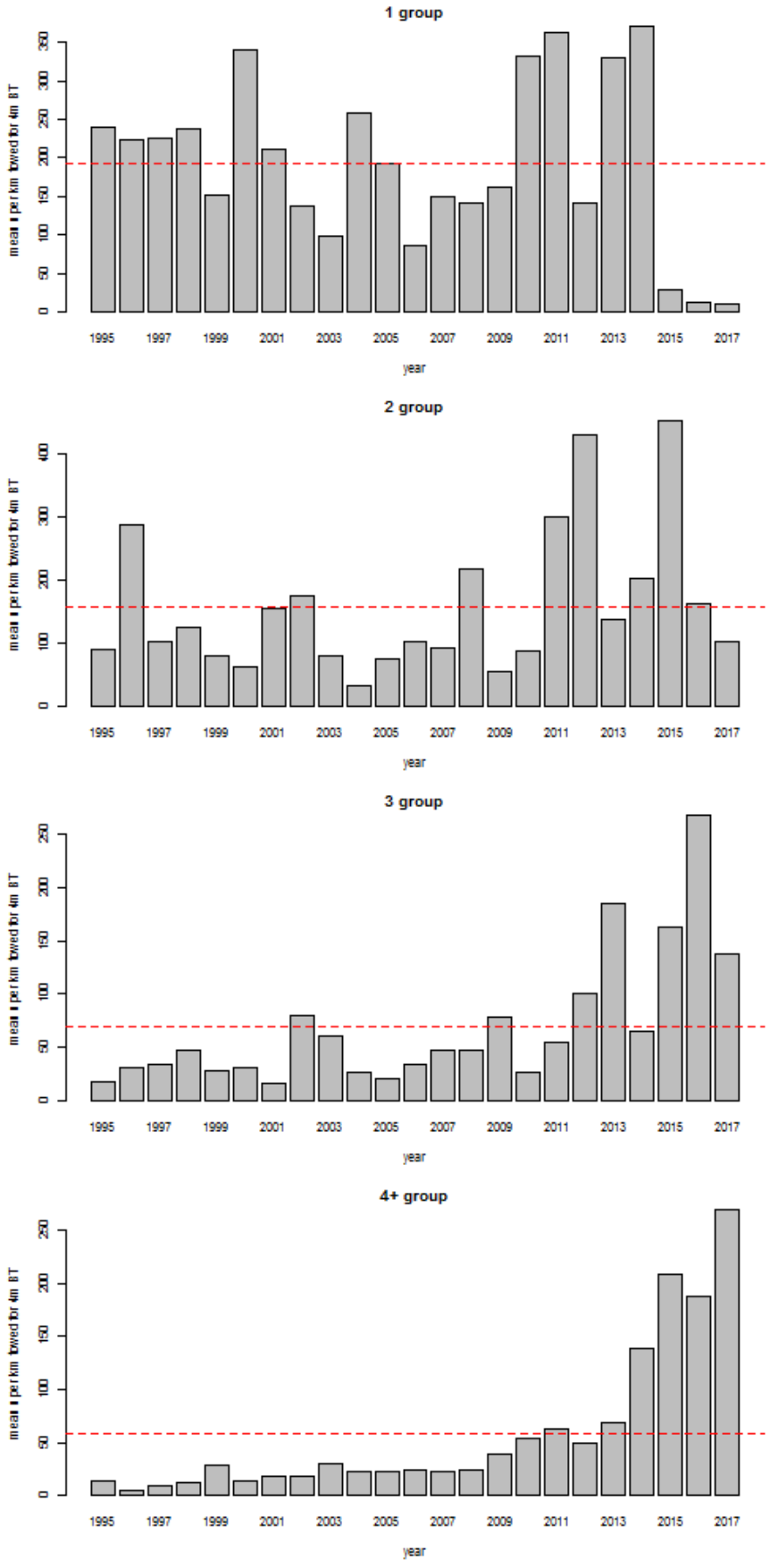
(c) Netherlands: plaice (N.hr^-1/8m trawl) North Sea (IV) RV "Isis" and RV "Tridens"



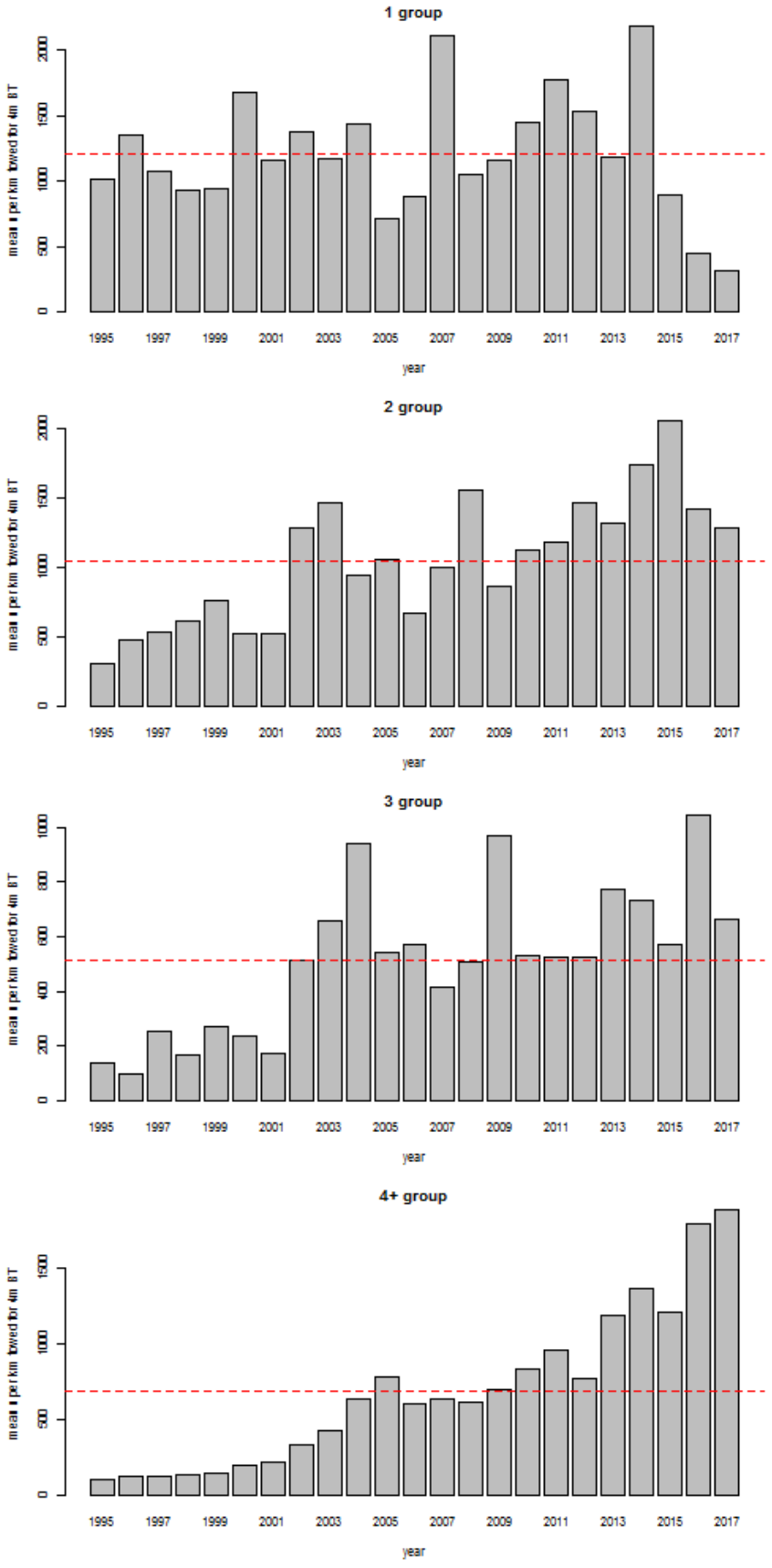
(d) UK: plaice (mean numbers per km towed for 4m beam trawl) Southern North Sea (IVc)



(e) UK: plaice (N.hr^-1/8m beam trawl) Eastern English Channel (VIId)



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



(h) UK: plaice (mean numbers per km towed for 4m beam trawl) Eastern Irish Sea (VIIa)

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 1000m² (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	6.44	2.15	1.39	78.052	0.19	0.89	3.447
2017	10.88	1.70	1.89	127.198	0.16	0.78	2.867

*** No valid survey**

b) Sole abundance indices in numbers per 1000m² (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	0.88	1.11	0.0046	12.276	0.08	0.36	1.888
2017	1.36	2.41	0.12	20.965	0.04	0.10	0.681

*** No valid survey**

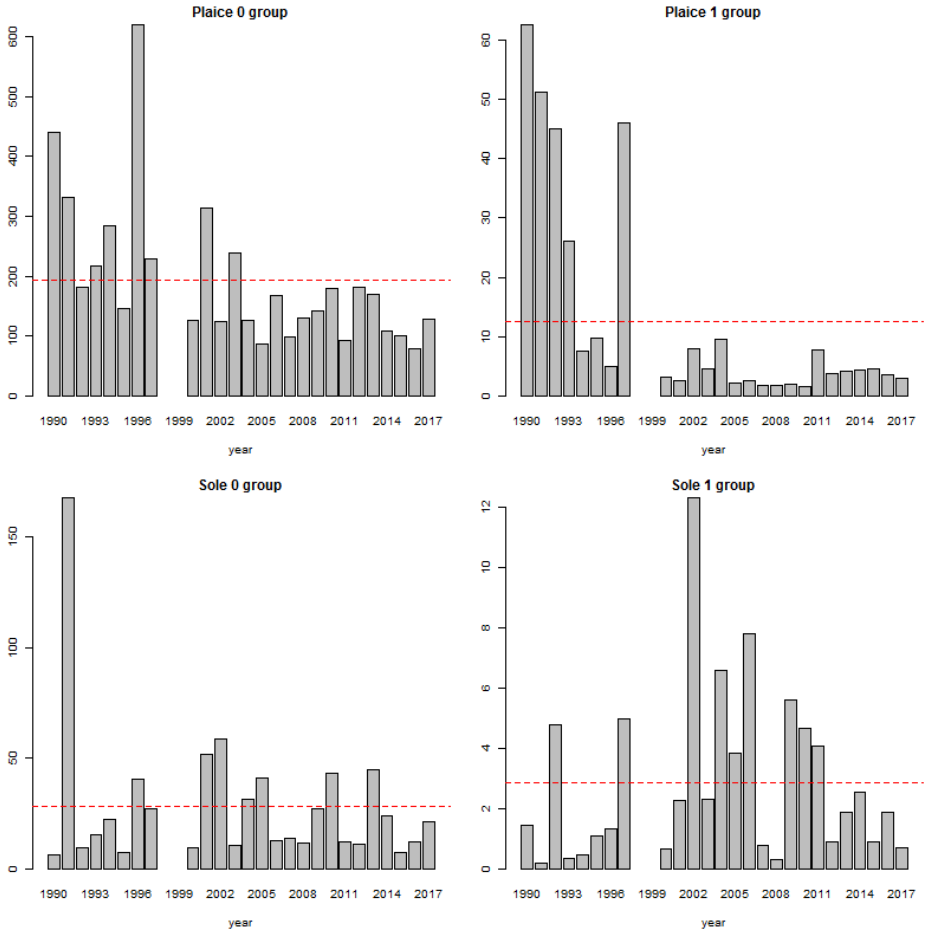


Figure 5.1.2.1. Combined inshore indices for 0 and 1 group plaice and sole. The horizontal line is the long-term mean for the period presented. The indices were declared to be invalid in 1998 and 1999, due to insufficient coverage of the Dutch survey area and are not displayed.

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	10384.82	2434.271	1086.255	521.600
2017	15935.91	1715.479	1211.712	534.073

*** 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

*** No survey**

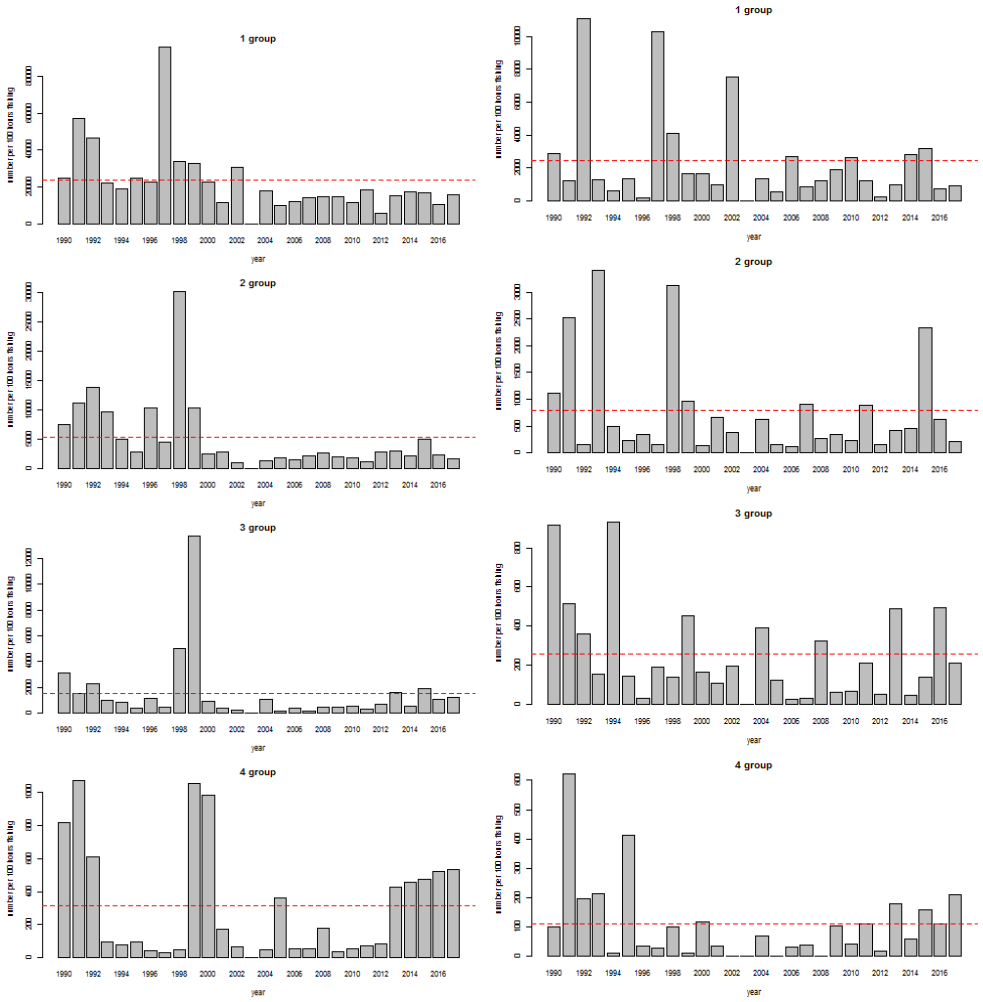


Figure 5.1.2.2. SNS indices for 1 – 4 group plaice (left) and sole (right), in numbers per 100 hours fishing. The horizontal line is the long-term mean for the period presented.

Annex 7: Combined GAM index update North Sea plaice and dab

a) North Sea plaice combined GAM index

	North Sea plaice								
	Age group								
	1	2	3	4	5	6	7	8	9
1996	25421.12	23782.96	5328.23	1825.36	1395.79	596.05	264.20	133.79	68.23
1997	86828.64	16109.78	6802.22	1655.09	581.29	451.27	161.39	205.02	31.36
1998	34532.56	82221.96	9515.33	2651.94	645.30	378.89	226.32	192.75	71.59
1999	44939.57	17802.28	29660.82	2780.62	1102.16	253.41	95.69	85.45	39.83
2000	42378.70	21451.02	9105.15	9996.27	614.59	218.23	109.42	95.99	15.71
2001	29311.13	19715.37	6791.29	3467.78	3463.81	269.99	90.63	72.11	54.84
2002	134367.00	16309.18	6894.77	3732.88	2068.26	1545.91	267.42	129.16	42.93
2003	32240.83	44967.87	6806.84	3385.74	1599.17	932.62	921.70	70.24	52.94
2004	44366.34	13238.66	17375.76	2954.90	1513.73	878.91	489.37	721.82	42.70
2005	37561.60	27225.89	4621.05	6827.36	908.44	1034.76	370.83	79.34	841.85
2006	41532.31	16493.16	9955.03	2370.24	3777.77	581.98	740.62	98.89	128.17
2007	84754.12	21429.36	10560.72	7984.10	1695.71	2521.42	283.90	616.23	71.69
2008	68596.86	45493.28	12562.69	6354.08	4409.53	941.64	1417.73	291.80	461.32
2009	64526.50	22690.93	19664.64	5073.72	3086.46	2538.55	647.03	1435.62	275.21
2010	80970.01	27581.32	13605.75	9941.44	3052.14	1698.59	1722.59	588.96	973.73
2011	126770.26	41926.87	17987.68	9149.69	6059.97	1944.20	907.24	1609.22	233.87
2012	58884.94	63231.74	38108.73	15013.82	7942.36	4960.89	1540.55	1170.55	1542.15
2013	87360.92	51484.72	37830.38	18759.52	7064.80	4167.67	3078.10	1239.23	755.31
2014	143731.62	59687.53	26609.82	20310.15	8602.01	3584.08	2191.79	1699.53	958.61
2015	51396.91	65837.62	33361.17	16222.40	12465.90	6519.72	2190.90	1600.17	1484.91
2016	82875.92	30990.84	31610.73	17223.99	9053.97	6309.65	3523.27	1625.70	1045.23
2017	140854.07	49998.49	17505.64	19195.88	10183.74	4911.48	3025.52	1891.28	651.94

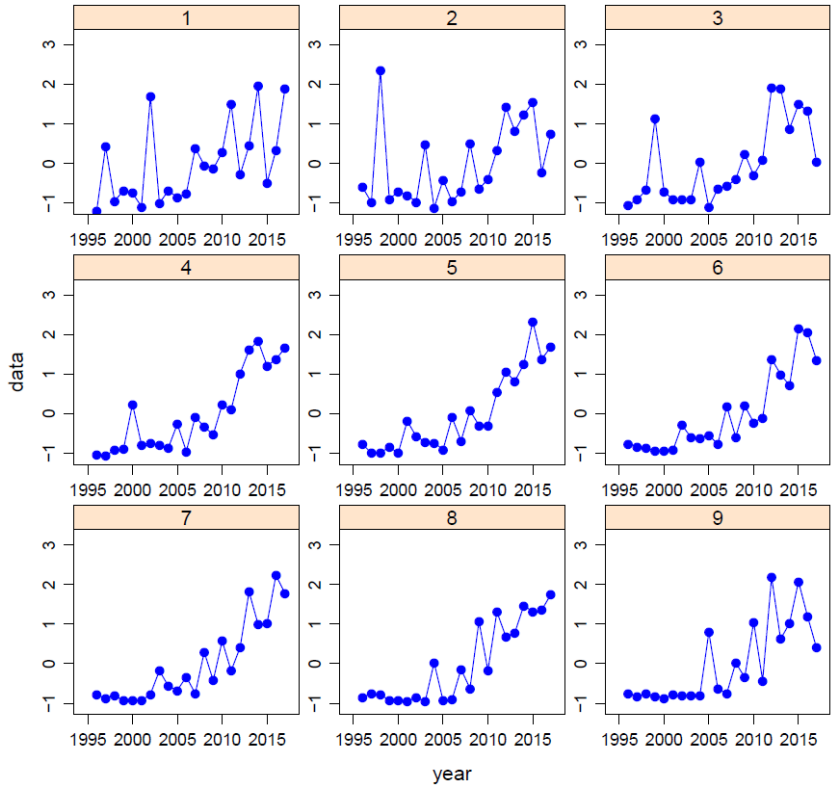


Figure 1. North Sea plaice combined GAM index 1996 – 2017 (standardized values).

b) North Sea dab combined GAM index

	North Sea Dab					
	Age Group					
	1	2	3	4	5	6
2003	74255.66	63602.40	16577.85	20513.88	15276.25	6704.73
2004	46896.42	69489.19	35241.38	21113.58	11674.11	5730.72
2005	76002.08	48183.98	22860.39	22626.81	7208.41	13315.01
2006	78931.37	43084.11	22075.59	18227.10	18064.67	6293.41
2007	73694.39	58512.47	46504.54	25422.45	15738.08	12005.09
2008	160309.56	61444.03	36580.90	25608.49	24389.89	6230.61
2009	104020.71	98247.74	46279.17	23919.96	15768.87	11850.48
2010	151147.60	103793.30	41394.08	17165.14	10987.91	8428.10
2011	89420.76	138057.48	68437.19	30654.61	19357.67	13941.34
2012	135008.84	153235.27	67884.90	46896.67	32252.53	21436.10
2013	134965.95	115376.84	78389.57	53007.01	31864.17	19453.22
2014	145025.46	157495.01	103591.95	62160.52	34352.47	17931.62
2015	116090.81	169664.80	151093.22	109339.26	55611.33	36612.61
2016	121849.70	171344.42	137637.51	77659.60	49639.25	25960.93
2017	138099.13	126513.92	96081.33	76333.78	44563.62	35111.52

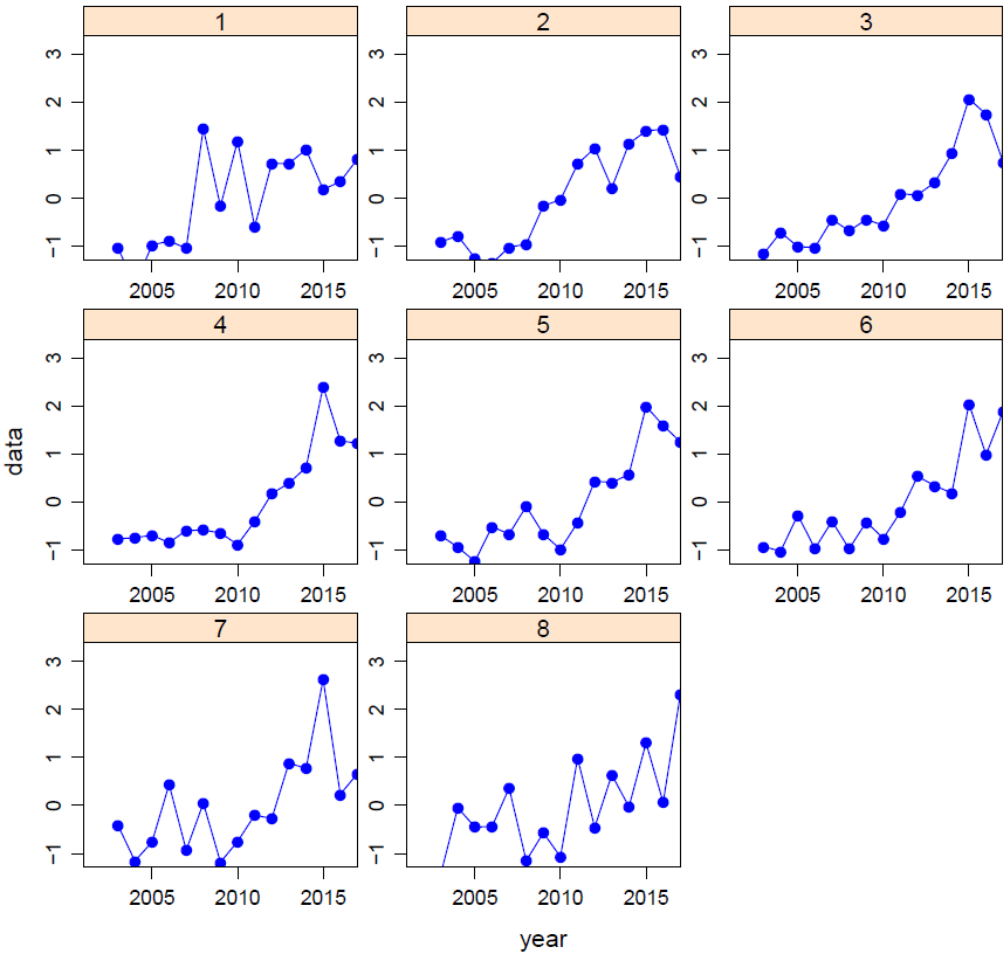


Figure 2. North Sea dab combined GAM index 2003 – 2017 (standardized values).

Annex 8: Survey summary sheet

Survey summary sheet

Survey, country	Area coverage	Running since	Methodology described in	Information to assessment WG	Data availability	Comments on 2017 survey	Data collected
Beam Trawl Survey, Belgium	Southwestern North Sea, figure 8.1	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 **WGML:** litter information per haul	Unaggregated data: datras.ices.dk Density plots per species: http://ecosystemdata.ices.dk/map/	The BTS_BEL was carried out from 28/08-8/09/2018 with RV Belgica. The meteorological conditions were favourable, and there were little technical issues. (nothing that jeopardized the outcome of the survey). 57 out of 62 stations were completed successfully. Two stations (37 & 38) could not be fished due to diplomatic clearance that was not granted in French territorial waters. Three stations (19, 20 and 72) were cancelled due to the risk of collision with static fishing gear. From this year onwards the number of otoliths collected per cm size class per ICES Statistical Rectangle for cod, brill, turbot, plaice and sole was reduced from 5 to 3.	**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 **Benthos:** all species, numbers and total weight per species per haul. *Sepia sp., Loligo vulgaris, Cancer pagurus, Nephrops norvegicus and Homarus gammarus* length measurements. Anthozoa, Bryozoa, Hydrozoa and Porifera only presence absence. **Marine litter:** all hauls **CTD:** continuous profile **Other:** /
Beam Trawl Survey, Germany	German Bight (North Sea), figure 8.2	1991	WGBEAM beam trawl survey manual (update in progress)	**WGNSSK:** Limanda limanda (dab.27.3a4), Pleuronectes platessa (ple.27.420 indices by age group, age 1-10+	Unaggregated data: datras.ices.dk	The BTS was carried out from 18 Aug to 04 Sept. 63 hauls were	**Fish species:** all species **Fish length:** all species; dab, plaice, elasmobranch by sex. **Fish weight:** sample weight per species, elasmobranch by sex

Survey, country	Area coverage	Running since	Methodology described in	Information to assessment WG	Data availability	Comments on 2017 survey	Data collected
				WGEF: elasmobranch species, CPUE per species per haul	Density plots per species: http://ecosys-temdata.ices.dk/map/	successfully fished out without incidents (approx. 31.5 hours fishing time).	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, *Nephrops norvegicus* length measurements. **Marine litter:** all trawls **CTD:** vertical profile planned for all hauls **Other:** -
Beam Trawl Survey, Netherlands	Southern and Eastern North Sea, figure 8.3	1985	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**: CPUE per species per haul	Unaggregated data: datras.ices.dk Density plots per species: http://ecosys-temdata.ices.dk/map/	Survey since 2017 carried out by RV Tridens; survey shifted one week ahead compared to previous years. Survey completed with minor issues.	**Fish species:** all species **Fish length:** all species, elasmobranch by sex. **Fish weight:** no sample weight per species, elasmobranch 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, *Nephrops norvegicus* 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:** -

Survey, country	Area coverage	Running since	Methodology described in	Information to assessment WG	Data availability	Comments on 2017 survey	Data collected
Beam Trawl Survey, Netherlands	Central and Western North Sea, figure 8.4	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 delay of 6 days (of 20). Sampling effort concentrated on the index area as used for the plaice index calculation as carried out by WMR (see figure 8.4) 54 stations out of 72, leading to incomplete spatial coverage as one haul per rectangle is carried out. Northerly stations not covered in 2017, also affecting number of otoliths collected for plaice, lemon sole, long rough dab.	**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, 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, *Nephrops norvegicus* 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 boxcorer samples for pulse trawling research for NIOZ PhD.
Beam Trawl Survey, England	Western English and Celtic Sea figure 8.5	2006	WGBEAM beam trawl survey manual (update in progress)	WGCSE Sole 7e Plaice 7e WGEF	Unaggregated data: Cefas Density plots per species: Cefas	The survey took place from 19 Mar to 05 Apr. Weather conditions were generally very good and the survey was completed without major incident. A total	**Fish species:** all species **Fish length:** all species. Elasmobrach species, four-spot megrim, megrim, plaice by sex.

Survey, country	Area coverage	Running since	Methodology described in	Information to assessment WG	Data availability	Comments on 2017 survey	Data collected
				Cuckoo ray 6 7 8abd Spotted ray 7ae-h Undulate ray 7de 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		of 128 successful tows were completed out of a total of 131 planned for the survey. This comprised 80 of the 81 planned tows in the western English Channel and 48 of the 50 planned tows in the Celtic Sea. The location not sampled in the western English Channel was in stratum 11, where operations were heavily affected by both the widespread deployment of commercial static gear and the 'foggy' conditions encountered. The two locations not fished in the Celtic Sea were both in stratum I, and the exclusion of these locations from the survey had been pre-planned, as colleagues from the Marine Institute in Ireland had already successfully worked these locations on their associated survey. One station was invalid because the gear had to pulled early because of a 10m "spike" in the seabed. In addition to the 4m beam trawl deployments a further 488 gear deployments were undertaken as part of the multi-displine survey.	**Fish weight:** sample weight by species and sex for all elasmobrach species, four-spot megrim, megrim, plaice. **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, sea bass, red mullet, four-spot megrim, (megrim), (turbot), (brill), witch, (lemon sole), (plaice), (sole). Ages determined for those species highlighted by brackets. **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. **Marine litter:** all trawls **CTD:** average surface and bottom temperatures and salinities collected for each tow.

Survey, country	Area coverage	Running since	Methodology described in	Information to assessment WG	Data availability	Comments on 2017 survey	Data collected
							Other: zoo-plankton (ringnet), phytoplankton (plankton image analyser), epi-benthos (2m beam trawl), infauna, PSA (grab), seabed images (drop camera), environmental data (ESM2), acoustic data, water samples for caesium and tritium analysis, opportunistic tagging of species of elasmobranch.
Beam Trawl Survey, England	Eastern English Channel and Southern North Sea figure 8.6	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://ecosystemdata.ices.dk/map/	The survey took place from 19 Jul to 01 Aug. The survey was completed without incident, within the time frame and in relatively good weather, although there were brief periods when conditions deteriorated. A total of 76 valid stations were successfully sampled. One station had to be hauled early, and subsequently abandoned because of the presence of static gear, another was invalid because an anchor was caught, although it was successfully repeated, and for one other the presence of a cable in the middle of the tow meant that it had to be repeated further to the north. One further station was not fished due to the presence of static gear and an	**Fish species:** all species **Fish length:** all species. Elasmobrach species, plaice by sex. **Fish weight:** sample weight by species and sex for all elasmobrach 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, (sea bass), 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 preselected stations. If not, species observed only. Sentinel and non-native species weighed and

Survey, country	Area coverage	Running since	Methodology described in	Information to assessment WG	Data availability	Comments on 2017 survey	Data collected
						anchored tanker. Ten stations were less than the standard 30min duration either to avoid static gear, or to avoid large catches of brittlestars that were previously known to be a problem or as an increase in weight during trawling. During the survey, time was available to complete a number of additional 15min comparative tows, and tows for the and tag and release of 339 sole for Ifremer.	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.
Beam Trawl Survey, England	Irish Sea and Bristol Channel figure 8.7	1988	WGBEAM beam trawl survey manual (update in progress)	WGCSE Plaice 7a Sole 7a Sole 7fg Plaice 7fg 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	Unaggregated data: datras.ices.dk Density plots per species: http://ecosys-temdata.ices.dk/map/	The survey took place from 06 to 26 Sept. At the beginning of the survey poor weather conditions meant that it was necessary to select where to fish but as the survey progressed conditions improved. The survey was completed without major complication, although due to time constraints it was not possible to complete six stations but this did not have an affect on any indicies calculation. Three stations were initially invalid, because of either the presence of a cable or static gear and were all successfully completed. The tow duration for 21 stations was less than	**Fish species:** all species **Fish length:** all species. Elasmobrach species, plaice by sex. **Fish weight:** sample weight by species and sex for all elasmobrach species, plaice. **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, sea bass, 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

Survey, country	Area coverage	Running since	Methodology described in	Information to assessment WG	Data availability	Comments on 2017 survey	Data collected
						the standard 30min duration either because of static gear or a history of large catches.	number of preselected 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, figure 8.8	2007?	WGBEAM beam trawl survey manual (update in progress)	Solea solea sol.27.8ab	Unaggregated data: datras.ices.dk Density plots per species: http://ecosystemdata.ices.dk/map/	The survey took place from 02. Nov. to 21. Nov., 49 Stations were carried out, one station was cancelled because the skipper considered that it was too risky to carry it out (on a position where it was difficult to haul back the trawl in 2015 because it was full of mud and mussels)	**Fish species:** all species **Fish length:** all species, hake, meagre, megrim, monkfish, red mullet, sea bass, 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, sea bass, sole, and whiting. Illicum for monkfish. **Benthos:** Numbers and total weight per species.

Survey, country	Area coverage	Running since	Methodology described in	Information to assessment WG	Data availability	Comments on 2017 survey	Data collected
							Marine litter: all trawls. **CTD: surface and bottom temperature collected for each tow (beginning end end).**
Beam Trawl Survey, Iceland	Waters around Iceland, figure 8.9	2016	WGBEAM beam trawl survey manual (update in progress). Same as CEFAS	**NWWG:** next year, Limanda limanda, Microstomus kitt, Pleuronectes platessa	Upon request	The Survey was carried out from 24.08. to 07.09.2017, 81 valid hauls were carried out and went very well. Two foul hauls were taken, when the trawl filled up with mud and shell hash, which resulted in some minimum net damage.	**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 Figure 8.10	2016	Same as CEFAS	Presented to **WGAngler** 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	**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,

Survey, country	Area coverage	Running since	Methodology described in	Information to assessment WG	Data availability	Comments on 2017 survey	Data collected
						selected but were sampled opportunistically. There was one foul haul but no gear damage. The weather was good for most of the survey.	four-spot megrim,lemon sole, turbot,witch, blonde ray, cuckoo ray, lesser spotted dogfish, spotted ray, common ray and thornback 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 8.11	2005	SoleMon handbook (available here: http://dcf-italia.cnr.it/reserved/lineeguida/1)	**FAO-GFCM-SAC-WGSAD, STECF**: *Melicertus kerathurus, Pecten jacobeus, Scophthalmus maximus, Scophthalmus rhombus, Sepia officinalis, Solea solea, Squilla mantis,* Index of Abundance by size and age for sole, mantis shrimp and cuttlefish.	Unaggregated data: datras.ices.dk for sole	The 2017 survey was carried out from 10/11-9/12/2017 with RV G. Dallaporta. 70 hauls were carried out (approx. 30 hours fishing time). The number of stations have been increased in 2016 because of 7 new stations carried out inside the Croatian national waters. The survey was completed without incident, and it was carried out in Croatian waters in the period 19/11/2017 to 22/11/2017. The vessel entered in Zara and Pula harbour to make the relevant entry-exit papers. Due to the bad weather, was not	a) **Fish species:** The primary target species is *Solea solea*, with additional species including cuttlefish, scallop, queen scallops, turbot, brill, skates, purple dye murex and caramote prawn. b) **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.

Survey, country	Area coverage	Running since	Methodology described in	Information to assessment WG	Data availability	Comments on 2017 survey	Data collected
						possible to sample station n. 20 inside Croatian waters as well as stations n. 9, 12 and 19 in the rest of the GSA 17.	c) **Benthos:** all hauls, more than 250 macro and megabenthos species d) **Marine litter:** all hauls **CTD:** vertical profile planned for all hauls
Inshore beam trawl survey	Coastal zone Belgium, figure 8.12	1971	Inshore beam trawl survey manual in progress	**WGNSSK:** Pleuronectes platessa (ple.27.420), Solea solea (sol.27.4), combined BEL/GER/NED recruitment index(see paragraph ZZZ)		i) The DYFS_BEL was carried out from 11/09-20/09/2018 with RV Simon Stevin. The weather did not interfere 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.	**Fish species:** all species **Fish length:** only commercial species **Fish weight:** sample weight per species for species that are measured **Fish biological data:** none **Benthos:** only *Crangon crangon* weight per size fraction and length of minimal 250 individuals. Marine litter: none **CTD:** continuous profile **Other:** -
Inshore beam trawl survey	Coastal zone and Germany and German Wadden Sea, figure 8.13	1972	Inshore beam trawl survey manual in progress	**WGNSSK:** Pleuronectes platessa (ple.27.420), Solea solea (sol.27.4), combined BEL/GER/NED recruitment index (see paragraph ZZZ)		The surveys on 4 chartered vessels were conducted from 25 Aug to 27 Sept. 186 valid hauls were carried out (24 hauls invalid). The survey on RV "Clupea" took place from 14 to 29 Sept. 101 hauls were carried out.	**Fish species:** all species **Fish length:** all species **Fish weight:** sample of all species Fish biological data: individual weight, length, sex, yearclass for plaice **Benthos:** all species, *Crangon crangon* total weight and length measurements of 250g subsample. **Marine litter:** no **CTD:** **Other:** -

Survey, country	Area coverage	Running since	Methodology described in	Information to assessment WG	Data availability	Comments on 2017 survey	Data collected
Inshore beam trawl survey	Coastal zone Netherlands, Dutch Wadden Sea, Eastern and Western Scheldt, figure 8.14	1970	Inshore beam trawl survey manual in progress	**WGNSSK:** Pleuronectes platessa (ple.27.420), Solea solea (sol.27.4), combined BEL/GER/NED recruitment index (see paragraph ZZZ)	Unaggregated data: datras.ices.dk Density plots per species: http://ecosystemdata.ices.dk/map/	Surveys in Eastern Scheldt, Western Scheldt and Wadden Sea completed without incident. Survey in coastal zone affected by weather conditions. Spatial coverage in line with planning, number of stations slightly less than planned.	**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 immarture and maturing. **Benthos:** all species numbers. *Crangon crangon*, 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	Dutch EEZ and southern German Bight, figure 8.15	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+	- (DATRAS under development)	Survey completed. Survey started almost a week later than planned due to weather conditions.	**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 immarture and maturing. **Benthos:** all species numbers. Cephalopods, edible crab length measurements. Marine litter: no

Survey, country	Area coverage	Running since	Methodology described in	Information to assessment WG	Data availability	Comments on 2017 survey	Data collected
							CTD: continuous during haul, CTD attached to net. **Other:** -

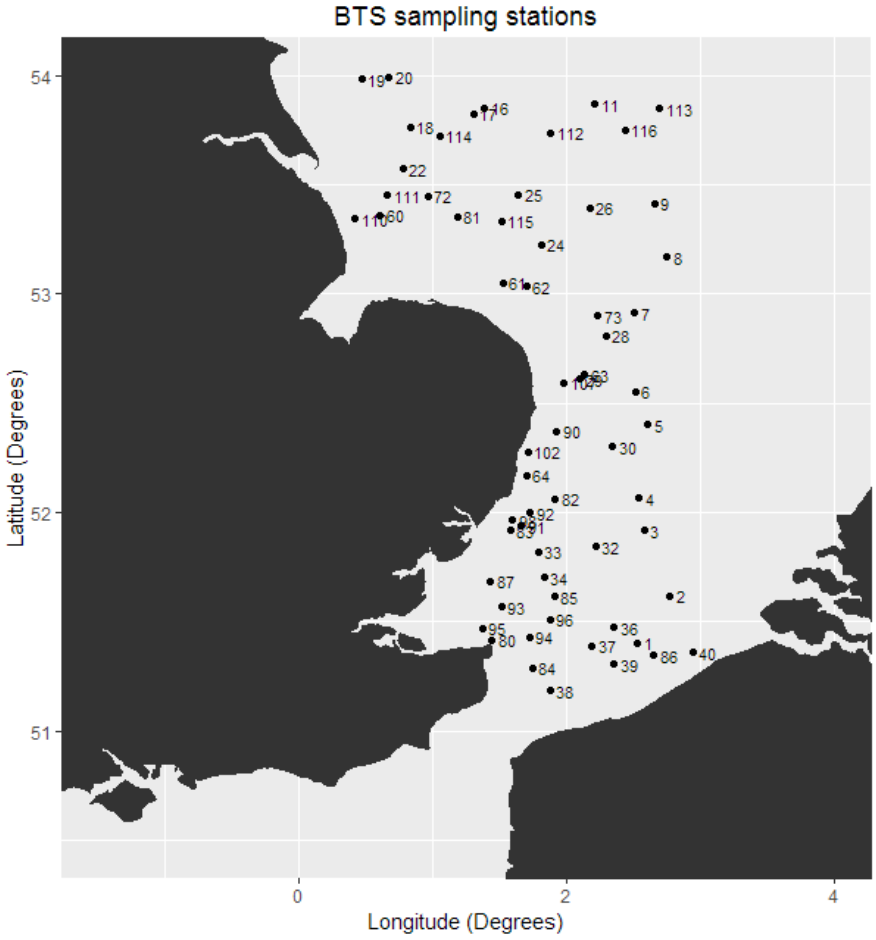


Figure 8.1 Map BEL BTS 2017

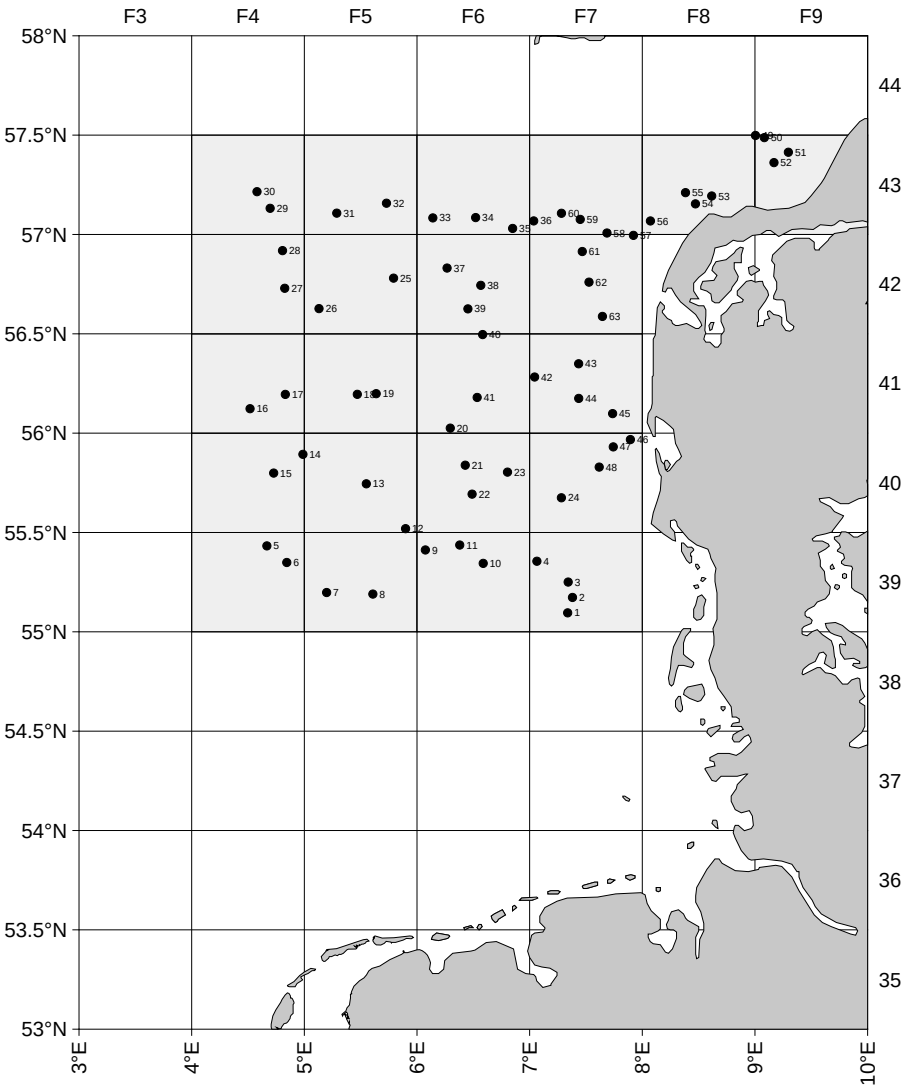


Figure 8.2 Map GFR BTS 2017

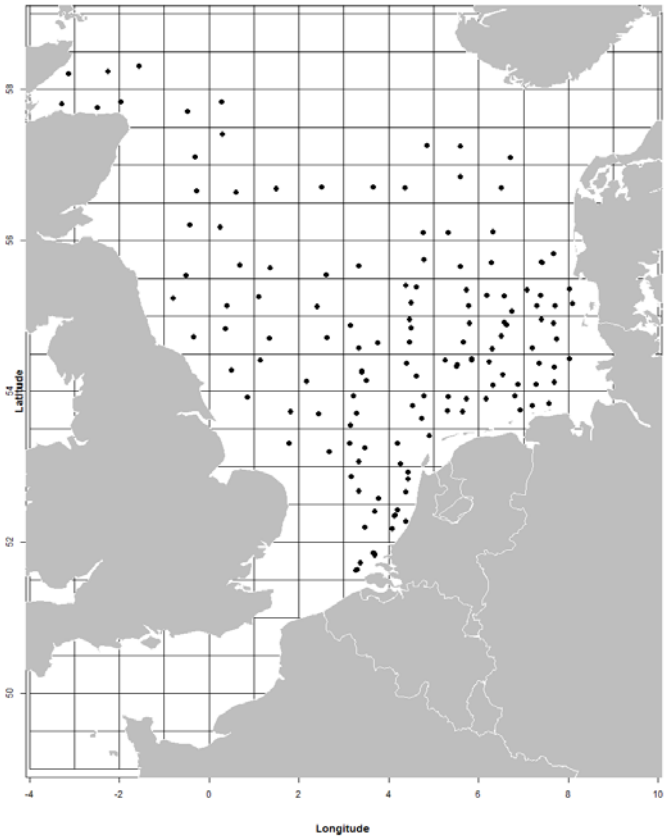


Figure 8.3 Map NED BTS 2017

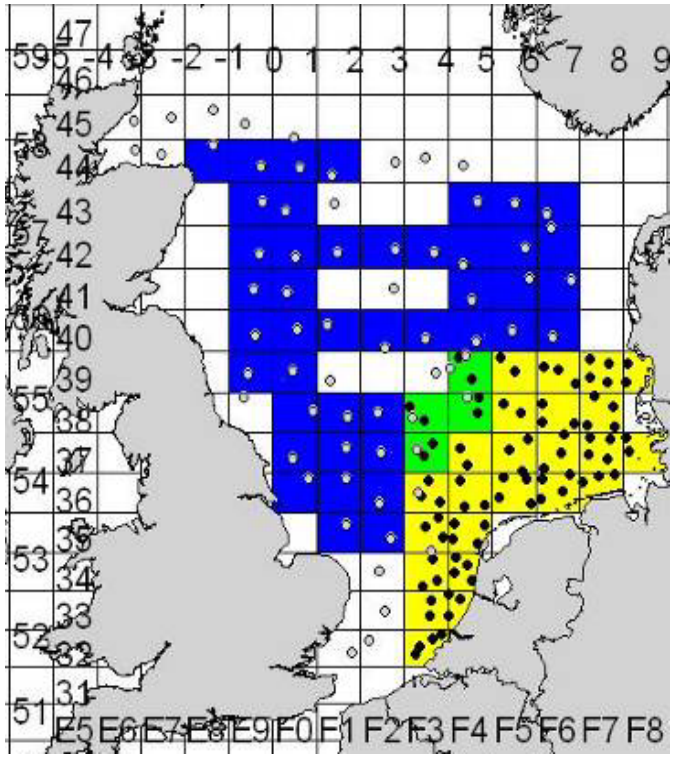


Figure 8.4 Map Index areas used for plaice and sole index calculation by WMR. Blue=index area central and western North Sea; Yellow=index area southeastern North Sea and German Bight; green: used in both index calculations.

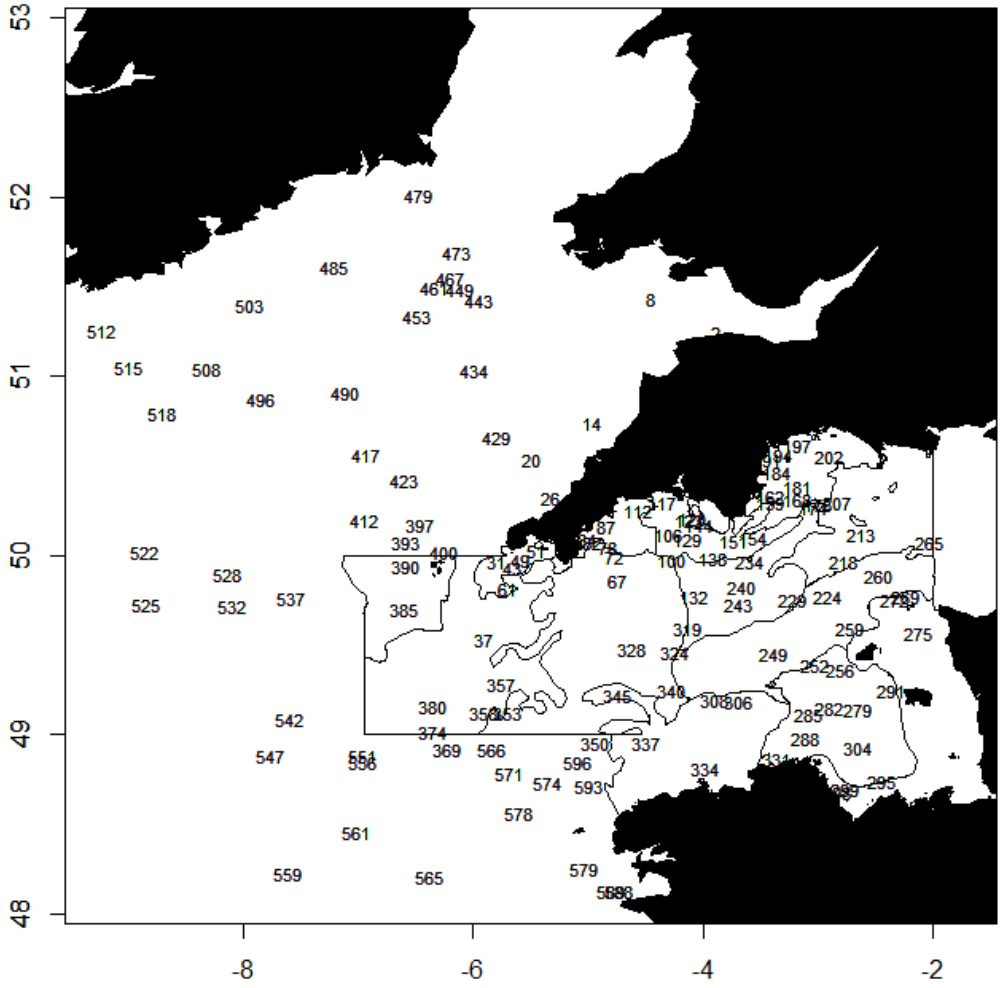


Figure 8.5 Map ENG BTS 2017 (VIIe and Celtic Sea)

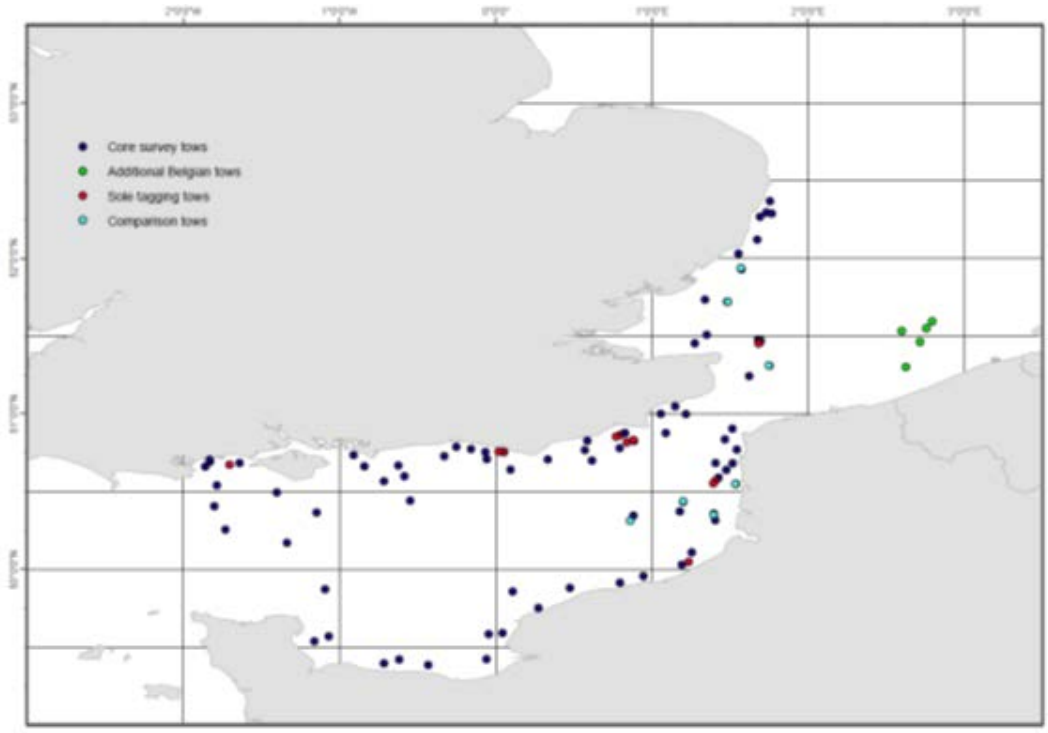


Figure 8.6 Map ENG BTS 2017 (VIId and IVc)

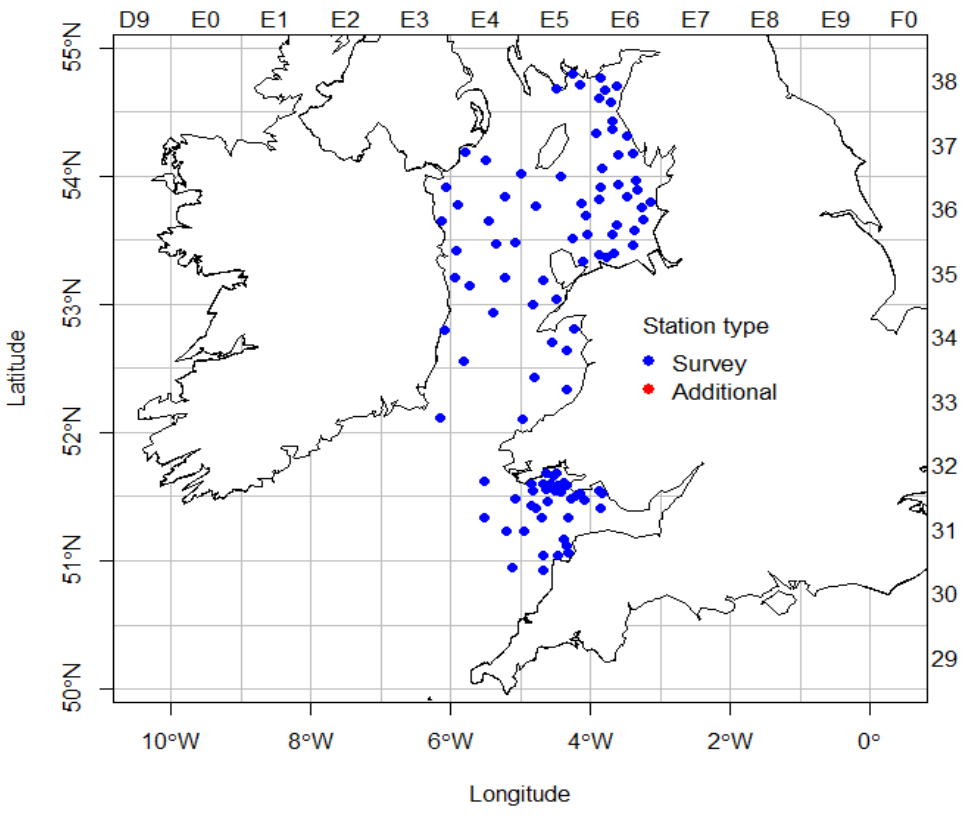


Figure 8.7 Map ENG BTS 2017 (VIIa and VIIf)

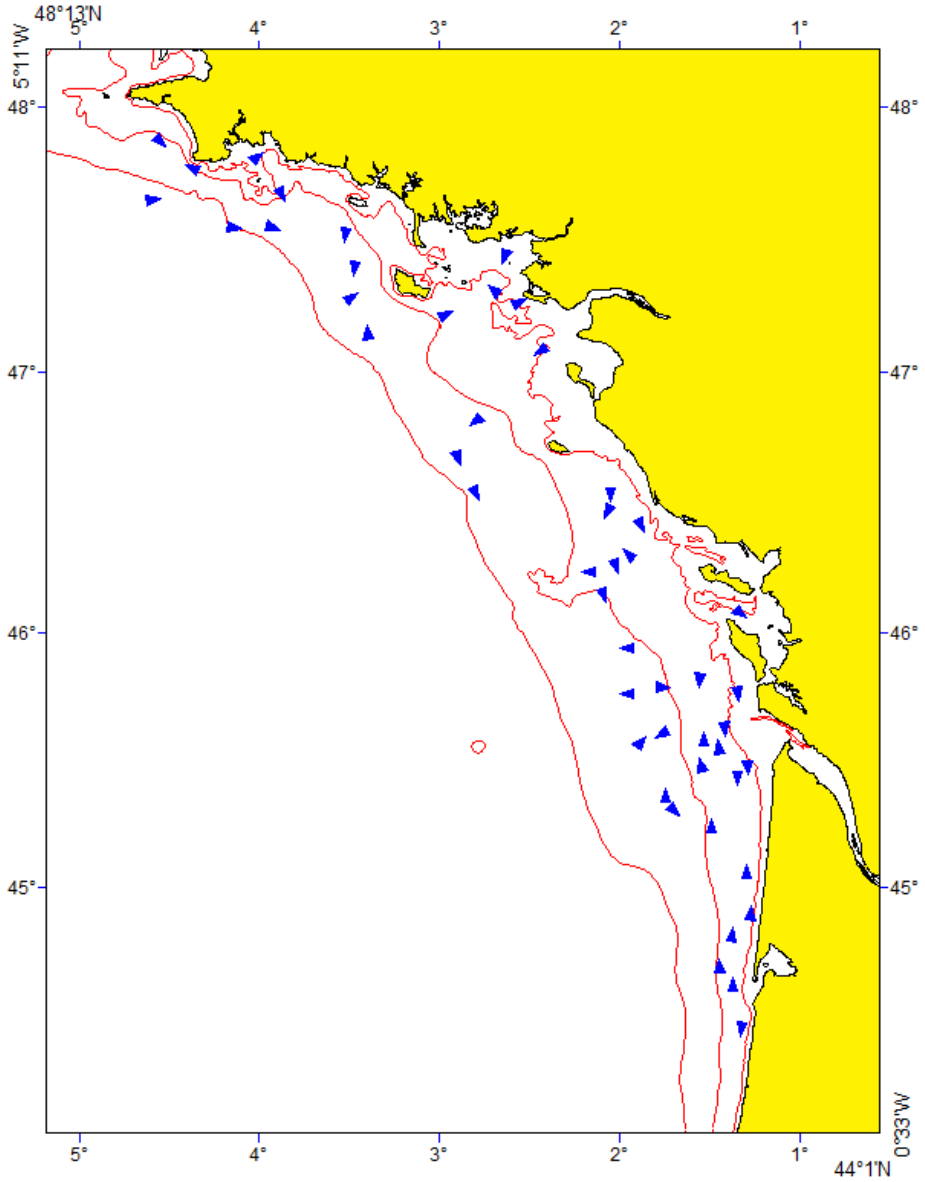


Figure 8.8 Map FRA BTS 2017

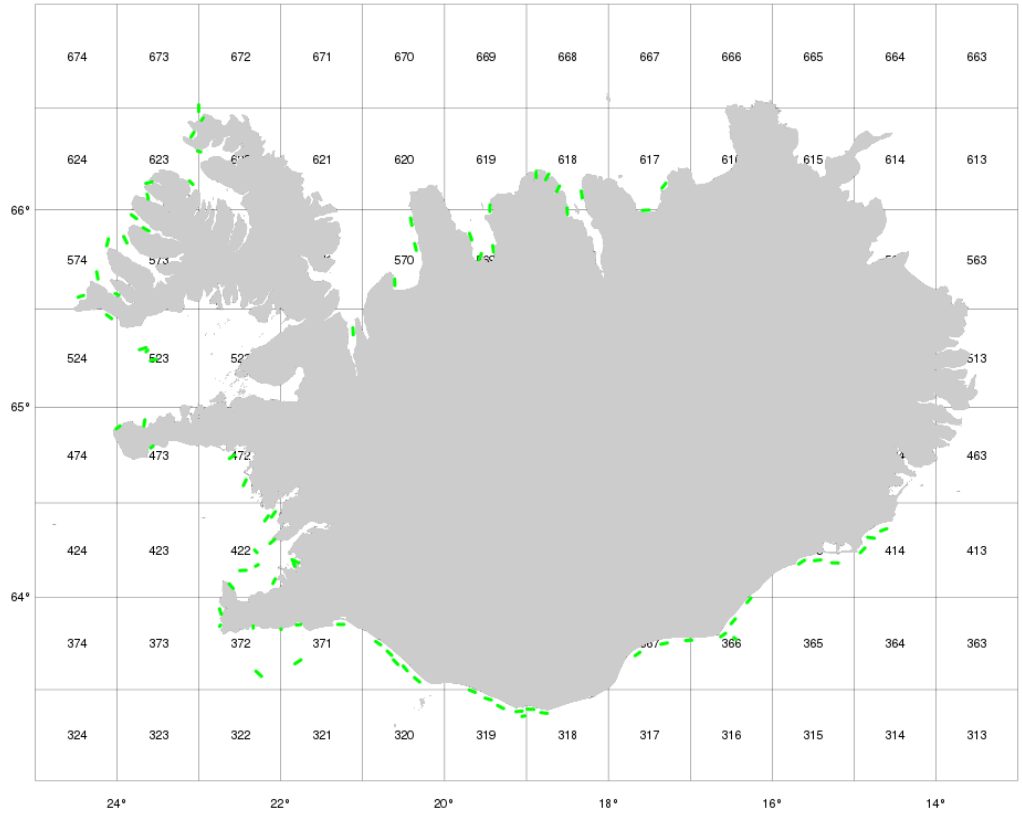


Figure 8.9 Map IS BTS 2017

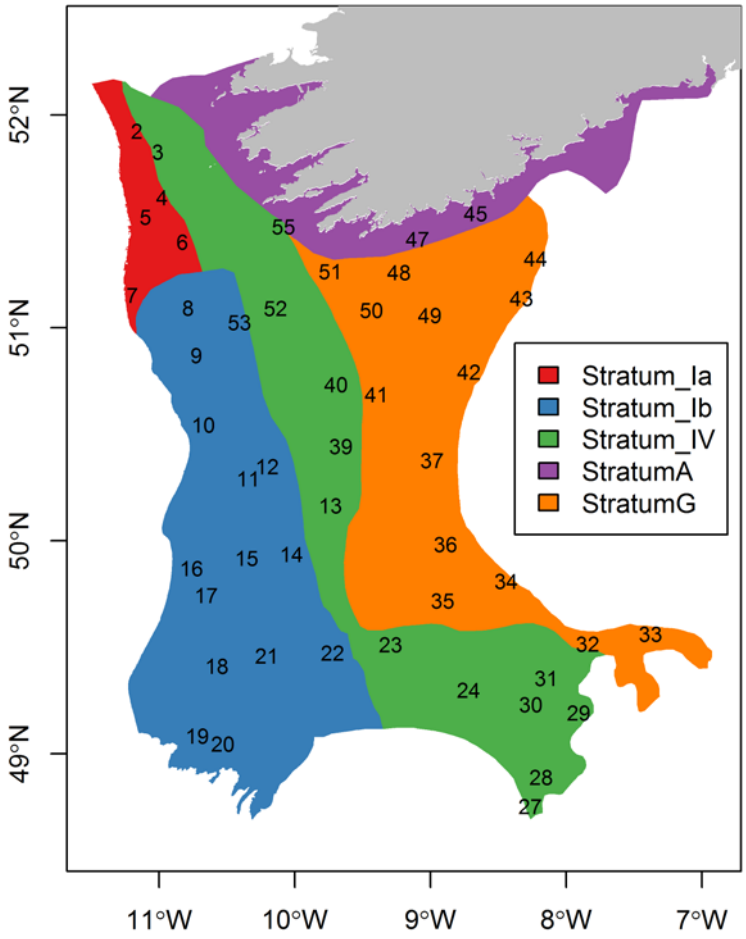


Figure 8.10 Map IRL BTS 2017

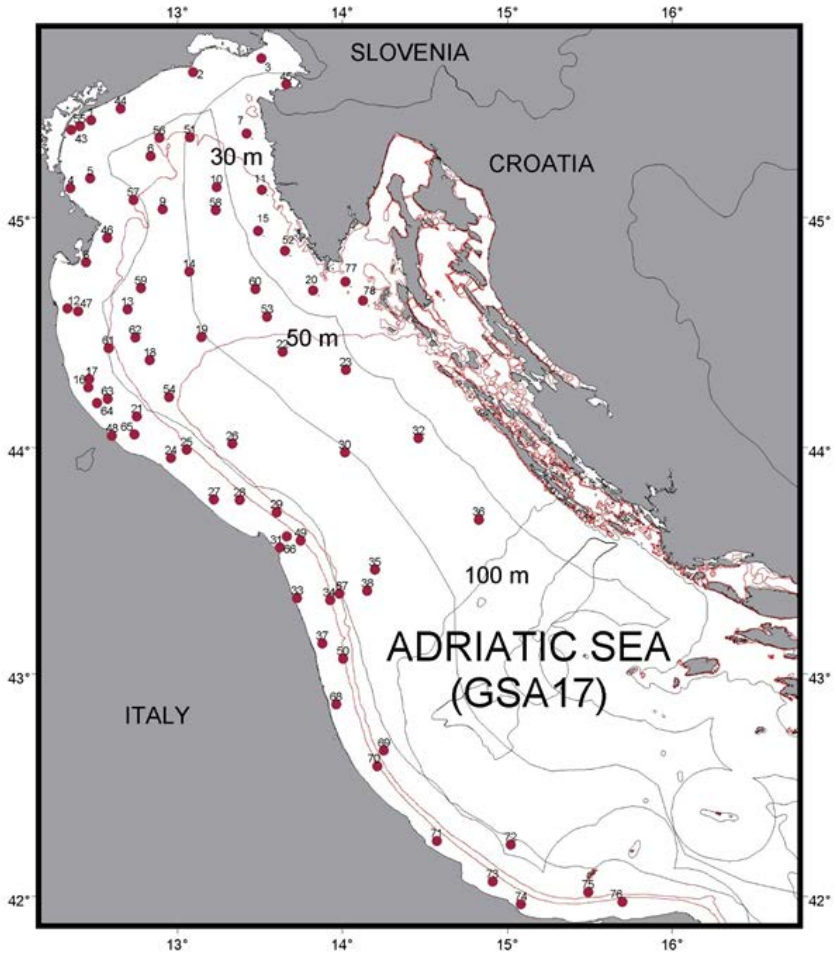


Figure 8.11 Map ITA BTS 2017

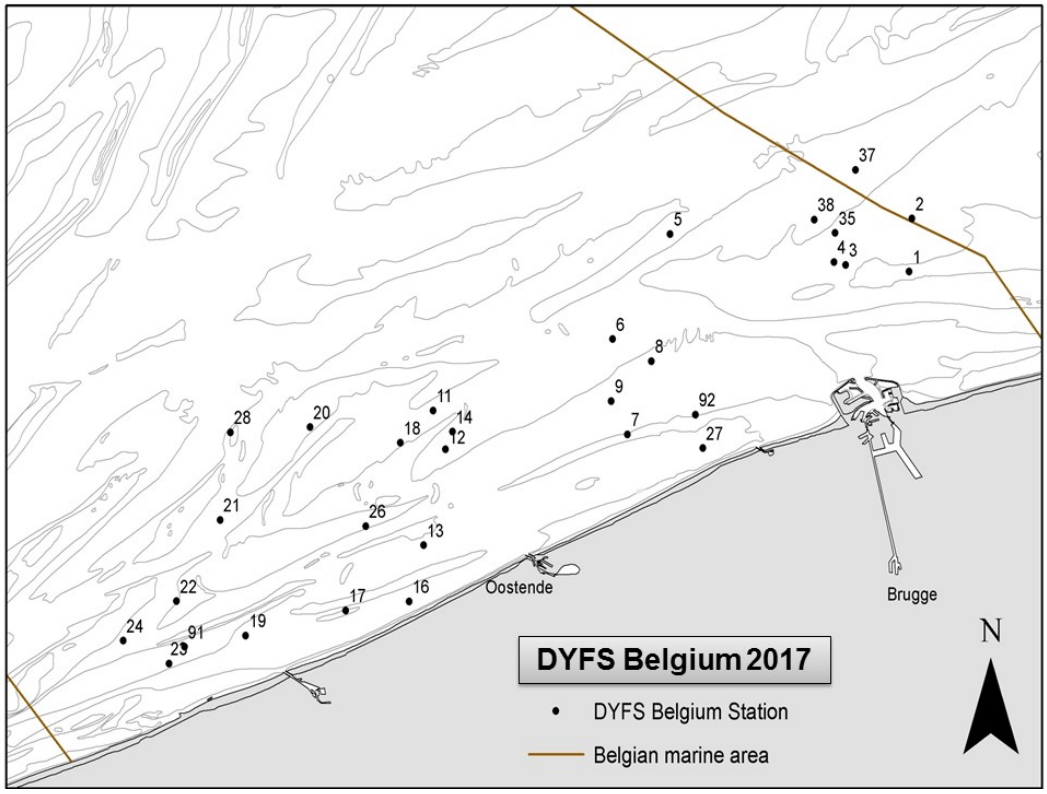


Figure 8.12 Map BEL Inshore Survey 2017

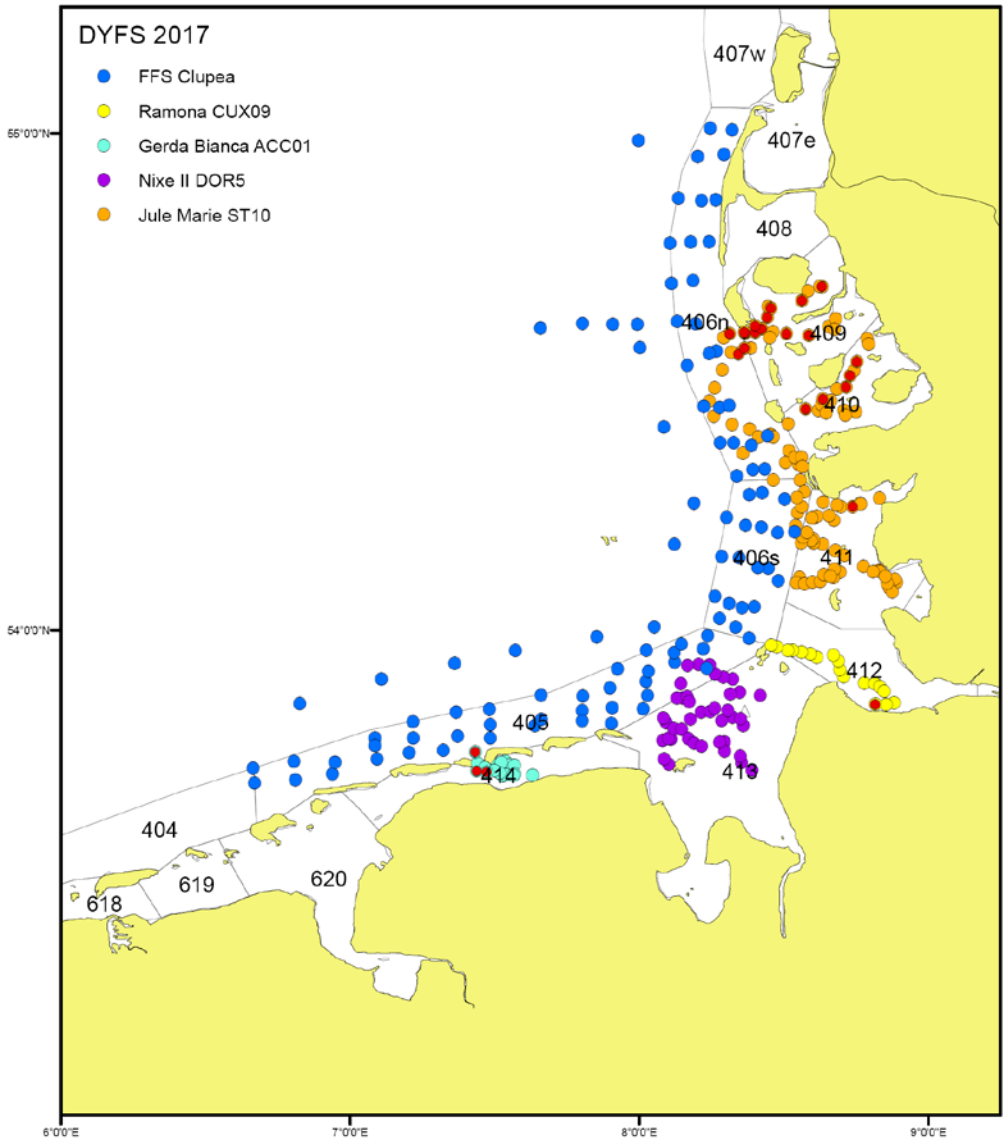


Figure 8.13 Map GFR Inshore Survey 2017

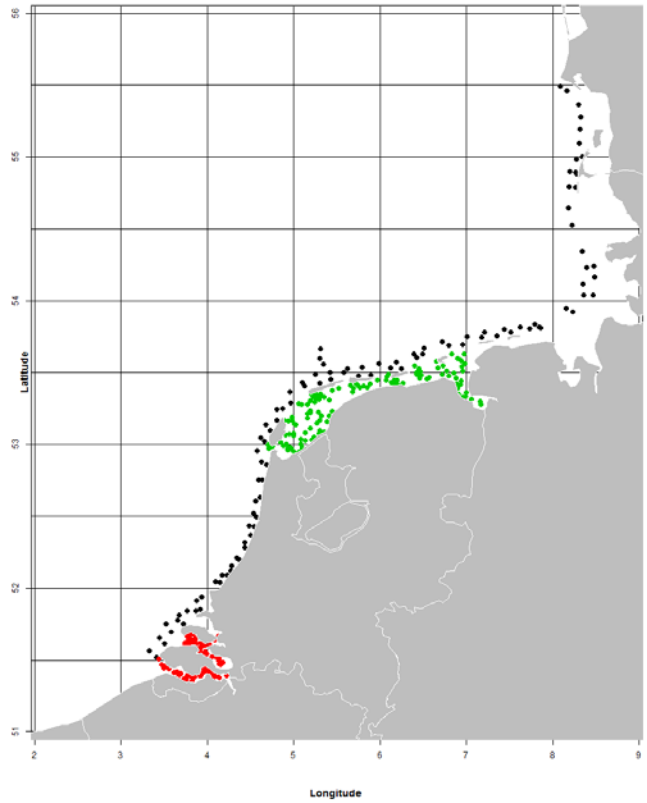


Figure 8.14 Map NED Inshore Survey 2017

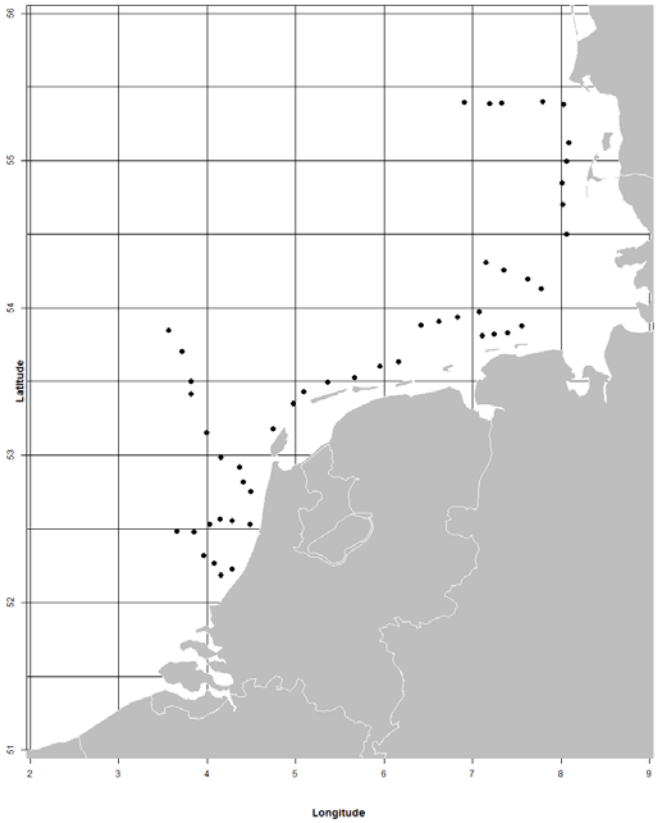


Figure 8.15 Map NED Sole net survey 2017

Annex 9: Offshore Beam Trawl Survey staff exchange: ILVO participant on WMR BTS – Q3 with RV Tridens August 2017

In the context of staff exchange and standardization of survey methods a member of ILVO (Institute for Agricultural, Fisheries and Food Research, Belgium) participated in the Dutch offshore Beam Trawl Survey organized by WMR (Wageningen Marine Research, Netherlands) in ICES division 4. The observations on differences and similarities by the staff involved in this exchange should help the involved parties and WGBEAM to better understand and coordinate the surveys from an international perspective.

The Dutch Beam Trawl survey is organized by WMR institute and takes place in different parts of the North Sea with different research vessels. The Belgian observer from ILVO joined the BTS in the southern and eastern North Sea, from the Dutch Belgian boarder up to Esbjerg Denmark, in the third quarter of 2017. The survey was carried out on board of RV Tridens (**Error! Reference source not found.**) that sailed from Scheveningen from 7 to 18 Aug 2017, with a mid-survey break on 12-13 Aug in Esbjerg Denmark. The Belgian participant stayed on board the entire trip and had the chance to contribute to the processing of the catches of all 35 hauls in the first week and all 29 hauls in the second week. This experience gave her the opportunity to make a detailed comparison between the vessels and scientific and general practices on the Dutch and Belgian offshore surveys.

Objectives and survey design

Although the Dutch and Belgian offshore beam trawl surveys were originally not set up as one survey, they nowadays follow the same manual and focus primarily on the same objectives (collecting fisheries independent data for plaice, sole and some additional commercially important species) under the coordination of WGBEAM.

Figure 9.1: RV Tridens (up) and RV Belgica (under)

The Belgian BTS is carried out with RV Belgica[1] (**Error! Reference source not found.**), while the Dutch BTS was done on board of RV Tridens[2] (**Error! Reference source not found.**). Both surveys attempt to fish a fixed number of stations annually (quarter 3), with tows lasting 30 min (shorter if large numbers of small fish or high bycatch of benthic species or non-biological materials, but not less than 15 min) while fishing at 4 knots over the ground during daytime. Belgian BTS stations are fixed in space, whereas on the Dutch BTS a pseudo-random design is applied. In this pseudo-random design RV Tridens targets a fixed number of priority stations, strati-

[1] see https://odnature.naturalsciences.be/downloads/belgica/belgica_techspecs.pdf for detailed technical specifications of RV Belgica

[2] see https://www.researchvessels.org/ship_info_display.asp?shipID=101 for detailed technical specifications of RV Tridens

fied by ICES statistical rectangle, but the positions of these stations are randomly distributed within the rectangles. The minimum distance between two hauls is set to 10 nautical miles. Although the Belgian design is fixed, during the span of the time-series, stations may have moved slightly, mainly due to obstacles such as passive fishing gear, drilling platforms, pipelines or changes in bottom type (sand sieves) that made it too dangerous to fish with the chain mats. The rationale for the new locations has been within 5 nautical miles from the original station, and on similar grounds and depth.

Survey gear and gear deployment

Due to the different origins of the two compared surveys, no standardization in gears has taken place over time. Belgium uses a commercially rigged 4 m beam trawl equipped with chain mats. The gear is trawled from the aft (Figure 9.2). The Dutch survey uses an 8 m beam trawl on each side of the vessel (Figure 9.2). The Dutch beam trawl is fitted with 8 chains, of which 4 are connected to the beam and 4 to the net. Both Belgium and the Netherlands have a 40 mm codend liner in the net. As opposed to the practice on RV Tridens, where the permanent vessel crew prepares, inspects, deploys and hauls the gear, and brings the catch to the scientists, the ILVO-crew plays an important role in all these tasks on board of RV Belgica.

In 2016 ILVO carried out a comparative fishing study to compare the differences between towing from the aft against towing from the side. The study was done in the Irish Sea with RV Cefas Endeavour and the Belgian commercial beam trawler Jasmine

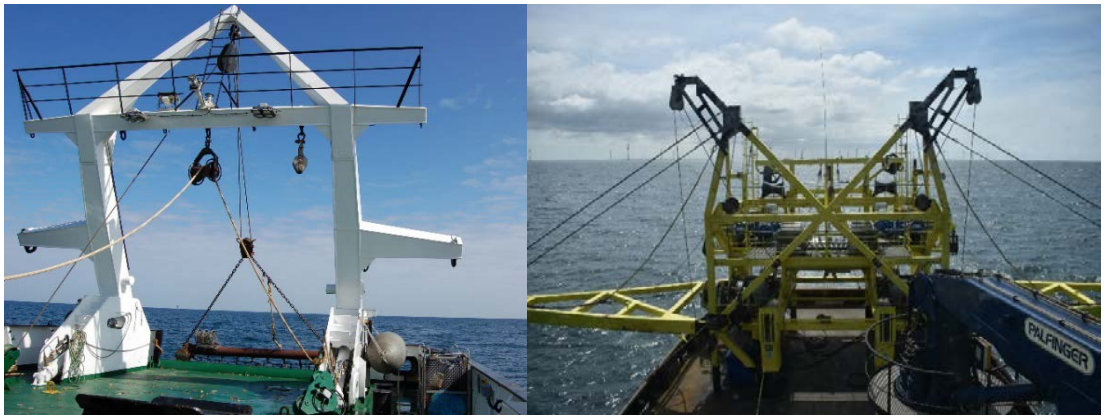


Figure 9.2: RV Belgica fishing from the aft (left) and RV Tridens fishing from the side (right).

(Z.483). Fishing was carried out in the same period (during the annual UK-Q3-BTS), in the same locations, in the same direction, with a comparable speed, haul duration and gear type (i.e. beam trawl with chain mats and 40 mm codend). The catch was processed against the same protocol and results were standardized to swept-area afterwards. The study focused on sole and showed that both the catchability and composition of the catch were very comparable, implying that there is little difference between the two fishing techniques. This study helps to justify the use of different fishing vessels applying different gear deployment techniques in internationally coordinated beam trawl surveys. However, comparative studies between member states in specific survey areas and periods of the year should still be executed to account for fine scale effects of vessel and gear. This study was part of the IRIS2 project funded by EMFF (the European Maritime and Fisheries Fund).

Processing of the catch

There are several differences between RV Belgica and RV Tridens regarding vessel properties, facilities and logistics. The most important finding relevant to this type of survey was the space available on the larger Tridens, which creates the possibility for more people to sort out the catch and work on different tasks simultaneously, making the process faster. In Figure 9.3 the facilities of RV Tridens (A) and RV Belgica (B) for the sorting of the catch are compared.

On RV Tridens the catch is deposited on the conveyor belt below deck where there is

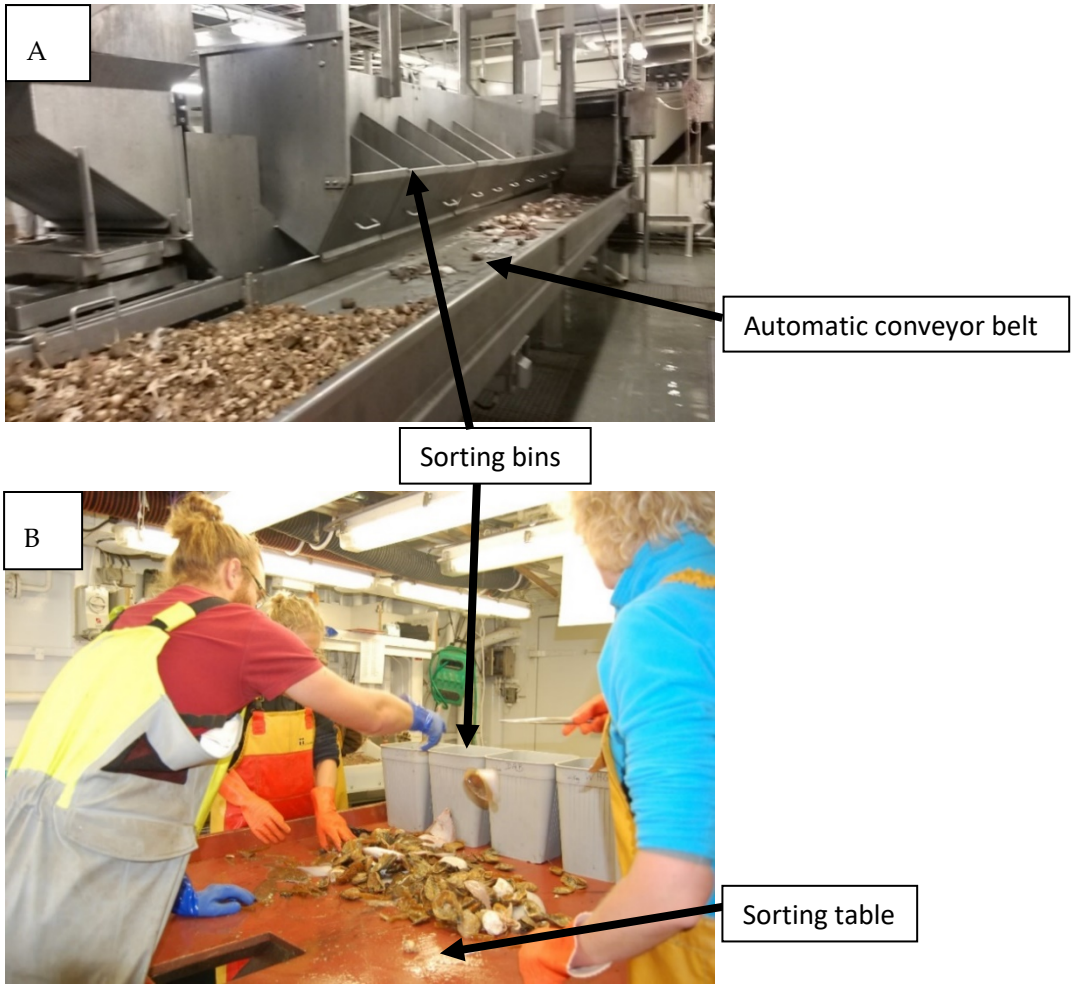


Figure 9.3: Sorting of the catch on the Dutch BTS on RV Tridens (A) and Belgian BTS on RV Belgica (B).

space for up to 6-8 people to line up along the conveyor belt and sort out the catch. Secondly, due to the automated operation of the conveyor belt the catch can be processed fast and efficiently. On RV Tridens there is also more space for the processing of the catch. A part is done on the conveyor belt such as measuring and the sorting and counting of (epi)benthos, but there is also a separate fish lab where litter and biological fish data are recorded (Figure 9.3, A). This gives the possibility to sort out larger catches, work faster and/or work in parallel, in other words getting the maximum out of the time at sea, which is considered to be a scarce resource. On RV Belgica on the other hand, there is only one small fish lab where everything needs to happen: sorting

of the catch, weighing, measuring of the fish, cutting of otoliths (Figure 9.3, B), litter, etc. This restriction in space forces the scientific crew to work in series and deal less efficiently with the valuable time at sea. Over the years, ILVO has developed a practical working scheme to make optimum use of the limited space on board of RV Belgica in order to comply with the DCF requirements.

In Figure 9.4, a comparison is made of the work flow for the collection of biological fish data on RV Tridens (Figure 9.4, A) and RV Belgica (Figure 9.4, B). On both surveys the registration of the biological fish data are done manually since there is no computer driven central system telling the user how many individuals of a certain species still need to be documented for certain parameters in a certain area. Due to the extra space on RV Tridens and the possibility to work in parallel (as described earlier), one haul can be entirely processed before the next haul comes on deck, whereas on RV Belgica the collection of biological fish data are done at night, when all fishing activity has ended.

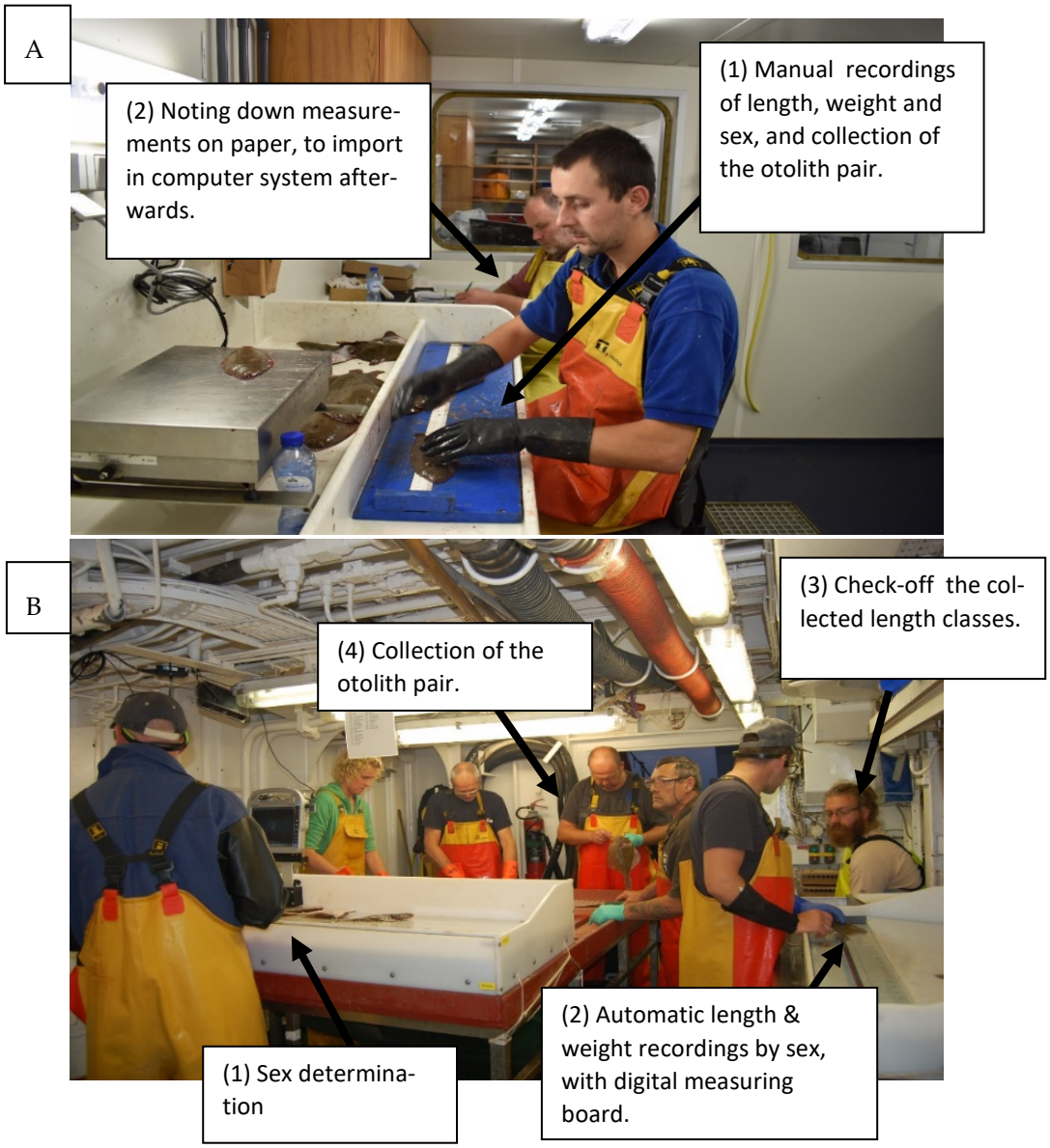


Figure 9.4: Work flow for the collection of biological fish data on the Dutch BTS on RV Tridens (A) and Belgian BTS on RV Belgica (B).

Sampling design

Both Belgium and the Netherlands weigh and sort the entire catch for all fish species and the main commercial invertebrates, identify these organisms to the lowest taxonomic level possible and document numbers by species. In case of the Dutch BTS that deploys two nets, only starboard is entirely sorted. Catches in portside are only used for missing length classes for the collection of otoliths for aging. The Belgian BTS does not only takes numbers, but also weights by species.

The remaining fraction of benthos/epibenthos (or – in case of large catches – a 'mixed' subsample that is representative for the entire catch) is sorted and identified to the lowest taxonomic level possible and numbers per taxon are recorded. Again, on the Belgian BTS also weight by species is taken, except for species belonging to Anthozoa, Bryozoa, Hydrozoa and Porifera where only absence presence is recorded. When a subsample was taken, the remaining catch is weighed on the Belgian BTS. On the Dutch BTS the total volume of the catch is estimated based on the volume of the remaining baskets and that of the subsample.

On the Belgian BTS all fish species and the main commercial invertebrates are measured to the cm below (total length). Brown crab, Norwegian lobster and common lobster are measured to 0.5 cm below by sex. The Netherlands does the same, but implements a finer resolution of 1 mm for cuttlefish, squid, brown crab, Norwegian lobster, common lobster, spiny lobster, Maja spider crab and king crab. Subsampling may occur on both the Belgian and Dutch survey when numbers of a certain species are extremely high. The subsample is than measured and the rest is counted.

Sampling design for the collection of otoliths may differ between BTS surveys. According to WGBEAM this might have implications if these differences are not been taken into consideration when data from different surveys are used for stock assessment. Also between the Belgian and Dutch BTS there are substantial differences. On the Belgian BTS sampling for age and sex is done for five species: cod, turbot, brill, plaice and sole. The number of otoliths taken is stratified by statistical rectangle. Usually 5 otoliths per cm class in each statistical rectangle are collected, but for budgetary reasons this number has been reduced from 5 to 3 in 2017. The Netherlands also stratify by ICES statistical rectangle and take 1-2 otoliths per cm class for sole and plaice. For flounder, brill, dab, turbot, lemon sole and cod they only collect four otoliths per cm class in each flatfish/roundfish area, which is at a larger spatial resolution than the ICES statistical rectangles. Maturity is staged for summer spawners such as lemon sole. On the Belgian BTS no maturity is staged for any of the five species, because quarter 3 is not the right period for determining maturity of these species. Stratification in the design and the minimum number of otoliths that should be collected by stratum in order to get the most complete length and age data for the use in stock assessment is open for discussion, but in itself, there is no problem that Belgium and the Netherlands have different sampling designs, as long as stock assessors are aware of these differences and take them into account when using the data.

Environmental data

The Belgian trawling gear is nowadays equipped with a CTD unit collecting continuous data (temperature, salinity, turbidity, …) during the tows. Additionally, RV Belgica has an onboard data acquisition system (ODASIII) which continuously collects oceanographic, meteorological, navigational and other abiotic information coming from different measuring units on board of the ship. On RV Tridens the CTD is not attached to the net, but a stationary vertical CTD profile is taken before every tow.

Team Structure

Team structures and the whereabouts of team members on the Dutch and Belgian BTS were very comparable. The Scientist In Charge (SIC) spends most of his/hers time in the fish lab where he/she takes the coordinating task of desk master. From the fish lab he/she keeps in touch with the vessel's captain and/or skipper(s) at all time. For Belgium one of the two skippers is a full time ILVO employee who deploys the fishing gear, while on RV Tridens the captain takes the responsibility for the deployment of the fishing gear.

The scientific team on the Dutch BTS was smaller than the Belgian team in 2017. On the Dutch BTS five scientists were active in the fish lab: one person measuring, one person sorting the benthos, and two persons collecting the biological fish data. A last person was responsible for putting all data in the computer system in the dry lab. Before each taking his/hers own task everyone helps with the sorting of the catch. In contract with the Belgian survey, on RV Tridens it is common that also crew members help with the sorting of the catch. On the Belgica crew members only assist with the operation of winches, all other tasks such as taking in the gear, releasing the catch and sorting of the catch is all done by ILVO employees. Next on the Belgian BTS, two people operate the digital measuring boards for length measurements. Two to three scientists help with the sorting of the epibenthos sample and one other person weighs the remaining catch. In this regard both surveys are comparable since every person has his/hers own responsibilities.

The collection of biological fish data are less similar between the two surveys. On RV Belgica this is done in the evenings after all fishing activities have stopped. Again everyone has his/hers specific responsibilities: one person takes the sex of the fish, another weights and measures with the digital measuring board, and a third person collects the otoliths (see Figure 9.3 B). On the Dutch BTS this is done in between tows and only one person carries out all the different steps of determining sex, measuring, weighing and cutting the otoliths (see Figure 9.3 A).

Conclusion

The main differences between the Dutch and Belgian offshore BTS observed were vessel dimensions, survey design and gear deployment, automation of catch sorting and sampling, and the sampling design for biological fish data. The large amount of space on board of RV Tridens is an asset for efficient catch processing, whereas on RV Belgica space is rather a limiting factor. On the Dutch BTS lengths and individual weights are still recorded manually, as opposed to the Belgian BTS where this is done automatically through the digital measuring board, permitting less errors to occur.

Although some differences between the two compared surveys are listed above, they obviously have a lot in common due to their similar objectives, joint manual and the common coordination by WGBEAM. The differences in vessel dimensions and approach are not considered to lead to differences in relevance and applicability of the data collected.

Annex 10: WGBEAM 2018 Working Document (WD1)

Epibenthic community data from the Dutch offshore beam trawl surveys

WD1 to WGBEAM 2018

Sven Kupschus and Ingeborg de Boois

Background:

WKPIMP 2016 requested that WGBEAM 'Compare the macro-epibenthos catches in species composition and quantity of at least IBTS Q3 and Beam Trawl Survey catches'. WGBEAM was unable to fully complete the request as the IBTS Q3 data on epibenthos is not available on datras. Instead the WG evaluated the epibenthic community structure from the Dutch BTS surveys carried out on Tridens and ISIS with those of the fish communities of both the beam trawl and GOV (IBTS Q1 and Q3 combined). Haul locations and number of hauls differ between these surveys so for the purposes of this analysis the data were aggregated by ICES-rectangle and year combinations to enable comparisons. The analysis was limited to the rectangle-year combinations where all three data types were available on datras.

WGBEAM concluded:

General community structure is highly consistent between epibenthic communities and fish communities as sampled simultaneously by the beam trawl and independently in the GOV.

For the three communities examined patterns are spatio-temporally very consistent and at the very least do not suggest large changes over time. Spatial differences are much more important than changes over time, suggesting that without considering spatial effects comparisons between years is unlikely to detect changes of the magnitude contained in the time-series.

Observed differences in the spatial extent of different clusters are largely artefacts of the clustering method chosen. Ordination analysis suggest that spatial changes are gradual and clustering responds differently to these changes. Correlation between the correspondence analysis eigenvectors is highly significant across the different communities with beam trawl and GOV fish communities having an r^2=0.934 on the first axes, and both fish communities correlating with epibenthic communities (r^2 0.88 and 0.87 for GOV and beam trawls respectively.

Spatial scales of community variability are significantly larger than the inter station distances, and correlation between communities sampled by different surveys (not the same location) suggest that habitats are either homogenous or a highly consistent mosaic of different communities at spatial scales much smaller than those of the trawls. In any case possible scales of marine spatial management are significantly larger than the scales of sampling.

The working group concludes that epibenthic sampling from gears designed for fishing can be indicative of epibenthic species at scales relevant to management and that combining epibenthic catches from the North Sea beam trawl surveys for integrated analysis with fish catches should be possible at least at the general level. Further analysis is necessary to investigate the utility for more specific purposes.

Approach and Results:

There is no single one appropriate method to evaluate the utility of the quantitative epibenthic information collected by the Dutch beam trawl survey. Choice of method is

ultimately dependent on the objectives of a specific analysis. To ascertain a general picture, qualitative (classification) and quantitative (ordination) multivariate techniques were used to attain a general picture of the systematic variance components in the data.

Epibenthic data were screened for taxonomic consistency with regards to identification. Where identification was questionable or recording at the taxonomic level inconsistent further data collectors were requested to provide additional information to ensure consistency. Generally, the information is evaluated at the species level with only a relatively small number of groups (hydrozoans and worms being excluded entirely) and about 10 taxa being aggregated at the genus level. Colonial species are evaluated as presence absence so are likely to be underrepresented in this analysis. This resulted in 86 epibenthic taxonomic groups over 16 years (2002-2017). Data on fish abundances by haul for both the BTS survey and the IBTS survey (both quarters combined) were not screened in detail for taxonomic consistency due to time constraints but given the greater focus on these taxa it is expected that recording is more consistent.

All three data types were aggregated at the ICES rectangle and year combination level and evaluation restricted to those combinations for which all three data types were available. IBTS data are generally more extensive so that mostly data are restricted by the availability of beam trawl data. The species matrix was log-transformed to reduce the weighting of the dominant species. Only the 60 most abundant species of each data type were used. Abundance by rectangle and year was log-transformed.

Cluster analysis:

Clustering was applied to the Bray–Curtis distance matrix and aggregated using Ward's method. The number of clusters chosen is arbitrary here 12 spatially consistent clusters are displayed, purely for the ease of recognition in plots. Figure 1 represents the dendrogram of the epibenthic cluster analysis (fish dendrograms not shown for brevity), with Figure 2 providing some information as to the species abundances that are characteristic of the various clusters. For the most part differences between clusters are based on changes in the relative abundance of species between clusters as opposed to differences in the presence and absence of species. Figure 3 demonstrates the temporal consistency of the clusters suggesting there have been few changes in the epibenthic communities at the ecosystem level, at the very least those differences are smaller than the differences between areas.

Given the qualitative results of the classification methods, quantitative comparison between the spatial and temporal variability of the three different sampling types are difficult. Never-the-less the two fish communities (BTS; Figure 4 and IBTS; Figure 5) indicate very much the same spatial patterns and largely a lack of temporal variability just like the epibenthic data. Differences of the areas of transition between communities are assessed differently in the communities, but the overall spatial structure is highly consistent.

Ordination:

One way to investigate the community structures more quantitatively is ordination. Catches should ideally be standardized for swept-area, however there are only a few stations where this is an issue so in this quick analysis this was ignored and catches rather than CPUE used. The analysis indicates that rather than discrete communities of epibenthic species there are gradients in species distribution, with the identified clusters representing somewhat arbitrary breaks in these gradients. The specific location of these breaks depends on the interaction between the clustering methodology

and the characteristics of the data. Therefore, the described differences in the location of communities between the different datasets is mostly an artefact of the clustering method rather than specific differences between communities.

A correspondence analysis was performed on each of the three separate datasets and the correlation between each pair was investigated. Figure 6-8 show the comparative plots of the site (ICES rectangle year combinations) scores, IBTS fish versus BTS epibenthos, BTS fish versus BTS epibenthos and IBTS fish versus BTS fish. Symbols are coloured by the classification associated with the sample and show generally that the ordination methods capture the same community information as the cluster analysis (i.e. clusters show significant separation in the ordination). Correlation coefficients for each of the axes are shown in the graphs. They are generally very high for the first axes with subsequent axes still being highly significantly correlated in all cases, but the magnitude of the fit is more variable and values generally lower. Even where correlation is poorer clusters still remain significantly grouped in the ordination.

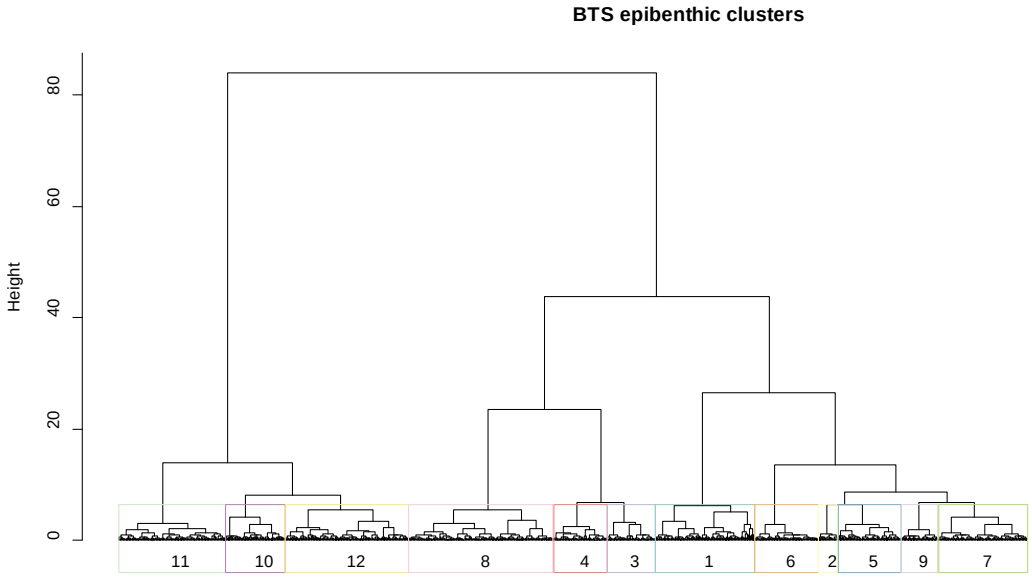


Figure 2: Dendrogram of the epibenthic clusters based on Bray–Curtis dissimilarity. The primary split (clusters 10-12 versus 1-9) corresponds spatially to a northwest / southeast split in the North Sea ecosystem. Colours correspond to the colours used in the spatial plot Figure 3)

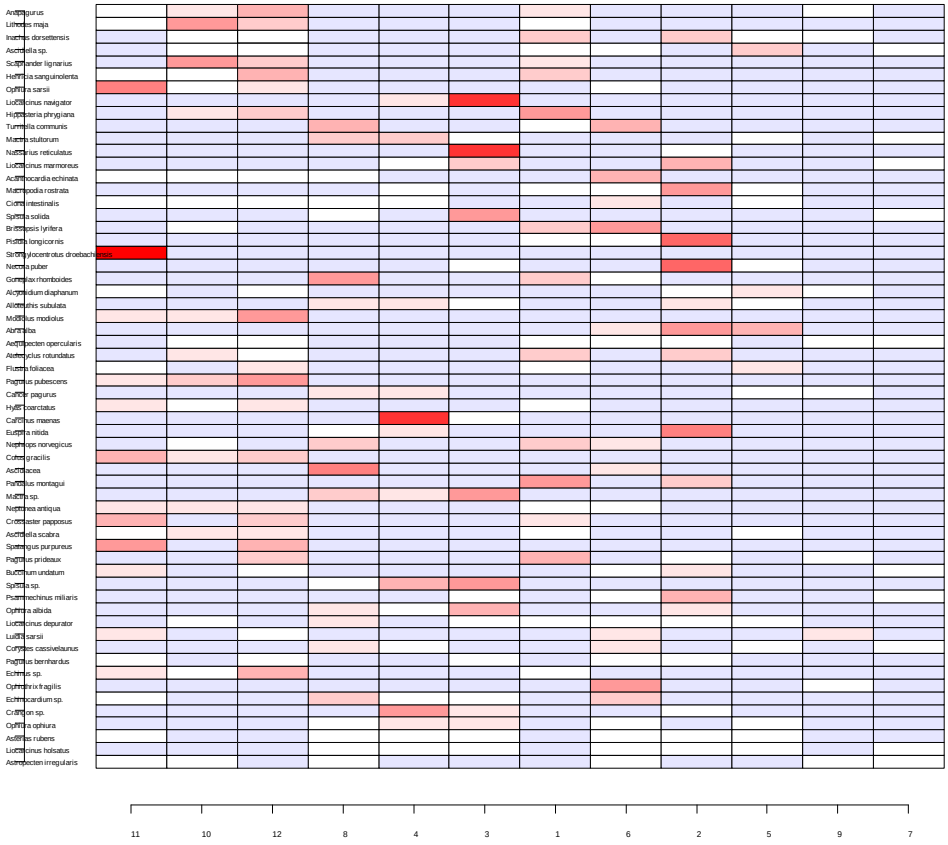


Figure 3 Means standardized abundance (mean species abundance within a cluster / mean species abundance in the data) heatmap by taxonomic grouping of the epibenthic data. Red colours indicate higher than average abundance blue colours less than average abundance with white indicating abundance close to the overall mean.

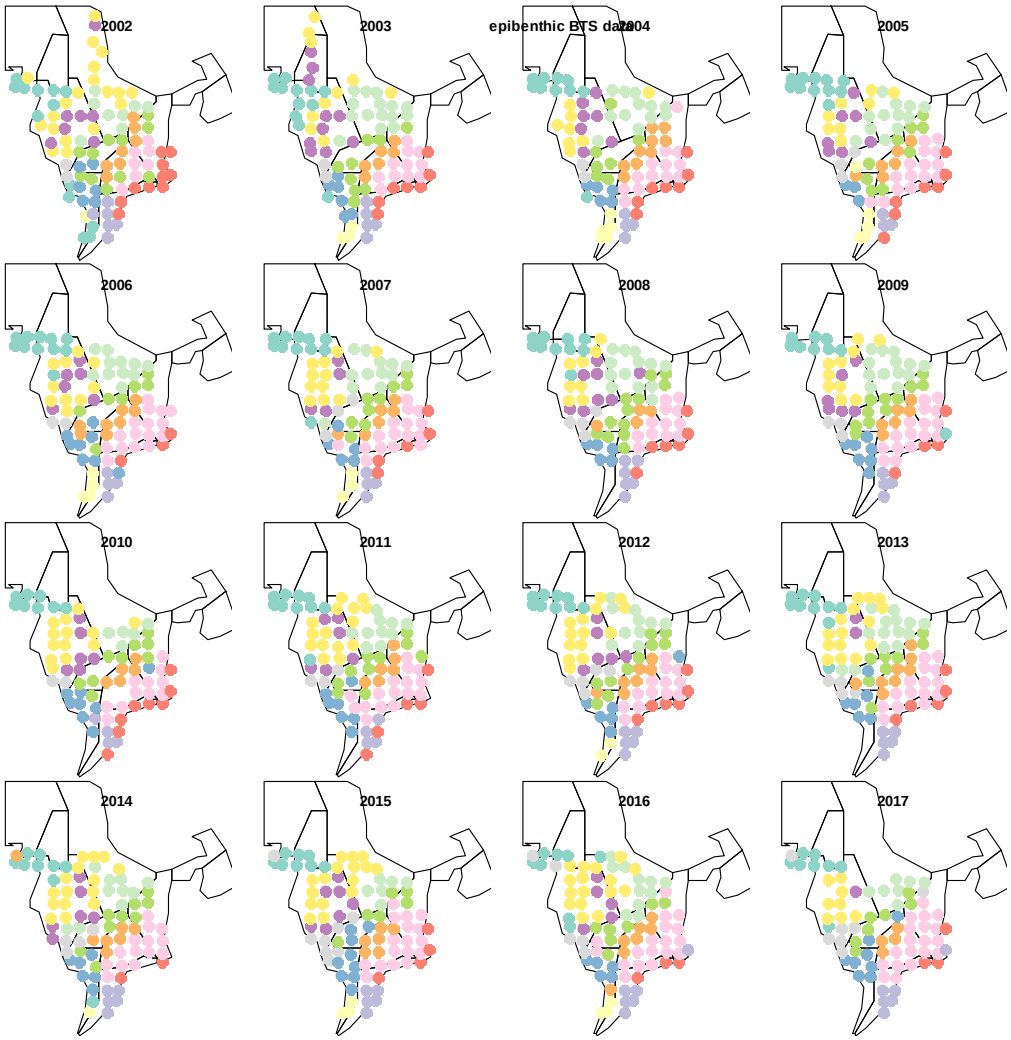


Figure 4: Spatial and temporal distribution of the epibenthic communities as represented in Dutch offshore beam trawl samples over the period 2002-2017.

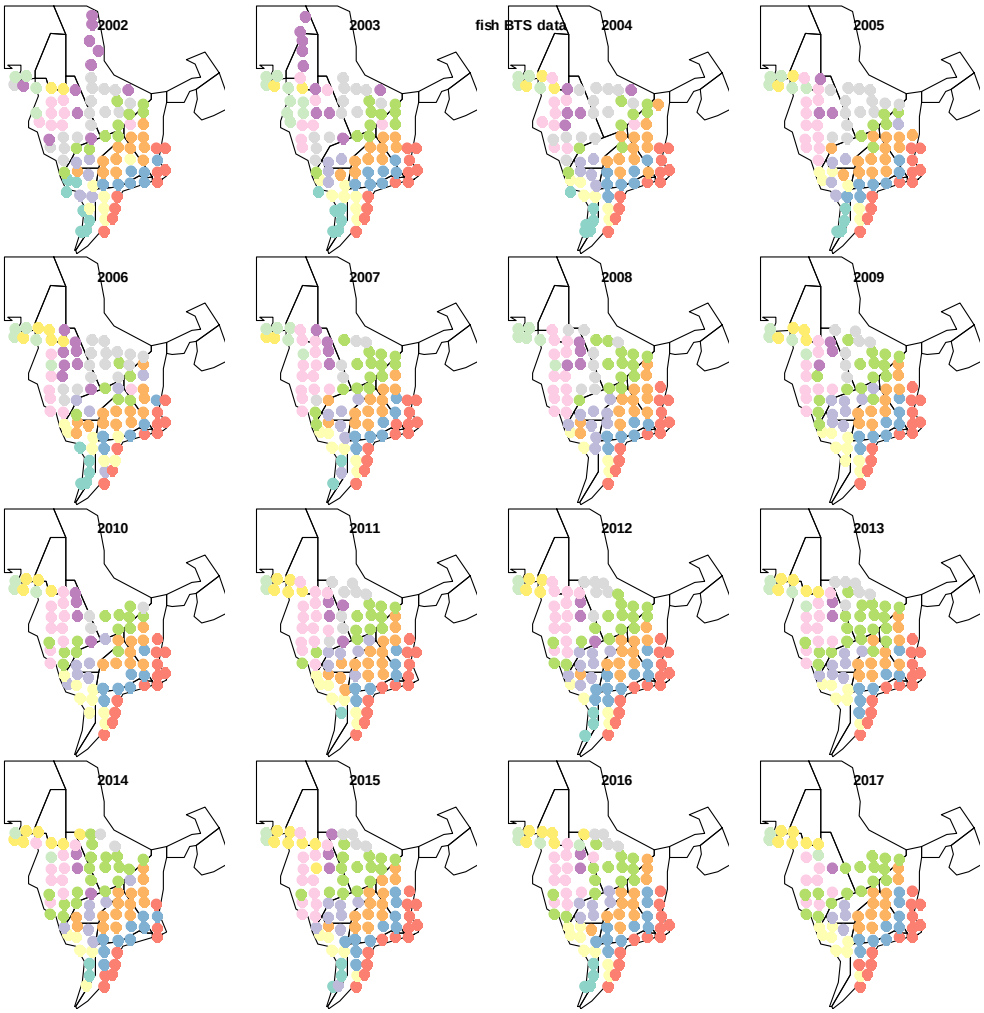


Figure 5: Spatial and temporal distribution of the fish communities as represented in Dutch offshore beam trawl samples over the period 2002-2017.

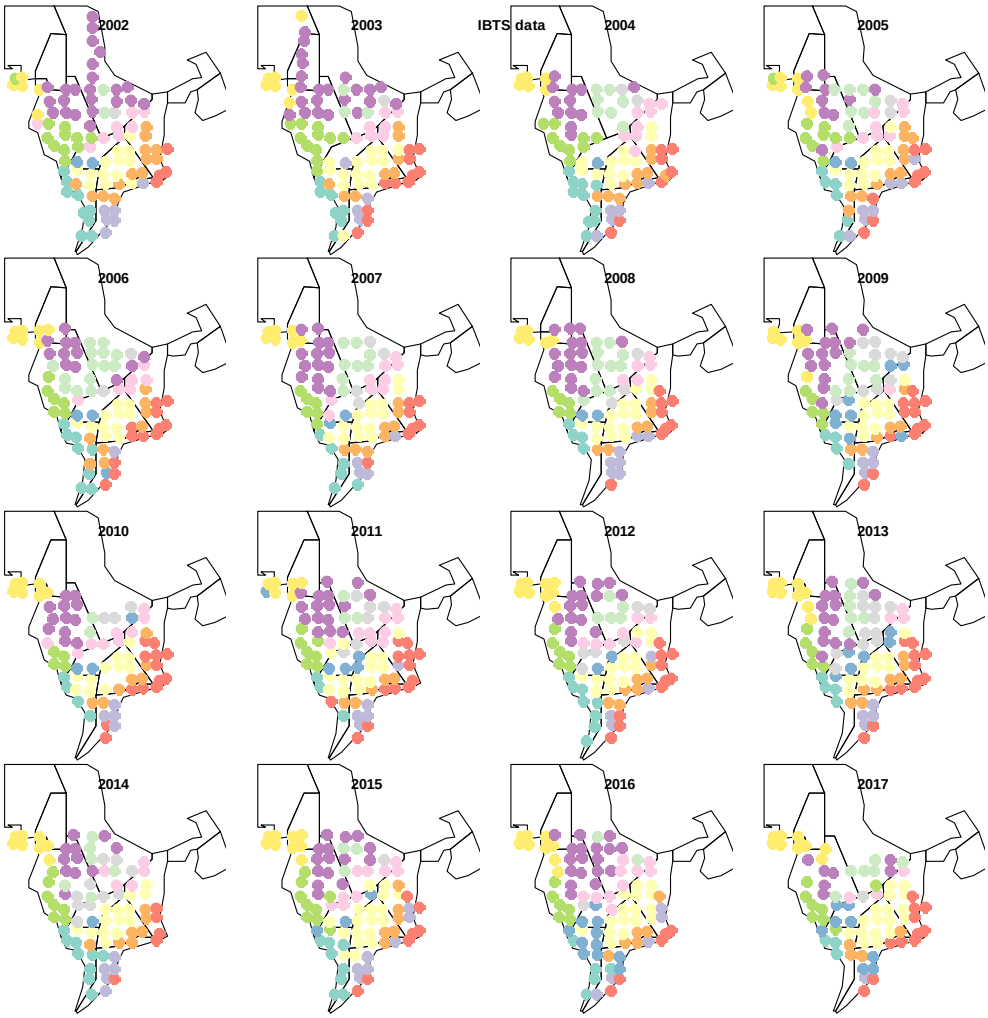


Figure 6: Spatial (aggregated to rectangle) and temporal distribution of the fish communities as represented in international IBTS GOV trawl samples (Q1 and Q3 IBTS combined) over the period 2002-2017.

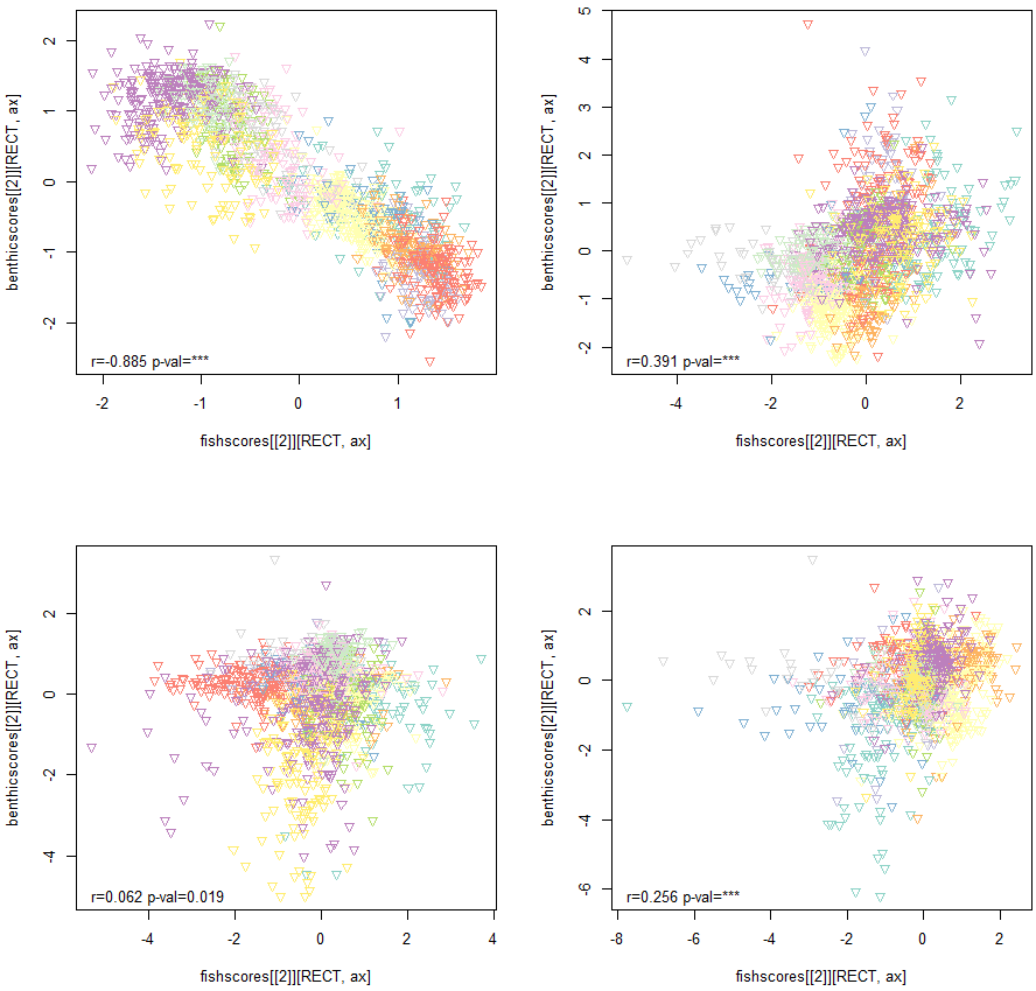


Figure 7: Comparative plots and correlation values of the site scores of rectangle and year aggregated independent ordinations. X-axis represents the IBTS fish communities y-axis are the BTS benthic communities with CA-axes 1-4 shown individually. Top-left are the respective first axes, top-right the second axes, bottom left the third axes and bottom right the fourth axes.

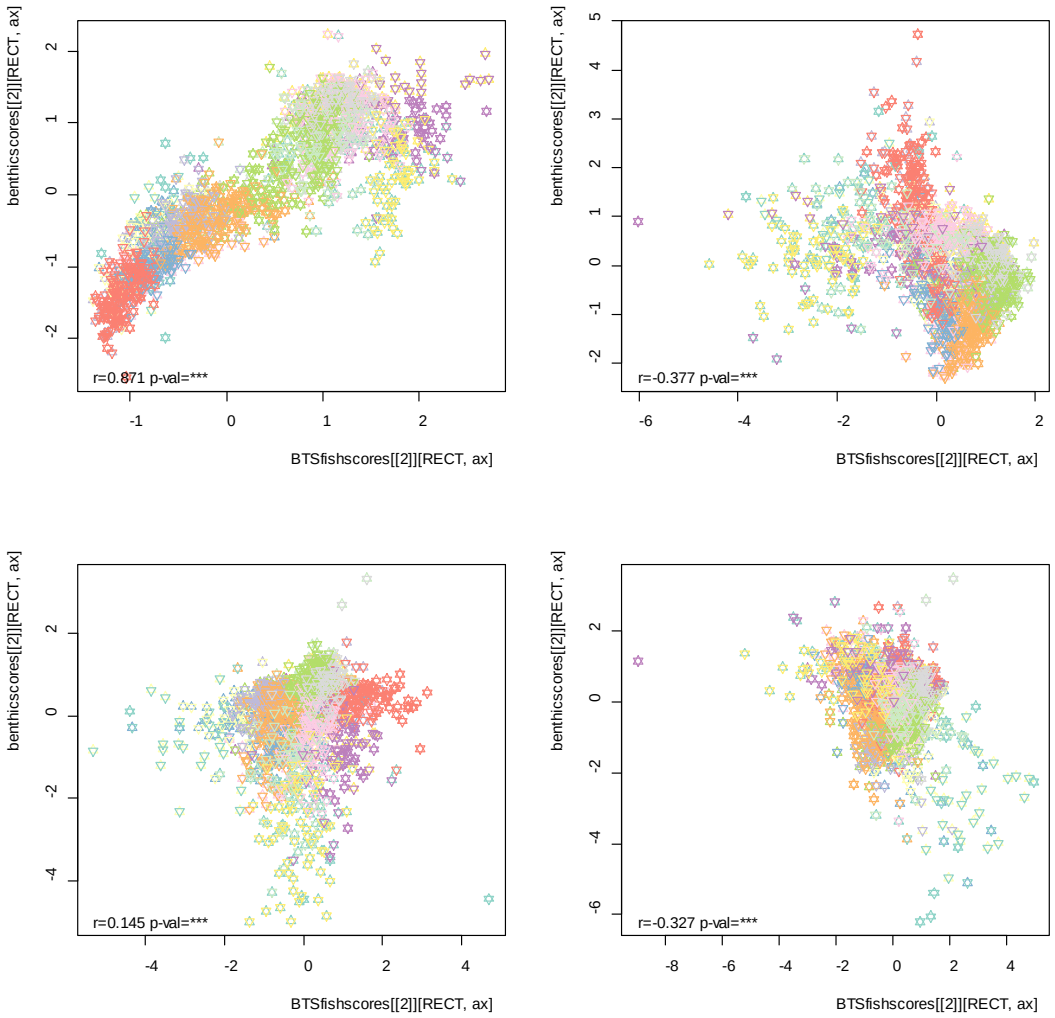


Figure 8: Comparative plots and correlation values of the site scores of rectangle and year aggregated independent ordinations. X-axis represents the BTS beam trawl fish communities y-axis are the BTS benthic communities with CA-axes 1-4 shown individually. Top-left are the respective first axes, top-right the second axes, bottom left the third axes and bottom right the fourth axes.

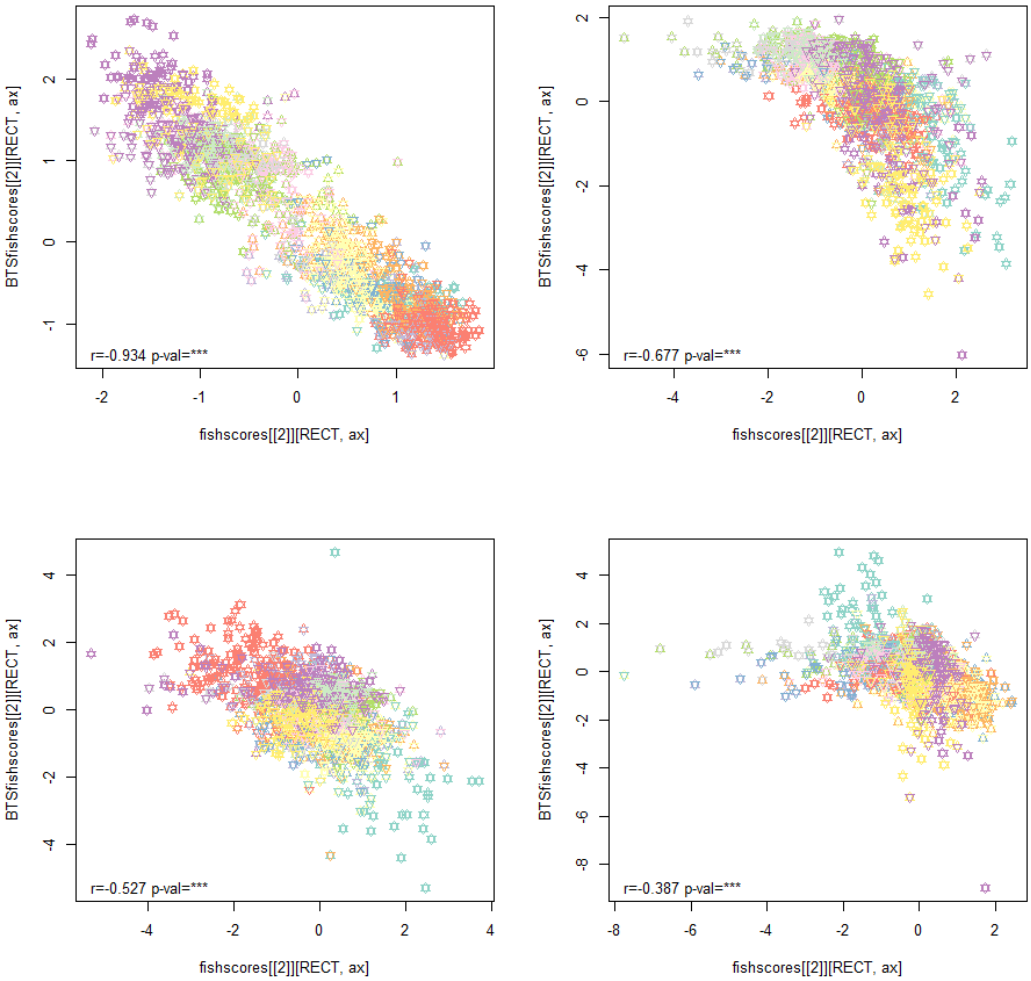


Figure 9: Comparative plots and correlation values of the site scores of rectangle and year aggregated independent ordinations. X-axis represents the IBTS fish communities y-axis are the BTS beam trawl fish communities with CA-axes 1-4 shown individually for completeness. Top-left are the respective first axes, top-right the second axes, bottom left the third axes and bottom right the fourth axes.